

아라온 멀티빔 잡음 제거 및 신호 활용을 통한
양극 해저면 물성 도출 연구

Araon Multi-beam Data Processing Research

(Noise Suppression and Polar Ocean Bottom Properties Controls)



중 원 대 학 교

제 출 문

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본 보고서를 “양극해 환경변화 이해 및 활용연구”과제의 위탁연구 “아라온 멀티빔 잠음 제거 및 신호 활용을 통한 양극 해저면 물성 도출 연구”의 위탁 연구 최종 보고서로 제출합니다.



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보고서 초록

위탁연구과제명	아라온 멀티빔 잡음 제거 및 신호 활용을 통한 양극 해저면 물성 도출 연구				
위탁연구책임자	김 형 수	해당단계 참여연구원수	7	해당단계 연구비	40,000 (천원)
연구기관명 및 소속부서명	중원대학교 산학협력단		참여기업명	해당사항 없음	
국제공동연구	상대국명 : 해당사항 없음 상대국연구기관명 : 해당사항 없음				
요 약			보고서 면수	57 (본문) 94 (차례, 부록 등 인쇄 보고서 전체)	
본 연구의 목적은 멀티빔 자료를 활용하여 양극 해저면의 물성을 도출하고 양극해 환경 특성 지도 작성을 위한 기본 자료를 제공하는 것임. 이러한 연구 목적을 위하여 수행한 주요 연구 내용과 범위는 다음과 같음. - 아라온호 설치 멀티빔 시스템 EM-122에 대한 제원, 현황 및 운영 방법 분석 - 아라온호 승선을 통한 시범 자료 획득 (2회) 및 관련 원시 자료 획득 - 양극해에서 획득된 멀티빔 자료에 대한 사전 편집 등 본격 잡음 제거 및 해저 물성 도출을 위한 사전 자료 편집 및 처리 - 시범 항해 및 양극해 조사 측선도 작성 - 상업용 멀티빔 자료 처리 프로그램인 Caris Hips & Sips를 통한 잡음 제거 및 보정 처리 - 공개용 멀티빔 자료 처리 프로그램인 MB-system 활용 잡음 제거 및 보정 처리 - 후방 산란 신호를 이용한 양극 해저면 물성 예비 평가 수행 - 해저면 물성 추정 해석 및 잡음 제거 해저 기복도 (bathymetry map) 작성처리 또한 본 연구과제를 통해 도출된 연구 주요 결과는 다음과 같음. - 아라온호 Kongsberg사의 멀티빔 시스템 EM-122에 해안 제원 및 현황 분석 완료 - 동해 시범 항해 (2012년 6월, 2014년 5월), 남극 로스해 (2012년 1월, 2013년 2월) 및 북극 척치/보포트해 (2012년 8월) 획득 자료 처리 및 조사 정밀 측선도 작성 - 동해 및 양극해 자료의 정밀 검토 및 주요 지점에 대한 잡음 제거 효과 분석 - 양극해 자료 후방산란 신호를 통한 해저 물성 추정 수행 - 멀티빔 자료 처리 프로그램별 주요 기능 분석 및 특성 비교 - 멀티빔 조사 대상 지역에 대한 해저 기복도 (bathymetry map) 구축 본 연구의 결과는 양극해의 환경 특성을 이해하고 이를 통한 환경 특성 지도 작성에 기본 자료로 활용될 수 있으며, 향후 필요 시 아라온호 멀티빔 시스템에 최적화된 자료 처리 모듈을 개발 할 수 있을 것임.					
색 인 어 (각 5개 이상)	한 글	극지환경, 로스해, 척치해, 멀티빔, 해저지형도, EM-122			
	영 어	Polar Environments, Ross Sea, Chuchi Sea, Multi-beam, Bathymetry Map, EM-122			

요 약 문

I. 제 목

아라온 멀티빔 잡음 제거 및 신호 활용을 통한 양극 해저면 물성 도출 연구

II. 연구개발의 목적

본 연구의 목적은 멀티빔 자료를 활용하여 양극 해저면의 물성을 도출하고 양극해 환경 특성 지도 작성을 위한 기본 자료를 제공하는 것이다.

III. 연구개발의 내용 및 범위

본 위탁과제에서 수행한 주요 연구 내용 및 범위는 다음과 같다.

- 아라온호 설치 멀티빔 시스템 EM-122에 대한 제원, 현황 및 운영 방법 분석
- 아라온호 승선을 통한 시범 자료 획득 (2회) 및 관련 원시 자료 획득
- 양극해에서 획득된 멀티빔 자료에 대한 사전 편집 등 본격 잡음 제거 및 해저 물성 도출을 위한 사전 자료 편집 및 처리
- 시범 항해 및 양극해 조사 측선도 작성
- 상업용 멀티빔 자료 처리 프로그램인 Caris Hips & Sips를 통한 잡음 제거 및 보정 처리
- 공개용 멀티빔 자료 처리 프로그램인 MB-system 활용 잡음 제거 및 보정 처리
- 후방 산란 신호를 이용한 양극 해저면 물성 예비 평가 수행
- 해저면 물성 추정 해석 및 잡음 제거 해저 기복도 (bathymetry map) 작성처리

IV. 연구개발결과

본 위탁과제를 통해 도출된 연구의 주요 결과는 다음과 같다.

- 아라온호 Kongsberg사의 멀티빔 시스템 EM-122에 해안 제원 및 현황 분석 완료
- 동해 시범 항해 (2012년 6월, 2014년 5월), 남극 로스해 (2012년 1월, 2013년 2월) 및 북극 척치/보포트해 (2012년 8월) 획득 자료 처리 및 조사 정밀 측선도 작성
- 동해 및 양극해 자료의 정밀 검토 및 주요 지점에 대한 잡음 제거 효과 분석
- 양극해 자료 후방산란 신호를 통한 해저 물성 추정 수행
- 멀티빔 자료 처리 프로그램별 주요 기능 분석 및 특성 비교
- 멀티빔 조사 대상 지역에 대한 해저 기복도 (bathymetry map) 구축

V. 연구개발결과의 활용계획

본 연구의 연구개발 결과는 양극해의 환경 특성을 이해하고 이를 통한 환경 특성 지도 작성에 기본 자료로 활용될 수 있다. 또한 본 연구 결과를 기초하여 향후 필요 시 아라온호 멀티빔 시스템에 최적화된 자료 처리 모듈을 개발 할 수 있을 것으로 생각된다.

S U M M A R Y

I. Title

Araon Multi-beam Data Processing Research

- Noise Suppression and Polar Ocean Bottom Properties Controls -

II. Purpose of R&D

The purpose of this study is to evaluate ocean bottom properties and provide the basic data for construction of environment characteristics map on Antarctic and Arctic Oceans by utilizing Araon multi-beam data.

III. Contents and Extent of R&D

In this dispatched research, the following studies were conducted in order to achieve the goals of main research :

- Analysis of specifications and status of multi-beam EM-122 system which were installed on Araon Research Ship
- Involving in two test cruises in East sea and acquisition of raw multi-beam data for the understanding EM-122 system
- Multi-beam data converting and preliminary data editing for the noise suppression and characterizing the sub-bottom sediments
- Preparing the survey maps for the test cruises and Arctic, Antarctic Oceans multi-beam survey cruises
- Processing multi-beam data using Caris HIPS & SIPS (commercial software licensed in KOPRI) for the noise suppression and data corrections
- Processing multi-beam data using MB-System (open source software) for the noise suppression and data corrections
- Preliminary evaluation of ocean bottom sediments in polar regions using back scattered multi-beam data
- Interpretation of ocean bottom sediment properties and preparing bathymetry maps in polar regions after noise suppression

IV. R&D Results

In this dispatched research, the following representative results were obtained :

- Analysis and understanding of specifications and status of Kongsberg multi-beam EM-122 system which were installed on Araon Research Ship
- Data processing of multibeam data acquired in East Sea, Ross Sea (Antiarctic Ocean) and Chucki/Beaufort Sea (Arctic Ocean) and preparing the detailed survey maps
- Detailed multi-beam data reviews and analysis of the effects on noise suppression in bathymetry study
- Preliminary prediction of ocean bottom sediments using back scattered multi-beam data in polar regions
- Comparing and analysis of Caris and MB-system program characters in multi-beam data processing steps
- Making detailed bathymetry maps in polar study regions after multi-beam data processing

V. Application Plans of R&D Results

It is believe that the results of this dispatched research would be used in basic data set for the preparing of polar environment maps. Also the results and developed (or reviewed) processing sequences would be helpful to construct optimal multi-beam processing algorithm of EM-122 system installed in Araon Research Ship.

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제 1 장 서론

제 1 절 연구 목적

본 연구의 목적은 멀티빔 자료 신호 처리를 통해 보다 효율적인 양극 해저면의 물성을 도출하는 방법을 제시하고, 궁극적으로 멀티빔 자료의 결과를 활용하여 양극해 환경 특성 지도 작성을 위한 기본 자료를 제공하는 것이다.

제 2 절 멀티빔 음향 측심기(Multi-Beam Echo Sounder) 개요

1. 기본 개요

해양 조사에 있어 음향을 활용한 수중과 해저면의 정보를 획득하는 기술은 이미 다양한 방식으로 적용되고 있다. 이중, 멀티빔 음향 측심기는 가장 발전된 방식의 음향 활용 정보 획득 방법에 해당되며, 다중의 음향 신호 발생기의 신호를 다중의 음향 수신기에 기록하여, 기본적으로 해저 기록, 해저면 상태 등을 확인하는 기술이다.

멀티빔 음향 측심기는 1960년대 미국 해군이 General Instrument사와 함께 최초로 개발하여 활용한 것으로 알려져 있다(Theberge and Cherkis, 2013). 이 후, 멀티빔 음향 측심기는 해양 공학, 해저자원탐사, 해저 건설 및 공사 등의 발전과 더불어 전 세계적으로 널리 이용되고 있으며, 특히 다중 채널 탄성과 탐사 장비(Multi-channel Seismic Survey Instrument), 해저 지층 탐사기(SBP : Sub-Bottom Profiler) 및 측면 주사 음향측심기(SSS : Side Scan Sonar) 등의 지구물리학적 방법과 함께 이용되고 있다. 음향 혹은 탄성파를 활용하는 다양한 장비 중에서도 멀티빔 음향 측심기는 정확한 위치 정보를 근거로 정밀한 해저 지형을 조사할 수 있게 한다. 뿐만 아니라 멀티빔 음향 측심기는 해저면에 반사되어 되돌아오는 음파의 음압을 기록하여 해저면 영상 자료의 취득도 가능하게 하여, 해양공간 정보를 정확히 획득하고 해저 지형을 면밀히 관찰할 수 있는 매우 유용한 탐사 장비이다. 멀티빔 음향측심기는, 단일빔 음향측심기에 비해 보다 정밀하고, 작업 효율성이 높으며 광대역의 해양 공간 정보를 제공하며, 다양한 보조적인 관측 센서들과 하나의 시스템으로 통합 운영되고 있다(박요섭과 김학일, 1999; 공기수 외, 2006; 정철훈 외, 2006).

군사용으로 처음 개발된 멀티빔 음향측심기는 수십~수백개의 수신기(Hydrophone)와 프로젝터(Projector)로 이루어져 있으며, 탐사선에 수직방향으로 해저면을 주사(Swath)하여, 한번의 송수신(Ping)으로 다중의 빔 자료를 얻는 측심기이다(박요섭과 김학일, 1999). 송신 변환기(transducer)로부터 부채꼴 모양으로 초음파 에너지를 방사하고, 해저면에서 반사 또는 후방 산

란된 에너지를 수신 변환기가 감지한다(김준식 외, 2009).

멀티빔 음향 측심기는 sonar transducer array로 구성되어 각 sonar array의 위상차(phase)를 조절하여 지향각(pointing angle)을 가지는 빔을 생성할 수 있으며, 음파를 발사할 때에는 현방향으로 넓고, 선수방향으로는 빔 폭이 좁은 부채꼴 모양의 빔을 생성하여 발사하고, 수신할 때에는 그와 직교되는 방향으로 여러 개의 빔을 수신하여 두 빔의 직교되는 방향으로 여러 개의 빔을 수신하여 두 빔의 직교되는 시점을 관측하여 경사거리를 측정하게 된다(노정식 외, 2009).

멀티빔 음향측심기는 세밀한 음향신호를 만들어내기 위해서 얇은 빔을 만들어 송신하고 시간 순서대로 수신하는 구조로 되어있다. 음향 빔을 세밀하게 만들어도 전파되는 과정에서 확산되기 때문에 얇은 빔을 만들어 관측 경로를 중심으로 횡방향으로 해상도가 저하된다. 다수의 음향신호를 소나방정식을 이용하여 거리를 계산하고 수신 각도 별로 재구성하여 해저 지형을 복원하게 된다. 심해용 시스템의 경우 12 kHz 이하 주파수의 음향신호를 만들고 기록하는 송수신기 센서가 매우 크기 때문에 설치할 수 있는 선박이 제한된다. 천해용 시스템의 경우 100에서 200 kHz 정도의 음향 신호를 주로 사용하며 연안 쪽을 관측하는 용도로 주로 사용된다. 고해상도 시스템의 경우 300에서 500 kHz 주파수 음향 신호를 사용하여 침몰한 배나 수중 구조물을 검사하는 용도로 사용된다(권광석, 2013).

멀티빔 음향 측심기는 해저의 심도에 해당되는 거리 측정 용도뿐 아니라, 해저면에서 반사 혹은 후방 산란되는 음향 신호의 강도를 통해 해저면의 상태, 다시 말해, 해양 퇴적물의 상태를 간접적으로 추정하는데, 활용될 수 있다. 멀티빔 음향측심기를 이용한 해저면 상태 평가는, 상대적으로 측면 주사 음향 측심기에 비해 정확도와 해상도가 낮지만, 넓은 범위를 빠르게 평가하는 데는 이점을 가지고 있다.

멀티빔 음향 측심기의 핵심 부품은 송신 장치(transmitter)와 수신 장치(receiver)로 그림 1에서 보는 바와 같이 송신 장치는 배의 진행 방향에 수직인 방향으로 음향 빔을 발생시키고, 수신 장치는 배의 진행 방향과 평행한 방향의 음향 신호를 받아내는 방식으로 해저면 전체 평면에서 반사되는 신호를 감지하여 처리할 수 있다.

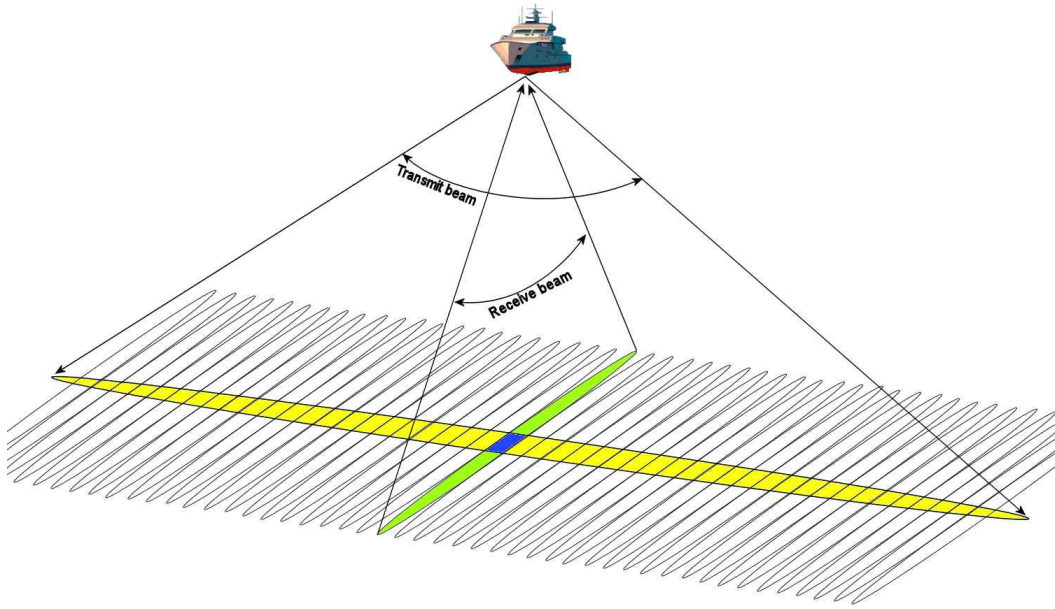


그림 1. 멀티 빔 송신 빔과 수신 빔 관계 (from <http://www.amloceanographic.com/>)

멀티빔 음향 측심기를 통해 획득된 자료는 일반적으로 조사 측선과 해저 기복도의 형식으로 제시되어 정보를 제공한다. 또한 해저면 상태의 경우는 주로 반사 신호의 강도를 흑백 혹은 천연색으로 구분하여 제시하고 특정 강도 범위에 대하여 추정되는 퇴적물을 평면적으로 표시(contour or color map)하거나 혹은 강도 곡선을 특정 구간에 대하여 표시하는 방식(profile)으로 제공한다. 본 위탁 연구 과제에서도 최종 결과는 주로 측선도, 해저 기복도 및 반사 신호 정보로 제공되었으며, 필요에 따라 개별적인 자료 처리 과정을 제시하였다.

2. 멀티빔 음향 측심기의 측심 원리 및 보정 기술

(가) 측심 원리

음향 측심의 기본 원리는 반사되어 온 주시 (travel time)을 이용하는 것으로 요약된다. 일반적으로 음향 측심기는 주제어부, 기록부, 송수신부 등으로 구성되어있다. 주제어부는 음파 신호 발진 주기, 강도, 신호보정 등을 담당하고 있으며 주제어부가 트랜스듀서에 전기적 트리거 신호를 입력하면 트랜스듀서에서 특정 주파수의 음파가 해수면을 향해 방사되며 해저면에서 반사된 반사파는 다시 트랜스듀서에 전달되어 전기적 신호로 수신된다. 이때 송신에서 수신까지 걸린 왕복 주사시간(t)과 수중에서의 음파 전달속도(v)를 곱하여 전달거리(R)로 환산하게 된다.

$$R = \frac{t}{2}v$$

즉 기본적으로 반사되어 되돌아오는 신호를 감지하여 가정된 속도에 따라, 심도를 환산하게 된다. 여기서 중요한 것은 많은 신호 중에서 어떠한 신호가 실제 해저면에서 반사되어 돌아온 신호인지를 구별하는 것으로 이에 대한 다양한 반사 신호 선별 방식이 존재하게 된다.

(나) 멀티빔 음향측심기의 오차 및 보정

멀티빔 음향측심기는 수심의 처리 성과를 높이는 반면, 오작동과 오정렬로 인하여 측심기의 Roll 오차, Pitch 오차, Heading 오차, Tide 오차, 음속도 오차 등을 발생시키는 문제점도 있다. 이들 오차 중, Yaw, Roll, Pitch, Heading은 배가 완전히 고정되지 못하고 끊임없이 움직이는 현상에 의해 나타나는 현상이다. 실제 진행 방향과 뱃머리의 방향의 편차를 Heading, 수직 방향축에 대한 회전을 Yaw, 진행방향 축에 대한 회전을 Roll, 진행방향의 수직한 수평면 축에 대한 회전을 Pitch라 하며(그림 2 참조), 이에 대한 상세한 사항은 다음과 같다.

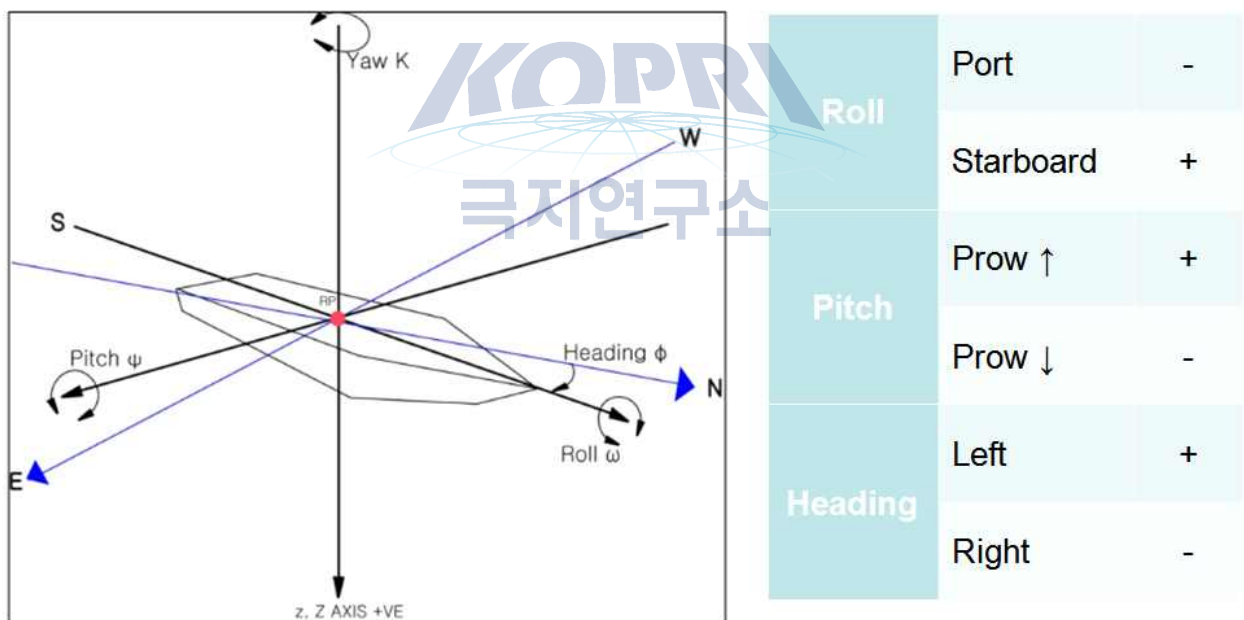


그림 2. 측심 오차를 일으키는 배의 움직임 정의

▪ Roll 및 Pitch 오차

Roll 오차는 수심측량 시 발생하는 오차 가운데 가장 크고 중요한 원인 중에 하나이다. 물에 의한 측심 오차는 평탄한 해저면에서 외곽빔으로 갈수록, 수심이 깊을수록 증가 한다. Roll 보정을 하지 않을 경우 이웃 측선과의 중첩지역 발생하지 않는 미 계측 구간이 생길 수 있다. Roll에 의한 측심의 위치 오에 의한 수심오차는 일정한 Roll 오프셋에 의해 빔이 수심에 비해

그 경사거리가 길어져 수평, 수직 오차를 발생시킨다. Roll 오프셋 값을 보정하기 위해 평탄한 해저면에서 측선을 설계하여 서로 다른 방향으로 탐사를 수행하여 보정해준다.

선체의 Pitch 오차는 소나헤드의 z축 상 거리의 변화에 영향을 미치며 이로 인해 주사폭의 변화에도 영향을 끼친다. 하지만 Pitch 오프셋이 측심 위치 및 수심 측정 결과에 미치는 영향은 다른 오프셋에 비해 상대적으로 적다. Pitch 오프셋의 경우 측위 시각 지연과 거의 같은 현상으로 파악되며, 이를 보정하기 위해서는 일정한 경사가 있는 동일한 측선에서 서로 다른 방향으로 같은 선속을 유지하며 탐사를 수행하여야한다.

MB-system을 활용하여 Roll 및 Pitch 오차를 보정하기 위해서는 mbrollbias 명령과 mbpitchbias 명령이 사용된다. 기본적으로 이 명령을 통해 측선의 일부 중, 유사 지역을 지나간 구간을 활용하여 그 오차 발생을 검토하고 이를 통해 개괄적인 Roll 및 Pitch의 오차를 보정하는 방식이다. 관련 상세 사항은 개별 명령의 상세 설명을 참조할 수 있다.

▪ Yaw 및 Heading 오차

Yaw 오차는 기본적으로 Heading 오차를 야기 시키게 되므로, 보통은 직접 사용되지 않고 Heading 오차의 형태로 보정에 이용되게 된다.

Heading 오차는 자이로 콤파스에서 측정한 선수각 기준과 트랜스듀서의 x축이 이루는 사이각의 오정렬로 발생된다. Heading 오차를 보정하기 위하여 측선은 약 20% 중첩되도록 하고 특정한 해저 목표물을 기준으로 동일한 선속으로 서로 다른 선수방향의 측선을 탐사하여 자료를 취득하고 보정해야한다.

위에 언급한 4가지 배의 흔들림과 관련된 오차 이외에 측정된 심도에 영향을 주는 대표적인 오차는 조석 오차와 음속도 오차가 있다. 조석 오차는 조석 효과에 의해 실제 해수면의 높이가 끊임없이 변화하는 현상으로 인해 발생되며, 음속도 오차는 실제 해양의 바닷물이 일정한 속도를 갖지 않고 수심에 따라 변화하는 현상에 의해 발생하는 오차이다. 이에 대한 설명은 다음과 같다.

▪ 조석(Tide) 오차

바다의 수위는 천체에 의한 인력, 천체와 지구 사이의 지구공전에 의한 원심력, 기압의 변동, 수면의 진동, 장주기 파랑에 의해 끊임없이 변화한다. 이러한 요인에 의하여 해면이 주기적인 승강운동을 하는데, 이를 조석(Tide)이라 한다. 조석 현상은 해양에서의 각종 과정에 큰 영향을 주는 뚜렷한 자연 현상으로 조석의 정확한 파악과 추정 은 매우 중요하다. 해변은 조석으로 인

하여 끊임없이 변화하고 있으므로, 이 높이와 수심 기준면 (datum level)의 차를 시각에 따라 측정 수심에 개정해야 실제 수심이 된다. CARIS HIPS & SIPS 7.0 소프트웨어의 경우 Process 메뉴의 Lode tide를 통해 조석 보정이 가능하다.

- 음속도 오차

수중의 음파 전달 속도를 결정해 주는 값으로 일반적으로 해수의 수피 변동 즉 수온, 수심 및 염분의 변동은 음파의 전달속도와 밀접한 관계를 보인다. 음속은 해양에서 항상 일정 하지 않으며 그 음향의 줄기 또한 똑바로 진행하지 않고 음원에서 전파되어 나감에 따라 굴절된다. 그 기본적인 관련성은 음속도가 다른 층들 사이에서 나타나는 굴절 각도와 관련이 있는 스넬의 법칙 (Snell's Law)에서 주어진다. CARIS HIPS & SIPS 7.0 소프트웨어의 경우, 관측한 다중빔 음향 측심 탐사를 하며 동시에 취득한 SVP (Sound Velocity Profile) 혹은 SSP (Sound Speed Profile) 자료를 SVP editor를 이용하여 속도 보정이 가능하다. 그러나 이러한 음속도 오차 보정을 위해서는 SVP 자료의 확보가 필수적인데, 현장에서 SVP 자료 획득은 한계가 있으므로 제한된 SVP 자료로부터 효과적으로 전반적인 해수층의 속도 분포를 유추하기 위한 노력이 필요하다.

MB-system에서는 Mbvelocitytool을 통해 수중 음파 속도를 보정하며, 특별한 수중 음파 속도 정보가 없는 경우에는 그 동안 오랜 시간에 걸쳐 전 세계적으로 수집된 자료를 데이터 베이스로 활용하는 MbLevitus 프로그램을 활용하여 개략적인 SVP 자료를 추정 활용 가능하다. Mbvelocitytool을 이용하여 측심을 보정하는 일련의 과정은 이 후의 주요 연구 내용 관련 부분에서 다시 설명한다.

제 2 장 국내외 기술개발 현황

기존 단일빔 음향 측심기는 수심이 측정되는 위치가 선박의 직하부 해저바닥에 국한되므로, 탐사측선 간격이 좁을수록 정밀한 성과를 얻을 수 있었으며 조사해역전체에 대한 해저지형은 등수심선으로 표현되었다. 한편, 멀티빔 음향 측심기를 사용하면 넓은 해역을 짧은 기간 내에 조사할 수 있을 뿐만 아니라 자료의 양이 방대하여 해저 지형을 3차원적으로 상세하게 표현할 수 있다.

국-내외 기술과 장비가 발전하면서 멀티빔의 활용뿐만 해석과 처리에도 많은 연구가 진행되고 있다. 정밀한 해저 지형조사에 필수 장비로 알려진 멀티빔 음향측심기는 정확한 수심 및 해저지형을 파악할 수 있어서 선박의 안전한 항해에 이용되며, 해난사고의 발생 근원인 해저면 위험 요소 조사와 해저퇴적물의 이동 및 변화 등에 대한 연구에 많이 이용된다. 국내에 사용 예로 해저 가스배관 조사, 침선 조사, 인공어초 조사 및 해저 분화구 조사 등의 연구가 진행되었다(김준식 외, 2009).

극지 환경의 이해는 미래의 환경변화 대응과 전 세계적인 관심사인 기후변화와 에너지 문제를 해결하는데 객관적인 근거 제공의 기회를 부여한다고 할 수 있다. 또한 최근 해양조사의 수요는 전 세계적으로 꾸준히 증가하고 있으며, 이러한 해양 조사는 해저 환경의 이해뿐 아니라 해저자원개발과 기타 인류의 해양공간 활용을 위한 기초가 되고 있다. 특히 멀티빔 음향 측심기를 이용한 정밀조사는 해저면 지도 작성은 물론 반복적 조사를 통해 해저환경의 변화를 직접적으로 알아내는데 크게 기여할 수 있다.

일반적으로 해양에서 음원과를 사용하는 시스템은 SONAR(Sound NAVigation and Range), 로 불리우며, 원리적으로 레이더 및 전자광학 시스템과 유사하다(Hodges, 2010). 1980년대 경부터 멀티빔 시스템이 등장하면서 정확한 위치정보를 근거한 정밀수심 자료와 해저면 영상자료의 취득이 가능하게 되었으며 1990년대 말에는 후방산란 음압자료를 이용한 해저표층퇴적물의 특성분류 시도가 시작되었다. 최근에는 음향특성을 고려하여, 해저면에서 반사되는 음향특성과 퇴적물의 지질학적 특성간의 상관 관계를 정량화하려는 연구가 꾸준히 진행되고 있다(Gonidec et al., 2003; Tang et al., 2005).

멀티빔 시스템은 우리나라에 1990년대 초 도입되기 시작하여 주로 해양수로 조사에 이용되었으며 후방산란 음압자료를 이용한 해저면 특성에 대한 연구는 많이 이루어지지 않다가 1990년대 후반부터 후방산란 음압의 오차 요인을 분석 처리하는 연구가 수행되면서 시작된 것으로 알려져 있다(박요섭, 2004). 또한 극지연구소에서 아라온호를 도입하면서 아라온호에 장착된 고

성능의 멀티빔 장치에 의해 매년 다양한 연구 과제의 일환으로 꾸준히 멀티빔 자료가 획득되고 있다. 본 연구 과제 수행을 위한 양극해 및 국내 연근해 (주로 동해) 시험 항해를 통해서도 멀티빔 자료가 착실하게 획득 보관되고 있다. 한편 국내의 경우, 울릉도와 독도 근해에서 정밀한 퇴적물 분포에 대한 연구가 최근에 수행된 바 있다(이명훈 등, 2015).

한편 최근 들어 간섭 효과 (interferometry) 기법을 이용하여 보다 정밀하고 신뢰도 높은 해저 심도 정보를 획득하는 연구들이 발표되고 있다(Kraeutner and Bird, 1999; Llorc-Pujol et. al, 2006; Llorc-Pujol et. al, 2012). 간섭 효과 기법은 기본적으로 이격되어 수신된 신호들끼리의 상호 상관 분석을 통해 일반적으로 놓칠 수 있는 신호를 향상 시키고, 사용하는 음파의 기본 파장의 한계로 인한 심도 오차를 최소화하는 기법으로 설명할 수 있다. 그림 3은 수신기들 사이에 생기는 기본적인 신호 도달 시간 차이에 대한 기하학적 해석을 보여주며, 결국 이러한 신호의 차이를 상호 상관을 통해 부각시켜 보다 정밀한 해저 심도 정보를 획득하게 된다.

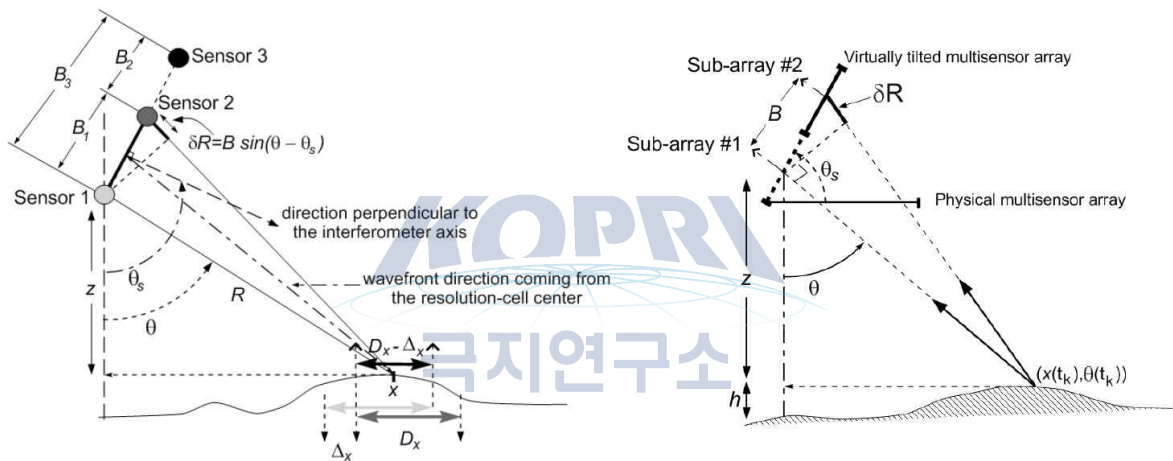


그림 3 음향 간섭 효과를 활용한 해저 심도 신뢰성 향상 기법 기본 원리 설명 사례 (Llorc-Pujol et. al, 2012)

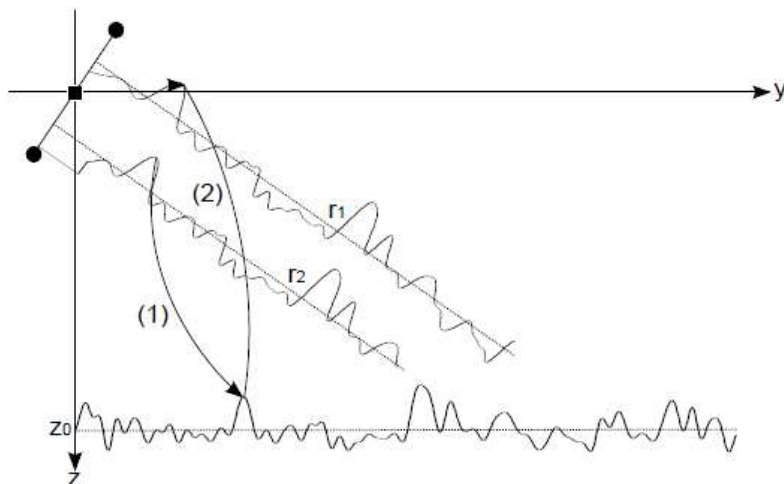


그림 4 . 인접한 두 수신기 상화 상관에 의한 간섭 신호 부각 사례 (Saeboe, 2010)

그림 5는 간섭 효과를 통해 기존 멀티빔 자료에서 부각 시키지 못했던 부위를 정밀하게 부각 시킨 해외 연구 사례를 보여주고 있다. 이러한 간섭 효과에 대한 연구는 본 위탁 연구 범위에 포함되지는 않지만 향후 양극해에서 얻어지는 멀티빔 자료에 대한 높은 정밀도의 해저면 자료가 필요한 경우, 연구해 볼 과제로 판단된다.

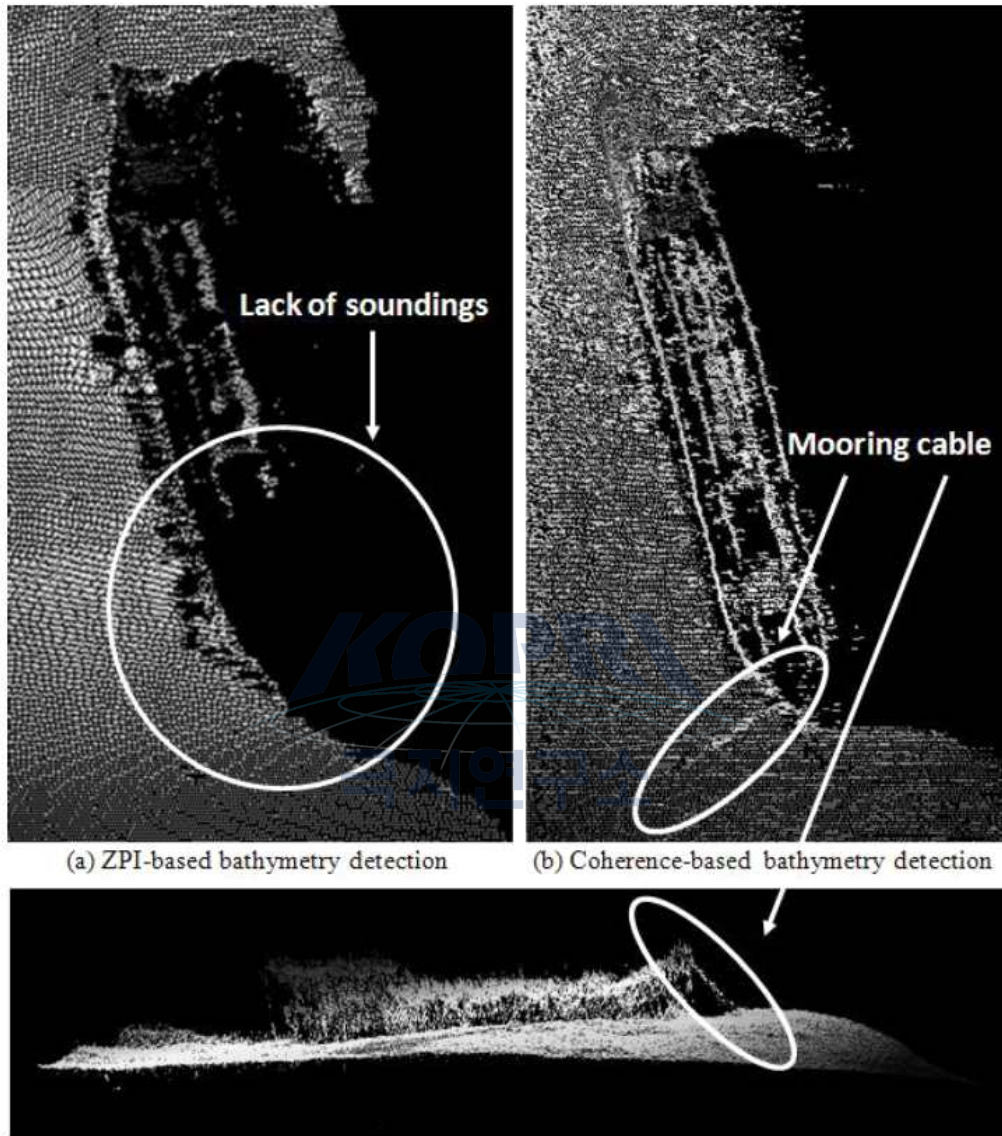


그림 5 상관 분석을 통해 정밀 분석된 해저 심도 자료 사례
(Llort-Pujol et. al, 2012)

앞으로 국제적인 수준의 멀티빔 자료 활용 자료 처리 기술 및 해석 기술의 개발은 국가 경쟁력 고양을 위해 매우 필수적인 기술이라고 할 수 있다. 현재 수행된 본 위탁 과제는, 신뢰성 있는 멀티빔 자료 확보를 위해 기본적으로 상업용/공개용 기존 프로그램을 통해 잡음 제거와 다양한 현장 획득 자료에 대한 보정 수행 그리고 일부 관심 구역에 대한 해저면 퇴적물 특성을 후방 산란 신호 분석 처리를 통해 조사하는 내용으로 연구 수행 범위가 한정되어 수행되었지만, 향후 경쟁력 있는 국제적인 수준의 멀티빔 관련 자료 처리 기술 확보를 위해 직접적인

프로그램 개발, 간섭 기법 적용 연구와 더불어 필요하다면 멀티빔 자료 획득 장치의 개선 등을 통해 보다 신뢰성 있는, 해양 환경과 양극해 환경을 이해하기 위한 기초 자료 확보를 위한 연구 투자가 필요할 것으로 생각된다.



제 3 장 연구방법, 주요 연구 내용 및 결과

본 장에서는 기본적으로 본 위탁 연구 과제를 통해 수행된 연구의 방법, 주요 내용 및 결과를 정리하여 기술하였다. 기존에 제출된 연차 보고서들을 통해 해당 년도의 연구 내용을 알 수 있으므로, 본 최종 위탁 보고서에서는 이들 내용을 연차별로 정리하지 않고, 주로 적용된 연구 방법과 연구 지역 등에 따라 구분하여 기술하는 방식을 취하였다. 또한 연차 보고서의 내용들을 기본으로 하였으며, 일부 오류가 있거나 미흡한 부분의 내용은 보완하여 기술하였다.

제 1 절 연구 방법

쇄빙연구선 아라온호에 장착된 Kongsberg사의 EM-122의 제원 분석은 기본적으로 기존 아라온호 관련 문헌 분석과 더불어 동해에서 2차에 걸쳐 수행된 (2012년 6월, 2014년 5월) 시험 항해에 연구원이 직접 승선하는 방식으로 수행되었다. 시험 항해 중, 실제 멀티 빔 자료 획득 운영 시스템에 대한 작동 과정을 기록하고 정리하였고, 현장에서 확인 가능한 자료와 추후 자료 처리를 위해 저장되는 자료에 대한 구분을 수행하였다.

시험 항해와 양극해에서 획득된 자료는 상업용 프로그램인 CARIS HIPS and SIPS (version 7.0, 운영체제 Windows, 극지연구소 구매 라이선스 확보)를 통한 방식과 공개용 프로그램인 MB-system (version 5.5, 운영체제 Linux/Ubuntu 14.04LT 배포판에 설치)를 통한 방식으로 주로 처리되었다. 자료 처리 과정에서 필요한 경우 자체적으로 작성된 간단한 스크립트나 프로그램을 활용하여 작업의 편의성을 도모하기도 하였다.

활용된 멀티빔 자료 처리 프로그램인 CARIS HIPS and SIPS와 MB-system은, 본 위탁 연구 과제에서 수행한 잡음 제거 및 보정 등을 통한 해저 기복도 작성과 후방 산란 신호를 이용한 해저면 특성 분석 이외에도 다양한 기능을 갖추고 있지만, 본 보고서에는 수행한 연구와 직접적으로 관련된 필요 부분에 대한 설명을 중심으로, 제 2 절 주요 연구 내용에 주로 기술하였다.

제 2 절 주요 연구 내용

1. 아라온호 설치 멀티빔 시스템 EM-122 제원 현황 및 운영 방법 분석

쇄빙연구선 아라온호에 장착된 Kongsberg사의 EM-122는 현재 제작, 판매되고 있는 멀티빔 음향 측심 시스템 중, 가장 깊은 심도까지의 해저면 조사가 가능한 고성능 멀티빔 장치다. 그림 6은 Kongsberg사에서 현재 제작 시판하는 대표적인 멀티빔 음향측심 장비들의 최대 조사 심도를 도식적으로 보여주고 있다.



그림 6. Kongsberg 멀티빔 음향측심 장비 최대 조사 심도 개념도

(source : www.km.kongsberg.com)

EM-122 멀티빔 음향 측심 장비는, 수중음파 탐지기 주파수 대역으로 12 kHz를 사용하며, 빔의 각도는 최대 150°까지 가능하지만, 아라온의 경우, 보통 좌우 70°씩 140°로 설정되어 사용되고 있다. 빔의 각도를 140°로 설정 할 경우, 수심의 약 3~5 배에 해당하는 해저면의 횡단면 스캔이 가능하며, 빔의 각도 및 범위는 제어를 자동으로 설정할 수 있어 해저면의 깊이에 따라 관측되는 폭의 범위도 자동으로 변환시킬 수 있다.

최소/최대 조사 심도는 20~11,000m로 아주 낮은 연근해와 매우 깊은 해구를 제외하고는 거의 모든 바다에서 조사를 수행할 수 있는 우수한 장비이다. 개별 구역으로 분할된 송신 팬은 항해 시 RPY 3축(roll, pitch, yaw)에 따라 독립적으로 활성화되어 운영되며, 항해 시 해양의 흐름과 파고로 발생하는 측정 오류를 특정 범위 내에서는 자동으로 보정이 가능하다. 평의 비

율은 주로 물의 왕복 소요시간에 의해 5 Hz (초당 5회)로 제한된다. 이 장비를 통해 넓은 범위의 해저면 데이터를 보다 정확하게 고 해상도로 얻을 수 있다.

한편, 다른 조사 장비(sub-bottom profiler, side scan sonar, seismic survey system 등)와 통합 운영이 가능하다. EM-122 장비에 대한 상세한 제원과 특성은 별도 부록 자료 (EM-122 Specification)로 보고서 뒤에 첨부하였다.

그림 7은 아라온호에 장착된 EM-122의 시스템 기본 구성도를 보여주고 있으며, 그림 8 및 9는 실제 아라온호에서 촬영된 EM-system과 자료 획득 운영 과정 및 시스템 일부를 보여주고 있다.

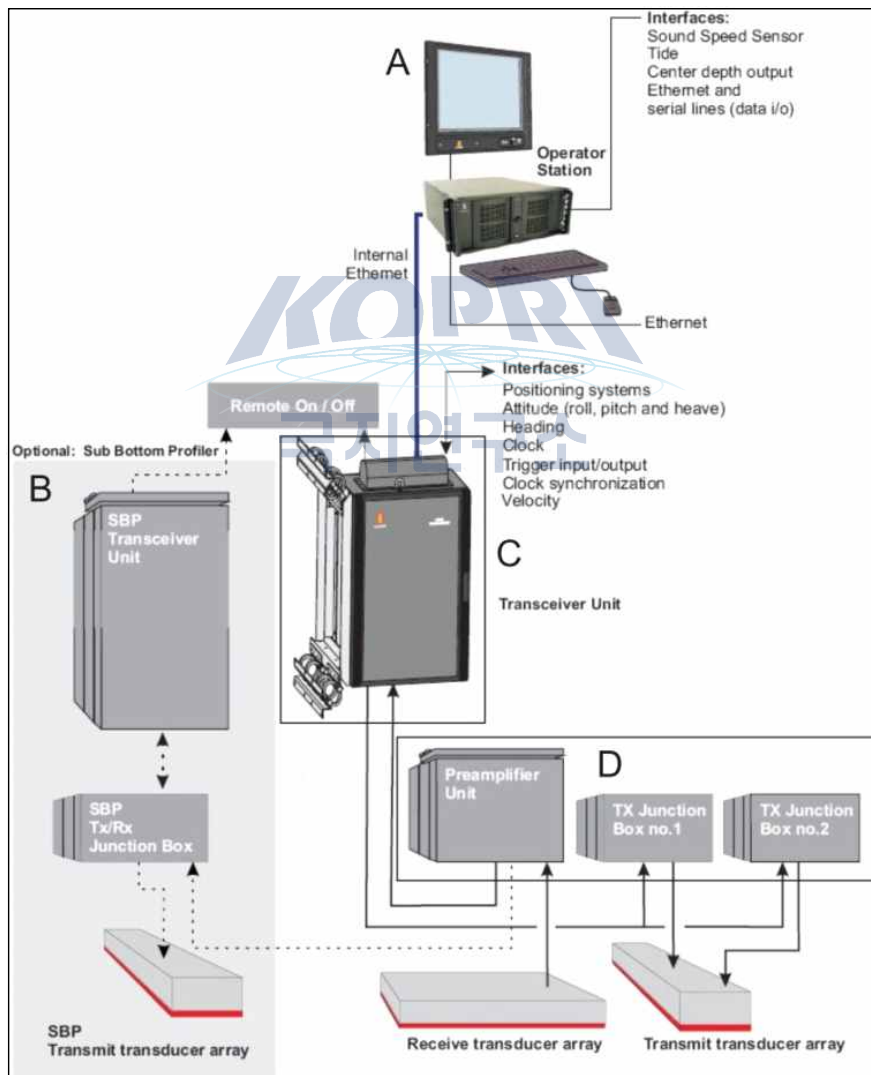


그림 7. 아라온호에 장착된 멀티빔 EM-122 시스템 구성
(A: 운영 시스템, B: SBP 송신 장치(옵션 장치), C: 멀티빔 송수신부 및 신호 처리부)

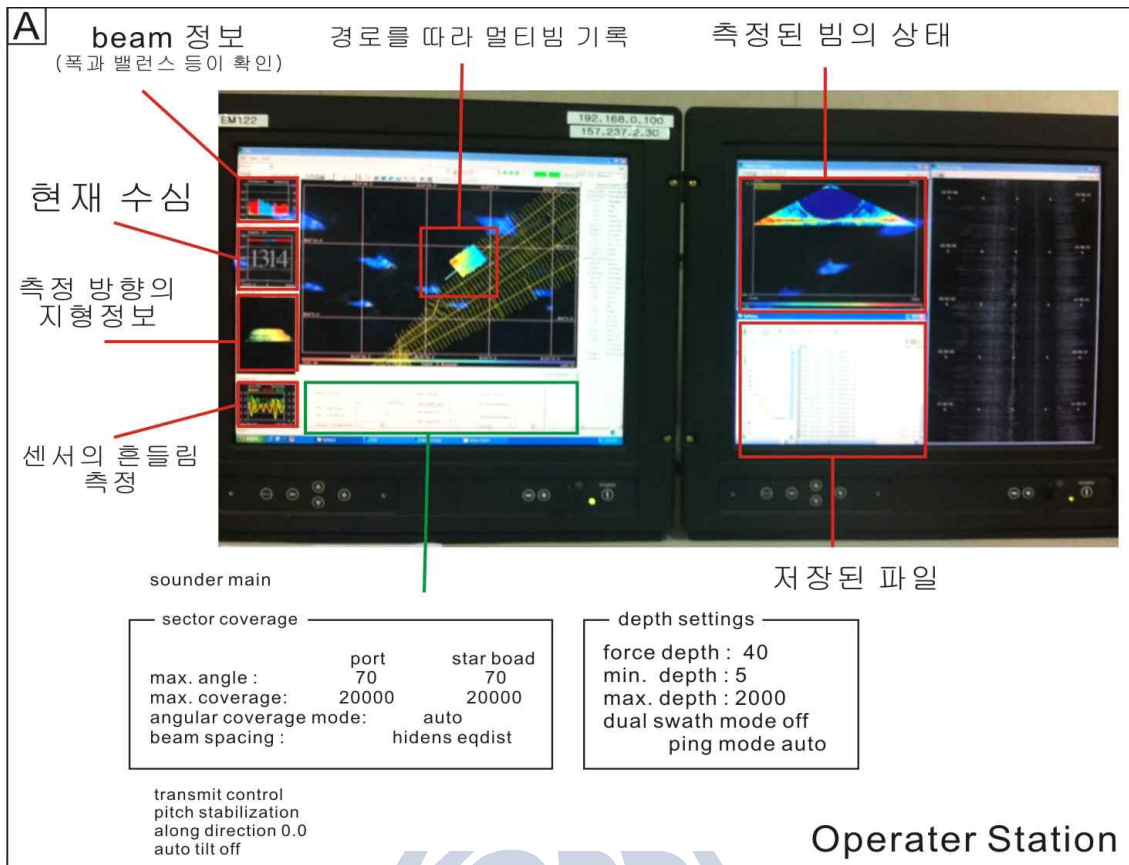


그림 8 아라온호에 설치된 EM-122 시스템

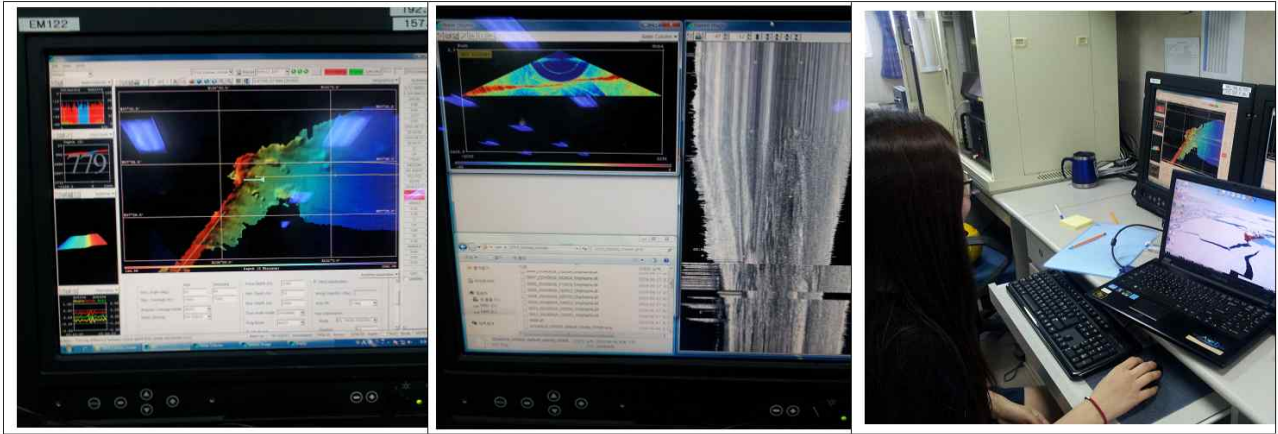


그림 9 아라온호 EM-122 멀티빔 자료 획득 운영 시스템 (2014년 동해 시험 항해 시 촬영)

강한 음향 신호를 발생 시키는 송신 변환기(Transmit transducer)는 빔 폭에 따라 96개의 모듈로 구성되어있으며, 각 모듈은 16개의 요소가 포함되어 있다. 각각의 요소는 개별적으로 TX 접속 배선함(TX Junction box)을 통해 연결되어 있고, 이를 통해 진폭의 범위와 송신 운영에 필요한 분야를 구동할 수 있다. 해저면에 반사되어 돌아온 신호는 수신 변환기(Receive transducer)를 통해 획득하여 전치 증폭기(Preamplifier unit)로 신호의 감쇠 및 신호잡음비(S/N)의 저하를 막고 송수신기(Transceiver unit)로 전송한다. 송수신기는 고성능의 제어장치와 연결되어 장비의 모든 매개 변수의 제어하고 작동시킨다.

한편, 현재 아라온의 자료 획득 운영 시스템은 자료 취득과 동시에 수심 분포에 대한 예비 처리 도면을 볼 수 있고 위치 설정 (geo-referencing)이 충분하지 않은 상태에서의 후방 산란 신호 강도 (seabed image)를 개괄적으로 볼 수 있다. 또한 획득되는 beam 신호를 조사선 진행 방향의 수직 단면 형태로 볼 수 있는 water column (혹은 beam fan)을 실시간으로 화면상에서 확인 할 수 있지만(그림 10 참조), 이 신호들에 대한 자료 저장 시스템은 현재 구비되어 있지 않아 후처리 등을 통한 해저면의 정밀한 특성 분석은 가능하지 않다.

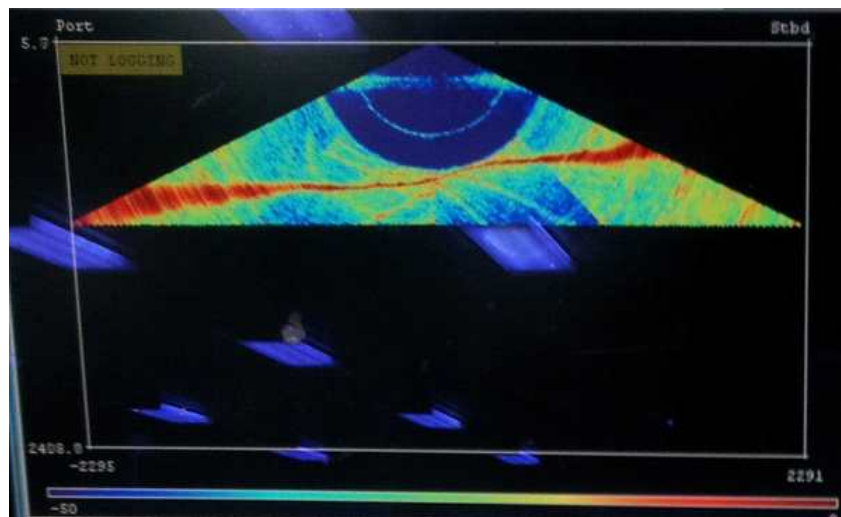


그림 10 아라온 멀티빔 운영시스템 water column 자료 실시간 도시 영상

향후 해저면의 열수 분출이나 가스 분출 등에 대한 정보 획득을 위해서는 water column 자료를 저장할 수 있는 시스템이 필요할 것으로 생각된다. 이러한 자료 저장 시스템은 시간에 대한 신호 강도 자료(time series amplitude)를 조사 구간 (range)에 대해 전체적으로 기록하므로, 다양한 해저면 정보를 매우 정밀하게 제공할 수 있는 것으로 알려져 있다. 그림 11은 실제 해외에서 water column 자료를 통해 해저면에서 분출되는 gas plume을 정확히 조사해 낸 사례를 보여주고 있다.

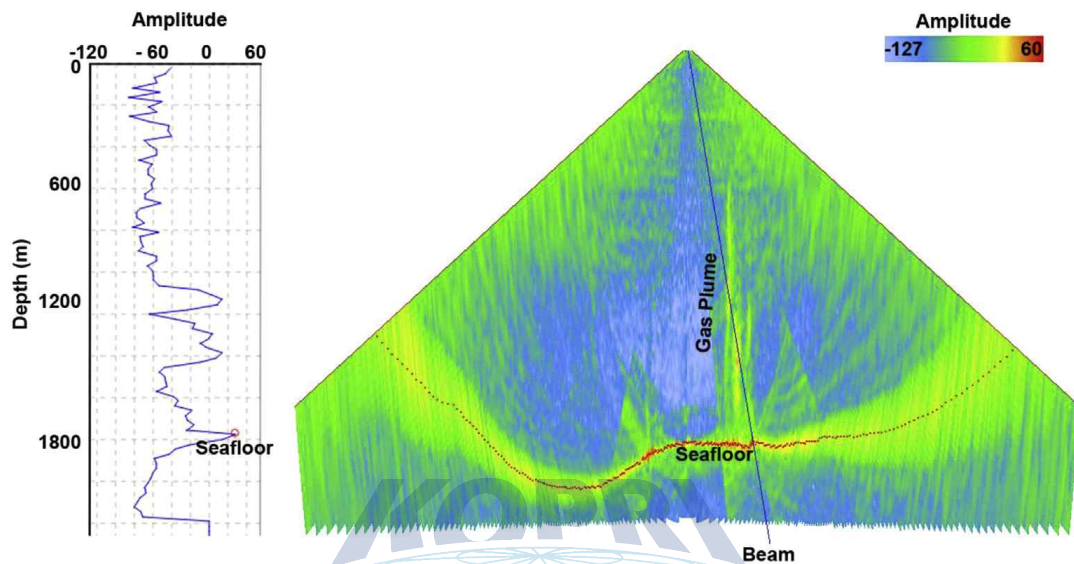


그림 11 Water column (beam fan) 자료를 이용한 해저 gas plume 조사 사례
(source : www.qps.nl/display/main/2015/06/17/20150617_UniversityHouston)

2. CARIS HIPS and SIPS 활용 해저 지형 조사 및 해저면 특성 분석 수행

CARIS HIPS and SIPS 프로그램은 대표적인 상용 멀티빔 자료 처리 소프트웨어로 2016년 현재 version 9.1까지 출시되어 있으나, 본 위탁 연구에서는 극지연구소가 구매하여 사용권을 가지고 있는 version 7.0을 활용하여 연구를 수행하였다. 본 소프트웨어 활용은 자체적인 도움말 기능을 통해 가능하지만, Caris사에서 제공하는 HIPS and SIPS 7.0 User's Guide(Caris, 2009)를 통해 체계적인 기능과 활용법을 숙지할 수 있다. 이 사용자 설명서 (User's Guide)는 부록에 차례를 소개하여 주요 내용을 파악할 수 있도록 조치하였다.

동해에서 수행된 시험 항해 자료 일부와 남극 로스해에서 획득된 자료 그리고 북극 척치해에서 획득된 자료들이 CARIS HIPS and SIPS 프로그램을 통해 처리되어 해저 지형도 (bathymetry map)로 작성되었으며, 이 때, 잡음 제거 및 처리 방식별 해저 지형 차이에 대한 고찰이 수행되었다. 또한 Geocoder 도구를 통해 해저면 퇴적물 특성 규명이 수행되었으나 실측된 퇴적물을 통한 확인이 수반되지 않아 절대적인 퇴적물 분류로는 한계가 있다고 판단된다.

그림 12는 CARIS HIPS and SIPS 사용자 설명서에 제시된 멀티빔 자료의 처리를 통한 해저 지형 조사의 일반적인 흐름도를 보여주고 있다. 한편 상술한 바와 같이 본 위탁 연구에서는 해저 지형 조사를 위한 아래의 일반적 자료 처리 업무 흐름 이외에 후방 산란 신호의 강도를 통한 퇴적물 분석이 Geocoder 도구를 통해 수행되었다.

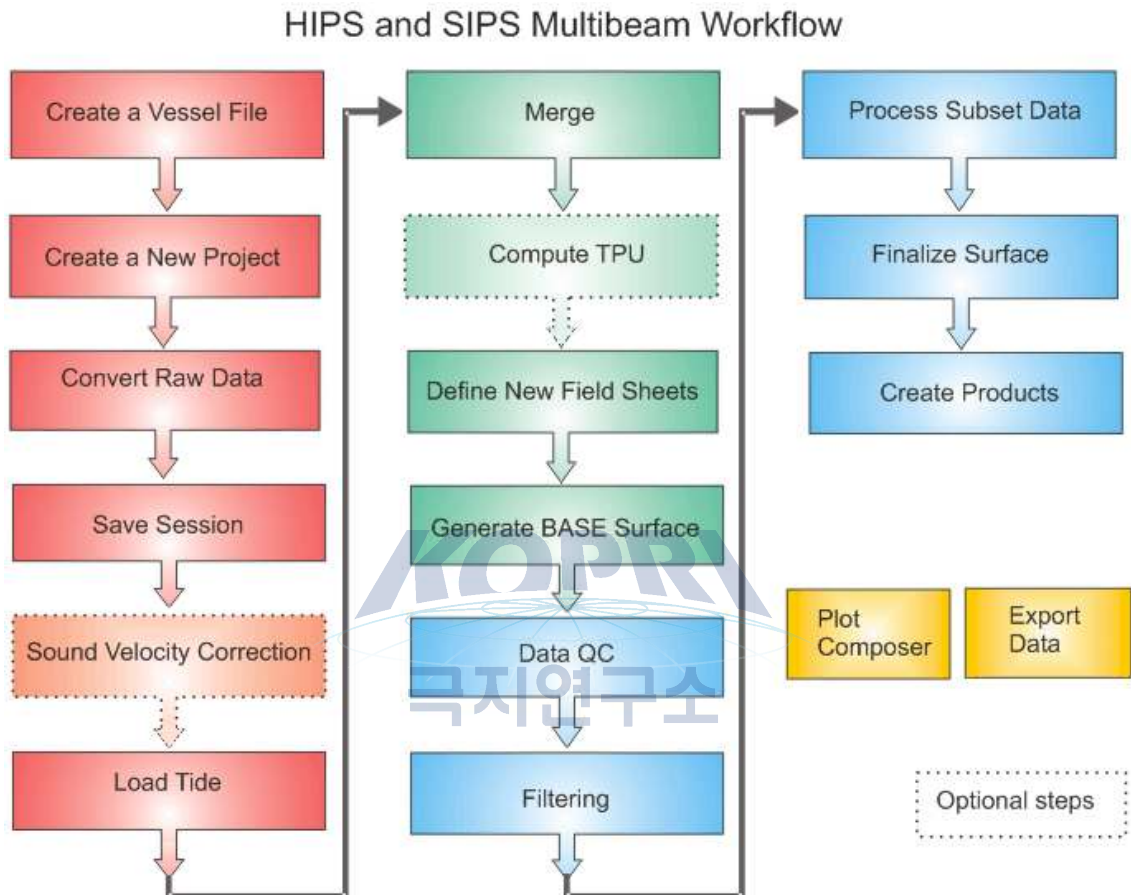


그림 12. CARIS HIPS and SIPS 해저 지형 도출 업무 처리 흐름도

획득된 멀티빔 원시 자료는 위의 흐름도에서 알 수 있듯이 조사선 특성 파일 (Vessel File) 을 이용하여 기본적인 멀티빔 장착 상태를 파악하게 된다. 이후, 기록에 사용된 측지 좌표계 정보, 멀티빔 자료 획득 장치와 기록 방식 등이 제공된 후, CARIS HIPS and SIPS에서 활용하는 파일 형식으로 전환된다. 보통 용량이 큰 자료의 경우, 이 전환 과정은 많은 시간이 소요되므로 높은 사양의 서버급 컴퓨터가 필수적이다. 또한 자료 전환이 이루어지면 대부분 원시 자료 이외의 추가적인 별도 파일이 생성되므로 대용량 별도 저장 장치가 준비되지 않으면 자료 처리를 진행하는 것이 곤란해 질 수 있다.

CARIS HIPS and SIPS 7.0는 자료 전환이 정상적으로 수행되면, 멀티빔 자료가 획득된 조사 측선을 도시 할 수 있다. 조사 측선의 도시는 가장 기본적이고 향후 특정 위치 선택, 특정

구간에 대한 자료 처리 등에 필수적인 사항이다. 보통 조사 측선이 그림으로 표현되는 부분을 CARIS HIPS and SIPS 7.0에서는 Display window라고 명명하며, 이들 조사 측선들에 대한 일련의 구조와 내부적인 정보는 다양한 window에서 확인할 수 있도록 구성되어 있다(그림 13 참조). 그림 14는 실제 2013년 2월 남극 로스해에서 수행된 멀티빔 조사 측선을 CARIS HIPS and SIPS 7.0를 이용하여 도시한 결과이다.

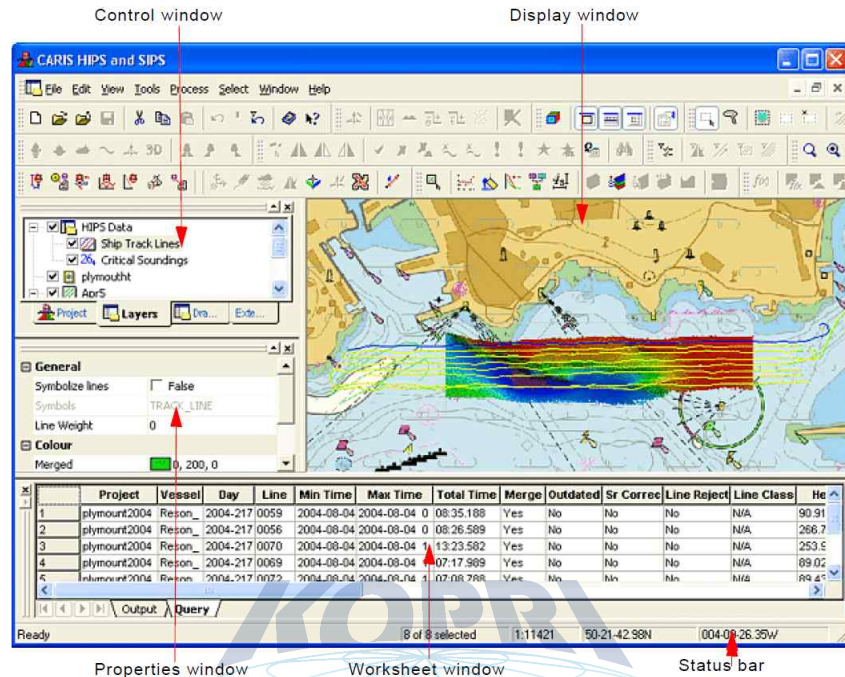


그림 13. CARIS HIPS and SIPS 7.0 기본 창 구조 사례

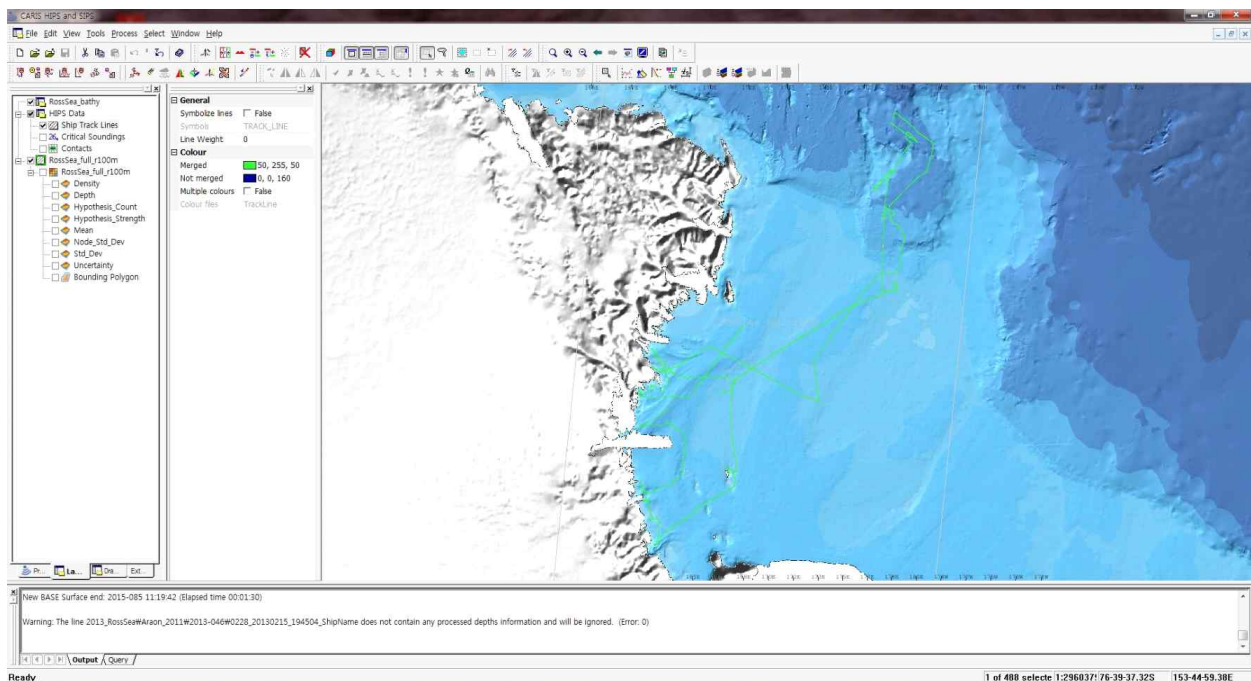


그림 14. CARIS HIPS and SIPS 7.0 이용 남극 로스해 조사 측선 도시 사례 (전체 화면)

(가) 멀티빔 신호 기본 처리 및 해저 지형 도출

원시 자료에서 전환된 멀티빔 자료는 일차적으로 3차원적인 좌표에 대한 보정과 위치 오차 보정이 수반되며, 그 처리 과정은 다음과 같이 정리된다. 조사선은 해수면에서 유수의 움직임에 의해 특정 기준점 (Reference Point)을 중심으로 3차원 회전체 운동을 한다. 이러한 운동은 제 1 장 서론부 그림 2에 설명되어 있다. 선체에 부착된 모션센서의 기준좌표계 (x, y, z)를 중심으로 x축을 기준으로 한 회전을 롤 (Roll), y축을 기준으로 한 회전을 피치 (Pitch), z축을 기준으로 한 회전을 헤딩 (Heading)이라 한다.

조사선의 거동과 연관된 회전은 Euler각도 ω , ψ 로 정의하며 변환행렬로 표현된다. 각도 ω 는 x축을 중심으로 회전하는 롤을 의미하며 우현이 내려가는 방향을 양으로 정한다. 각도 ψ 는 y축을 중심으로 한 회전인 피치를 의미하고 선수가 올라가는 방향을 양으로 정한다. z축을 기준으로 한 회 선수방향의 회전을 헤딩이라 정의하며 시계방향을 양으로 정한다. 거리기준점은 선박의 무게중심점 (선박거동의 중심)으로 결정하며, 이 기준점이 위치 및 수심정보에 대한 기준점이 된다.

멀티빔 자료 파일에는 탐사선의 위치에 대한 정보가 저장되어 있다. 이는 보통 WGS84 체계의 경위도좌표 값으로 GPS 위성 항법 자료이다. 이 자료를 검토해 보면, 위치 정보가 연속된 위치 자료가 아닌 비상식적으로 벗어나 있는 다른 위치에 표시되는 경우가 간혹 발생된다. 이러한 원인은 GPS 수신 장치의 교란 혹은 불량이나 전파 간섭 등에 의해 일어날 수 있다. 잘못된 탐사선의 위치정보는 수신된 빔의 위치 결정에도 동일하게 잘못된 정보로 나타나며, 이러한 결과는 해저 지형에 오차를 발생시킨다. 따라서 이러한 탐사선 위치 오차는 반드시 제거되어야 한다. 보통 CARIS사의 HIPS & SIPS 7.0 소프트웨어의 경우에는 Navigation editor를 사용하여 조사선의 조사 측선 위치 등을 검토와 보정이 가능하다. 참조로 MB-System의 경우 조사 측선 위치의 검토와 보정은 mbnaveedit와 mbnavadjust로 가능하다.

멀티빔 자료를 통해 해저 심도를 알아내기 위해서 필요한 주요 정보는 수중의 음파 전달 속도에 대한 정보가 요구된다. 실제 멀티빔 자료에 기록되는 값은 신호의 강도와 주시 시간이므로 실제 수심을 알아내기 위해서는 수중 음파 전달 속도가 필수적이다. 그러나, 해양의 수중 음파 전달 속도는 실제로 수심별, 위치별로 변화하므로 이에 대한 정보와 이를 통한 음속/심도 보정이 필요하다. 보통 수중의 음파 전달 속도를 결정해 주는 값으로 일반적으로 해수의 수피 변동 즉 수온, 수심 및 염분의 변동은 음파의 전달속도와 밀접한 관계를 보인다.

해양에서 음파 전달 속도는 항상 일정 하지 않으므로 그 음향의 파선 또한 똑바로 진행하지 않고 매체 (바닷물)의 속도 분포에 따라 완만히 굴절된다. 그 기본적인 관련성은 음속도가 다른 층들 사이의 굴절 각도와 관련이 있고 이러한 굴절 각도는 잘 알려진 스넬의 법칙

(Snell's Law)에 따른다. CARIS HIPS & SIPS 7.0 소프트웨어의 경우, 실측된 SVP 자료를 활용하거나, 다중빔 음향 측심 탐사를 하며 동시에 예측된 SVP (Sound Velocity Profile) 자료를 이용하여 심도를 결정한다. 또한 필요한 경우, SVP editor를 이용하여 해수층의 속도 보정이 가능하다. 확보된 SVP 자료를 통해 심도/속도 보정을 수행하였다

다음 그림 15는 CARIS HIPS and SIPS를 사용하여 2012년 6월에 동해에서 수행된 시험 항해시 얻어진 자료에 대한 기본적인 보정 작업 (변경 혹은 삭제)과 편집 작업을 수행하고 있는 사례를 보여준다.

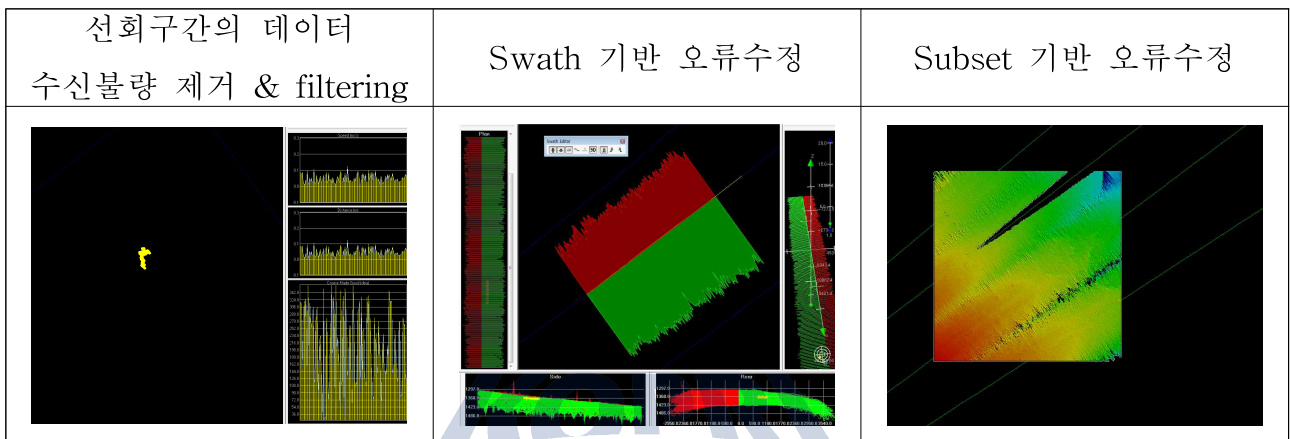


그림 15. CARIS HIPS and SIPS를 활용한 멀티빔 오류 수정 작업 사례

CARIS HIPS and SIPS 7.0 소프트웨어를 사용하여 멀티빔 신호에 대한 조석 보정 전후 신호를 비교 그림은 그림 16과 그림 17에 주어져 있으며, 조석 효과가 크지 않은 지역으로 신호에 현저한 변화가 관찰되지는 않지만, 조석 효과 보정 후 신호의 정렬 상태가 다소 좋아진 것으로 볼 수 있다.

마찬가지로 서브셋 (특정 부위)보정 (삭제, cleaning) 작업 사례는 그림 18에 주어져 있으며, 삭제 보정된 신호는 회색으로 표시되어 있다.

그림 19은, 2013년 2월 남극 로스해에서 수행된 멀티빔 조사에 대한 해저 심도 도시 처리를 기본적인 처리 과정만 적용하여 얻어진 결과 사례를 보여준다. 붉은 색 계통은 상대적으로 낮은 수심을, 푸른색 계통은 상대적으로 깊은 수심을 지시한다. 그림 19는, 그림 14의 CARIS HIPS and SIPS 기본 상태에서 해저면 도출 처리가 수행된 결과이며, 이러한 해저면 도출을 위한 일련의 과정은 SWATH editor, CUBE editor 등을 통해 이상 신호들을 제거, 보완하는 과정을 거치는 것이 일반적이다.

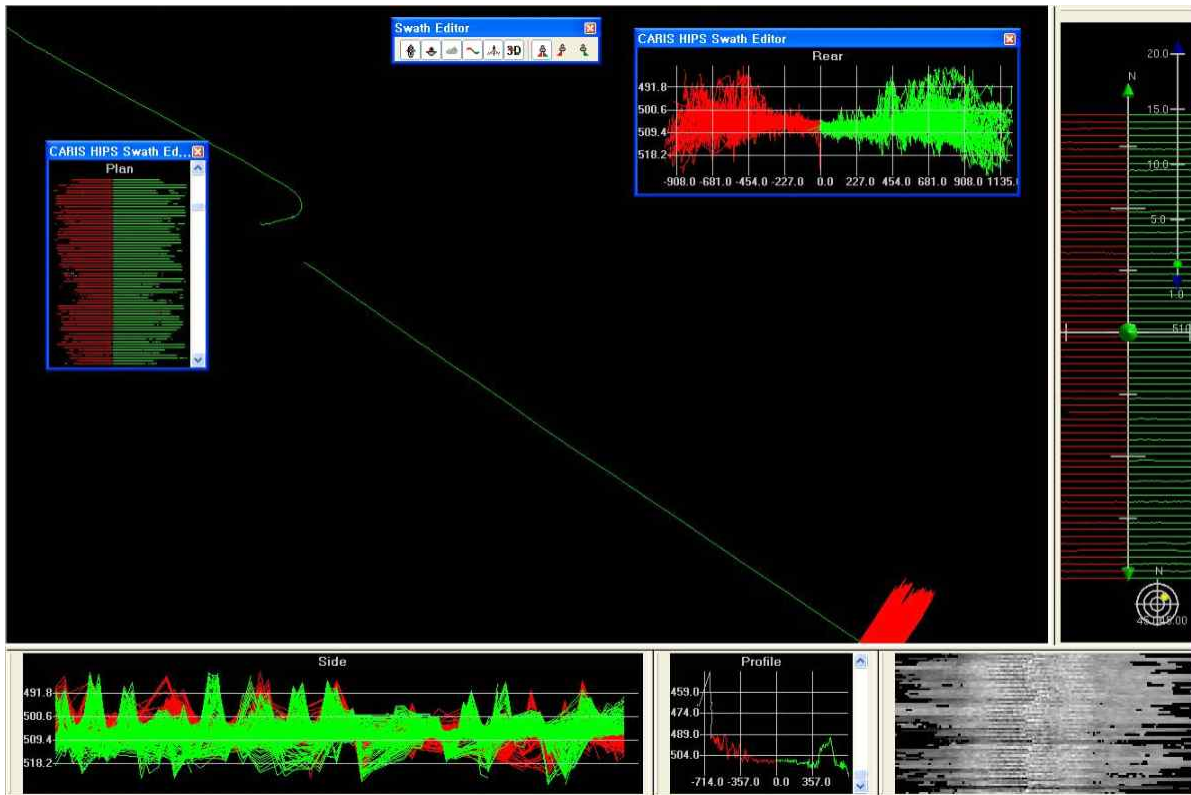


그림 16. 조석 보정 이전 멀티빔 신호 분포 (남극 로스해 2013년 3월 자료)

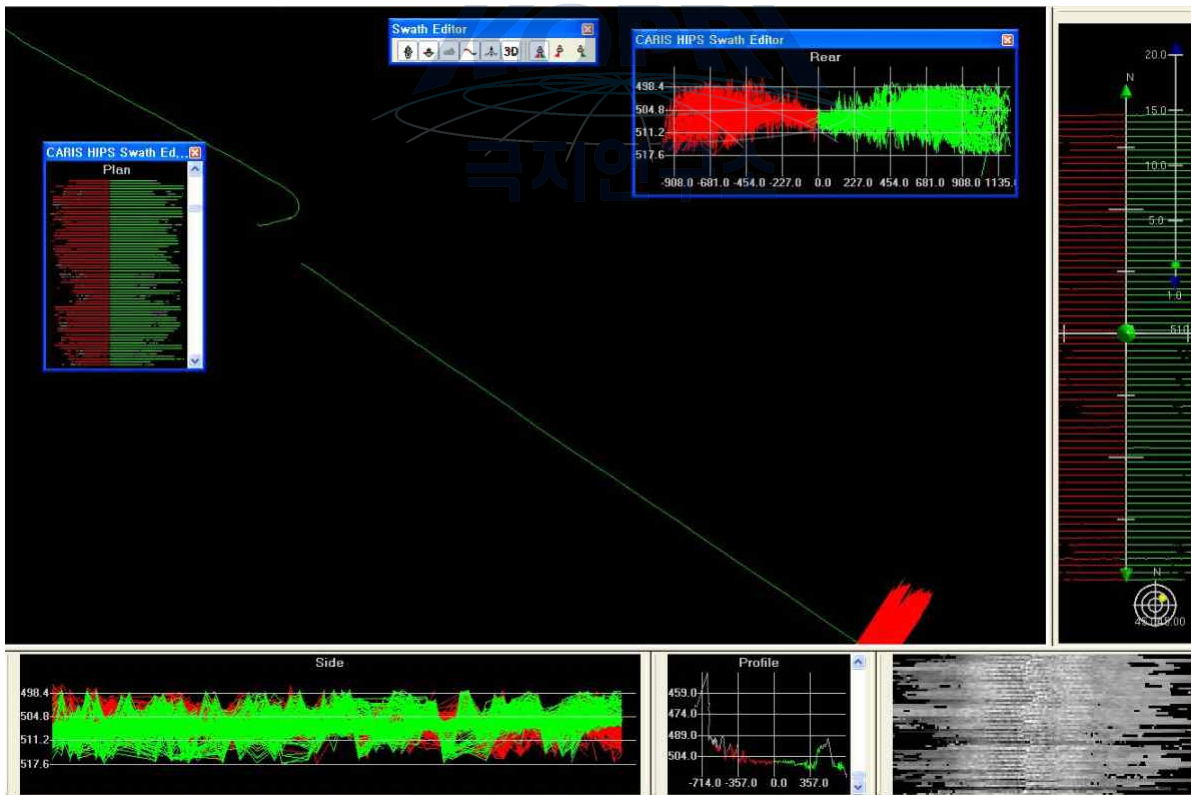


그림 17. 조석 보정 이후 멀티빔 신호 분포 (남극 로스해 2013년 3월 자료)

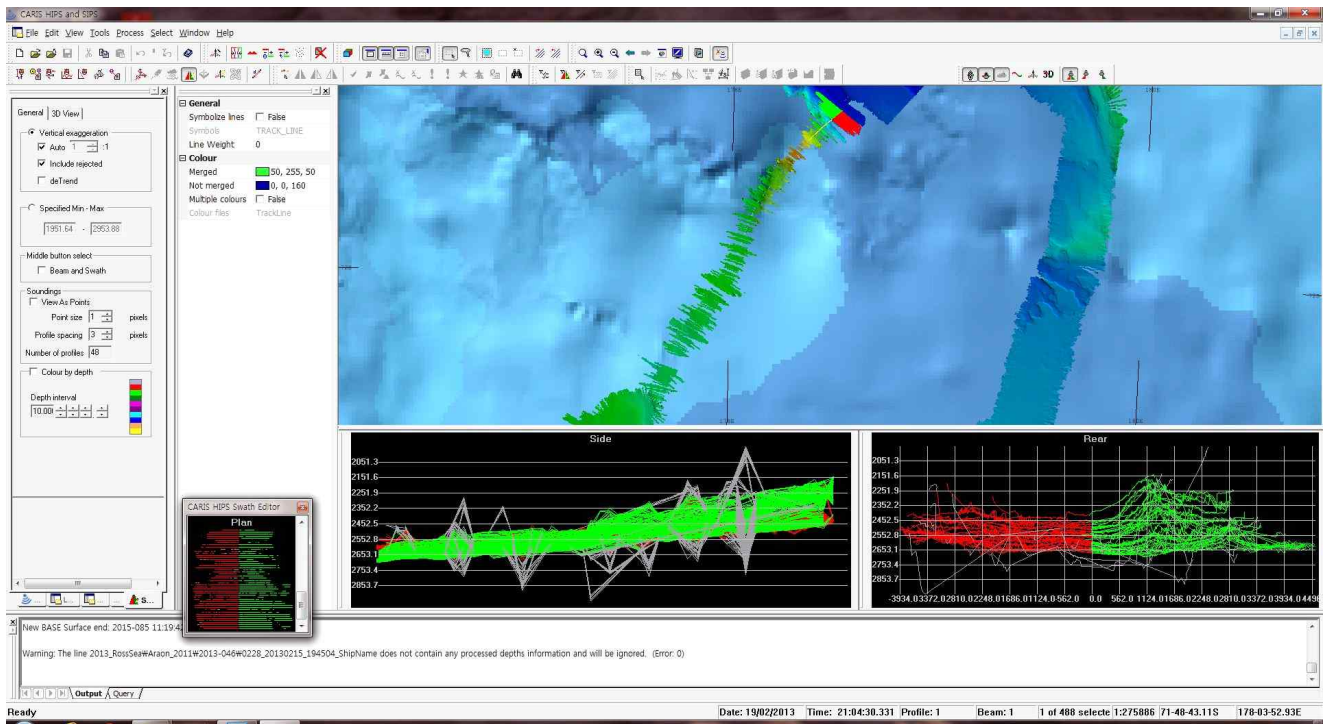


그림 18. 서브셋 보정 (삭제) 처리 신호 (남극 로스해 멀티빔 자료)

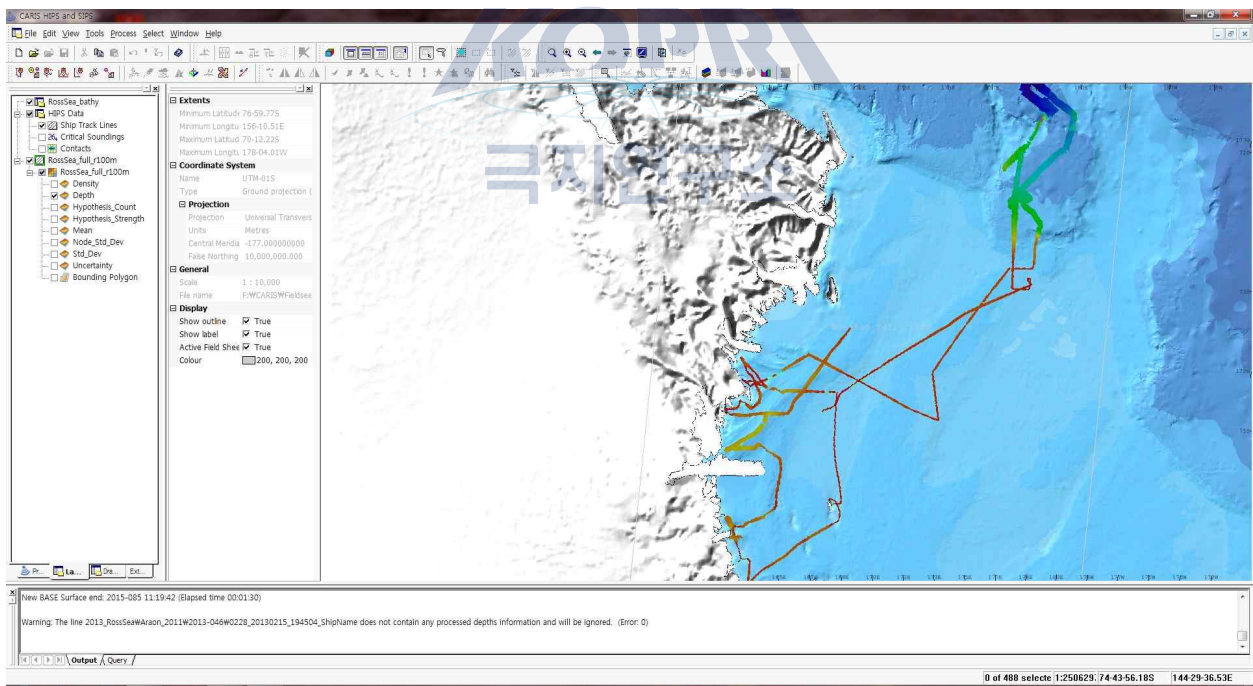


그림 19. 남극 2013년 Ross Sea 트랙 라인에 대한 개략 심도 분포도

다음 그림 20은 CARIS HIPS & SIPS 7.0 소프트웨어를 사용하여 후방 산란 신호 분석 작업을 수행하고 있는 사례를 보여준다. 활용된 자료는 2013년 2월 로스해에서 획득된 자료이며, 반사 신호의 강도를 음영으로 모자이크 방식 처리하여 표시한 사례이다. 반사 신호 강도는 기본적으로 해저면 퇴적물 평가에 활용될 수 있으며, 이에 대한 사항은 후술할 “(나) 멀티빔 반

사 신호를 이용한 해저면 특성 분석”의 Geocoder를 이용한 해저면 평가 관련 부분에 기술되어 있다.

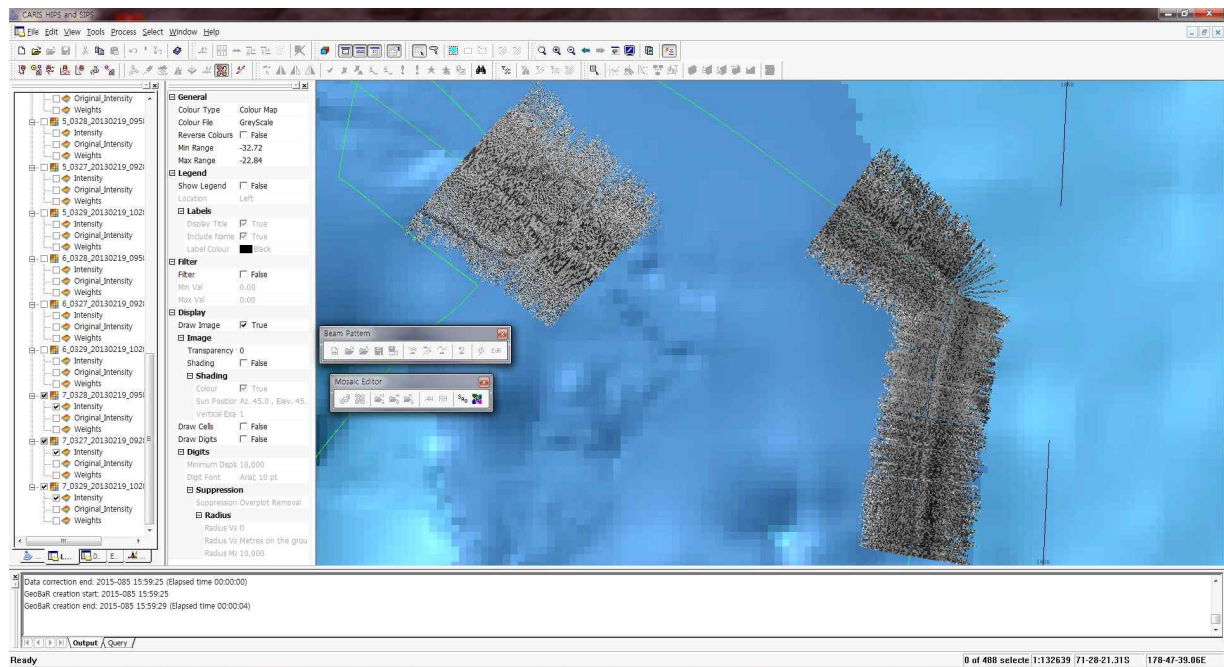


그림 20. 남극 로스해 멀티빔 자료 CARIS 활용 후방 산란 신호 처리 편집 작업 사례

획득된 멀티빔 자료에 대한 신호 보정은 해저면 지형을 보다 정밀하게 추출하는데 도움을 주게 된다. CARIS HIPS and SIPS에서는 보통 SWATH Editor를 이용해, 조사 측선별 신호를 컴퓨터와 대화식 수작업으로 검토/수정 하거나 이미 프로그램에서 기본 값으로 주어진 몇몇 변수 조건에 맞지 않는 신호들을 제거하는 방식으로 해저 심도 분포를 산정한다. 보통 이러한 수작업에 의한 자료 조정은 동일 지점을 지난 측선에서의 심도 값 편차를 최소화하는 방식으로 많이 진행되며, 본 위탁연구에서는 이러한 방식의 보정을 SWATH 방식 보정으로 칭해 사용하였다. 또한 특별한 자료 정보가 없는 경우에는 대부분 프로그램에서 제공하는 기본 값을 활용하여 이상 신호를 제거한 후 해저 지형을 작성하였다.

그림 21과 22는 2012년 1월 로스해 장보고 기지 인접 지역에서 획득된 자료를 SWATH editor를 통해 처리하기 전, 후 신호 분포를 보여준다. 측면 신호와 전후 신호에서 주변과 차이를 보이던 이상 신호 부분이 정상적으로 제거된 형태를 볼 수 있다.

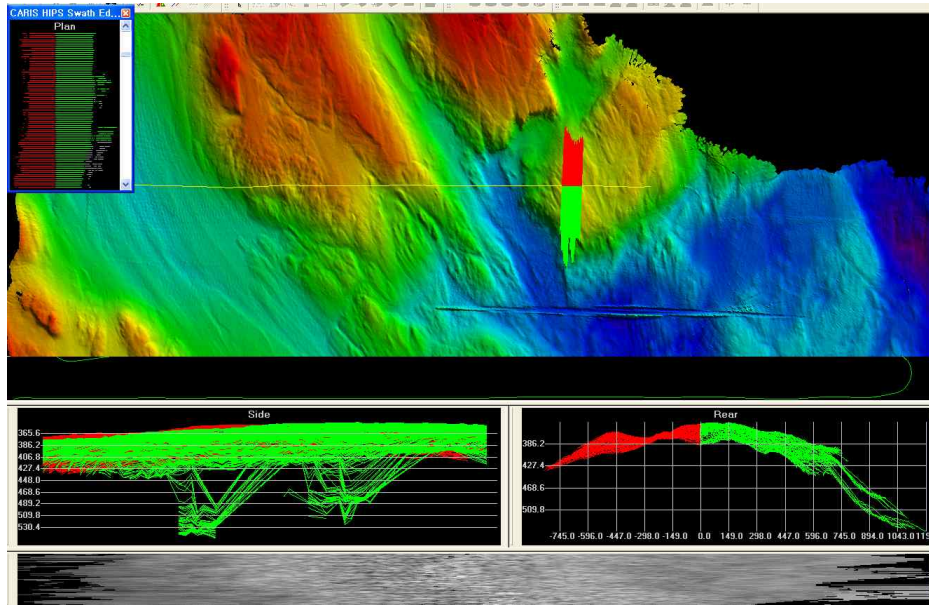


그림 21. SWATH editor 신호 처리전 (로스해 2012년 1월 자료)

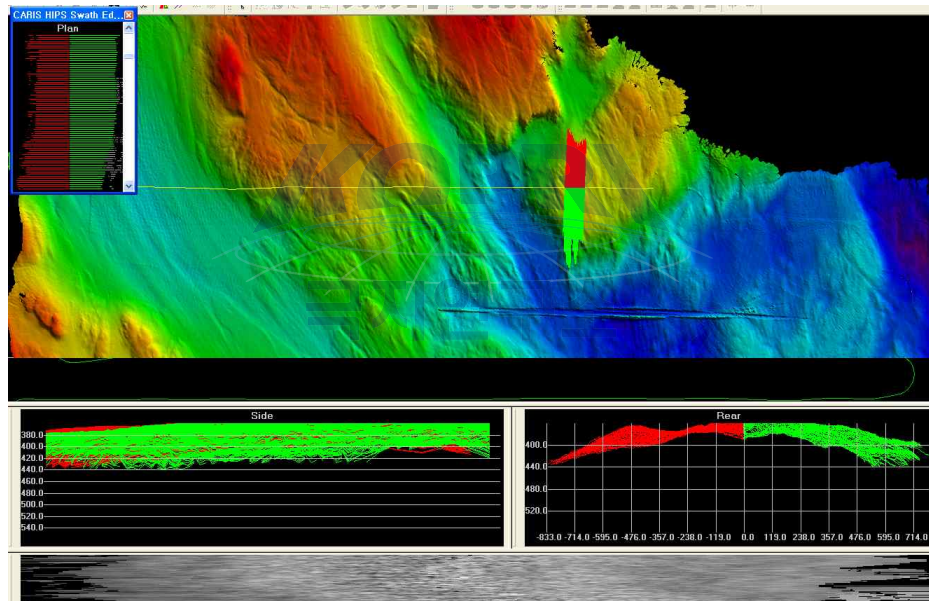


그림 22. SWATH editor 신호 처리후 (로스해 2012년 1월 자료)

그림 23은, 2012년 8월 북극 척치해/보버트해 멀티빔 자료 중 일부로, SWATH editor를 통해 이상 신호를 설정, 제거된 형태를 보여주고 있다. 선택되어 제거될 신호는 측면과 전후 신호 자료 창에 회색으로 보여지고 있다. 2012년 8월부터 9월에 북극 척치해에서 조사된 멀티빔 측선의 개황도는 그림 24에 주어져 있으며, 실제 위치도는 다음 절 MB-system을 활용한 자료 처리 부분에서 별도로 상세하게 제시되어 있다.

의 주관적 판단을 배제하면서 이상 신호를 제거할 수 있다. 그러나 실제로 CARIS HIPS and SIPS의 CUBE editor를 통해 해저면 지형을 도출할 때, 사용자는 기본적으로 중요한 몇 가지 요소들을 결정하여야 한다. 이 중 대표적인 요소는 격자 해상도 (grid resolution; GR), 추정 이격 거리 (estimate offset; EO), 모호성 제거 방법 (disambiguation method) 등으로 상세한 요소들에 대한 정보는 사용 설명서를 참조할 수 있다. 이러한 요소의 결정은 일반 사용자들이 쉽게 결정하기 어렵고, 요소에 따라 최종 해저면 지형의 변화도 다양하므로 보통은 프로그램이 제공하는 기본 값을 사용하게 된다. 본 위탁 연구에서도 기본적으로 특별한 언급이 없는 한 CUBE editor가 제공하는 기본 값들을 요소 값으로 사용하였다.

동해 시험 항해 자료, 남극 장보고 인접 로스해 자료, 남극 로스해 자료 및 북극 척치해/보버트해 자료의 해저면 지형 정보는 위에 언급한 자료 신호 처리 과정을 통해 작성되었으며, 이 결과는 제 3 절 연구 결과에 제공된다.



(나) 멀티빔 반사 신호를 이용한 해저면 특성 분석

송신기에 의해 발생한 음파는 해수층을 지나 해저면에서 반사되며 다시 해수층을 지나 궁극적으로 수신기에 기록된다. 수신기에 기록되는 값은 기본적으로 도달시간과 음압이며, 기록된 음압의 강도는 해저면에 대한 정보를 반영하게 된다. 보통 멀티빔 시스템에서는 해저면에서 반사되어 수신기에 기록되는 신호를 후방 산란 신호라고 하며, 멀티빔의 특성상 송신기와 수신기의 위치가 거의 동일하므로 반사법칙에 의해 반사된 신호는 대부분 수신기에 도달하지 못하고 수신기에 도착하는 신호는 상대적으로 미약한 산란 신호 (일부 해저면에 거의 수직으로 도달하는 신호들은 예외임) 들이기 때문이다.

CARIS HIPS and SIPS 프로그램은 후방 산란 신호 처리를 위해 그림 25와 같이 우선적으로 해저 지형 (Bathymetry) 처리가 수행된 후, 후방 산란 신호 처리를 통해 입사 각도에 따른 해저면의 퇴적물을 분석이나 후방 산란 반사 신호의 강도를 이용한 모자이크 음영도를 작성하게 된다.

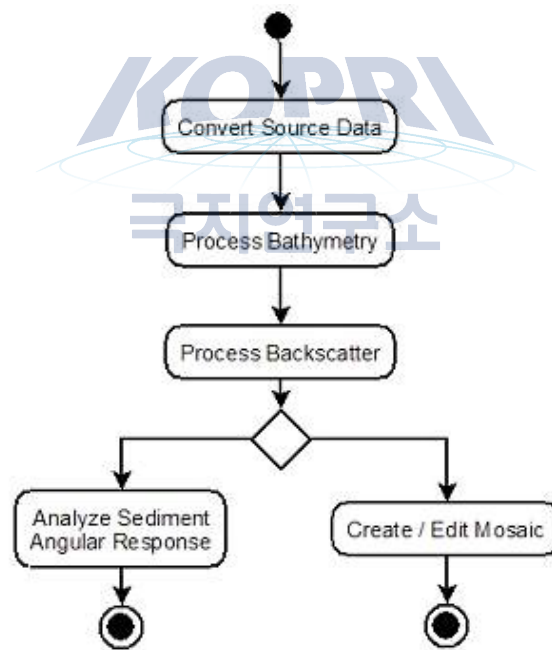


그림 25. CARIS HIPS and SIPS 후방 산란 신호 처리 흐름
(MacDonald and Collins, 2008)

CARIS HIPS and SIPS 프로그램은 입사 각도에 따른 후방 산란 신호 강도의 변화를 분석하기 위해 Geocoder라는 도구를 제공하며, 이 결과는 GeoBaR (Geo-referenced, Backscatter Raster)라고 불리는 파일로 저장된다. 그림 26은, 다른 연구에서 수행된 이 처리 과정을, 예제 분석 자료와 함께 보여주고 있다.

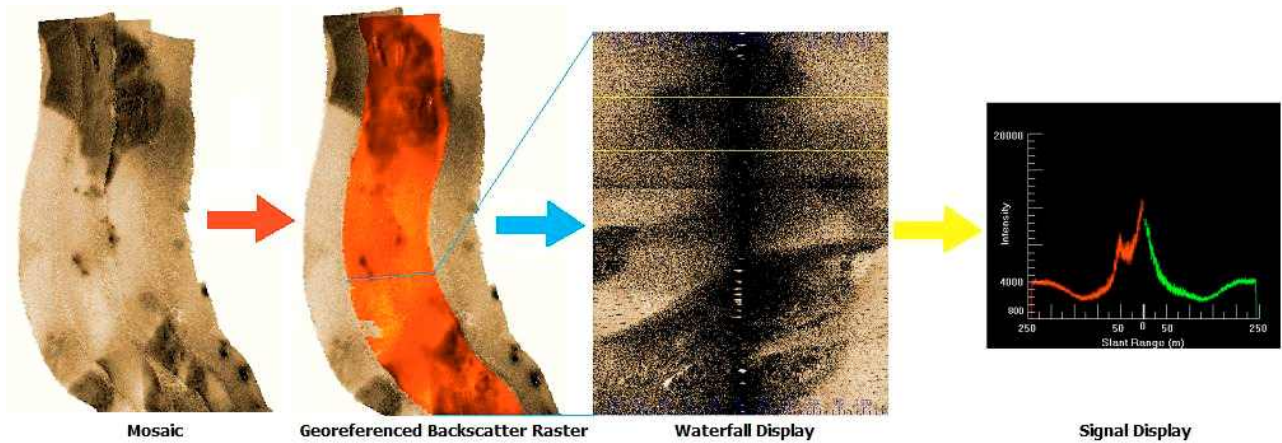


그림 26. CARIS 후방 산란 신호를 통한 해저면 분석 사례
(MacDonald and Collins, 2008)

해저면 퇴적물의 다양한 음향 반사 특성이 입사각에 따른 후방 산란 신호 강도를 결정하며, 대표적인 음향 반사 특성으로는 해저면 퇴적물의 밀도, P파 속도, 반사 체적, 음파 중심 주파수 등으로 알려져 있다(Artilheiro, 1998). 또한 이러한 입사각에 따른 반산 강도 변화는 Lambert 법칙과 몇몇 대표적인 모델을 이용하여 추정할 수 있다. 그림 27은 Jackson 모델을 이용하여 퇴적물의 종류에 따른 후방 산란 신호 강도 변화의 변화 사례를 보여준다.

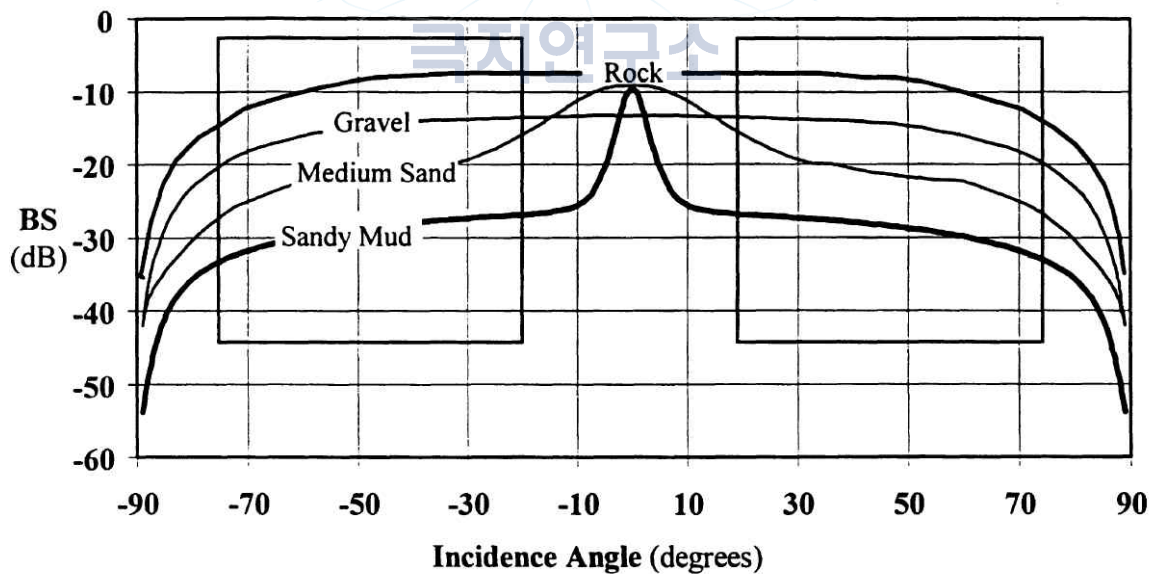


그림 27. 입사각도에 따른 해저면 (퇴적물) 후방 산란 반사 강도 변화 사례
(95kHz, Jackson 모델 활용; Artilheiro, 1998)

CARIS HIPS and SIPS를 활용하여, 본 위탁과제에서는 동해 시험 항해 멀티빔 자료, 남극 로스해 자료 및 북극 척치해 자료의 입사각에 따른 후방 산란 반사 강도 변화를 통해 퇴적물의 특성을 분석하였다. 이 과정은 전술한 바와 같이 우선 해저 지형 분석 이후 수행되었으며,

기본적으로 Mosaic Editor 내의 Geocoder 도구를 활용하였다. 한편 본 위탁과제는 멀티빔 자료에 한정하여 해저면 특성을 분석하였으나, CARIS HIPS and SIPS에는 멀티빔 자료와 함께 측면 주사 음향 조사 장비 (side scan sonar)와 함께 이 분석 도구를 활용할 수 있으며, 이 경우 보다 신뢰성 있는 해저면 특성 분석이 가능하다.

그림 28은 동해 시험 항해에서 획득된 자료 중 Geocoder 도구를 통해 자갈층(좌현)과 중립질 모래 내지 자갈 섞인 점토(우현) 평가된 구간의 자료를 보여주고 있으며, 그림 29는 같은 항해에서 점토질 모래 (좌현)과 모래질 실트로 예비 평가된 사례를 보여준다. 자료에서 볼 수 있듯이 해석자의 최종 판단에 도움을 주기 위해 신뢰 정도도 함께 명기되는데, 그림 29로 주어진 사례의 자료의 경우, 신뢰성이 높지 않아, 단정할 수 없음 (inconclusive) 주석이 제공되었음을 확인 할 수 있다.

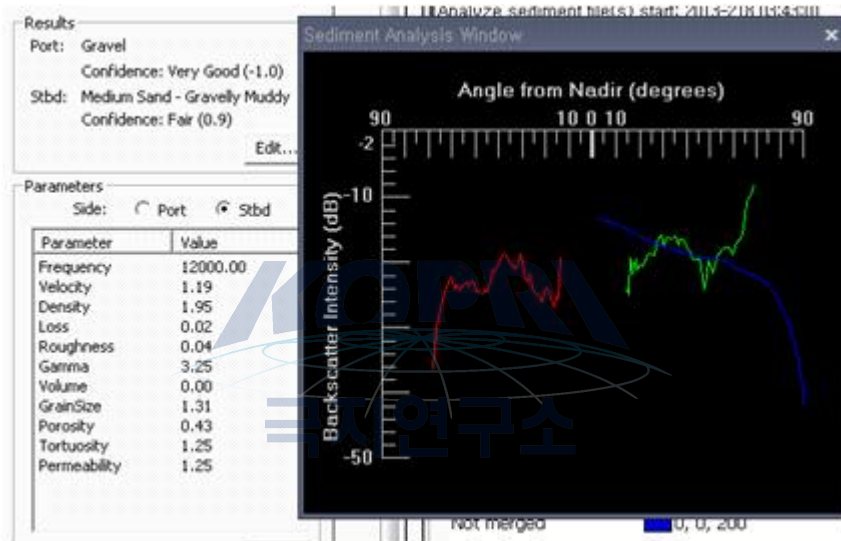


그림 28. 동해 시범 항해 CARIS HIPS and SIPS geocoder 활용 퇴적물 평가 사례 1

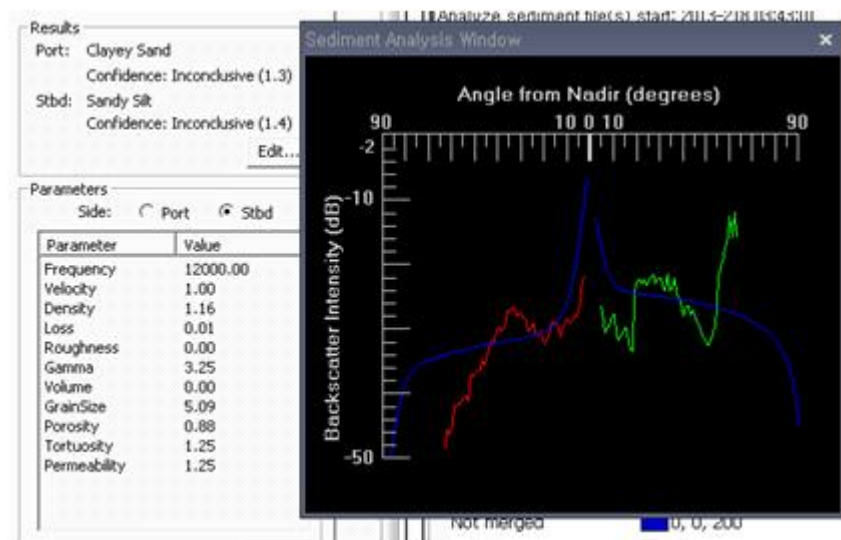


그림 29. 동해 시범 항해 CARIS HIPS and SIPS geocoder 활용 퇴적물 평가 사례 2

그림 30과 그림 31은 각각 2012년 8월 수행된 북극 척치해 지역에서의 해저면 퇴적물 특성 분석 사례와 2013년 2월 남극 로스해 지역에서의 해저면 특성 분석 사례를 보여주고 있다. 그림 30은 기본적으로 조사 측선 도시 배경에서의 분석을, 그림 31은 후방 산란 신호 모자이크 처리 배경에서의 분석을 보여주고 있으며, 그림 31의 경우 해당 부분을 확대할 경우, 유사한 신호 강도를 보이는 영역을 추정하는데 도움이 된다.

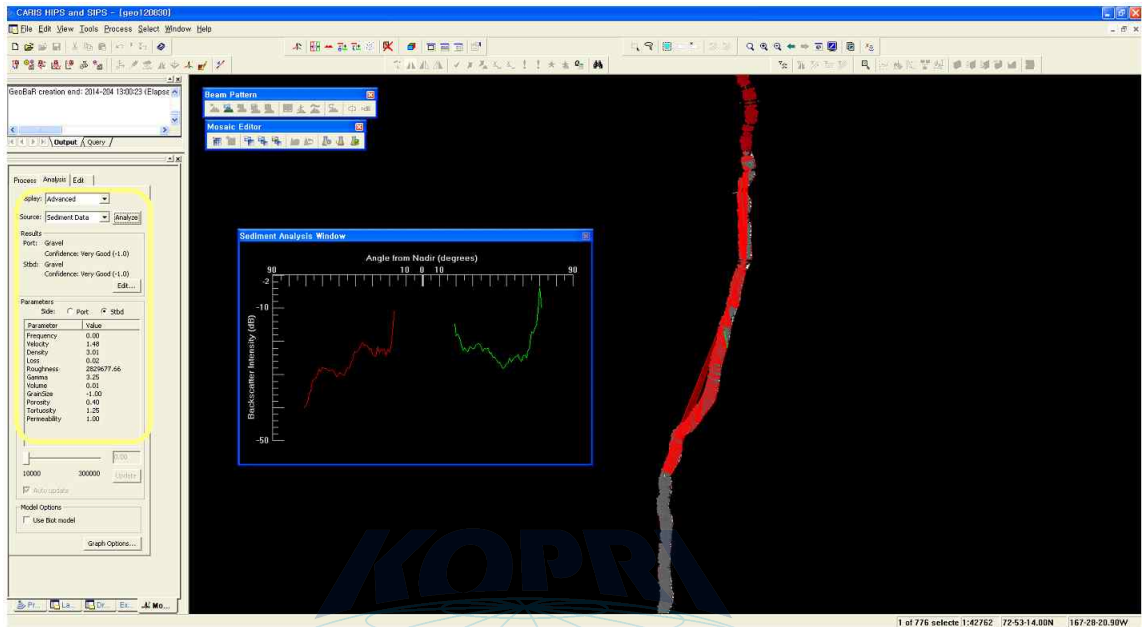


그림 30. 퇴적물 추정 분류를 통한 해저면 특성 분석 사례 (2012년 북극 척치해 획득 자료)

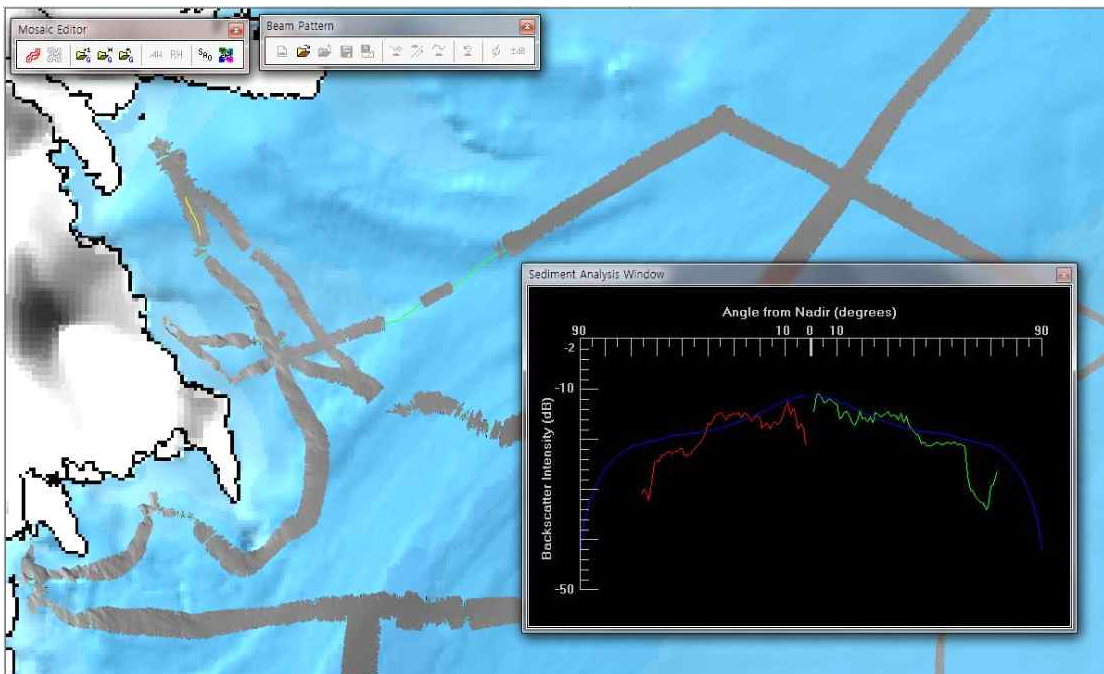


그림 31. 모자이크 및 퇴적물 추정 분류를 통한 해저면 특성 분석 사례 (2013년 남극 로스해 획득 자료)

3. MB-System 활용 해저 지형 조사 및 해저면 특성 분석 수행

MB-System은 멀티빔(multibeam), 간섭과동(interferometry) 및 사이드 스캔 소나(side scan sonar)로 얻어진 해저 지형(bathymetry)와 후방 산란신호(backscattered) 영상 자료를 처리하는 유닉스 환경에서 구동되는 공개용 소프트웨어 패키지(open source software package) 프로그램이다. 1993년부터 개발이 시작된 MB-system은 2016년 2월 현재 MB-system 5.5 (2016년 1월 7일 공개 버전)으로 지도 작성 도구인 GMT 5.2.1 version을 포함하고 있다.

MB-System은 기본적으로 명령줄 입력 방식 (command line interface; CLI)으로, 기존의 GUI (graphic user interface) 방식 상업용 프로그램들에 비해 처음 접할 때 다소 불편한 점이 있지만, 어느 정도 익숙해지면, Unix 셸 스크립트 작성이나 배치 작업 등을 통해 편하게 큰 용량의 자료도 처리 가능하다는 장점을 갖는다.

MB-System 5.5는 총 54개의 명령 프로그램, 3개의 GMT 관련 처리 명령 및 24개의 매크로 명령으로 구성되어 있으며 (부록 MB-System Program List 참조) 기본적으로 모든 프로그램은 소스 (source)가 공개되어 있어 필요에 따라 수정하여 활용할 수 있다. MB-System은 멀티빔 장비의 제조사에 따라 다른 형식으로 획득되는 원시자료들을 적절하게 변환하여 처리할 수 있다는 장점을 갖는다. MB-System 매뉴얼에 따르면 현재 이 소프트웨어로 처리 가능한 멀티빔의 종류는 아래와 같다. 기타 상세한 내용을 확인하기 위해서는 명령줄에서 “man mbio”를 입력하여 확인할 수 있다.

- SeaBeam "classic" 16 beam multibeam sonar
- Hydrosweep DS 59 beam multibeam sonar
- Hydrosweep MD 40 beam mid-depth multibeam sonar
- SeaBeam 2000 multibeam sonar
- SeaBeam 2112, 2120, and 2130 multibeam sonars
- Simrad EM12, EM121, EM950, and EM1000 multibeam sonars
- Simrad EM120(122), EM300, EM1002, and EM3000 multibeam sonars
- Hawaii MR-1 shallow tow interferometric sonar
- ELAC Bottomchart 1180 and 1050 multibeam sonars
- ELAC/SeaBeam Bottomchart Mk2 1180 and 1050 multibeam sonars
- Reson Seabat 9001/9002 multibeam sonars
- Reson Seabat 8101 multibeam sonars
- Simrad/Mesotech SM2000 multibeam sonars
- WHOI DSL AMS-120 deep tow interferometric sonar

- AMS-60 interferometric sonar

현재 아라온에 장착된 멀티빔은 Kongsberg사의 EM-122 시스템으로 MB-System이 활용하는 입출력 형식 (MBIO) 구분에 의하면 58번 및 59번에 해당된다. 59번은 일종의 58번 확장형으로 sidescan 값의 저장과 beam flags (특정 빔에 의미 부여용, 보통은 문제 등이 있어 삭제 처리 등을 하기 위한 표식) 저장이 가능한 형태에 해당된다. 특히 대표적인 멀티빔 제조사인 Kongsberg사의 소위 제3세대 멀티빔 시스템에 해당되는 EM122, EM302, EM710, EM2040 및 M3 획득 자료는 별도의 파일 전처리 명령인 mbkongsbergpreprocess를 활용하여 mbcopy 혹은 mbm_multicopy 및 mbdatalist 등의 일련 명령 작업을 대신할 수 있다. 또한 상기한 시스템 획득 자료에 대해서는 기본적인 파일 정보제공 보조 파일인 확장자 inf 파일 (file statics), 개략 심도 정보 제공 파일인 확장자 fbt 파일 (fast bathymetry), 개략 항로 정보 파일인 확장자 fnv 파일(fast navigation) 이외에 위치 보정 등에 활용할 수 있는 보조 파일인 ata 확장자 파일 (asynchronous attitude (roll and pitch)), ath 확장자 파일 (asynchronous heading), ats(asynchronous sonar depth) 확장자 파일 및 sta 확장자 파일(synchronous attitude (roll and pitch))을 한 번의 명령 처리를 통해 제공되어 전처리 과정을 용이하게 수행할 수 있게 되었다.

MB-system의 MBIO 형식에 맞게 원시 자료가 전환되면 우선 특별한 자료 처리가 되어 있지 않은 상태에서 항해 측선, 해저 지형 및 후방 산란 반사 강도 등을 점검 할 수 있다. 이러한 점검은 명령문에서 몇 종류의 명령을 통해 직접 신호 수치를 확인하는 방법과 흑백 음영, 혹은 칼라 매핑 등의 그림으로 표현하여 확인하는 방식이 가능하다. 직접 신호 수치를 확인하기 위한 명령은, mbinfo, mblist, mbdatalist 등이 있다.

2012년 동해에서 수행된 시험 항해를 통해 얻어진 멀티빔 자료의 내용을 전체적으로 확인하기 위해서는 변환된 파일을 리스트로 만든 후, 그 리스트에 명기된 파일들의 값들을 검토하여 전체적인 내용을 확인하는 방식이다. 만약 멀티빔 파일들 (MBIO 형식으로 변환되어 확장자가 *.mb59인 파일들) 목록이 Donghae.lst에 보관된 경우, 다음과 같은 명령을 통해 기본 정보를 확인가능하다.

```
$ mbinfo -F-1 -I Donghae.lst -O
```

위의 명령이 수행되면 Donghae.lst.inf라는 파일이 생성되며, 이 파일에서는 리스트 파일에 기록되어있는 99개의 원시자료 파일에 대한 파일 형식 등을 보여주고 전체 자료에 대해서 통합적으로 아래와 같은 기초정보를 제공하여 준다.

Data Totals:

Number of Records:	35096
Bathymetry Data (432 beams):	
Number of Beams:	15161472
Number of Good Beams:	13528444 89.23%
Number of Zero Beams:	0 0.00%
Number of Flagged Beams:	1633028 10.77%
Amplitude Data (432 beams):	
Number of Beams:	15161472
Number of Good Beams:	13528444 89.23%
Number of Zero Beams:	0 0.00%
Number of Flagged Beams:	1633028 10.77%
Sidescan Data (1024 pixels):	
Number of Pixels:	35938304
Number of Good Pixels:	32109772 89.35%
Number of Zero Pixels:	0 0.00%
Number of Flagged Pixels:	3828532 10.65%

Navigation Totals:
 Total Time: 68.7570 hours
 Total Track Length: 1063663.9494 km
 Average Speed: 15469.8996 km/hr (8362.1079 knots)

Start of Data:
 Time: 06 11 2012 11:43:54.471000 JD163
 Lon: 0.0000 Lat: 0.0000 Depth: 736.4567 meters
 Speed: 0.0000 km/hr (0.0000 knots) Heading: 62.8500 degrees
 Sonar Depth: 5.8728 m Sonar Altitude: 721.0340 m

End of Data:
 Time: 06 14 2012 08:29:19.685000 JD166
 Lon: 130.0501 Lat: 36.0511 Depth: 1389.8182 meters
 Speed: 4.4280 km/hr (2.3935 knots) Heading: 180.9000 degrees
 Sonar Depth: 5.9495 m Sonar Altitude: 1382.7908 m

Limits:			
Minimum Longitude:	-0.0321	Maximum Longitude:	130.4345
Minimum Latitude:	-0.0308	Maximum Latitude:	37.0307
Minimum Sonar Depth:	4.5237	Maximum Sonar Depth:	6.9999
Minimum Altitude:	64.4290	Maximum Altitude:	2156.7036
Minimum Depth:	67.1276	Maximum Depth:	2408.8057
Minimum Amplitude:	-62.4000	Maximum Amplitude:	3.1000
Minimum Sidescan:	-99.2000	Maximum Sidescan:	3.1000

마찬가지로 mblist 혹은 mbdatalist 등의 명령도 다양한 옵션에 따라 사용자가 원하는 멀티빔 자료의 정보를 확인할 수 있게 하여 준다. 그러나 이러한 값으로 자료를 확인하는 방식 보다 일반적으로는 항해 측선, 해저 지형 등의 정보를 그림으로 표현하는 것이 더욱 편하고 빠르게 정보를 확인하는 방식이다.

다음 그림 32는 동해 시험 항해 멀티빔 자료에 대한 전체 조사 측선과 심도 분포를 보여주는 사례이며, 그림 33은 이중 첫 번째 측선만 별도로 도시한 것이다. 또한 MB-System은 후방 산란 신호의 강도를 송신 음파의 음압에 대한 비율로 보여 줄 수 있으며, 그림 34는 그 사례를 보여주고 있다.

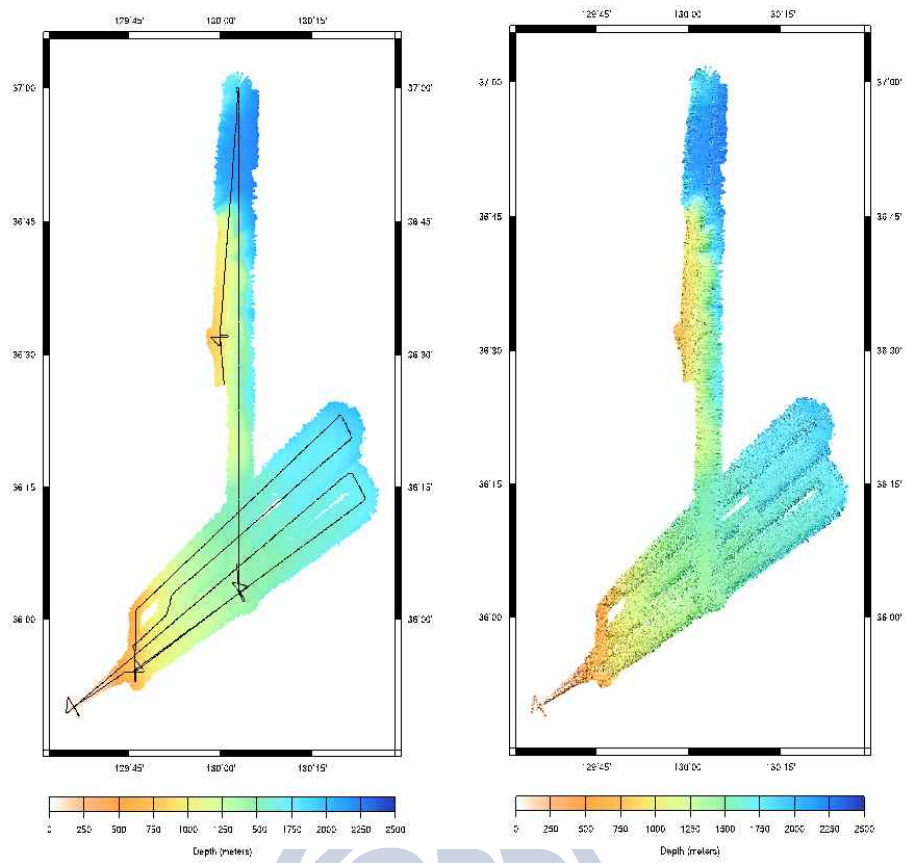


그림 32. MB-System을 이용한 2012년 동해 시험 항해 조사 측선도 및 심도 분포 사례

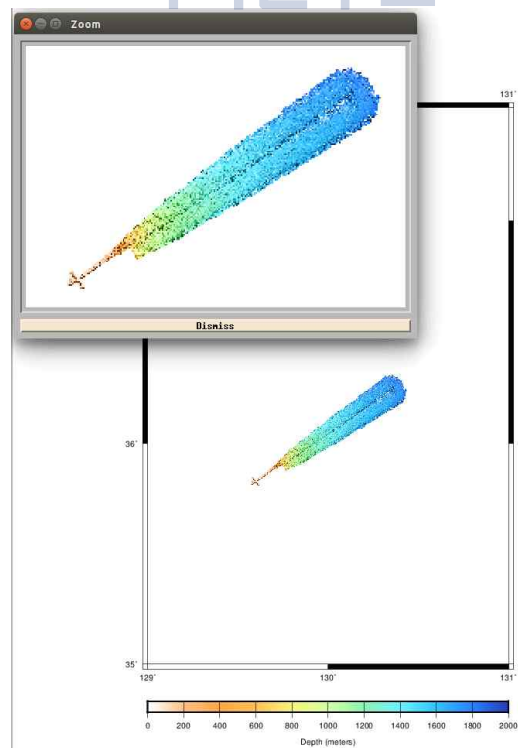


그림 33. MB-System을 이용한 2012년 동해 시범 항해 1번 측선 및 해저 심도

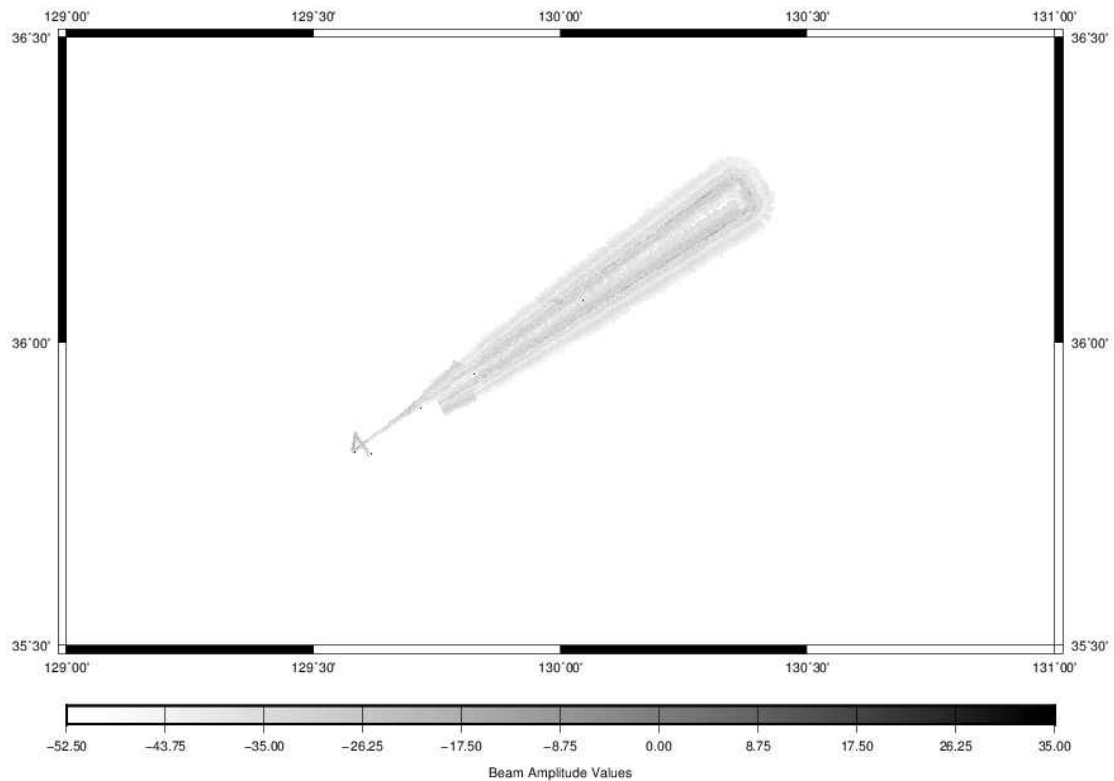


그림 34. MB-System을 활용한 후방 산란 신호 강도 표시 사례

많은 경우 획득된 멀티빔 자료는 다양한 원인으로 인해 해저 심도 추정과 해저면 반사 특성을 평가하는데 방해가 되는 오류 신호를 포함하게 된다. 이러한 오류는 주로 항해하는 배의 흔들림, 조석 변화, 부정확한 위치 정보와 해수층 속도 정보 등이 원인이다. 이러한 오류 자료들은 수동으로 보정이 가능하며, MB-System은 명령 방식 보정의 한계를 극복하기 위하여 GUI(Graphic user interface) 형태의 몇몇 수동 보정 기능을 제공한다.

수동보정 기능들은 datalist 파일을 사용하여 먼저 순차적으로 불러워질 목록을 활용하기도 하지만 기본적으로는 각각의 .mb59 자료 파일을 이용하며, 자료 처리 과정에서 만들어지는 부속 파일들을 이용하여 처리된다. 또한 수동 조정을 통해 별도의 부속 파일을 생성하여 mbclean 이나 mbprocess와 같은 명령 시행 시 수정 편집 정보를 가지고 있는 부속 파일들이 활용되기도 한다.

MB-System에서 제공하는 GUI 형태의 수동 보정 기능은 다음과 같다.

mbedit: 측심자료의 불량 자료에 수정/표기 철

mbnavedit : 측심자료 중 불량 항로자료에 수정/표기 처리

mbvelocitytool : SSP (Sound speed profile) 수정/보정 처리

만약 현장조사 시 rolling과 pitching을 보정하기 위한 별도의 항해를 수행하고 데이터를 수집한 경우 mbedit, mbprocess와 같은 패키지를 이용하여 이러한 값들의 보정을 가능하게 한다. 그러나 아라온호에 장착된 EM122 시스템의 경우 모션 센서에 의해 이러한 값들이 자동으로 보정되어 원시 자료에 반영되므로 별도의 보정작업을 필요로 하지 않는다.

MB-System은 또한 mblevitus, mbvelocitytool과 같은 패키지를 통해 SSP (Sound Speed Profile)의 보정을 가능하게 한다. 아라온호 동해안 시험 항해 시에는 휴대용 SVP (Sound Velocity Profile)를 이용하여 측정 후 EM122시스템을 보정하였고 획득한 원시자료는 이미 보정된 값이므로 별도의 보정 작업을 필요로 하지는 않았다.

그림 35와 그림 36은 동해 시험 자료와 북극 척치해 자료를 mbedit를 통해 수동으로 점검하고 편집하는 방식을 보여준다. 또한 mbedit는 멀티빔 신호 정보를 측면, 평면 등 다양한 양식으로 표현할 수 있어 오류 신호를 손 쉽게 선별할 수 있다(그림 37 참조).

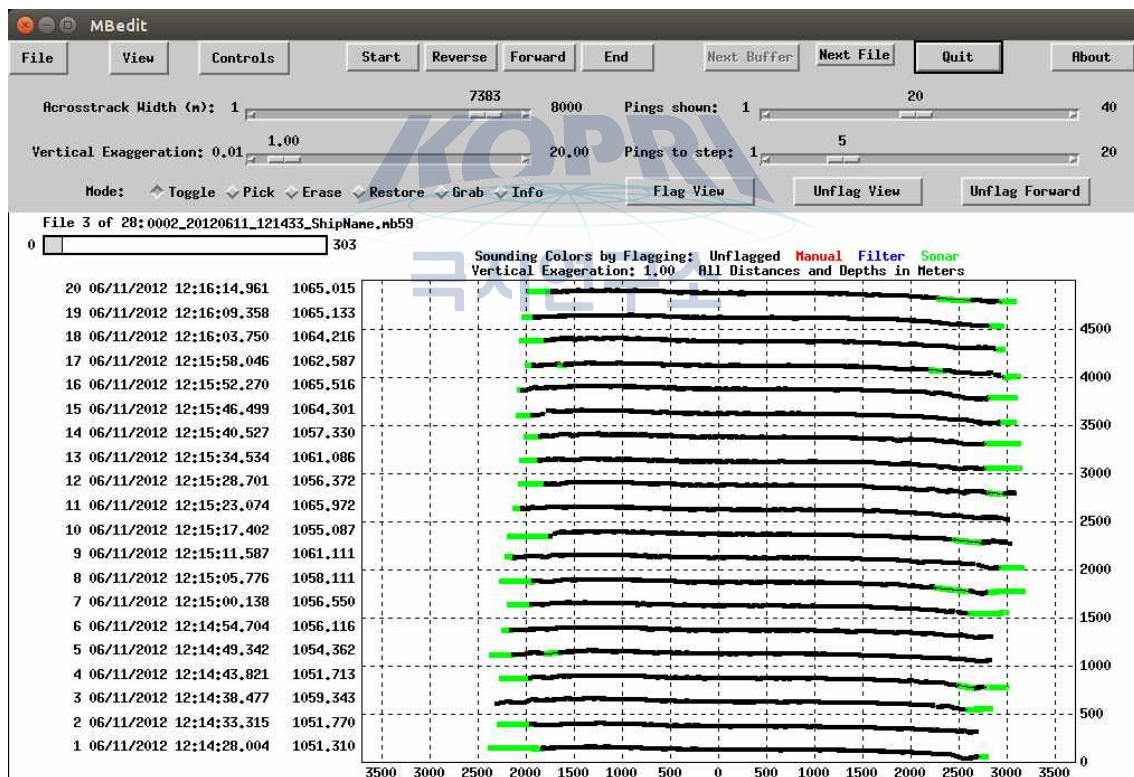


그림 35. mbedit를 이용한 멀티빔 편집 (2012년 동해 시험 항해 자료) 사례

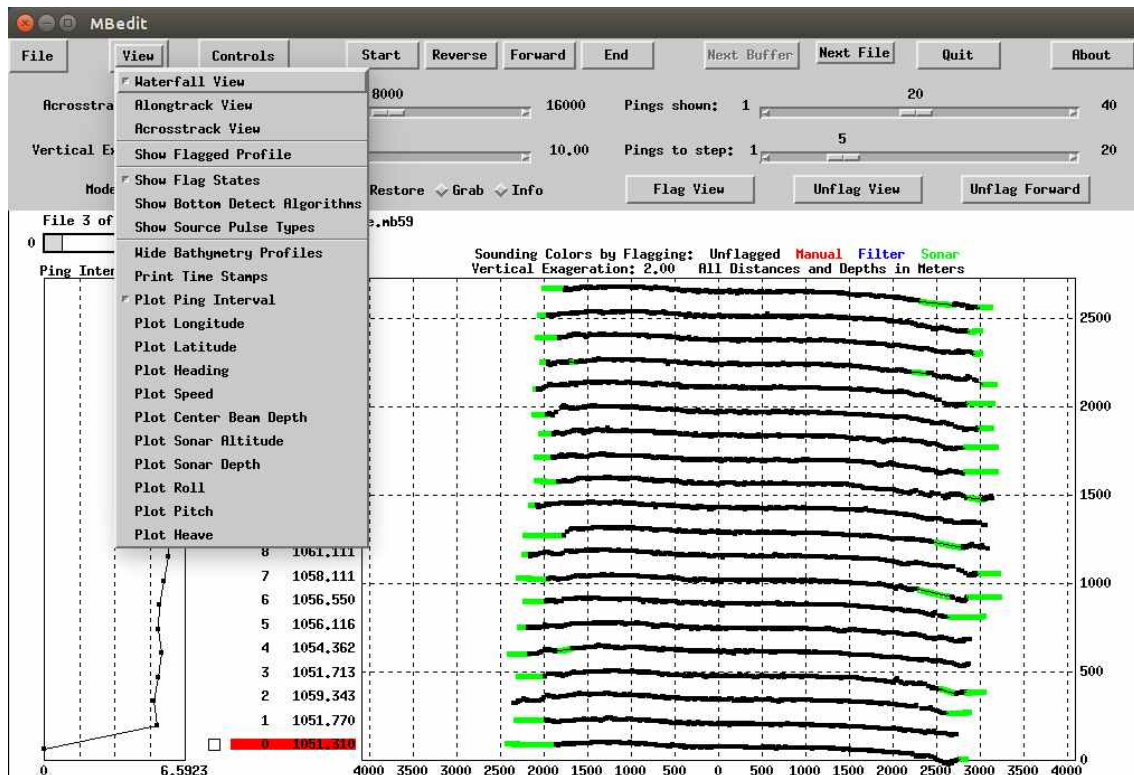


그림 36. mbedit를 이용한 멀티빔 편집 (2012년 북극 척치해) 및 플롯 정보 선택

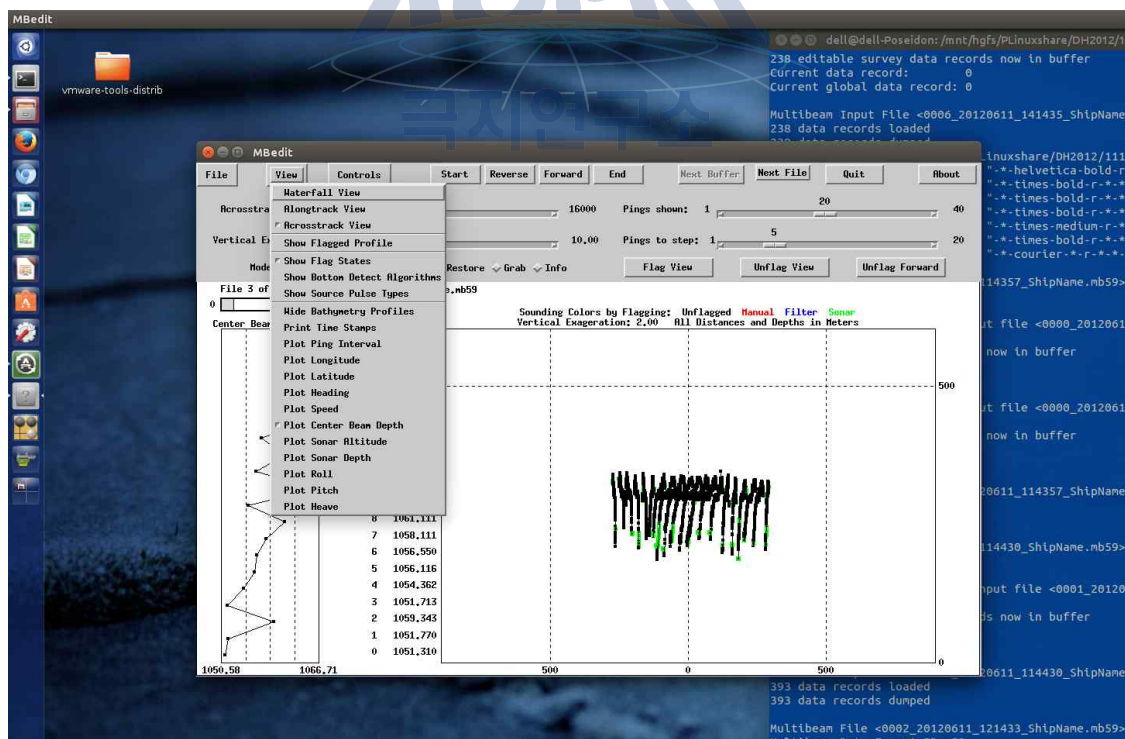


그림 37. 멀티빔 신호 평면 플롯을 통한 mbedit 자료 편집 사례

그림 38은 mbvelocitytool 프로그램을 통해서 해수층 속도 분포를 추정 평가하고 정확한 해저 심도 단면을 작성하는 사례를 보여준다. 이 프로그램은 직접 해수층의 음파 속도 곡선을 수

동으로 조정하면서 해저면에서 반사되는 빔에 의한 심도 잔차를 조정해 나갈 수 있다.

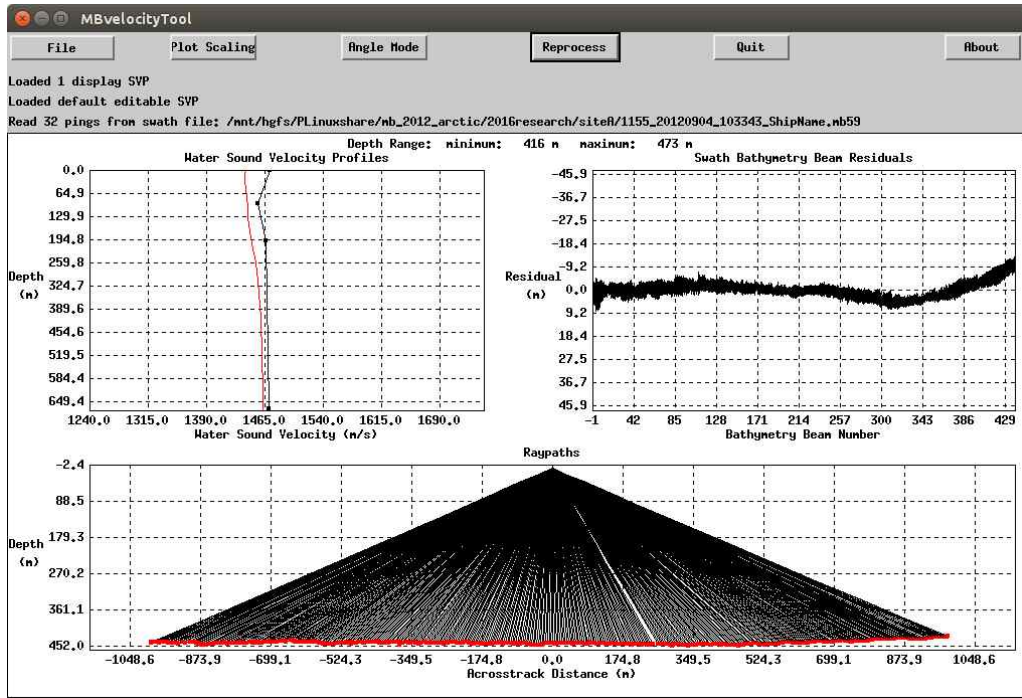


그림 38. mbvelocitytool 활용 SVP 추정 및 해저면 잔차 보정 사례 (2012년 북극 척치해 자료)

MB-System은 mbeditviz 명령을 통해 3차원적인 멀티빔 신호에 대한 편집과 보정과 더불어 전체적인 해저면 형상 검토를 가능하게 해주는 기능을 제공한다. 그러나 이 명령은 전산기의 사양이 충분하지 않은 경우, 매우 느리게 작동되거나 간혹 작업이 갑자기 정지하는 등 다소 불안정하게 작동하는 문제가 있어 매우 고성능 전산기로 작업할 것을 권장한다. 그림 40은 북극 척치해 집중 조사 구간 B (그림 39 참조) 일부를 보여준다.

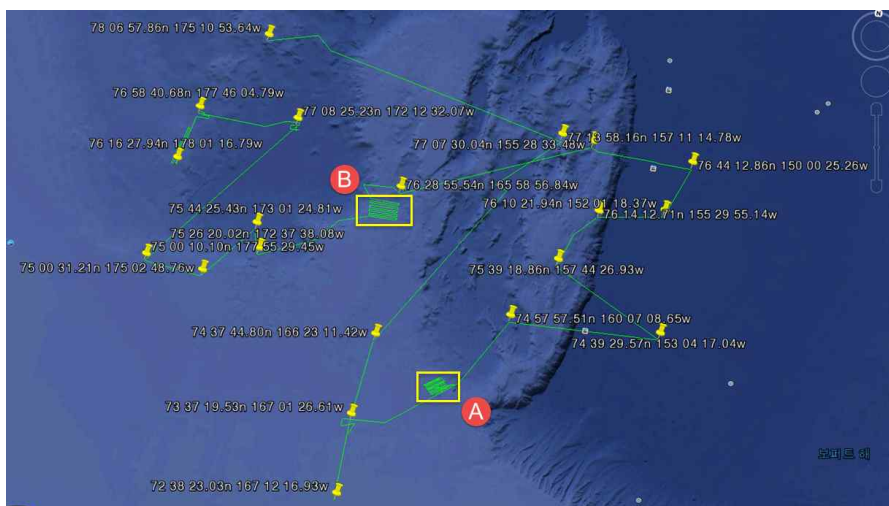


그림 39. 2012년 8월 및 9월 북극 척치해 멀티빔 조사 측선

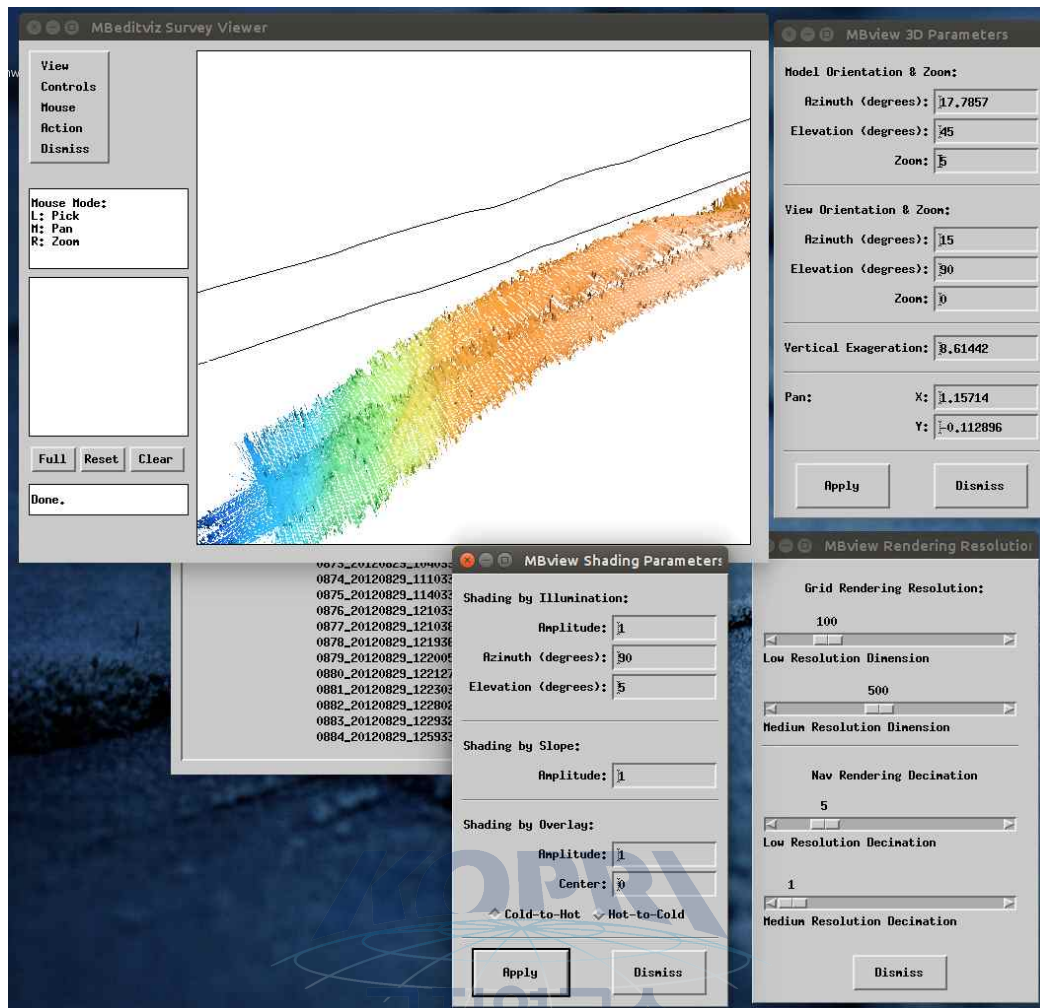


그림 40. mbeditviz 활용 북극 척치해 site B 일부 지역 멀티빔 자료 검토/편집 사례

그림 41은 2012년 장보고 인접 로스해에서 획득된 자료 mbeditviz의 경사도 분석 결과와 함께 3차원으로 도시한 후, profile view 기능을 통해서 심하게 왜곡된 해저 지형 정보를 찾고 수정하는 과정을 보여준다. 이러한 3차원 자료 확인과 편집 기능을 통해 MB-System은 편리하게 수동으로 잡음을 제거할 수 있는 기능을 제공한다.

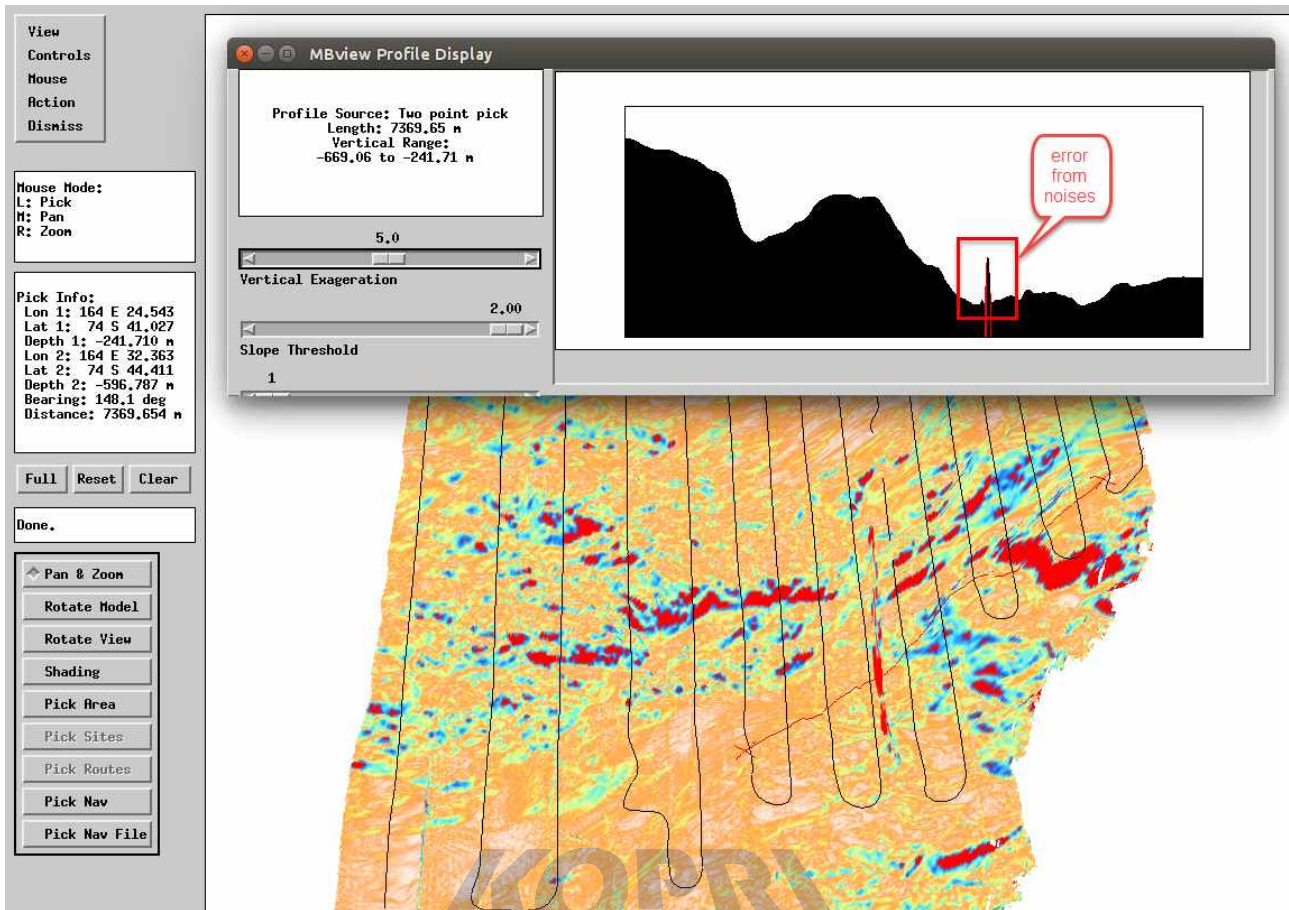


그림 41. 3차원 경사 분포 및 해저면 측선 보기 (profile display)을 통한 잡음 제거

MB-System은 전술한 다양한 수동 기능을 통해 잡음 신호를 표시하고 제거하는 방식과 더불어 특정 조건을 mbclean 명령에 함께 제공하는 방식으로 자동적인 자료 보정과 잡음 신호를 제거하는 기능을 가지고 있다. mbclean 명령은 우선 조건에 적합하지 않은 멀티빔 신호를 선별해내는 과정으로 다음과 같은 명령 형식(옵션은 값은 단순 사례로 변경 가능)을 갖는다.

```
$ mbclean -F-1 -I araonem122 -M2 -C3.0 -D0.01/0.20 -G0.70/1.30 -V
```

M: 과도한 경사를 가진 빔에 대해 표기

C: 최대 허용 가능 경사 (단위: tangents)

D: 빔사이의 거리에 대한 최대 최소 허용 기준, 평균심도에 대한 배율, meter

G: 심도값에 대한 최대 최소 허용 기준, 평균심도에 대한 배율, meter

V: 처리과정을 화면에 표시

위에서 예로 제시한 mbclean은 -M2 -C3.0 옵션에 따라 약 70도 이상의 빔에 대해서, -D0.01/0.20 옵션에 따라서 평균심도가 1,000 m인 경우 빔 사이의 거리가 10에서 200 m를 벗어나는 경우, -G0.70/1.30 옵션에 따라서 평균심도가 1,000 m인 경우 심도 값이 700에서 1,300 m

를 벗어나는 경우에는 표식(mark)가 되어 진다. 명령이 수행되면 전체 멀티빔 자료가 점검되고, 이 중 몇 개의 자료가 주어진 조건을 만족하지 못해 표식 되었는지 알려준다. 또한 폴더안의 모든 .mb59 파일들에 대하여 각각 .esf .esf.stream .par 파일이 생성되어 표식 정보를 이 후 처리과정에 제공하게 된다. 이 때, .esf .esf.stream 파일에는 표기된 빔이 이벤트 형식으로 기록되고 .par 파일에는 변화된 파라미터에 대한 정보가 기록된다.

MB-System의 자동 및 수동 기능을 이용하여 불량 및 오류 데이터에 표기를 하였고, 이러한 표기된 자료들은 여러 종류의 부가파일에 표식 정보가 저장 되어 있을 뿐 실제 측심 자료에 보정 값이 반영되는 것은 아니다. 모든 자동 및 수동 표식은 mbprocess를 이용하여 실제 측심자료에 반영된다. 다음은 mbprocess 명령을 통해 멀티빔 자료 보정이 되는 과정을 설명한다.

```
$ mbprocess -F-1 -I araonem122
```

mbprocess의 실행결과로 폴더 안의 모든 .mb59 원시자료 파일의 이름 마지막에 processed의 'p'가 첨부된 파일들이 새로이 생성되며, 이후 보정된 측심 자료를 얻기 위해서는 이 파일이 사용되어야 한다. 이 후 처리된 자료의 도시 방법은 앞에서 설명한 mbplot 사용 방식과 동일하다.

(처리 전후 파일명 예시)

0001_20120611_114430_ShipName.mb59 --> 0001_20120611_114430_ShipName**p**.mb59

그림 42와 그림 43은 2012년 북극 척치해/보버트해 Site A의 멀티빔 자료의 보정 처리 전후를 비교하여 보여준다. 결과 그림에서 알 수 있듯이 보정 전후의 큰 차이는 나타나지 않고 일부 구간, 특히 북동부 경사면 지역에서 미세한 차이를 보일 뿐이다. 이는 항해 시 아라온호에 장착된 EM-122 멀티빔 시스템에서 1차적으로 navigation, heading, rolling, pitching 등에 대한 오차를 최대한 줄일 수 있도록 설치 및 작동되고 있기 때문이며 또한 조사 기간 동안 크게 데이터를 보정해야할 만한 이벤트가 없었기 때문으로 생각된다. 실제 매우 정밀한 심도 분포를 확인하기 위해서는 별도의 해수층 속도 정보 (SVP) 확보와 더불어 개별 자료들에 대한 수동 점검과 속도 추정 작업이 면밀하게 수행되면 보다 현저한 보정 효과를 기대할 수 있을 것으로 생각된다.

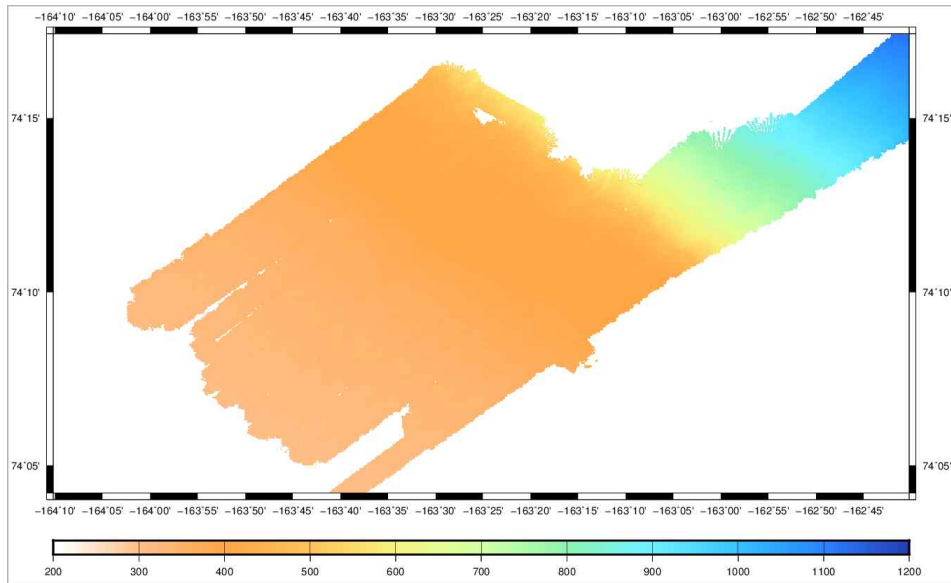


그림 42. 북극 척치해 Site A 지역 멀티빔 신호 보정전 해저 심도 분포

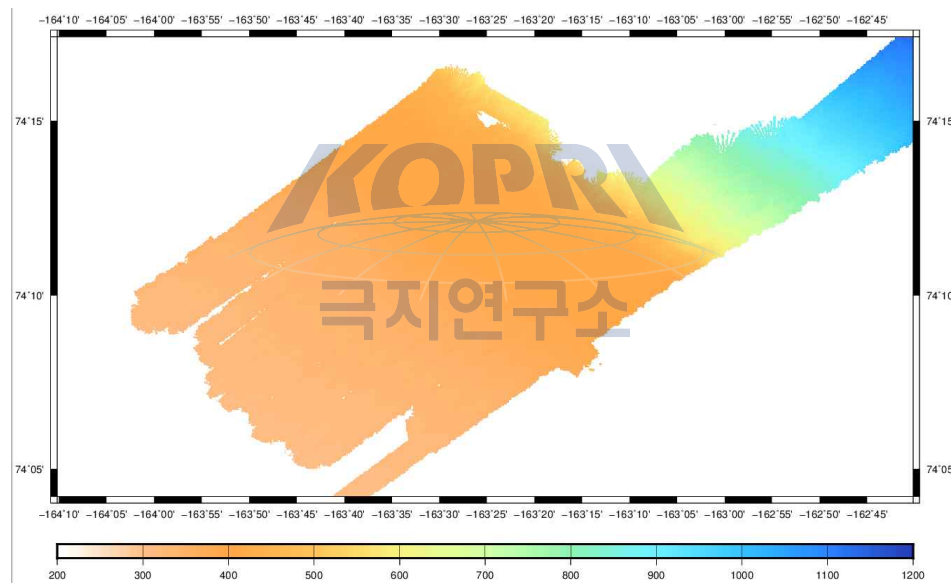


그림 43. 북극 척치해 Site A 지역 멀티빔 신호 보정후 해저 심도 분포

제 3 절 연구 결과

양극해 환경 특성을 이해하기 위하여 양극해에서 획득된 멀티 빔 자료를 처리하고 이를 통해 해저 지형과 해저면 퇴적물 특성을 분석하기 위한 방법이 연구 개발되었다. 자료 처리와 해저 지형 및 해저면 퇴적물 특성 도출을 위해 상업용 프로그램과 공개용 프로그램이 동시에 적용되어 각 각의 기능과 편의성 최종 결과 도출을 위한 일련의 과정이 검토되고 제시되었다.

기본적으로 멀티빔 신호의 특성을 분석하여 다양한 잡음 요소를 제거하기 위한 자료 처리가 수행되었으며, 최종적으로 이를 통해 남극 로스해와 북극 척치해에서 획득된 멀티빔 자료를 처리하여 조사 지역에 대한 해저 지형이 작성되었고, 필요한 구간에 대한 해저 퇴적물 분포 특성을 평가하였다.

멀티빔 조사가 수행된 조사 구간 중, 그림 43와 그림 44는 2012년 8월부터 9월까지 수행된 척치해/보버트해 지역 중 정밀 해저 지형과 해저면 특성을 조사하기 위한 site B 지역에 대한 해저 지형 및 후방 산란 반사 신호 강도를 보여주고 있다. 이 지역에 대한 상세 조사 측선은 그림 45에 제시 되어 있다.

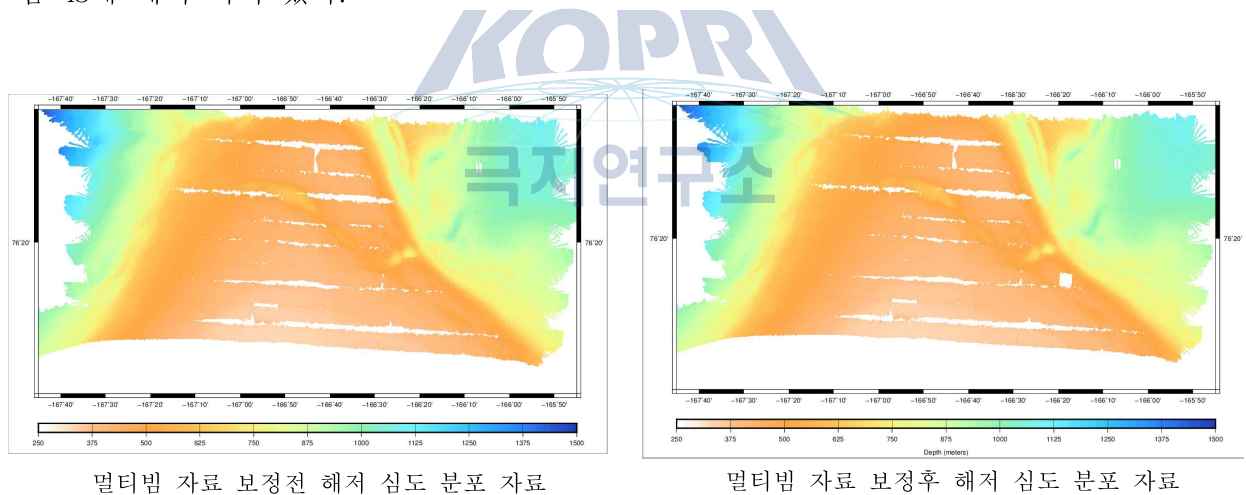


그림 43 북극 척치해 멀티빔 (2012년 8월~9월 획득) Site B 지역 해저 지형 조사 결과

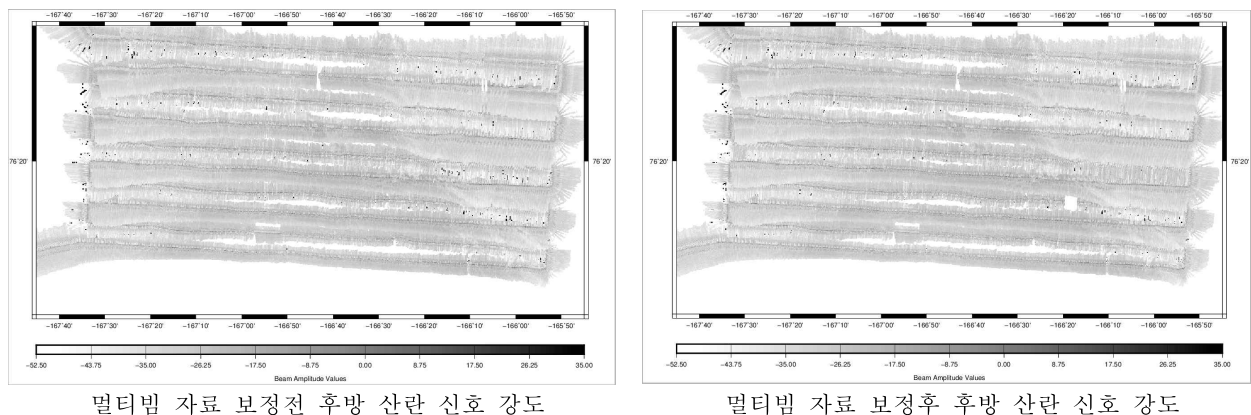


그림 44 북극 척치해 멀티빔 (2012년 8월~9월 획득) Site B 지역 해저면 신호 특성

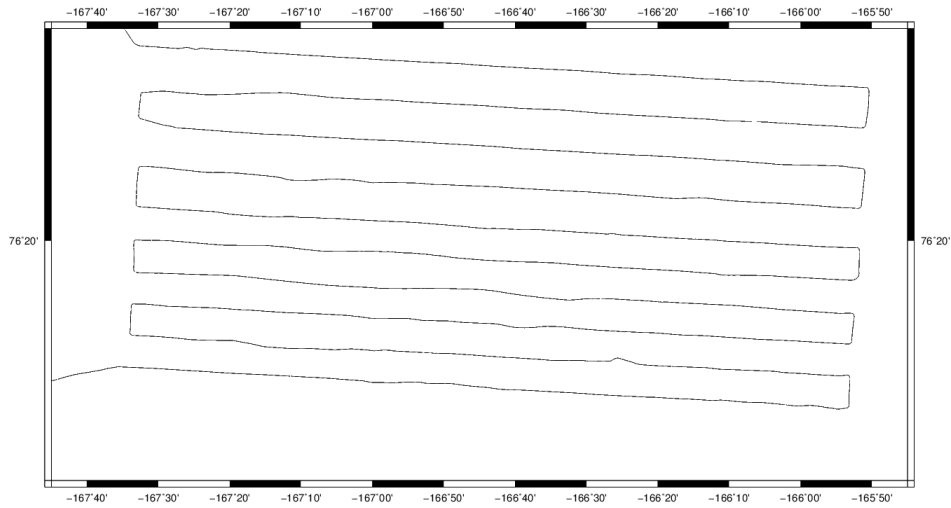


그림 45. 북극 척치해 멀티빔 정밀 조사 지역 site B 조사 측선 상세도

그림 46과 그림 47은 북극 척치해 멀티빔 상세 조사 지역인 Site A와 Site B의 3차원 해저 지형 조사 결과를 보여주며, 그림 48과 그림 49는 2012년 1월에 획득된 남극 장보고 기지 인접 로스해에 대한 3차원 해저면 지형 기록 조사 결과를 보여준다. 남극 장보고 기지 인접 로스해의 전체 상세 조사 측선도는 부록에 제공된다.

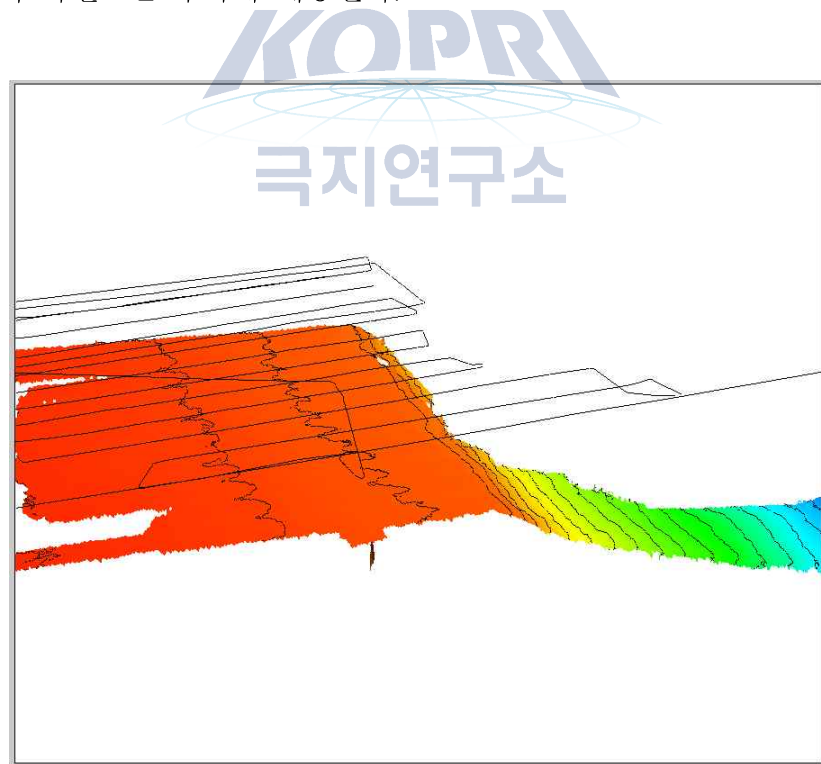


그림 46. 북극 척치해 site A 지역 해저 지형 결과

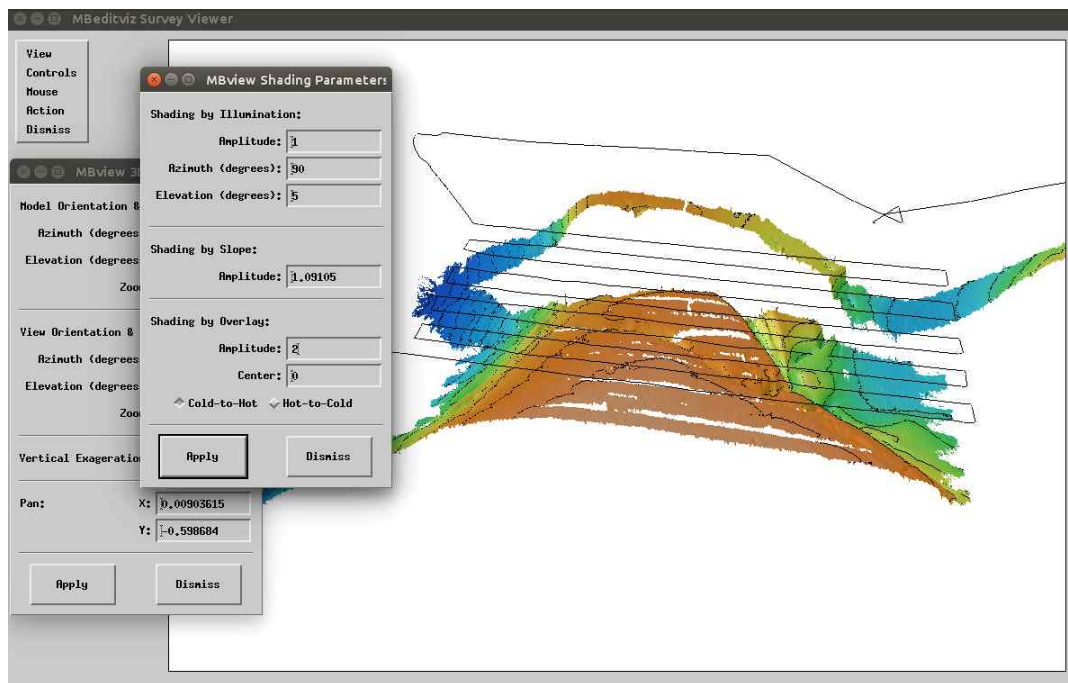


그림 47. 북극 적치해 site B 지역 해저 지형 결과

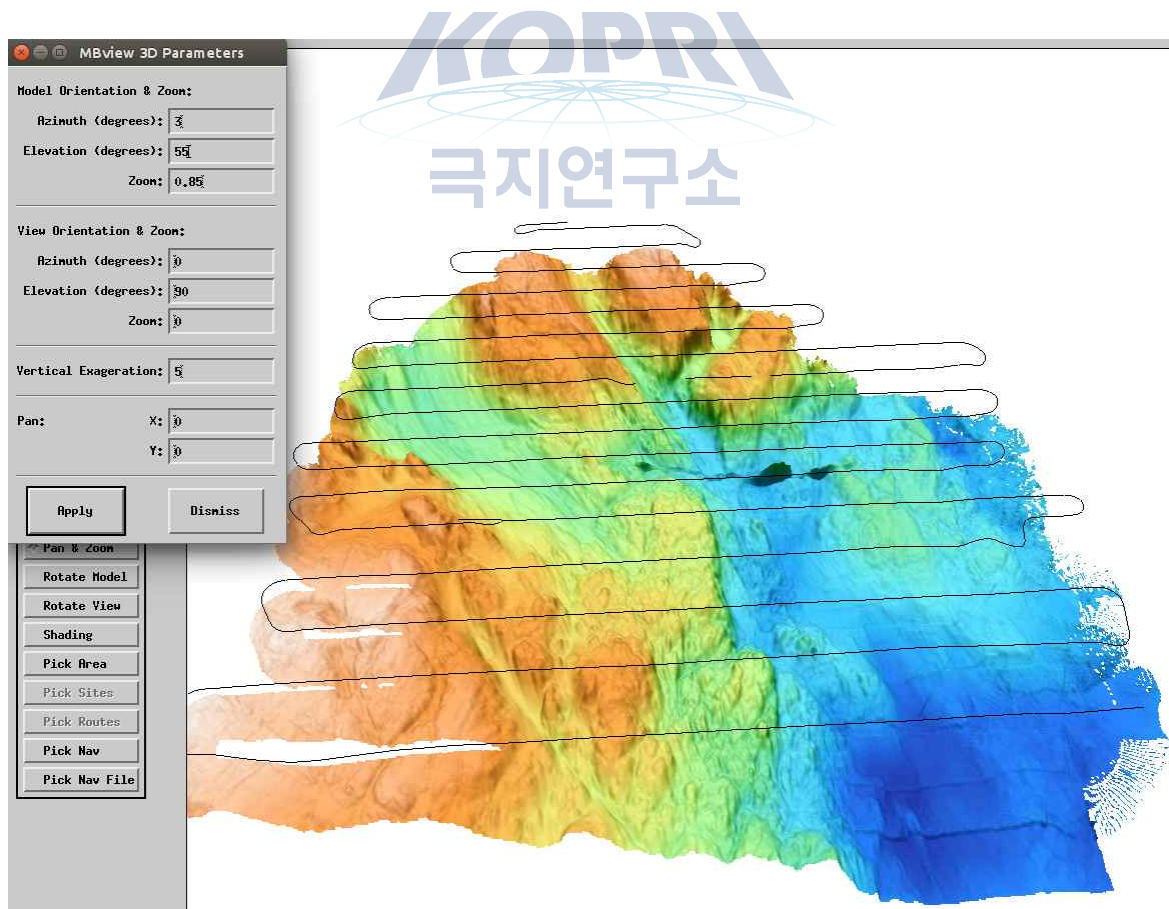


그림 48. 남극 장보고 기지 인접 로스해 2012년 1월 획득 해저 지형 기록

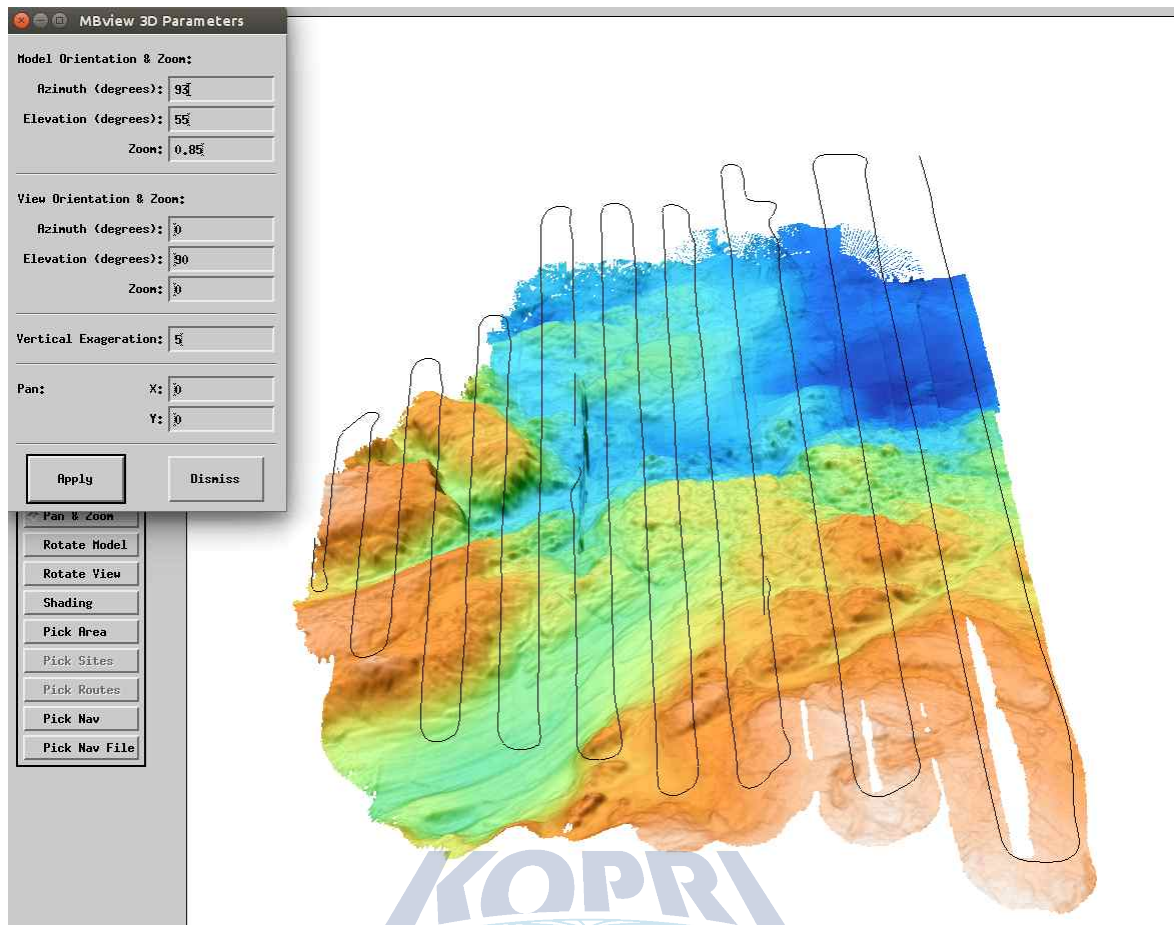


그림 49. 남극 장보고 기지 인접 로스해 2012년 1월 획득 해저 지형 기록
(그림 48동일 조사 측선 90도 회전 방향)

그림 50 역시, 2012년 1월에 획득된 남극 장보고 기지 인접 Ross Sea 멀티빔 자료를 보정한 결과를 보여준다. 그림 50의 상부 구역이 그림 48 및 그림 49에 제시된 영역에 해당된다. 특히 그림 50의 우측 그림들은 CTD 데이터 중 얻어진 SVP(Sound Velocity Profile)를 통해 보정이 수행된 결과로 실측한 SVP 자료가 있는 경우, 다소 결과가 향상 되는 것을 알 수 있다. 그러나 전반적인 형태에 있어 큰 차이는 발생하지 않는 점을 미루어 예측된 SVP 입력 값이 큰 문제가 없었음을 알 수 있다.

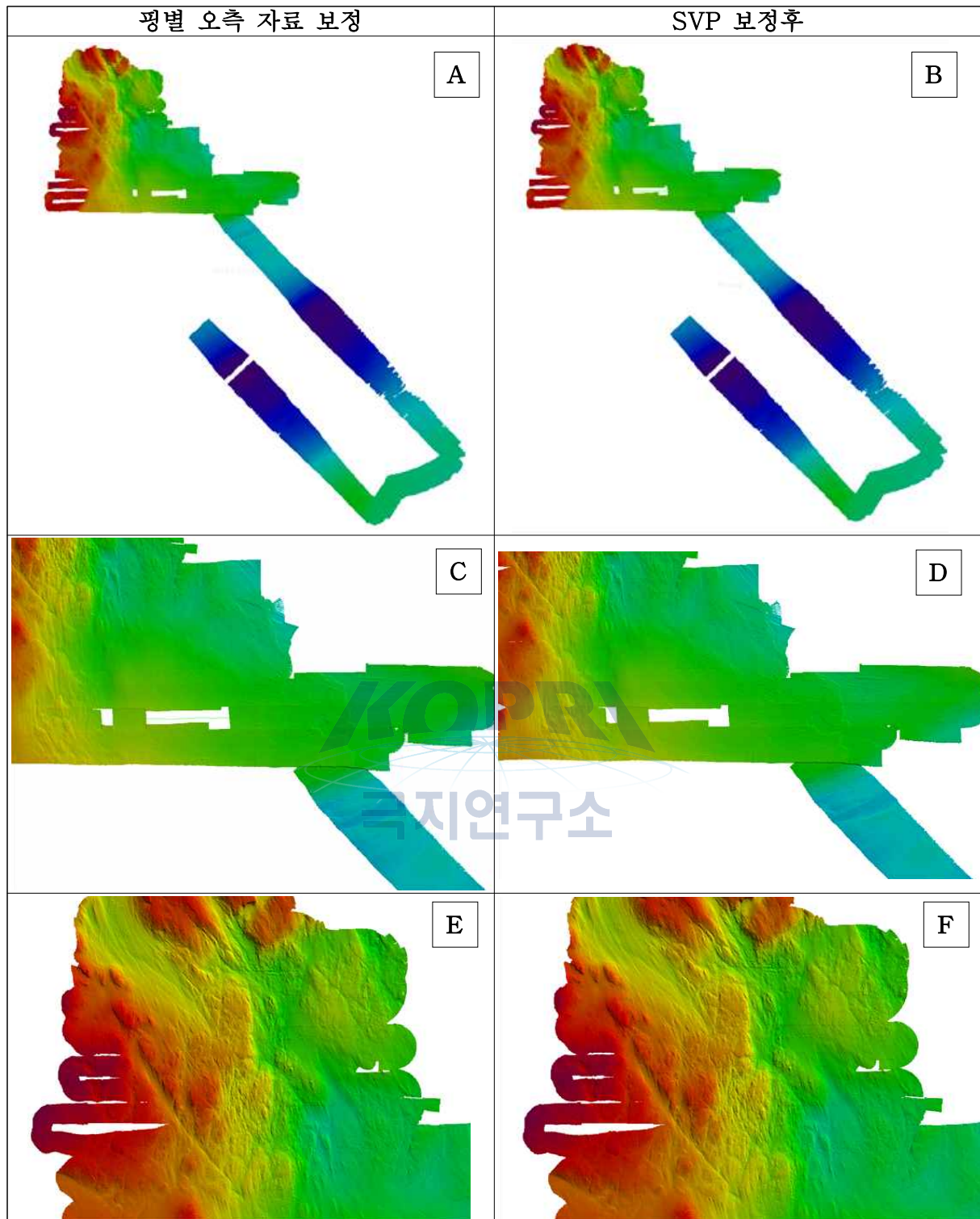


그림 50. 남극 2012 획득 Ross Sea의 평별 오측 자료 보정과 SVP 보정 결과

한편 그림 51과 그림 52는 2013년 2월에 획득된 남극 Ross Sea 멀티빔 자료를 보정한 처리 결과를 보여준다. 그림 51은 상대적으로 깊은 수심 지역 (심해 지역)에서 수행된 결과를 보여주고 있으며, 그림 52는 낮은 수심 지역 (근해 지역)의 결과를 보여준다 (정확한 위치는 그림 53 표시 부분 참조).

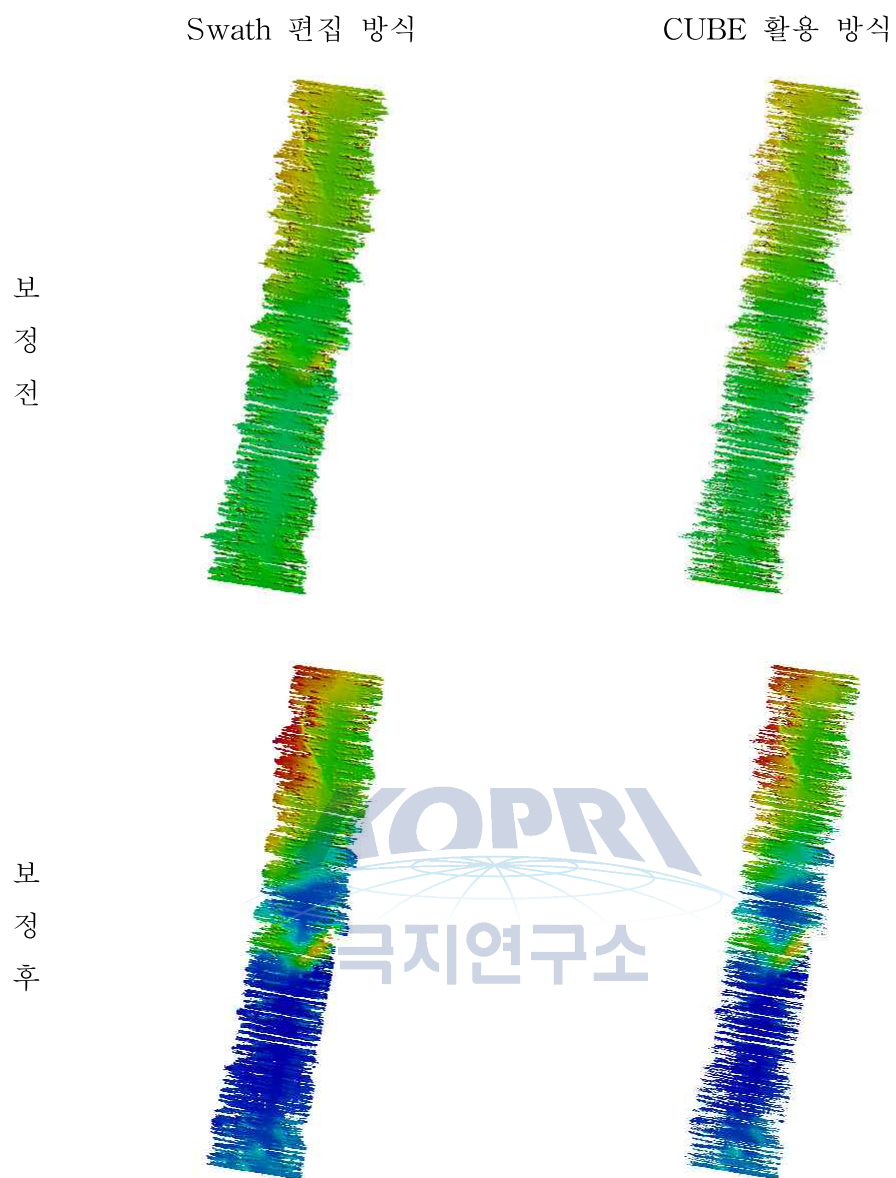


그림 51. 남극 2013 획득 Ross Sea의 평별 오측 자료 보정 결과 (심해 지역)

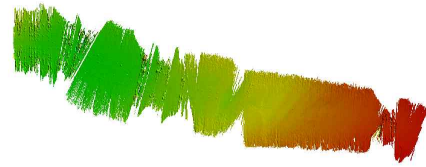
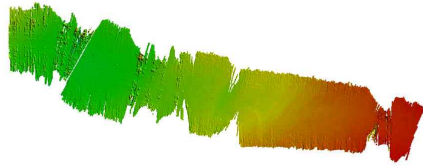
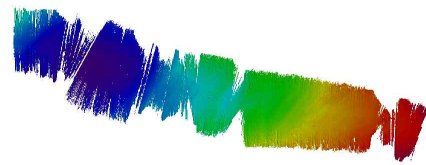
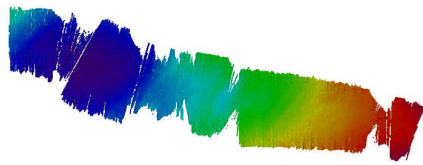
보
정
전보
정
후

그림 52. 남극 2013 획득 Ross Sea의 평별 오측 자료 보정 결과 (근해 지역)

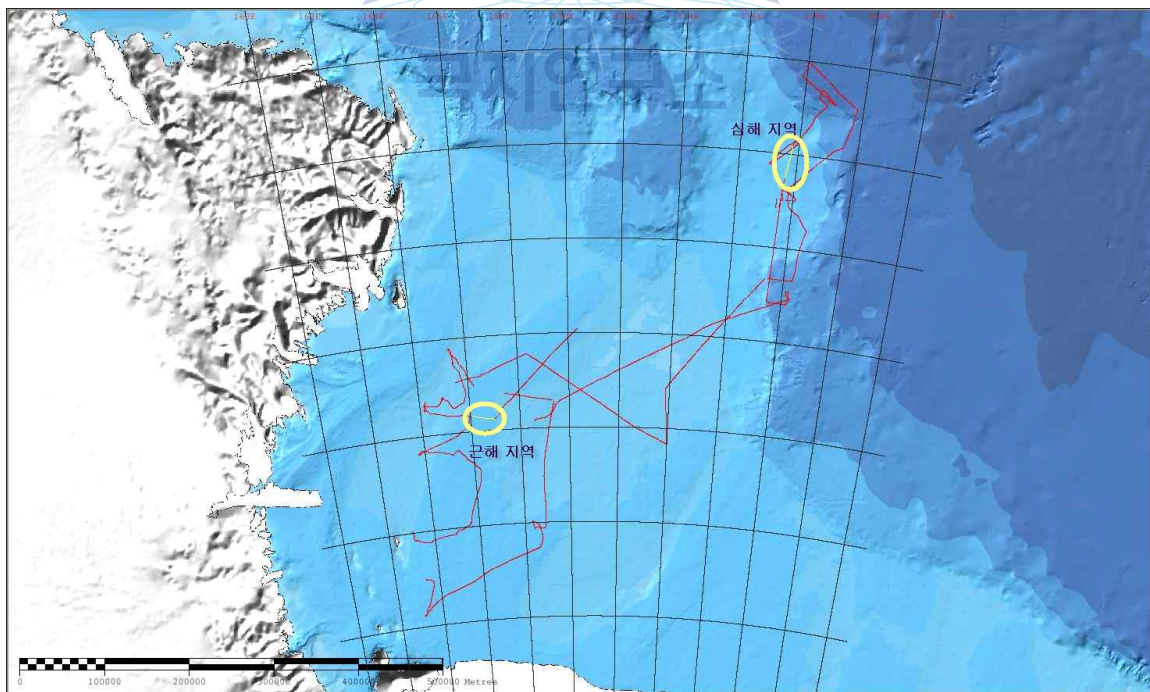


그림 53. 남극 2013 획득 Ross Sea의 평별 오측 자료 보정 결과 비교 지역 표시도

후방 산란 강도에 의한 퇴적물 특성 분석은 해저면을 생성하여 퇴적물로부터 반사되는 강도의 분석 그래프 및 해저 퇴적물의 일반적인 강도 자료를 비교하는 방식으로 가능하였다. 그

러나 전술한 바와 같이 실제 퇴적물 채취를 통한 비교 확인은 수행되지 못하여 이러한 후방 산란 신호를 통한 퇴적물 분류는 상대적인 비교 자료로 이해되어야 한다.

아래 그림 54는 멀티빔 신호의 후방 산란 강도 그래프의 분석 결과 사례를 보여준다. 분석은 CARIS HIPS and SIPS의 geocoder 모듈이 활용되었으며, 주로 입사각에 따른 반사 강도 변화 곡선 형태를 통해 판단 방식이 적용되었다.

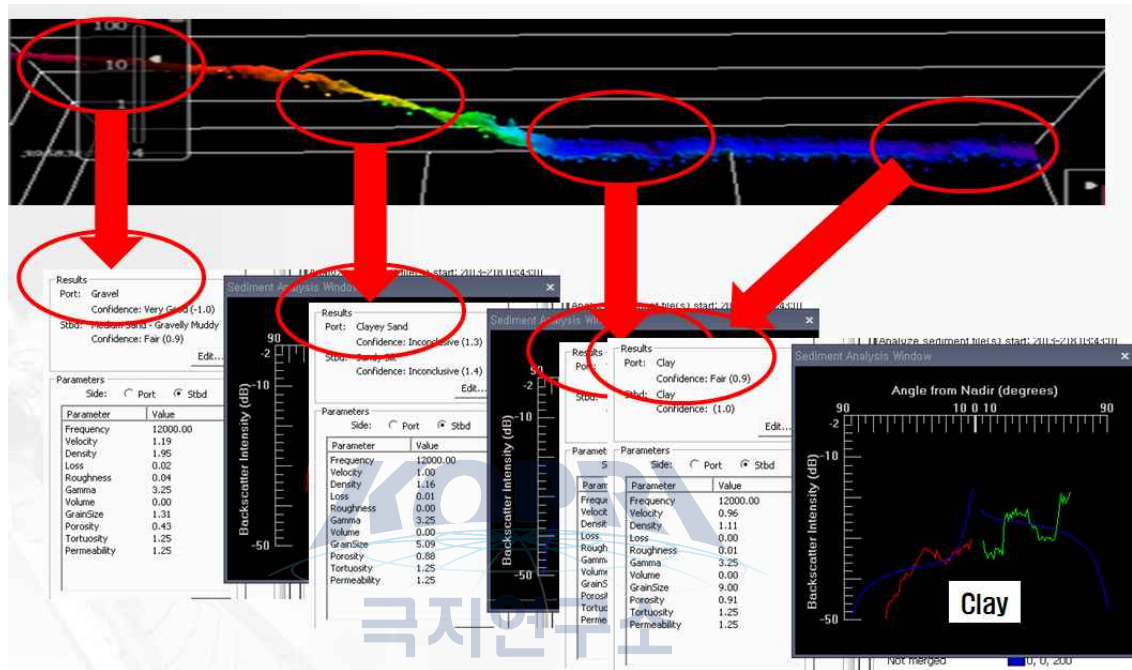


그림 54. 해저면 퇴적물 특성 분석 자료 사례

그림 55은 2013년 남극 로스해에서 획득된 멀티빔 자료의 후방 산란 신호 강도를 흑백 음영으로 표시하고 이들 산란 신호 강도를 입사각 별로 분석하는 사례를 보여준다. 이러한 후방 산란 신호에 대한 반사 강도를 입사 각도별로 표시하여 실제 그 형상에 따른 퇴적물 유추할 수 있는 도구로 활용 가능함을 확인할 수 있었다. 그러나, 이들 후방 산란 신호를 통한 최종 퇴적물 분포 결정은 실제 현장에서 채취된 일부 퇴적물 시료와 비교 분석될 필요가 있으며, 본 위탁 연구에서는 퇴적물에 대한 직접적인 자료 확보가 포함되지 않아 본 연구에서 제시하는 분석 결과는 상대적인 입도 분포를 보여주는 한계가 있을 것으로 생각된다.

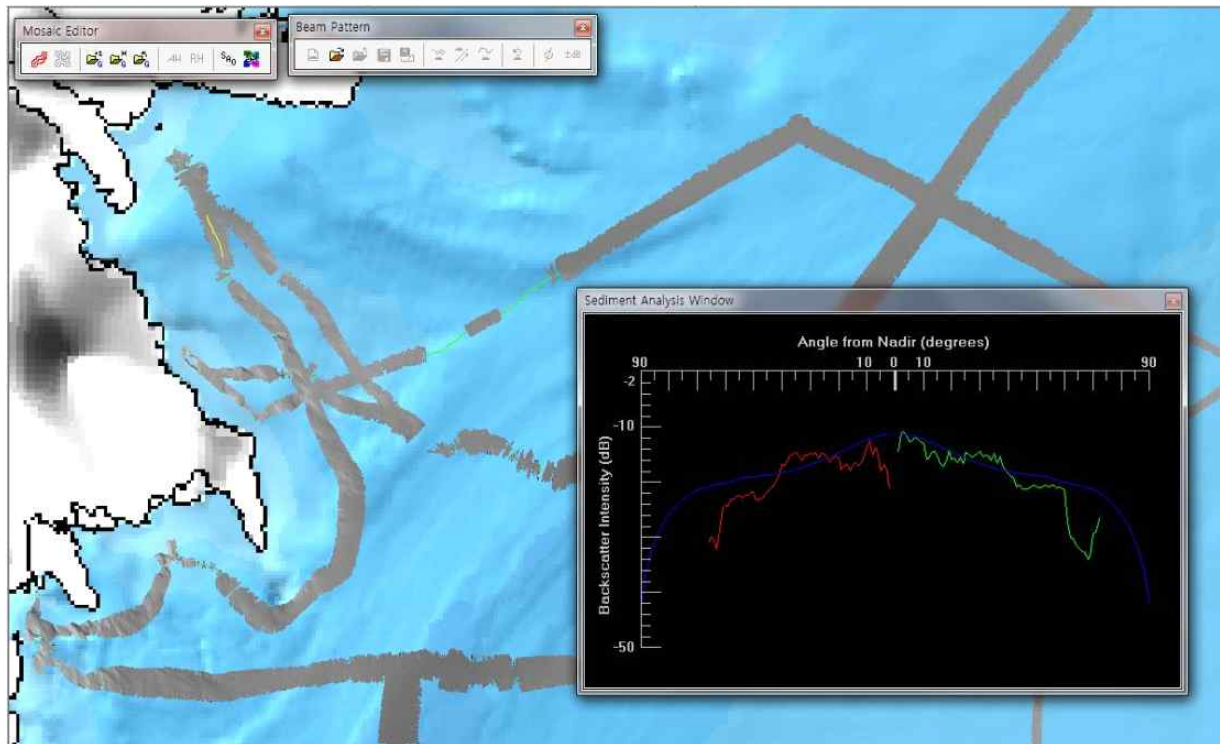


그림 55. 남극 2013 Ross Sea 후방 산란 강도 분석을 통한 해저면 퇴적물 평가 예시

본 위탁 연구 과제를 통해 도출된 연구의 주요 결과는 다음과 같이 정리된다.

- 아라온호 Kongsberg사의 멀티빔 시스템 EM-122에 해안 제원 및 현황 분석 완료
- 동해 시범 항해 (2012년 6월, 2014년 5월), 남극 로스해 (2012년 1월, 2013년 2월) 및 북극 척치/보포트해 (2012년 8월) 획득 자료 예비 처리 및 조사 정밀 측선도 작성
- 동해 및 양극해 자료의 정밀 검토 및 주요 지점에 대한 잡음 제거 효과 분석
- 양극해 자료 후방산란 신호를 통한 해저 물성 추정 수행
- 멀티빔 자료 처리 프로그램별 주요 기능 분석 및 특성 비교
- 대상 멀티빔 조사 지역에 대한 잡음 제거 해저 기록도 (bathymetry map) 구축

제 4장 연구개발목표 달성도 및 대외기여도

연구목표	연구 내용		달 성 도	수행 사항
멀티빔 신호 특성 분석 및 잡음 제거 기법 개발	(1차년 도)	아라온 EM-122 제원 분석	100%	아라온호에 설치되어 있는 Kongsberg사의 멀티빔 시스템 EM-122에 대한 제원 및 현황 분석
		멀티빔 자료 획득 및 후처리 기존 프로그램 특성 분석	100%	실제 자료획득과정을 파악하고 시험항해 동안 수행된 멀티빔 조사의 원시자료 획득 멀티빔 자료 후처리 프로그램인 MB-System의 처리과정 분석
		멀티빔 원시자료 Input/Output 처리	100%	MB-System을 이용하여 EM-122 시스템에서 획득된 원시자료의 Input/Output 처리방법을 파악하고 실제 자료 처리 활용
		멀티빔 자료 처리 모듈 활용성 평가	90%	MB-System의 일부 모듈을 이용하여 멀티빔 자료의 처리 활용성 평가 수행, 일부 자료 처리 모듈은 활용 미흡
		기획득 자료 처리	100%	동해안 시험항해에서 획득된 멀티빔 자료를 후처리 프로그램을 이용하여 처리
	(2차년 도)	산란 신호특성 분석	100%	입사각도, 반사 퇴적물 등 후방 산란 신호에 영향을 미치는 요소와 결과 분석 수행
		산란 잡음 제거 기법 제시	100%	불필요한 산란 잡음 제거 기법들에 대한 이해와 수동/자동 처리 기법 적용방식 제시
		산란 신호 semi-automatic 분리 알고리즘 개발	90%	기존 개발 알고리즘 활용 중심 수행, 부분적 수동 처리 부분은 기개발 프로그램 활용, 독자적 알고리즘 개발 미흡
	(3차년 도)	멀티빔 활용 도출 해저면 특성 제시	100%	기존 프로그램 관련 모듈 적용을 통한 멀티빔 후방 산란 신호를 이용한 해저면 특성 분석 및 평가 결과 제시
		척치해 멀티빔 자료 처리	100%	북극 척치해 멀티빔 자료를 활용한 해저 지형 결과 제시
		척치해 해저면 특성 분석	100%	후방산란 반사 강도 분포 및 geocoder 활용 척치해 해저면 특성 분석
멀티빔 신호 특성 분석 및 잡음 제거 기법 개발 멀티빔 자료 활용 해저 정량 정보 제공	(4차년 도)	로스해 멀티빔 자료 처리	100%	남극 로스해 멀티빔 자료를 활용한 해저 지형 결과 제시
		로스해 해저면 특성 분석	100%	후방산란 반사 강도 분포 및 geocoder 활용 남극 로스해 해저면 특성 분석
	(5차년 도)	북극해 멀티빔 자료 처리	100%	북극 척치해 멀티빔 자료에 대한 보정 처리 전후 자료 활용 해저 지형 결과 제시 및 비교 수행
		북극해 해저면 특성 분석	100%	북극 척치해 멀티빔 자료에 대한 보정 처리 전후 자료 활용 후방산란 반사 강도 분포 및 geocoder 활용 해저면 특성 분석 및 비교 결과 제시

전반적인 연구 목표에 따른 달성도는 전체적으로 약 95% 이상으로 평가된다. 일부 자체 알고리즘 개발과 기존 프로그램의 전체 모듈 활용은 현재 아라온에 장착된 시스템이 water column 방식 자료 저장이 되지 않는 부분 및 일부 보조 자료 (SVP 실측 자료 등)

의 미흡 등으로 완전하게 수행되지 못하였다. 특히 최초 유빙 산란 신호 제거 방식에 대한 접근은 연구 기간 동안 확보된 자료 중, 특별히 유빙에 의한 잡음으로 평가되는 부분이 없고, 실질적인 개발을 위해서는 기존 프로그램의 원시 코드 분석 등이 수행되어야 하는 시간적 한계와 연구 능력 미비로 충분하게 수행하지 못하였다. 그러나 조사 지역에 대한 분명한 해저 지형 작성 및 후방 산란 신호를 활용한 퇴적물 분석 결과 등은 극지 환경 이해 및 양극해 환경 특성 지도 제작을 위한 기초 자료로 향후 활용 가능할 것으로 평가된다. 또한 멀티빔을 통한 해저 지형 정보 등은 극지 해양 및 지질 연구에 가장 기본적이고 필수적인 자료로 이를 필요로 하는 타 연구에 적극적으로 기여 할 수 있을 것으로 판단된다.



제 5 장 연구개발결과와 활용계획

멀티빔 장비 및 후처리 프로그램의 특성을 파악함으로써 멀티빔 자료의 구성 및 획득 방법을 정확히 파악할 수 있고, 그에 맞는 분석 기술을 확보할 수 있다. 또한 이러한 연구는 해저면의 지질정보에 대한 획득 기술의 발전을 위해 기본이 되는 연구로 다른 연구에 비해 선행적 수행되어야 할 과제이다. 또한 공개용 프로그램인 MB-System을 활용함으로써 필요한 연구 목적에 맞는 처리 및 분석을 위한 기법을 개발하는 것이 가능할 것으로 판단된다.

한편 상업용 멀티빔 자료 처리 프로그램은 단시간에 결과를 도출하여야 하는 경우 크게 도움이 되며, 특히 많은 양의 자료를 처리하는 데 필수적으로 활용될 수 있다. 다만, 활용 모듈별로 필요한 경우 별도의 검증을 하여 프로그램의 신뢰성을 높일 필요가 있다고 생각된다. 향후 멀티빔 자료의 잡음을 효과적으로 제거하여 필요한 정보를 확보하여야 할 때 본 위탁 연구 과제의 결과는 적극적인 활용이 가능할 것으로 판단되며, 축적된 연구 및 다양한 방법의 자료 처리는 해저면의 지질정보에 대한 멀티빔을 이용한 효과적인 자료 획득 및 최적 분석기법의 효율적인 개발에 꼭 필수적 기술이라고 할 수 있다. 이러한 내재된 정보를 활용하고 극대화하는 것은 특이한 극지 환경의 발견 가능성을 높이고, 경제성 있는 조사 평가 기술을 확보하는데 기여할 것이다.

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부록 목록

1. □ EM-122 Specitification 『Kongsberg 제공』
2. □ CARIS HIPS and SIPS User' Guide 차례
(전체 설명서는 전산 PDF 파일로 제공)
3. □ MB-System Program List
4. □ EM multibeam datagram 차례
『Kongsberg 제공』
(전체 내용은 전산 PDF 파일로 제공)
5. □ 남극 장보고 인접 로스해 멀티빔 조사 상세
측선도 (2012년 1월 조사 수행)

부록 1.

EM-122 Specitification 『Kongsberg 제공』



Kongsberg EM® 122

12 kHz multibeam echo sounder



KONGSBERG

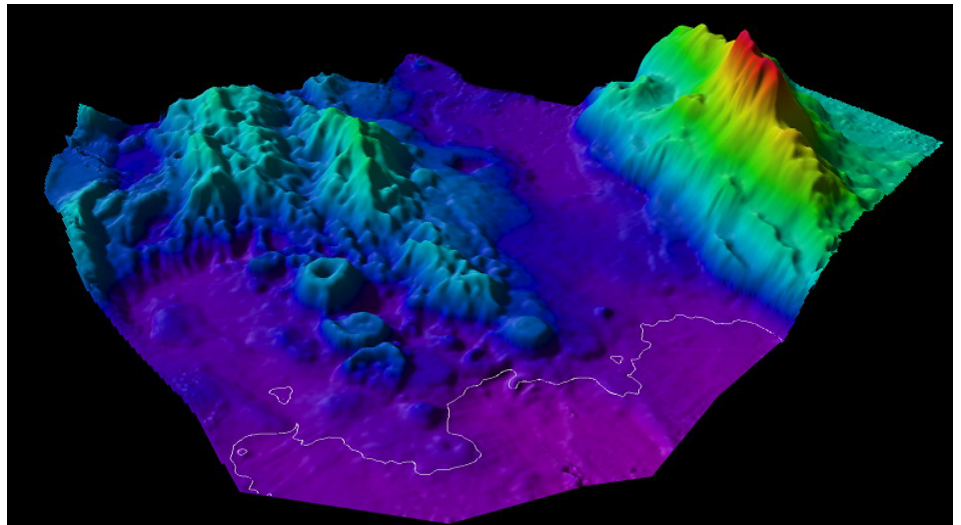
Advanced functions

- Depth range from 20 to 11000 m
- Swath width up to 6 times water depth/30 km
- Focused beams for transmission and reception
- High density and multiping modes for increased resolution
- Up to 864 soundings per ping
- Yaw, pitch and roll compensation and stabilization
- High accuracy
- Seabed image (sidescan) data display and recording
- Water column data display and recording
- Modular design, beamwidths 0.5 to 4 degrees
- Dual and triple frequency versions possible
- Integrated sub-bottom profiler available
- Mammal protection

The EM 122 12 kHz multibeam echo sounder is designed to perform seabed mapping – bathymetry and seabed imagery- to full ocean depth with an unsurpassed resolution, coverage and accuracy. It represents a major improvement from previous models by offering significantly larger swath width, improved data density, and greatly improved resolution. Beam focusing is applied both during reception and transmission.

EM 122 is equipped with a function to reduce the transmission power in order to avoid hurting mammals if they are close by.

The system has up to 432 soundings per swath with pointing angles automatically adjusted according to achievable coverage or operator defined limits.



EM 122 survey of the Gakkel Ridge by the Swedish Icebreaker ODEN, depth 4000 m.

Data courtesy of Stockholm University



With multi-ping (two swaths per ping) the transmit fan is duplicated and transmitted with a small difference in alongtrack tilt. The applied tilt takes into account depth, coverage and vessel speed to give a constant sounding separation alongtrack.

In multiping mode, 2 swaths are generated per ping cycle, with up to 864 soundings. The beam spacing is equidistant or equiangular.

EM 122 uses both CW pulses and FM sweep pulses with pulse compression on reception, in order to increase the maximum useful swath width. The FM pulses will also increase the resolution compared to CW pulses of the same length.

The transmit fan is split in several individual sectors with independent active steering. This allows stabilization which compensates for

the vessel movements: yaw, pitch and roll. Each transmit sector has individual beam focusing.

The EM 122 transducers are modular linear arrays in a Mills cross configuration with separate units for transmit and receive. The projector array is available as 0.5, 1, 2, or 4 degree resolution, while the receive array is available as 1, 2, or 4 degrees.

The receive transducer is wideband. In conjunction with a separate low frequency transmit transducer, the EM 122 may optionally be able to deliver sub-bottom profiling capabilities with a very narrow beamwidth. This system is known as the SBP 120 Sub-bottom Profiler.

Dual or triple frequency versions can be obtained by integration with other EM multibeamers.

EM 122 performance data

Operating frequency..... 12 kHz
 Depth range..... 20-11000 m
 Swath width..... 6 x Depth, to approx 30 km
 Pulse forms..... CW and FM chirp
 Swath profiles per ping..... 2

Motion compensation:

- Yaw..... ± 10 degrees
- Pitch..... ± 10 degrees
- Roll..... ± 15 degrees

Sounding pattern..... Equi-distant on bottom/equiangular
 Range sampling rate..... 3.03 kHz (25 cm)
 High resolution mode..... High Density processing
 Sidelobe suppression..... - 25 dB
 Suppression of sounding artefacts..... 8 frequency coded transmit sectors
 Beam focusing..... On transmit and on reception
 Beamforming method..... Time delay
 Gain control..... Automatic
 Swath width control..... Manual or automatic, all soundings intact when reduced swath width
 Seabed imagery/sidescan sonar image..... Standard
 Water column display..... Standard
 Mammal protection..... Standard
 Multi frequency operation..... Yes, by integration with other EM
 Sub-bottom profiling..... Yes, by integration with SBP 120 and Topas

Versions of EM 122

System version	0.5x1	1x1	1x2	2x2	2x4	2x4
Transmit array [deg]	150 x 0.5	150 x 1	150 x 1	150 x 2	150 x 2	150 x 4
Receive array [deg]	1 x 30	1 x 30	2 x 30	2 x 30	4 x 30	4 x 30
No of beams/swath	288	288	288	288	144	144
Max no of soundings/swath	432	432	432	432	216	216
Max no of swaths per ping	2	2	2	2	2	2
Max no of soundings/ping	864	864	864	864	432	432

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KONGSBERG

부록 2.

CARIS HIPS and SIPS User' Guide 차례
(전체 설명서는 전산 PDF 파일로만 제공)





HIPS and SIPS 7.0 User Guide

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- The Ocean Mapping Group of the University of New Brunswick
- The National Oceanic and Atmospheric Administration (NOAA)
- University of New Hampshire

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Part I: Processing in HIPS&SIPS

- 1.** Introduction
- 2.** The HIPS & SIPS Interface
- 3.** Workflow in HIPS and SIPS
- 4.** Create Vessel File
- 5.** Create a New Project
- 6.** Convert Data
- 7.** Sound Velocity Correction
- 8.** Correct for Tide
- 9.** Merge
- 10.** Compute TPU
- 11.** Create Field Sheets
- 12.** BASE Surfaces
- 13.** CUBE Processing
- 14.** Data QC
- 15.** Filtering
- 15.** Statistical Surface Cleaning
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- 18.** Create Product Surfaces
- 19.** Processing in SIPS—Mosaic Editor
- 20.** Processing in SIPS—Side Scan Editor
- 21.** Processing Single Beam Data
- 22.** Processing Lidar Data
- 23.** Batch Processing
- 24.** Create Publications
- 25.** Export Data



1

Introduction

“PURPOSE OF HIPS AND SIPS” ON PAGE 4

“LICENSING” ON PAGE 5

“CONFIGURATION REPORT” ON PAGE 6

“IF YOU NEED ASSISTANCE...” ON PAGE 7

“FIELD SHEET EDITOR FUNCTIONS” ON PAGE 8

Purpose of HIPS and SIPS

HIPS and SIPS are designed to receive bathymetric and side scan sonar data from a variety of industry standard data-logging formats. HIPS and SIPS contain tools for interactively and automatically identifying bathymetric outliers. Also, there is a wide range of proven and powerful algorithms for applying value-added processes to the data. The result of all these operations is a clean and final dataset that is ready for the creation of wide range of data products, available within the HIPS and SIPS software and other integrated CARIS products.

- The HIPS and SIPS products share a common Windows interface containing editors for vessel, attitude, navigation, single beam bathymetry, swath bathymetry, side scan sonar, and other data sensors.
- The program also contains a georeferenced project view window for displaying the spatial location of these observed data with other georeferenced data, for example orthophotos, raster charts, CARIS vector map files, and S-57 Edition 3.1 data.
- HIPS and SIPS also performs the tasks necessary to generate finished field sheets, as well as contours and shoal soundings selections. It can also add cartographic data to the field sheet and define a customized plot layout, as well as generating composited mosaics and seafloor sediment analysis.

Licensing

HIPS and SIPS is comprised of three distinct products, each with its own license. This table outlines these licensing levels and the options that are included with each.

Product	Supported Formats	Data Cleaning	Data Processing
HIPS Singlebeam	• Atlas • GSF • Hypack • Winfrog • generic ASCII data	• Interactive single beam depth cleaning • Automatic single beam spike filters • Subset area cleaning • Automatic TPU filtering	• tide zoning, • sound velocity corrections • batch processing
HIPS Multibeam Professional	HIPS Singlebeam plus • Elac • Furuno • LADS • Seabeam • Seafalcon • Simrad • UNBReson • XTF	HIPS Singlebeam plus • interactive swath cleaning • automatic swath filters • refraction repair, • integrated side scan display • 3-D subset area cleaning • statistical surface cleaning	HIPS Singlebeam plus • tide zoning, • sound velocity corrections • BASE surfaces
SIPS Professional	• Atlas • CMAX • Coda • EdgeTech • MarineSonics • Qmips • Seabeam • Seafalcon • SEG Y • Simrad • XTF	• side scan viewing and cleaning • digitize towfish altitude	• Recompute towfish navigation • slant-range correction • mosaics • generate side scan contacts

All HIPS and SIPS products include the following features:

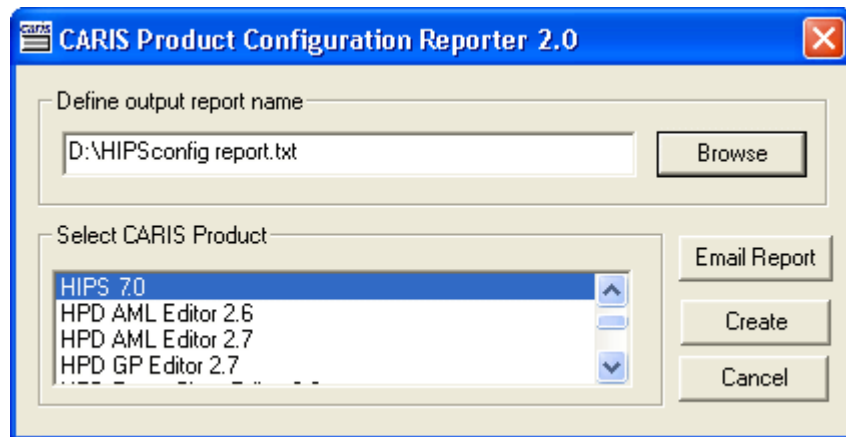
- vessel configuration
- tide/sound velocity preparation
- attitude/navigation cleaning
- GPS RTK tide
- background displays
- variable depth tiling
- contouring
- plotting

Configuration Report

The configuration report is a text file containing a list of program, environment and system resources used by HIPS and SIPS.

1. From the Windows main menu, select **Start > Caris > Utilities > Configuration Reporter**.

The Configuration Reporter is displayed.



The CARIS Product Configuration Reporter contains a list of CARIS products already installed on your computer. This list is inactive until you select a path and name for the configuration report

2. Type a file path and name for the configuration report file, or click **Browse** and select a file path and type a name.

The list of CARIS products is now active.

3. Select HIPS and SIPS (version number) from the list.
4. Click **Create** to create a report in the selected folder, or click **Email Report** to create the report and send it as an email attachment to CARIS support.

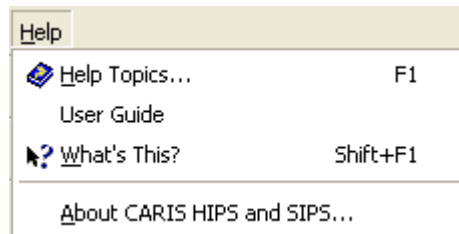
The Configuration Report contains the following information:

- list of program files with version info
- HIPS and SIPS environment settings
- CARIS kernel registry
- system information
- system and user's environment
- CARIS licensing report

If you need assistance...

There are several options for getting help:

- Refer to the **User Guide** for the HIPS and SIPS editor you are using.
- Refer to the **Online Help** file in the editor you are working with by selecting Help > Help Topics.



- Refer to the **training material** you received when you attended the CARIS classroom training.
- Call **Customer Support** if you are unable to find an answer in Help or in the user documentation.

Before you contact CARIS Customer Support:

Are you able to reproduce the problem?

Have you looked for an answer in the documentation listed above?

Be prepared to describe the task(s) you were performing when you encountered the situation.

Be prepared to provide a description of what happened and any error messages you received. You can refer to the log files generated when the error occurred.

Field Sheet Editor functions

Field Sheet Editor functions were integrated into the HIPS and SIPS interface in this release. The following table lists the location of commonly used commands:

Command in Field Sheet Editor	New location in HIPS&SIPS interface
View > Scale / Alter Scale	View > Zoom > Zoom To
Delete Field Sheet	Delete - on right-click menu in Layers window
Delete layer of a Field Sheet	Delete - on right-click menu in Layers window
Turn off field sheet	
Session tab FS tab	Layers window/tab
Contours	Process > Products > Contours
Product Surface	Process > BASE Surface > Product Surface
Exporting / Importing Profiles	Process > Products > Profile > Import / Export
Projection Grid	Select Field sheet layer & Process > Products > Projection Grid...
Use Coordinate System	On right-click menu in Layers window
Sounding Selection Wizard	Process > Products > Selected Soundings ...
View > Object Filter	Create Layer > by Attribute Value, Feature Type, Rule wizard etc.
Tools > Options > General - Contour options	Tools > Options > Display > Contours
Remove Layer	Remove layer on right-click menu in Layers tab
Tools > Tiles > Tiling Wizard	Process > Products

2

The HIPS & SIPS Interface

This chapter describes the interface and its components, and how to open projects and background data, use viewing and selection tools and take screen captures.

It also describes the 3-D Display Window and its properties.

In this chapter...

- "OPENING HIPS AND SIPS" ON PAGE 10
- "MAIN DISPLAY" ON PAGE 11
- "DISPLAY WINDOW" ON PAGE 12
- "CONTROL WINDOW" ON PAGE 13
- "PROPERTIES WINDOW" ON PAGE 16
- "WORKSHEET WINDOW" ON PAGE 18
- "REPOSITION AND RESIZE WINDOWS" ON PAGE 25
- "TOOLBARS" ON PAGE 27
- "OPEN PROJECTS AND BACKGROUND DATA" ON PAGE 31
- "DISPLAY TOOLS" ON PAGE 38
- "SELECTION TOOLS" ON PAGE 42
- "SCREEN CAPTURES" ON PAGE 46
- "3D DISPLAY WINDOW" ON PAGE 47
- "MEASURE DISTANCE" ON PAGE 65

Opening HIPS and SIPS

1. To open HIPS from the Windows interface, select Start > Programs > CARIS > HIPS and SIPS *version number* > CARIS HIPS and SIPS



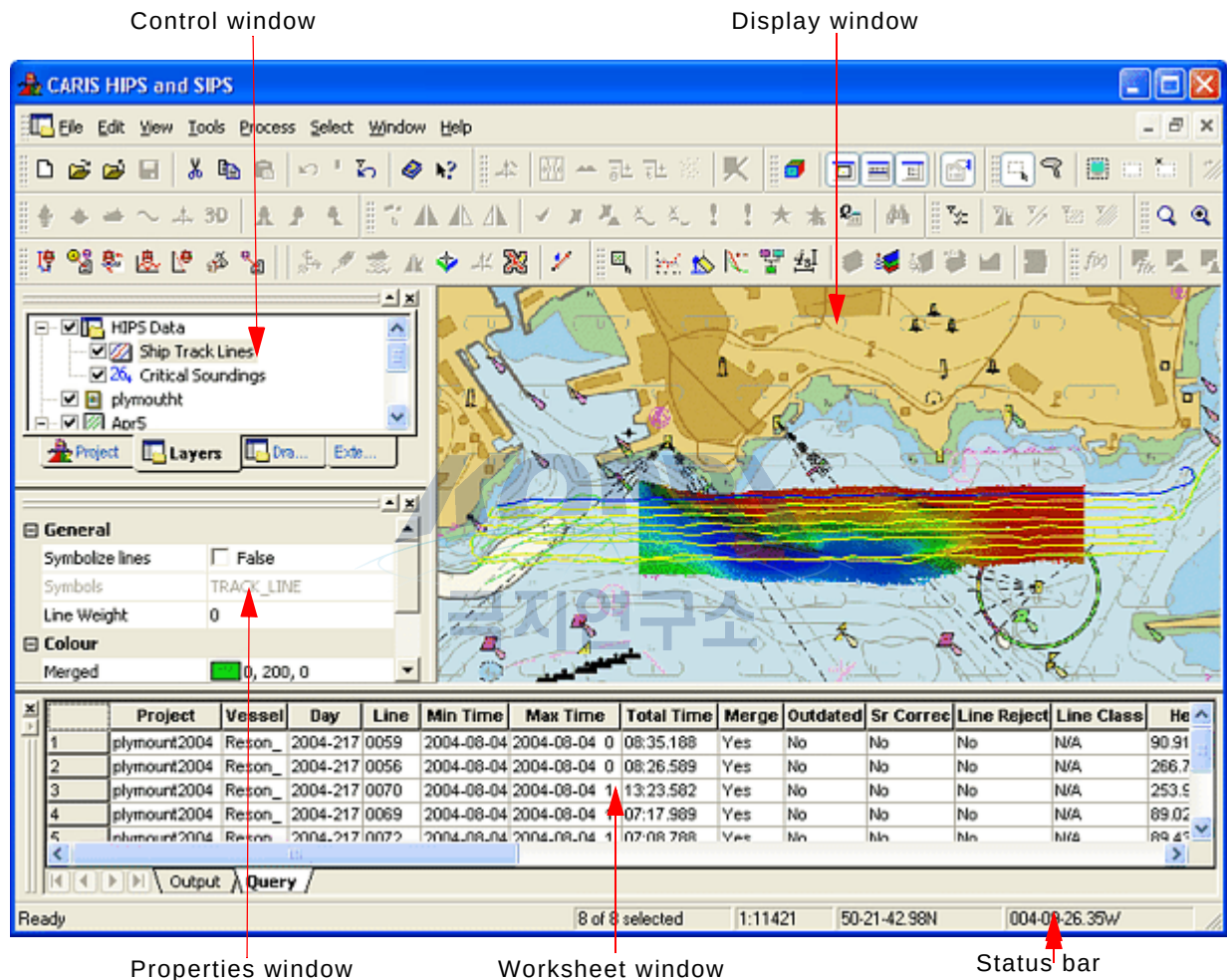
During installation you were prompted to place a HIPS icon on the desktop. If you selected this option you can also open HIPS and SIPS by double-clicking this icon.



Main Display

The HIPS and SIPS interface has four windows:

- Display window
- Worksheet window
- Properties window
- Control window



The windows can be displayed, hidden, or resized and moved to another location (see "REPOSITION AND RESIZE WINDOWS" ON PAGE 25).

The interface also includes toolbars (see "TOOLBARS" ON PAGE 27) and a status bar (see "STATUS BAR" ON PAGE 26).

Display Window

Menu	Window > Display
Tools	

The Display window shows a graphical representation of the survey area.

1. Select the Display window command.

You can perform the following functions in this window:

- select track lines (see “[QUERY LINE DATA](#)” ON PAGE 290)
- zoom and pan data (see “[ZOOM](#)” ON PAGE 39 and “[PAN](#)” ON PAGE 38)
- view graphic files (see “[OPEN BACKGROUND DATA](#)” ON PAGE 33) and S 57 data (see “[DISPLAY S-57 DATA](#)” ON PAGE 36)
- define a field sheet area (see “[CREATE A FIELD SHEET](#)” ON PAGE 210).
- save screen captures of the display in the window (see “[SCREEN CAPTURES](#)” ON PAGE 46)

For options for the display of the ship and towfish track lines see “[DISPLAY WINDOW](#)” ON PAGE 661.



Control Window

Menu	Window > Control
Tools	

The Control window has four tabbed windows: Project, Layers, Draw Order and Extended Query.

A fifth tabbed window will be available when you open a HIPS and SIPS editor, such as the Mosaic Editor or Attitude Editor.

The Control window is open as part of the default HIPS and SIPS layout, but it can be closed. To reopen the Control window:

1. Select the Control window command.

Project tab

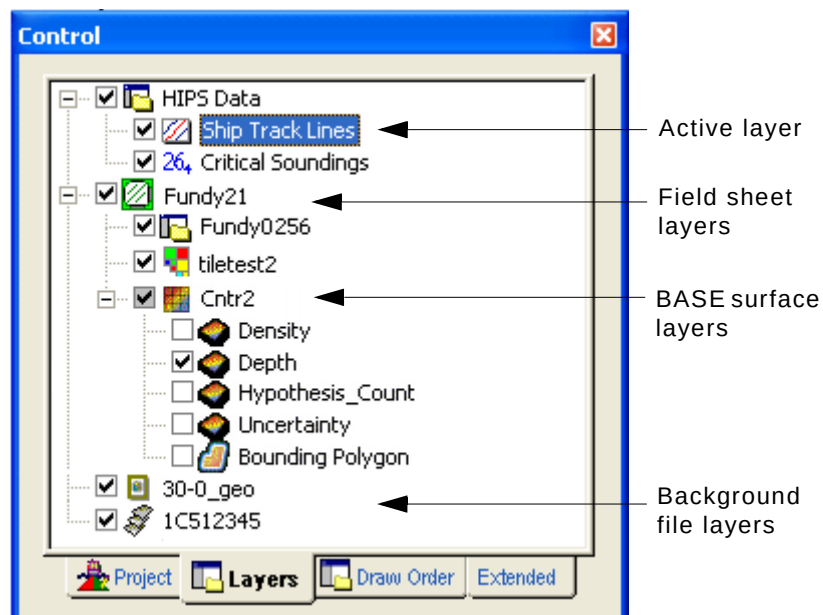
The **Project tab** displays the currently open project files. Files are organized in a Project-Vessel-Day-Line hierarchy. You can expand a file tree by clicking the plus sign (+) beside a folder.

You can perform the following operations in this window:

- open and close lines (see “CLOSE A PROJECT” ON PAGE 68)
- select track lines (see “QUERY LINE DATA” ON PAGE 290)

Layers tab

The **Layers tab** lists the open data layers. Besides survey data, a layer can consist of a CARIS map, an image, or field sheet products such as contours, selected soundings, tiles, etc.

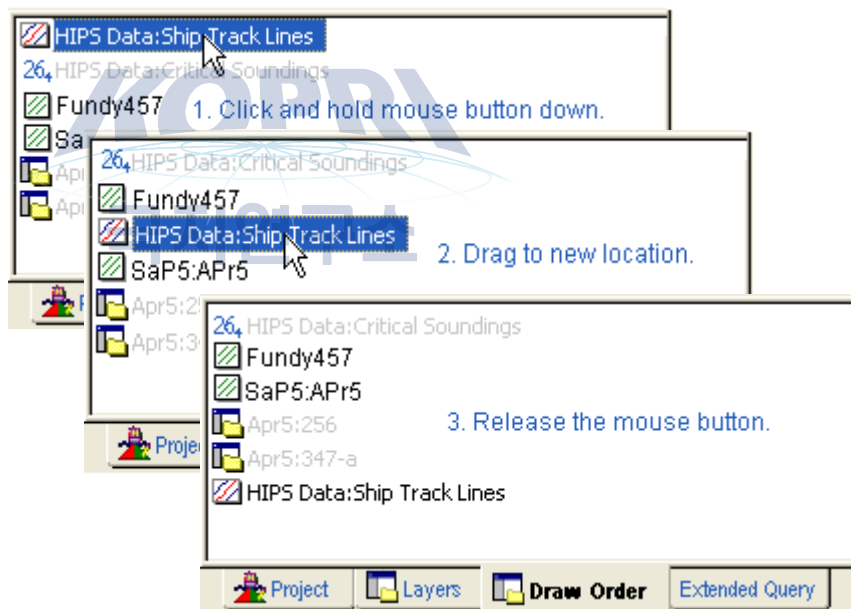


You can control what is viewed in the Display window by selecting or clearing the layer check boxes.

1. If necessary, expand an object file tree by clicking the + icon beside it.
2. Show/hide a layer by selecting or clearing the check box beside the layer name.
3. Select the Refresh command, or make sure the Automatic Refresh option in the General Options dialog box is selected (see “GENERAL” ON PAGE 657).

Draw Order tab

The **Draw Order** tab displays the order that objects are drawn to the Display window. Objects are drawn in order, from top to bottom, as they appear in the Draw Order tab. You can change the draw order by dragging an object to another position on the list.

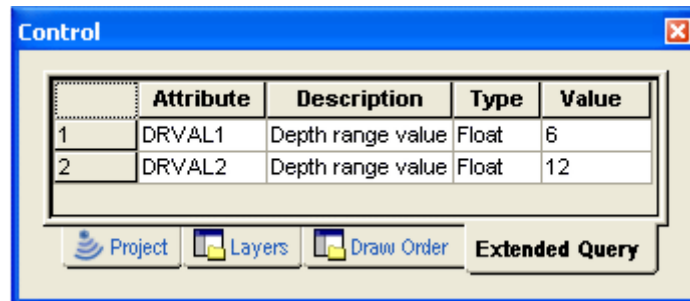


Extended Query

The **Extended Query** tab displays attributes of selected S- 57 background features when they are queried.

For example, after you have used the Query command on features selected in an S-57 (*.000) or HOB file opened as background data, you can then select one of the queried features

in the Query tab and its attributes will display in the Extended Query tab.



Tab for editors in HIPS

When you open HIPS and SIPS editors such as the Attitude, Navigation, Subset or Sidescan Editor, a fifth tab will be displayed in the Control window. It will contain the controls for the active editor, for example, you can:

- filter attitude data (see [“ATTITUDE FILTER” ON PAGE 284](#)).
- examine navigation data (see [“EXAMINE NAVIGATION DATA” ON PAGE 279](#)).
- control the display of subset data (see [“SUBSET EDITOR TAB” ON PAGE 623](#)).
- modify Swath Editor windows (see [“SWATH EDITOR DISPLAY OPTIONS” ON PAGE 640](#)).
- repair refraction problems (see [“THE REFRACTION EDITOR” ON PAGE 326](#)).
- set display options, create contacts in side scan data (see [“SIDE SCAN EDITOR CONTROLS” ON PAGE 425](#)).

Properties Window

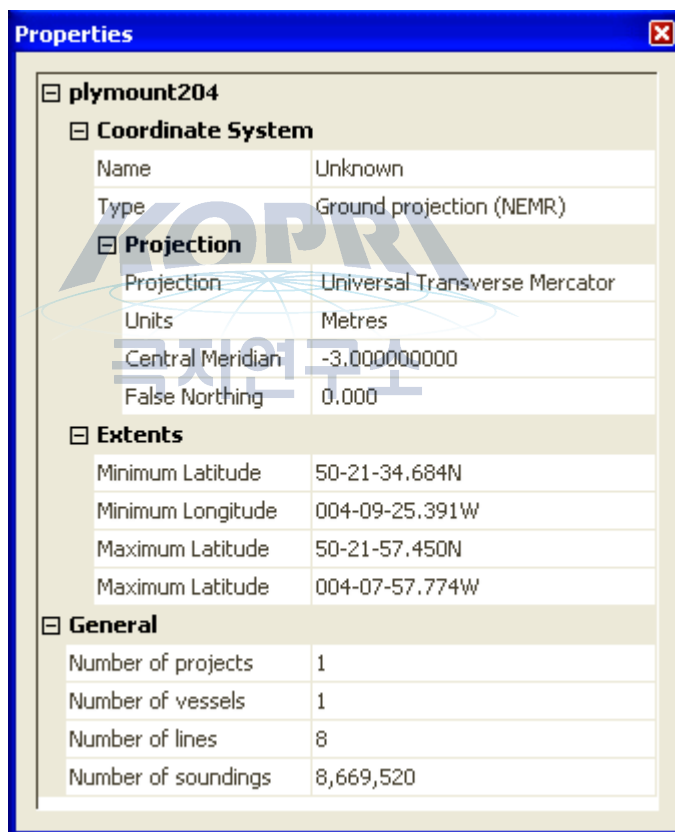
Menu	Window > Properties
Tools	
Pop-up	Properties

The Properties window controls the properties of lines, surfaces and features that appear in the Display window, and that are listed and activated in the Layers tab. The Properties window can be undocked and moved around the interface.

The display options shown in the window are determined by the selected layer type, e.g., ship track lines, field sheet layer, BASE Surface layer(not all layers contain display properties).

1. Select the Properties window command.
2. Select a layer in the Layers tab of the Control window.

The display properties for that layer are shown in the window. The undocked Properties window shown below shows properties for the HIPS Data layer.



Properties

☐ **plymount204**

☐ **Coordinate System**

Name	Unknown
Type	Ground projection (NEMR)

☐ **Projection**

Projection	Universal Transverse Mercator
Units	Metres
Central Meridian	-3.000000000
False Northing	0.000

☐ **Extents**

Minimum Latitude	50-21-34.684N
Minimum Longitude	004-09-25.391W
Maximum Latitude	50-21-57.450N
Maximum Longitude	004-07-57.774W

☐ **General**

Number of projects	1
Number of vessels	1
Number of lines	8
Number of soundings	8,669,520

3. Click **Apply** to implement the property changes.

See the following topics for more information on setting properties for specific layers:

- “SET TRACK LINE PROPERTIES” ON PAGE 32“
- “CRITICAL SOUNDINGS” ON PAGE 296
- “SET IMAGE PROPERTIES” ON PAGE 34“

- “VIEW SURFACE PROPERTIES” ON PAGE 231 AND “SET ATTRIBUTE PROPERTIES” ON PAGE 232 for BASE Surface layers.
- “SET FIELD SHEET PROPERTIES” ON PAGE 215 for Field Sheet layers.



Worksheet Window

The Worksheet window has two tabs which are visible at all times while HIPS and SIPS is open: Query tab and Output tab.

- Query (for viewing information on selected data)
- Output (for viewing the result of a command or process).

The Quality Control, Graph, and Profile tabs display as needed when those functions are activated.

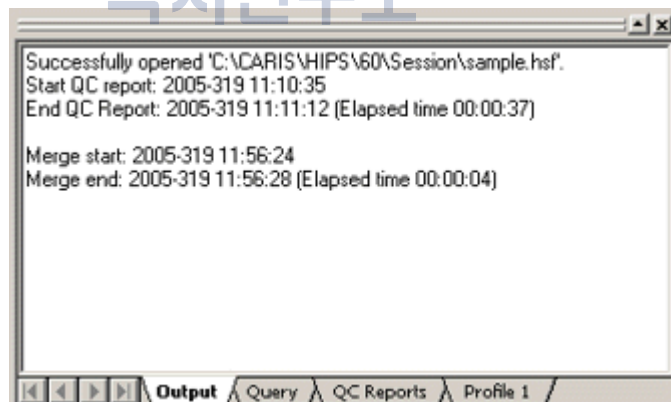
- Quality Control (for displaying quality control reports)
- Graphs (for displaying graph information)
- Profile (for displaying cross-sectional views of the BASE Surface or Tile area).

If the Worksheet window is closed, it can be re-opened with the Worksheet menu command or tool button on the Windows toolbar.



Output Tab

In this tab you can view the results of a command or process.

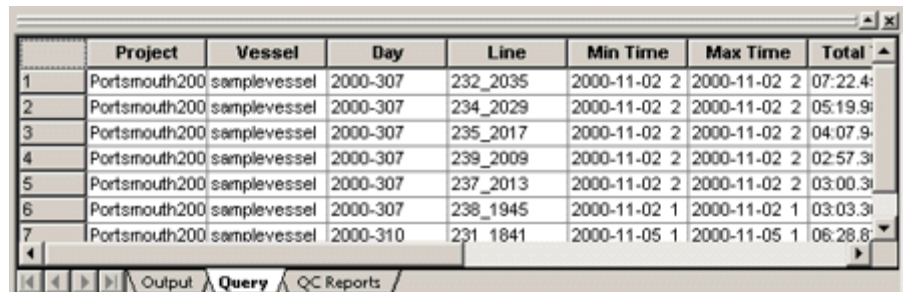


Information in this tab is read-only and cannot be modified.

If you want to remove the information in this tab, right-click the mouse and select Clear from the pop-up menu.

Query Tab

The Query tab is used to view data on selected features in the Display window.



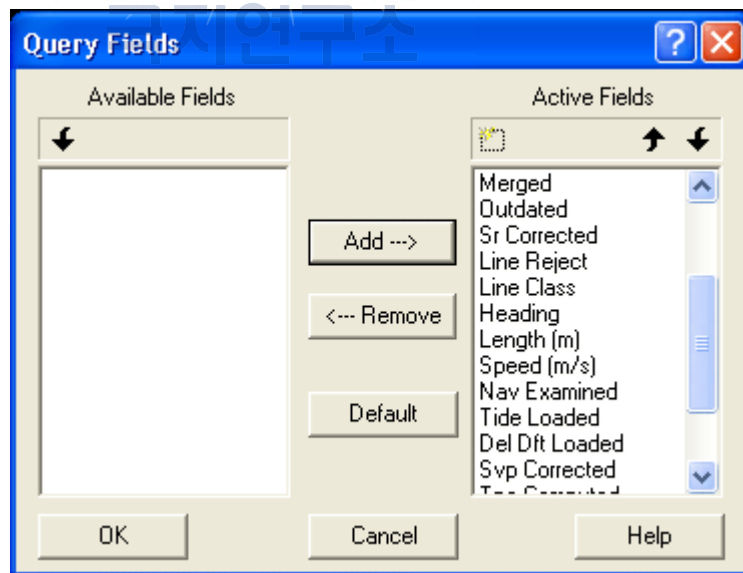
	Project	Vessel	Day	Line	Min Time	Max Time	Total
1	Portsmouth200	samplevessel	2000-307	232_2035	2000-11-02 2	2000-11-02 2	07:22.4
2	Portsmouth200	samplevessel	2000-307	234_2029	2000-11-02 2	2000-11-02 2	05:19.9
3	Portsmouth200	samplevessel	2000-307	235_2017	2000-11-02 2	2000-11-02 2	04:07.9
4	Portsmouth200	samplevessel	2000-307	239_2009	2000-11-02 2	2000-11-02 2	02:57.3
5	Portsmouth200	samplevessel	2000-307	237_2013	2000-11-02 2	2000-11-02 2	03:00.3
6	Portsmouth200	samplevessel	2000-307	238_1945	2000-11-02 1	2000-11-02 1	03:03.3
7	Portsmouth200	samplevessel	2000-310	231_1841	2000-11-05 1	2000-11-05 1	06:28.8

The data is shown in tabular format. You can invert the order of data by double-clicking a column header.

The type of data fields displayed in the Worksheet window and the order in which these fields are displayed is controlled by the Query Fields dialog box.

1. Right-click the *Query* tab in the Worksheet window and select the Query Fields command from the pop-up menu.

This opens the Query Fields dialog box.



The data types listed in the dialog box are determined by the editor currently open in the application.

2. To add data fields to the Worksheet window, select a data type in the *Available Fields* list and click **Add**.

The data field is now listed in the *Active Fields* list.

3. To remove a data field from the Worksheet window, select a data field in the *Active Fields* list and click **Remove**.

The data field is now in the *Available Fields* list.

4. To restore the default listing of fields and their order, click **Default**.
5. To change the display order of data, select a data field in the *Active Fields* list and click the up or down arrow buttons.

The data field is now in a different position on the list.

6. Click **OK**.

The fields moved to the *Active Fields* list are now visible in the Worksheet window, displayed in the order you set.

Query options

The following options are also available in the Query tab.

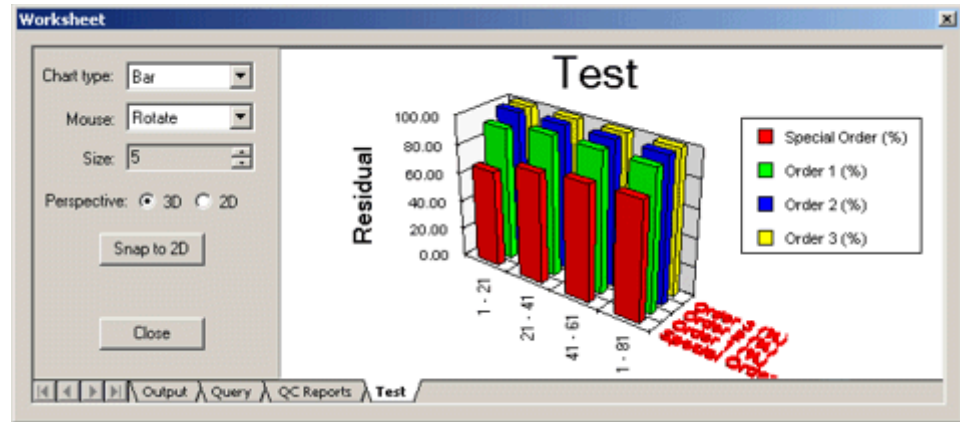
1. To save the data as a text file, right-click in the Query tab and select Save As from the pop-up menu.
2. To print the data, right-click in the Query tab and select Print from the menu.
3. To copy data, right-click in the field you want to copy (or use the Select All command to highlight all data), then use the Copy command.
4. To remove row(s) from the table, select the rows so they are highlighted, right-click and select Remove Selected from the menu.

Menu	Edit > Copy
Tool	
Pop-up	Copy
Key	<Ctrl+C>



Graph Tab

The Graph tab displays the data from the tables in the Query and QC Reports tabs in graphical format. The Graph tab only becomes visible when data from the Query tab or from the QC Reports tab is graphed. It appears with the name of your graph on the tab.



The graph can be rotated. Zoom and pan operations can also be applied. A legend is automatically generated when more than one data type is displayed.

Create Graph

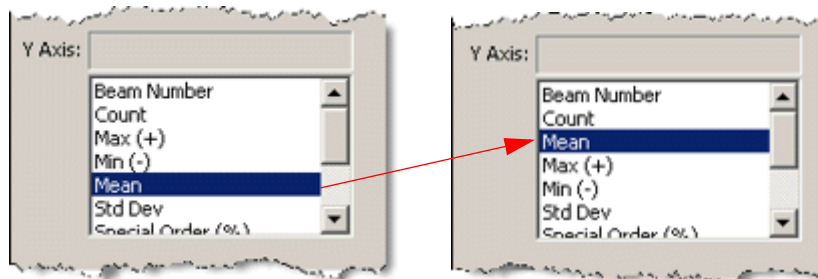
1. While the cursor is in the Query and QC Report tabs of the Worksheet window, right-click and select New Graph from the pop-up menu.

The New Graph dialog box is displayed.

The fields in the Query or QC Report tab of the Worksheet window determine the available values for creating the x- and y-axes of the graph.

2. Type a name for the graph in the *Title* field. This name will appear on the Graph tab.
3. Select values for the x- and y-axes. You can select more than one value for the y-axis.

Data is displayed in the graph according to the list order. If you select more than one data type for the y-axis, the first data type may hide the other types in the graph. You can avoid this by using the mouse to move a data type up or down on the list in the dialog box.

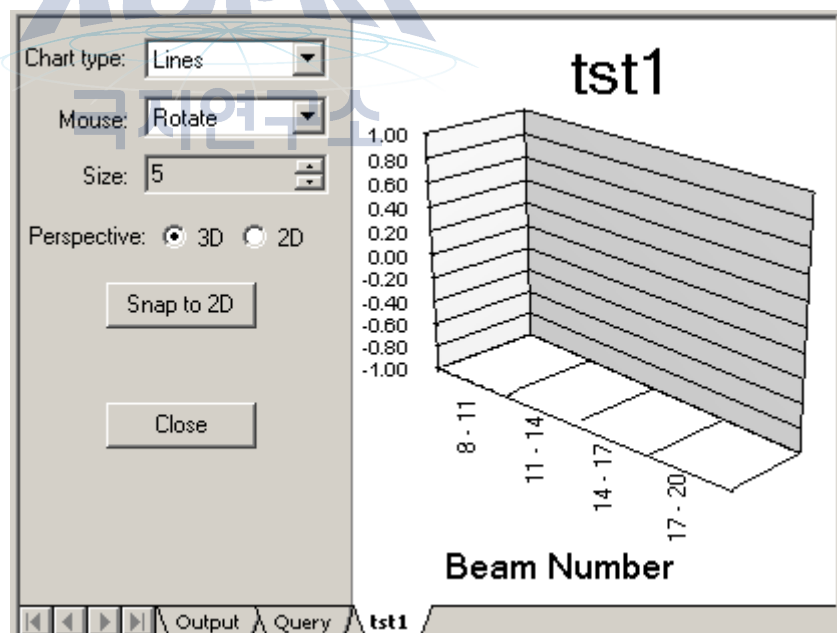


4. Select a data type, press and hold the mouse button while moving the data type to a new position on the list.
5. Click **OK**.

A graph is created in the tab.

Graph Controls

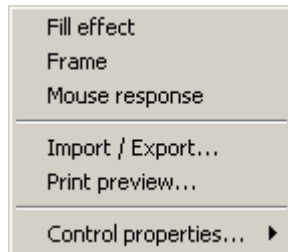
The display and control options are located on the left side of the tab. The image below shows an example of the 3D view and controls.



1. Choose a display mode from the *Chart Type* drop-down list. You can select from various points, lines or bars.
2. Graph positioning and other movement is controlled using the left mouse button. Select a mouse operation (rotate, pan, or zoom) from the *Mouse* drop-down menu.
3. Change the size of points, stars, diamond, crosses, diagonal crosses, and tubes in the *Size* field.

4. Select *3D* to display the graph showing depth, or select *2D* to display the graph in an orthographic display without depth.
5. To flatten the chart, click the **Snap to 2D** button.

More detailed graph control options are available from a pop-up menu in the graph area.



QC Reports Tab

The QC Reports tab contains statistical data generated from the QC Reports tool (Process > QC Report...). For details on creating QC reports, see “[QUALITY CONTROL](#)” ON PAGE 215.

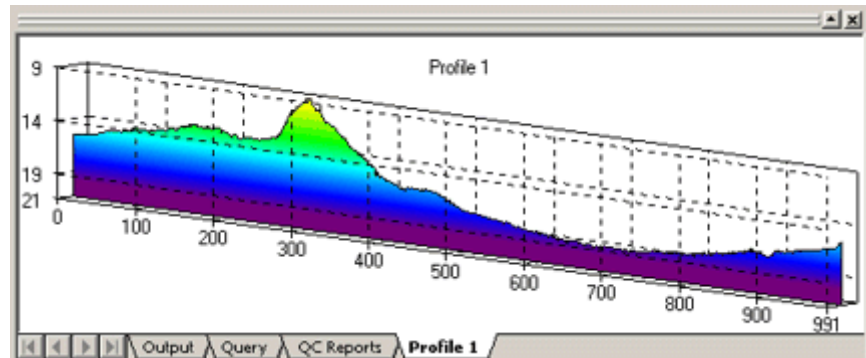
	Beam Numb	Count	Max (+)	Min (-)	Mean	Std Dev	Special Orde
1	1 - 21	109951	1.487	1.356	0.027	0.161	61.1
2	21 - 41	212132	3.156	2.080	-0.001	0.117	72.6
3	41 - 61	221608	1.710	1.560	-0.004	0.100	75.9
4	61 - 81	209505	1.623	1.759	-0.012	0.109	76.9
5	81 - 101	89956	1.461	2.235	0.029	0.170	59.2

The QC Reports tab has the same options available as in the Query tab. See “[QUERY TAB](#)” ON PAGE 19 for more information.

You can also create graphs using data from the table, see “[GRAPH TAB](#)” ON PAGE 21 for more information.

Profile Tab

This tab displays a cross-sectional diagram (profile) of a BASE Surface, weighted grid, or tile.



To create and display profiles, see “PROFILES” ON PAGE 354.



Reposition and Resize Windows

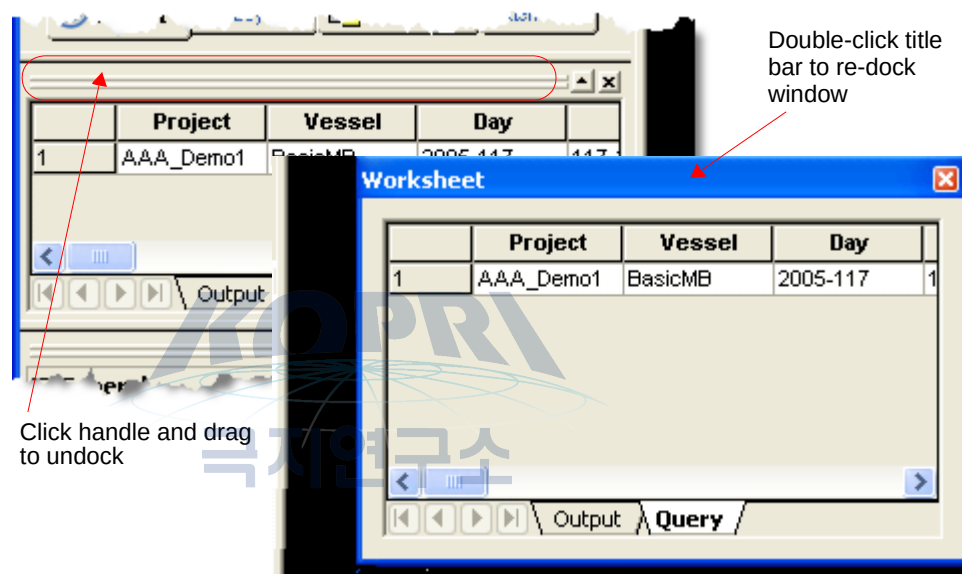
Repositioning

All windows can be undocked from their default positions and moved anywhere on the screen.

1. Click and hold your cursor on the title bar or handle of the window and drag the window to the new position.

As you drag the cursor, the window undocks from its current location and moves with the cursor. To prevent a window from automatically docking, hold the <Ctrl> key while dragging the window.

2. Release the mouse button when you want to dock the window in its new location.



Resizing

Windows can also be sized to a new length and width.

1. Position the cursor on any edge of the window.

The cursor becomes a two-headed arrow.

2. Press and hold the mouse button and drag the edge of the window to a new position.

As you drag the cursor, the window expands or contracts, depending on whether you are pulling or pushing the window edge.

3. Release the mouse button when you have resized the window to the desired length and width.

Restore default windows layout

Menu	Window > Restore Default Window Layout

This command will close all editors open in the HIPS and SIPS interface, and reset the interface windows (e.g. Control window) to the same position as when the application was first installed.

You will be prompted to save data as editors are closed.

1. Select the Restore Default Window Layout command.

Status Bar

The status bar at the bottom of the interface displays the following information:

- message about the operation currently taking place, or the information in the tool tip for the command button or menu item your cursor is on
- number of track lines selected out of the total lines open in the interface
- scale of the current display in the Display window
- coordinates of the current cursor position in the units chosen in Tools > Options
- disk usage for a selected data repository



Depending on which editor you have open, the status bar will also display information such as the day the survey was conducted, profile and beam number, etc.



Status Bar options

You can hide the status bar:

1. Select the Status Bar command.

The check mark beside the Status Bar option is gone and the status bar is no longer visible in the desktop.

Cursor coordinates

The units for the coordinates of the cursor's current position are set in the Options dialog box of the Tools menu. You can use the Units option to set the type of unit e.g. Geographic or Ground.

The Position Precision option is used to set the number of places to the right of decimal point in the coordinate display.

For further information see "UNITS" ON PAGE 90.

Toolbars

Toolbars allow swift access to commonly used commands. Toolbars can be undocked and moved about the interface.

The following is a list of toolbars.

- **Standard:** Access standard Windows commands such as opening and saving files.
- **Edit:** Access functions used for editing data.
- **Window:** Access commands for toggling windows to on or off.
- **View:** Access functions for controlling the view in the Display window.
- **Tools:** Access functions for opening editors and for processing data.
- **Process:** Access functions for executing processes such as creating BASE surfaces and merging.
- **Filter:** Access functions for defining and executing automatic filters.
- **Select:** Access functions for selecting objects in the Display window.
- **Swath Editor:** Access functions for examining and cleaning pre-merged sounding data.
- **Single Beam Editor:** Access functions for examining and cleaning single-beam data.
- **Subset Editor:** Access functions for examining and cleaning sounding data in the subset mode.
- **Side Scan Editor:** Access functions for examining data, slant-range correcting raw side data, and creating contacts.
- **Lidar:** Access functions for selecting and examining soundings recorded by a lidar system.
- **Surface Cleaning:** Access functions for surface cleaning and tiling.

You can also create a custom toolbar (see “[CREATE A CUSTOM TOOLBAR](#)” ON PAGE 29).

Modify Existing Toolbars



Most toolbars are visible when the application is opened. You can remove toolbars from the desktop.

1. Select the Toolbars command.
2. Click a toolbar name from the Toolbars sub-menu so it is no longer checked.

The toolbar is removed from the desktop.

To make a toolbar visible again, select the toolbar name from the sub-menu so it is checked.

Move toolbars

Toolbars can be moved to any location on the desktop.

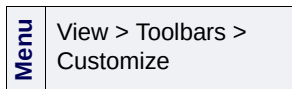
1. Position the cursor over any area of the toolbar not covered by a button, or double-click the double bar grab handle on the left side of the toolbar.
2. Press and hold the mouse button while dragging the toolbar to a new location.
3. Release the mouse button to position the toolbar.

When moving a toolbar, press and hold the <Ctrl> key to stop the toolbar from automatically docking.

Modify appearance

You can alter the buttons' size and appearance.

1. Select the Customize command.



The Customize dialog box is displayed.

2. Select any of the following three options by checking a box.
 - *Tool Tips*: Display the name of a command button when the cursor is placed over it.
 - *Cool Look*: Remove the border outline from the buttons.
 - *Large Buttons*: Display buttons with 32 x 32 pixel icons instead of 16 x 16 pixel icons.
3. Click **OK**.

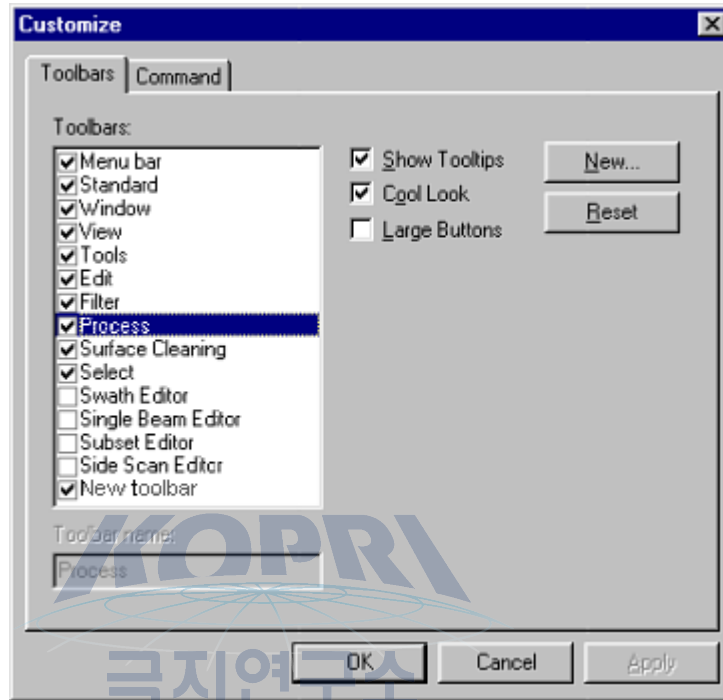
Create a Custom Toolbar

Create a custom toolbar with buttons from other toolbars.

1. Select the Customize command.

The Customize dialog box is displayed.

Menu	View > Toolbars > Customize



2. Click the Toolbars tab.
3. Click **New** to open the New Toolbar dialog box.
4. Type a name for the toolbar, and click **OK**.

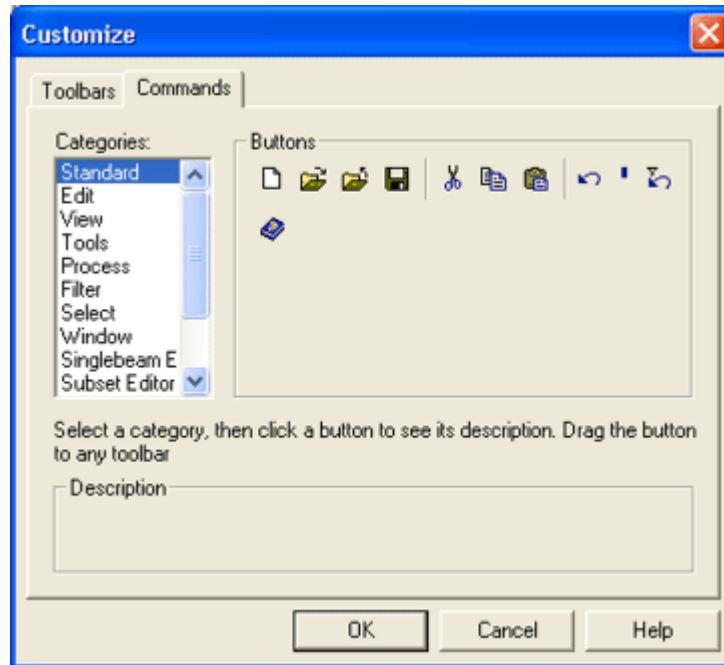
A new toolbar is displayed in the HIPS&SIPS interface.

5. Click the Commands tab.

The existing toolbars and the toolbar command associated with them are displayed.

6. Select a toolbar name in the *Categories* list.

The buttons associated with that toolbar are displayed on the right side of the dialog box.



To add a command button to your new toolbar:

7. Select the desired button so it is highlighted.
8. Press the mouse button and drag the highlighted button to the new toolbar.
9. Repeat Steps 7 and 9 until you have all the required buttons.

Delete a toolbar

Use this command to remove a new toolbar from the interface.

The Delete option can only be applied to new toolbars and cannot be applied to default toolbars.

Menu	View > Toolbars > Customize

1. Select the Customize command.

The Customize dialog box opens.

2. Select the *Toolbars* tab (if the tabbed window is not already visible).
3. Select the new toolbar's name in the *Toolbar* section, so the name is highlighted.

The **Reset** button becomes a **Delete** button.

4. Click the **Delete** button.

The toolbar is removed from the desktop and is no longer listed in the Customize dialog box.

Open Projects and Background Data

In HIPS and SIPS, survey data is organized into projects. All projects are organized in a Project-Vessel-Day file tree.

Before any data from a vessel can be processed, a vessel configuration file must exist. For information on creating or editing vessel configuration files, see “[CREATE A NEW HVF](#)” ON PAGE 81.

Once a HIPS Vessel File is set up, a new project is defined to organize the survey data in the Project-Vessel-Day-Line hierarchy. (The process to create a new project is described in “[DEFINE NEW PROJECT](#)” ON PAGE 116 in the Workflow chapter.)

Open a Project

To open a defined project:

1. Select the Open Project command.

The Open Project dialog box is displayed.

2. Select a Project folder so it is highlighted.

If the project contains both bathymetric and side scan data, you can open either the vessel or towfish navigation, or open both. Your choice is saved in the registry and the session file for future use.

3. Select either *Open ship track lines* or *Open towfish track lines*, or both options, to open the appropriate track lines in the Display window.
4. Click **Open**.

The track lines associated with the project are opened in the Display window. The Project/Vessel/Day/Line file tree is displayed in the Control window.

Open specific data

You can also open the data for a specific vessel (if the project contains more than one), or for a specific survey day, or for an individual track line. As you expand each folder, the contents are displayed in the Contents pane of the Open Projects dialog box.

1. Choose the Open Project command.
2. In the Open Project dialog box, expand the folder tree by clicking the + icon so that the Vessel and Day folders are visible.
3. Select a vessel folder name so it is highlighted, and click **Open**, or
4. Expand the Vessel folder to see the Day folders.
5. Select a Day folder and click **Open**, or
6. Expand the Day folder to see the Line folders.
7. Select a Line folder and click **Open**.

Menu	File > Open Project
Tool	
Key	<Ctrl + O>

Combining project data using Windows shortcuts

You can use a Windows shortcut to link HDCS Project\Vessel\Day\Line data on different drives or network locations. The project, plus the shortcut to the other data, is displayed in the Open Project dialog box. The data folders must contain a Vessel Configuration File.

1. Create a Windows shortcut in any P\VD\L directory.
2. Copy the shortcut to the project where you want to place the shortcut. Remember that the shortcut must be copied to the appropriate folder. A Project folder shortcut must be copied to a HDCS data folder, a Vessel folder shortcut must be copied to a Project folder, etc.
3. Open the data using the Open Project command.

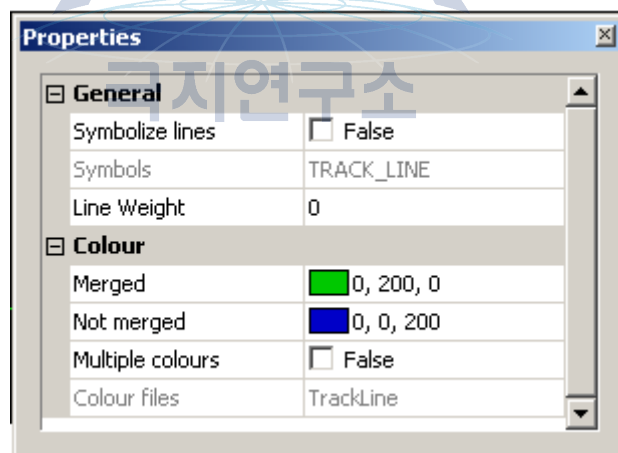
Set Track Line Properties

Change the colour and symbology of ship and towfish track lines.

1. Select the ship or towfish track lines layer in the Layers tab of the Control window.
2. If the Properties window is not open, select the Properties window command.

The Properties window for ship or towfish track lines is displayed.

Menu	Window > Properties
Tools	
Pop-up	Properties



The colour of ship track lines can be changed to highlight whether data has been *Merged* (combined into a position/depth file) or *Not Merged*.

Tow fish track lines can be coloured to indicate *Slant-Range Corrected* or *Raw Side Scan*.

3. Select a colour from the colour palette, or create a custom colour from the standard Windows colour picker.

The following steps are applicable to both ship and towfish track lines.

4. Select the *Symbolize Lines* check box to add symbolization according to a selected feature code.
5. Select a *Feature Code* for line symbolization from the drop-down list.

The *Use Multiple Colours* option uses a set of 10 distinct colours to colour the track lines in the Display window. This is useful if the data was logged as multiple files along the same runline.

6. [Optional] Select the *Use Multiple Colours* check box to implement this option and select a colour map from the drop-down list.
7. Click **Apply**.

Open Background Data

HIPS and SIPS can open any of the following data types as background in the Display window:

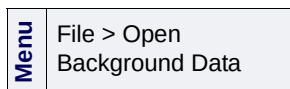
- AutoCAD files (DXF, DWG)
- geo-referenced TIFF (GeoTIFF, TIFF/TFW, TIFF/IGA)
- JPEG 2000 (JP2)
- Shapefiles (SHP)
- raster charts (BSB, HCRF)
- CARIS maps (DES)
- S-57 Ed 3.1¹ (.000)
- Hydrographic Object Binary (HOB) files (including Edit and Marker layers created in CARIS Notebook).
- MrSid image files (SID)²
- Bathymetric Attributed Grid files (BAG)

1. Select the Open Background Data command.

The Open dialog box is displayed. More than one data type can be selected while the dialog box is open.

2. Select a file or group of files by one of three methods:

- Select an individual file by highlighting it.
- Select a group of files by pressing the <Ctrl> key and selecting each file.
- Select a range of files by pressing the Shift key and selecting the first and last file in the range. All files between the first and last file are highlighted.



-
1. Update files included with the .000 file are automatically opened with the original S-57 file.
 2. MrSID image files can only be opened if you have installed the CARIS plugin for MrSID images. This free plugin can be downloaded from <http://www.caris.com/products/mrsid.cfm>.

3. Click **Open**.

The files are opened in the Display window and are listed as layers in the Control window.

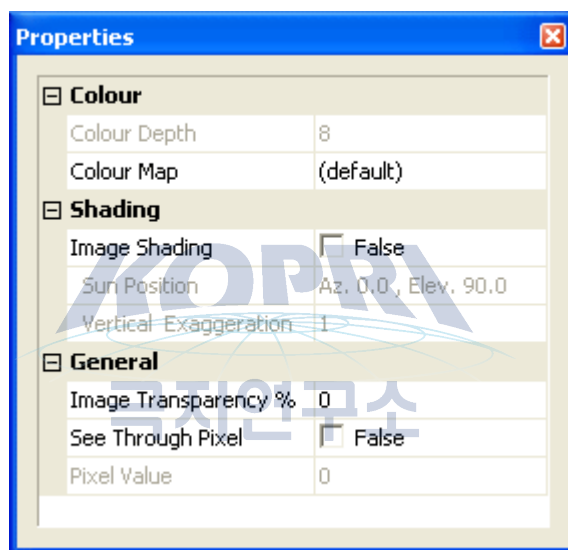
Set Image Properties

Set the display options for image files (TIFF, TWF, IGA, raster images, etc.).

1. Select the Image layer in the Layers tab of the Control window.
2. If the Properties window is not open, select the Properties window.

The Properties window automatically displays the display options for the selected image layer.

Menu	Window > Properties
Tools	
Pop-up	Properties



3. If applicable, select a colour map for a raster image from the drop-down list.

The Shading options are applied to GIS raster images where height values are available.

The *Image Shading* option controls the lighting angles of the raster image. Using this option may highlight fine scale features in the image that would not normally be seen.

Sun position controls the shading effect in the image. The azimuth varies from 0 to 360 degrees in a clockwise direction. The elevation varies from 90 to 0 degrees starting from the middle of the sundial.

4. Select the *Shading* check box to activate the sundial and *Vertical Exaggeration* options.
5. Position the cursor over the button in the sundial and press and hold the mouse button to drag the button to a new position.

6. Change the exaggeration of the illuminated sea floor by selecting a *Vertical Exaggeration* value. Increasing the exaggeration may improve the view of finer features in the image.
7. To set a transparency level for the entire image, type a *Transparency* percentage.
8. Set the *See Through Pixel* option to “True” to make a pixel value totally transparent.

You can re-project a georeferenced raster image to a project projection using two methods:

- The *Full Raster* option is a pixel-by-pixel reprojection to the project coordinate system. This option can take a long time if the image file size is large.
 - The *Rubber Sheet* option uses the centre coordinate in the Display window as a starting point for image reprojection. This is done by aligning the same coordinate in the georeferenced image to the centre coordinate in the window. The raster image is then reprojected out from the centre coordinate. This means that the image is reprojected every time you pan or zoom the Display window.
9. Select either the *Full Raster* or *Rubber Sheet* options.
 10. Click **Apply** to implement the changes.

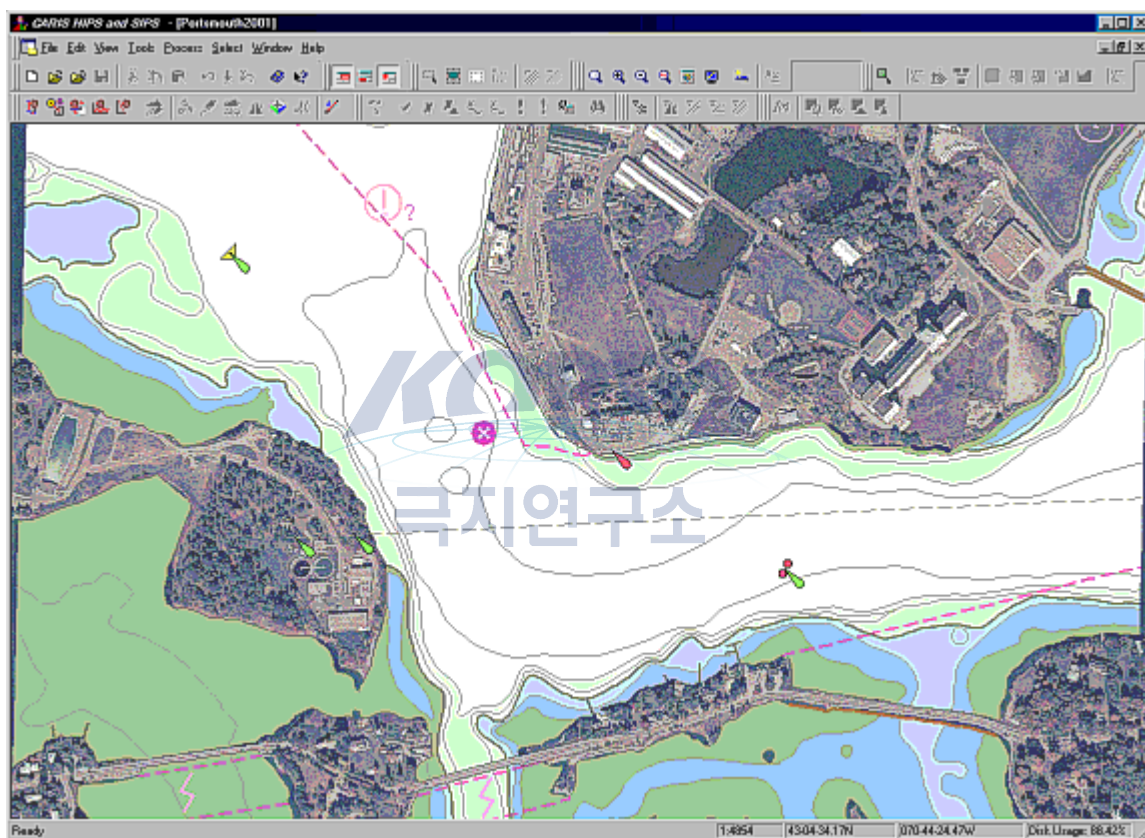


Display S-57 Data

HIPS and SIPS is capable of displaying S-57 Ed 3.1 and HOB (Hydrographic Object Binary) files. How the data is displayed is controlled by the Object Filter controls and by the settings in the Options dialog box (see “S-52 DISPLAY” ON PAGE 678).

1. Select the Open Background Data command (see “OPEN BACKGROUND DATA” ON PAGE 33) and open an S-57 dataset.

The S-57 dataset is opened in the interface and the file is listed in the data tree in the Layers tab of the Control window.



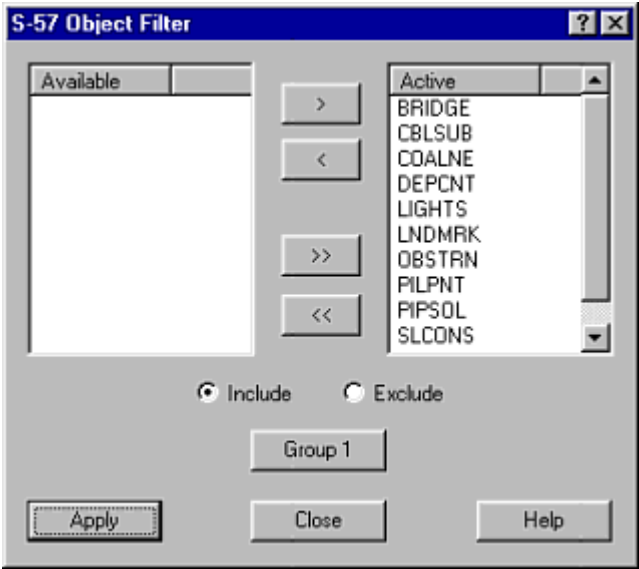
Object Filter

Menu	View > Object Filter
Pop-up	Object Filter

You can determine what objects are shown in the Display window.

1. Select the S-57 file in the *Session* tab of the Control window.
2. Right-click the mouse and select the Object Filter command.

The S-57 Object Filter dialog box is displayed.



The *Available* list contains all objects in the S-57 file. The *Active* list contains the S-57 objects that are currently shown in the Display window.

3. You can move objects between the lists.
 - To move objects from the *Active* list to the *Available* list, select the object(s) and click the (<) left-arrow button.
 - To move objects from the *Available* list to the *Active* list, select the objects and click the (>) right-arrow button.
 - To move all objects from the *Active* list to the *Available* list, click the (<<) double left-arrow button.
 - To move all objects the from the *Available* list to the *Active* list, click the (>>) double right-arrow buttons.
 - To move all Skin of the Earth objects to the *Active* list, click **Group1**.
4. Select the *Include* or *Exclude* options to show or hide objects in the Active list.
5. Click **Apply** to save the settings.

Query S-57 objects

Data about selected S-57 objects can be displayed in the Worksheet window using the Query command.

1. Select the S-57 file name in the Control window.
2. Select the S-57 objects in the Display window that you want to query.
3. Select the Query command.

Menu	Edit > Query
Tool	
Key	<Q>

Information about the selected S-57 objects is displayed in the Worksheet window.

If further information about an object is available, it can be seen by selecting the object and then the *Extended Query* tab.

Display Tools

There are two kinds of tools that you can use to manipulate the view of data in the Display window: Pan and Zoom. The Pan function lets you reposition your view within the Display window. The Zoom function magnifies or reduces the viewing area within the Display window.

The Zoom/Pan Reverse and Forward tools let you toggle between views, and you can zoom to centre on a specific set of coordinates using the Zoom To command.

Menu	View > Pan > Up/ Down/Left/Right

Pan tool

Pan

There are two ways to move the view of data up, down, or to the left or right, within the Display window:

- by using the Pan tool to move by a defined amount, or
- by dragging with the mouse.

The Pan tool will let you move the view by a percentage of the view extents. You can set the amount that the view will move in the *Pan Factor* field on the General tab of the Tools > Options dialog box. (See “GENERAL” ON PAGE 657.)

To move the view of data with the Pan tool:

1. select a Pan command:
 - *Pan Up*: Re-centre the display at a position that is above the current display area.
 - *Pan Down*: Re-centre the display at a position that is below the current display area.
 - *Pan Left*: Re-centre the display at a position to the left of the current display area.
 - *Pan Right*: Re-centre the display at a position to the right of the current display area.

The Pan commands on the View menu can be added as buttons to a new or existing Toolbar by using the View > Toolbars > Customize... command.

Pan with the mouse

You can pan the display with your mouse by using a press and drag action.

To pan with the mouse:

1. Press and hold down the scroll wheel or middle button on your mouse. (The cursor changes to a hand.)
2. Use the mouse to drag the view in any direction.
3. Release the mouse button when you have repositioned the view.

Zoom

There are two ways to magnify or reduce the viewing area in the Display window:

- use the scroll wheel on your mouse, if available
- use the Zoom tools

Zoom with the mouse

To zoom in or out using a mouse:

1. Click in the Display window.
2. Scroll back and forth with the scroll wheel to zoom the view up and down.

Zoom tool

Use the Zoom tool to select a specific area of the Display to enlarge:

1. Select the Zoom command.

The cursor changes to a magnifying glass icon.

2. Press and hold the mouse button and drag the cursor to create a rectangle around the area you want to magnify.

The display is enlarged so that the area within the rectangle now fills the Display window.

Once the area has been zoomed, the Zoom tool button is no longer active. To keep the Zoom tool active, select the *Enable Constant Zoom* function in the Options dialog box (see “GENERAL” ON PAGE 657).

Menu	View > Zoom
Tool	
Key	<F10>

Zoom In

The Zoom In tool lets you enlarge the viewing area in the Display window automatically by a set amount.

1. Select the Zoom In command

The display is automatically enlarged by the percentage set in the *Zoom Factor* field on the General tab of the Options dialog box (see “GENERAL” ON PAGE 77).

Menu	View > Zoom In
Tool	
Key	<Ctrl+Down>

Zoom Out

Zoom Out automatically reduces the viewing area in the Display window by a set amount.

1. Select the Zoom Out command.

The display is automatically reduced by the percentage set in the *Zoom Factor* field on the General tab of the Options dialog box (see “GENERAL” ON PAGE 77).

Menu	View > Zoom Out
Tool	
Key	<Ctrl+Up>

Menu	View > Zoom/Pan Previous
Tool	

Zoom/Pan Previous

This tool returns the view to the position or magnification that was displayed before you zoomed or panned the view.

1. Select the Zoom/Pan Previous command.

Menu	View > Zoom/Pan Forward
Tool	

Zoom/Pan Forward

This tool returns the view to the position or magnification that it was in prior to using the Zoom/Pan Previous command.

1. Select the Zoom/Pan Forward command.

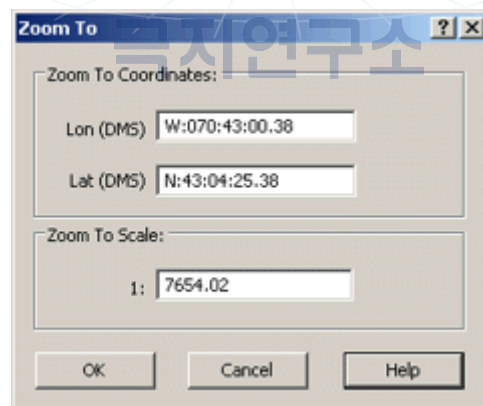
Zoom To

Re-centre the view on specific coordinates in the Display window, or zoom in so that the viewed area is displayed at a specific scale.

1. Select the Zoom To command.

The Zoom To dialog box is displayed.

Menu	View > Zoom To



2. Type the new coordinates in their respective fields to re-centre on that point in of the Display window,

OR

3. Type a new scale to zoom into or out of the display.
4. Click **OK**.

Menu	View > Refresh
Tool	
Key	<F5>

Refresh Display

Redraw the view in the Display window.

1. Select the Refresh command, or click the middle mouse button when the cursor is in the Display window.

The display is redrawn.

Menu	View > Overview
Tool	
Key	<F9>

Overview Display

Redraw the Display window to the full extent of all the data that is currently open.

1. Select the Overview command.

Menu	View > Cancel Draw
Key	<Esc>

Cancel Draw

Select the Cancel Draw command to stop a display from being drawn in the Display window. This command is only active while the image is being drawn.

You can create a Cancel Draw tool button and place it on a new or existing Toolbar by using View > Toolbars > Customize... command.

Selection Tools

You can select an individual track line or object in the display by clicking on it with the mouse so it is highlighted.

You must select a survey line to use these editor tools:

- Attitude Editor
- Navigation Editor
- Single Beam Editor
- Swath Editor
- Side Scan Editor

You must select one or more survey lines to use the following tools and processes:

- single beam filters
- swath filters
- Total Propagated Uncertainty (TPU) filters
- restart cleaning
- load tide
- sound velocity corrections
- compute GPS tide
- compute TPU
- load delta draft
- load TrueHeave
- close track lines
- merge
- recompute towfish navigation
- slant range correction

While you can select a group of objects by holding down the <Ctrl> key while clicking on each object in turn, the following tools make selection of multiple objects easier.

Select by Range

Menu	Select > By Range
Tool	

Select one or more objects.

1. Select a layer in the Control window.
2. Choose the Select by Range command.
3. Press and hold the mouse button while dragging the cursor to define a rectangular area.

The selected objects from the layer are highlighted.

Select All in Display

Select objects that are totally or partially in the current viewing extent of the Display window.

This command is useful for selecting a single object or group of objects in an enlarged section of the Display window.

1. Select a layer in the Control window that contains the objects you want to select.
2. Use the zoom tool to enlarge a section of the Display window (see “[ZOOM](#)” ON PAGE 39).
3. Choose a Select All in Display command.

Objects that cross or are within the current view of the Display window are highlighted.

Menu	Select > All in Display
Tool	

Select All

Select all objects in a layer.

1. Select a layer in the Control window that contains the objects you want to select.
2. Choose the Select All command.

All objects are highlighted.

Menu	Select > Select All
Tool	
Key	<Ctrl+A>

Select By Lasso

In the Swath Editor, Subset, Navigation and Attitude Editors, use the By Lasso tool to select objects by enclosing an area.

The area is defined by the mouse in one of two ways: either by dragging the mouse around the area to be selected or by inserting a series of points to create an outline. All objects inside the defined area are selected when the lasso is closed.

Use Lasso in editors

Menu	Select > By Lasso
Tool	

1. Select the Lasso command.
2. Click and drag the mouse in any of the editor windows. The lasso outline is updated as you move the mouse,
OR
repeatedly click the left mouse button in the editor window to define a point-to-point outline.

Note: These two modes can be used together in the editor windows.

Menu	Select > Close Lasso
Key	<C>

To complete the selection area, you must close the lasso outline. This can be done in one of three ways:

- release the left mouse button and right-click.
- select Close Lasso from the Select menu
- press the letter C key.

The first and last points will be connected and the lasso shape will be closed. The objects within the enclosed area are selected.

Use Lasso in Display window

To use the lasso tool to select objects in the Display window:

1. Select the layer in the Control window that contains the objects you want to select.
2. Select the Lasso command.
3. Use the mouse to insert a series of points around the area in the Display window that you want to select.

The points are connected by a line as you continue clicking. When you have outlined the area:

4. Press <C> to close the lasso outline.

Select Next Line

Select track lines by ascending file order. This command is enabled only when the Attitude, Navigation, Swath and Single Beam Editors are open.

The file order can be sorted according to time or name by right-clicking in the Display window and selecting Sort > By Name/ By Time from the pop-up menu.

1. Select the Next Line command.

The track line directly below the currently selected line in the project data tree is highlighted.

Menu	Select > Next Line
Tool	

Select Previous Line

Select track lines by descending file order. This command is enabled only when the Attitude, Navigation, Swath and Single Beam Editors are open.

The file order can be sorted according to time or name by right-clicking in the Display window and selecting Sort > By Name/ By Time from the pop-up menu.

1. Select the Previous Line command.

When you select the command, the track line directly above the currently selected line in the project data tree is highlighted.

Menu	
Tool	Select > Previous Line

Select Lines From the Control Window

Menu	Window > Control
Tool	

1. Make sure the Control window is open.
2. Select the Project tab.
3. Click a track line file so it is highlighted.

The track line in the Display window is highlighted.

You can also select more than one file.

- To select a Project, Vessel or Day folder, click the folder. All files in that folder are highlighted.
- To select multiple files, press and hold the <Ctrl> key while clicking the files with the mouse.
- To select a range of files, click the first file in the range, press and hold the <Shift> key while clicking the last file in the set. This highlights all adjacent files between the first and last file.

Clear All

Menu	Select > Clear All
Tools	

Deselect track lines or objects.

1. Select the Clear All command, or click anywhere in the display away from the lines.

The previously selected track lines or objects are no longer highlighted.

Screen Captures

You can take a screen capture of the current display in the Display window or 3D Display window and save it as an 8-bit or 24-bit GeoTiff image.

Menu	View > Save Image
Pop-up	Save Image

1. Right-click in the Display window or 3D Display window and select a Save Image command.

The Save As dialog box is displayed.

2. Select a directory for saving the image.
3. Type a name for the image in the *File Name* field.
4. Select to either save the image as an 8-bit or 24-bit image by selecting the appropriate option.
5. Select a *Dots Per Inch* (DPI) setting from the drop-down list.

The file size of the image is shown in the dialog box. If you select a large dpi setting, the image is resampled to that setting.

6. Click **Save**.

The image is saved to the selected directory.



3D Display Window

The 3D Display window shows project-level information in three dimensions. Turn layers on and off in the Layers tab to determine which data will be displayed in the 3D display.

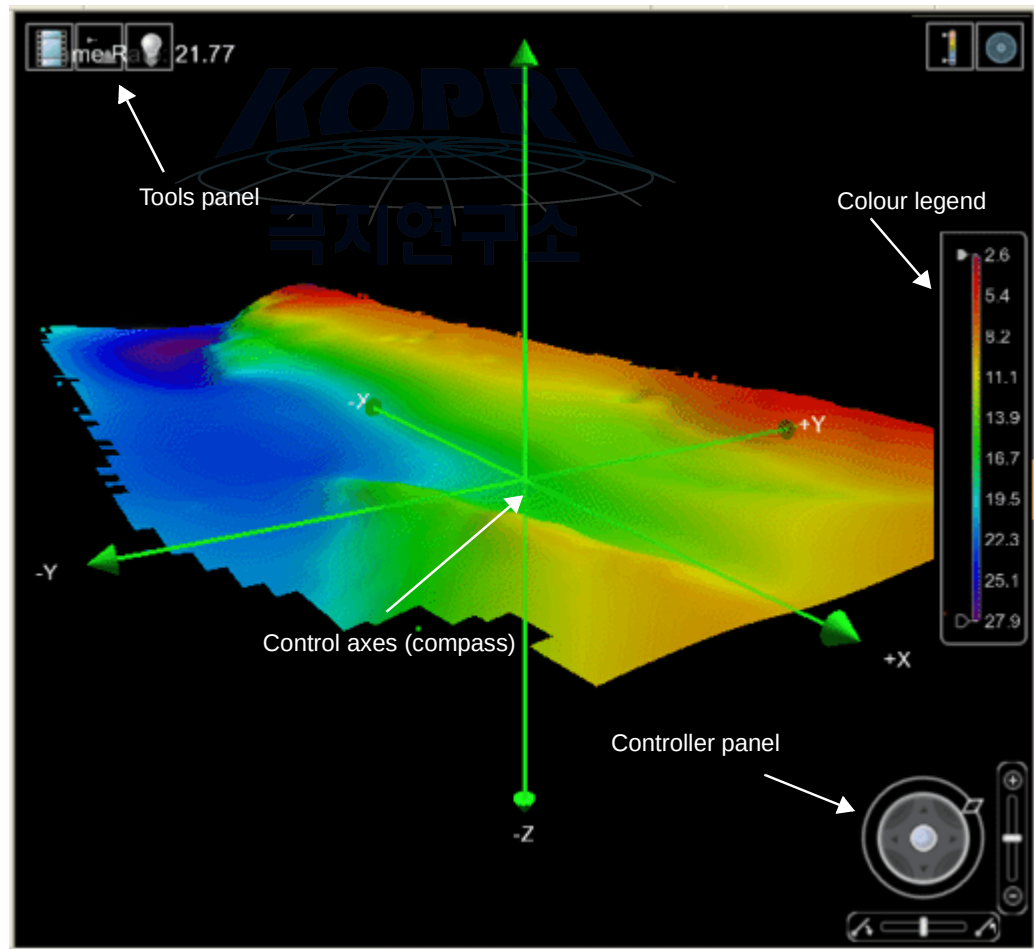
Data layers that are viewable in the HIPS and SIPS Display window can be viewed in 3D. This includes attribute layers for BASE Surfaces, vector data and background images such as GeoTiffs.

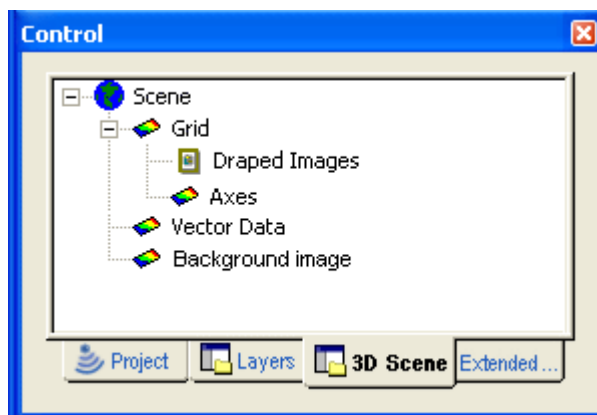
The 3D Display is enhanced with a “fly-through” effect that gives the effect of gliding through the display. With practice manipulating the fly-through controls, you will be able to zoom and pan seamlessly in this 3D window.

To activate the 3D Display window,

1. Select the 3D Display command or tool button.

The 3D Display is shown in the Display window and the 3D Scene tab replaces the Draw Order tab in the Control window.



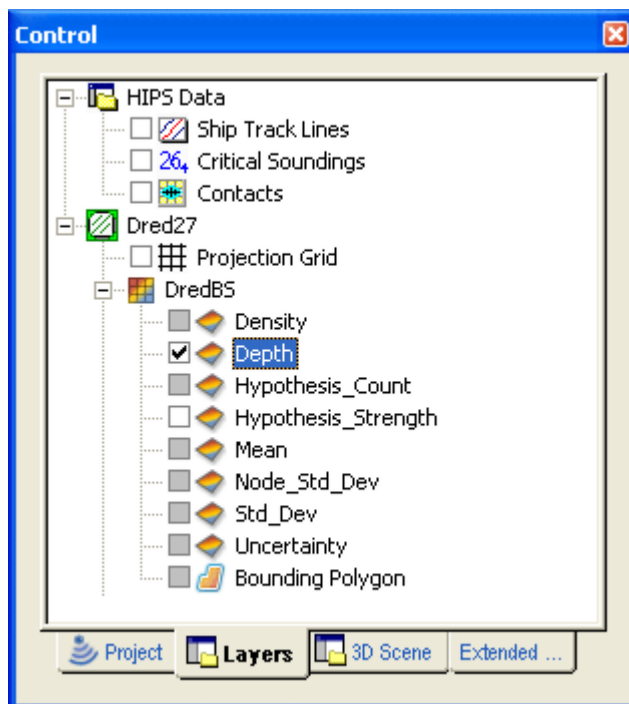


Each type of data displayed in the 3D Display has its own layer in the 3D Scene tab.

- The Grid layer contains data for the surface being displayed.
- The Draped Images layer contains the data for all draped images.
- The Axes layer contains the Terrain Axes for the surface. The Terrain Axes (displayed as an x,y,z grid) are only visible when turned on in Tools > Options.(See “3D DISPLAY” ON PAGE 659.)
- The Vector Data layer contains all vector data.
- The Image layer contains data for open raster images.

Select data for display

2. Adjust the content of the 3D Display by turning layers on or off in the Layers tab. Any layer that cannot be displayed is greyed out.



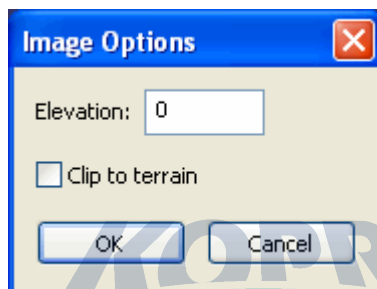
Moving your mouse over the data will display a tooltip which gives the name of the data source and the value at the current location (based on the layer selected in the Layers tab).

The coordinates of the current location are displayed in the status bar. Also displayed in the status bar is the depth value for the surface, based on the camera depth.

View Background Images

If you have background images to accompany the surface data, they can also be displayed in the 3D Display.

1. In the Layers tab, click the image layer check box to enable the image.
2. The Image Options dialog box is displayed.



The *Elevation* field allows you to specify the height at which the image sits on the surface.

3. Type a value if you would like the image displayed at a particular elevation.

The *Clip to terrain* option allows you to display only the part of the image that is within the extents of the surface.

4. Select the *Clip to terrain* check box to limit the display of the image.

The image is added to the 3D Display, and listed in the 3D Scene tab.

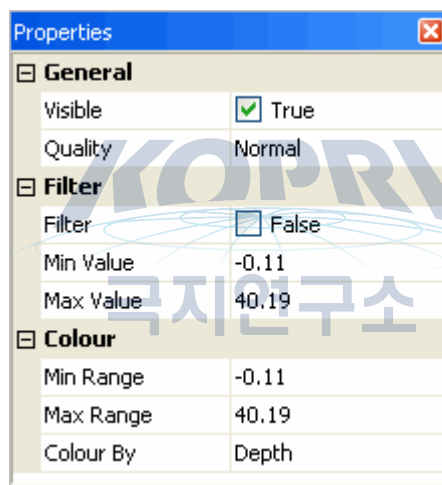
3D View Properties

The display in the 3D View can be adjusted using properties available for each type of data that can be displayed. Selecting a layer in the Layers tab will display the properties in the Properties window. Refer to the following sections for information on the available properties:

- “[SURFACE DATA](#)” ON PAGE 50
- “[VECTOR DATA](#)” ON PAGE 51
- “[RASTER DATA](#)” ON PAGE 53

Surface Data

1. Select the displayed attribute layer in the Layers tab to view the available properties in the Properties window.



The *Visible* property allows you to have the data open and included in calculations, without actually having it displayed. This frees up resources to speed up processing time. By default this option is set to *True*.

1. Click the *Visible* check box to display the selected image, if desired.

The *Quality* property allows you to display the surface using a finer or coarser resolution. The default setting is *Normal*.

2. Select the *Quality* property and select an option from the drop-down list.

The Filter properties can be used to filter data displayed in 3D.

3. Enable the *Filter* property by clicking the check box.

The value will change to *True*.

4. Enter the *Min* and *Max Value* of the data you want displayed.

5. Refresh the display.

Filter Properties

Menu	View > Refresh (F5)
Tool	

Colour Properties

Only data that falls within the range of the *Min* and *Max* values will be displayed.

Colour properties enable you to adjust the colour range used to colour the displayed data. (See also “[COLOUR RANGE](#)” ON PAGE 56.)

6. Enter the *Min* and *Max Values* to be covered by the colour range.

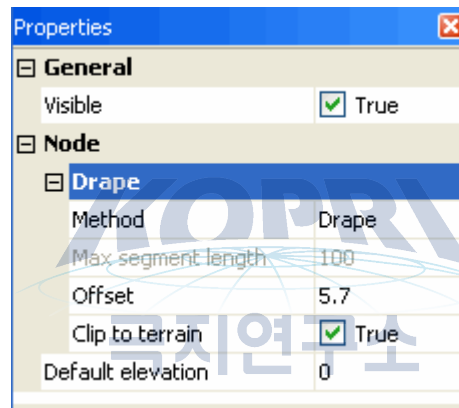
Using the *Colour By* property, you can choose which attribute will be used as the source data for colouring the display.

7. Select an option from the *Colour By* drop-down list.

The display is updated to match the selected properties.

Vector Data

1. Select a vector data layer in the Layers tab while the 3D Display is active, to display its properties in the Properties window.



The *Visible* property allows you to have the data open and included in calculations, without using resources to actually have it displayed. By default this option is set to True.

2. Click the *Visible* check box to display the selected image, if necessary.

When visible, you have the option of draping data over the surface, so you can accurately view contours and other vector data.

3. Expand the Drape property and in the *Method* field, select one of the following three options:
 - None: Data is displayed according to the *Default Elevation* property. With this option, all vector data will be on a level plane unless the data contains its own Z value. The *Elevation* defines the height at which the data sits above the surface.

The other Draping properties are disabled when *None* is selected as the method.

- Drape: Data is draped using the bathymetry of the surface and the *Offset* property. The bathymetry will apply the proper

Z value to the data and the *Offset* will define the height at which it sits above the surface.

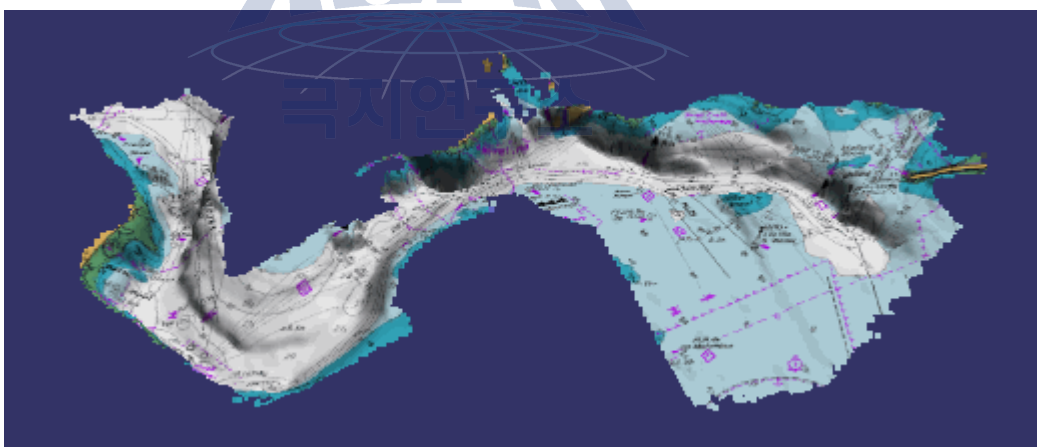
- *Drape (use line splitting)*: Data is draped using the same values as the *Drape* method, but line segments are adjusted in length based on the *Max segment length* property. A larger segment length means less vertices and faster processing times. A smaller segment length means more vertices and slower processing times, but a more accurate representation of the elevations.

The *Max segment length* property is only enabled when the *Drape (use line splitting)* method is selected.

4. Choose an option from the drop-down list.
5. Depending on the selected method, enter any necessary values in the other properties.

The image is draped over the surface.

Data that extends beyond the extents of the surface will be displayed according the *Default Elevation* value, regardless of the selected method.



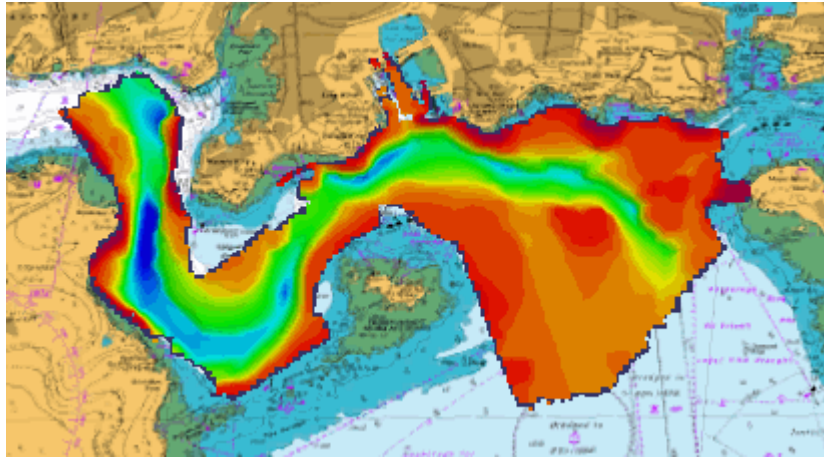
6. [Optional] If the image extends beyond the extents of the data, select the *Clip to terrain* check box to only show the section of the image within the surface extents.

You can also perform the opposite of the drape function where the image is cut away according to the bounding polygon of the surface. This allows you to view a background chart image with the actual surface visible within the chart.

To cut the image:

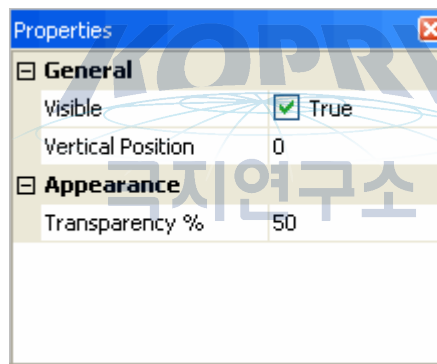
7. In the Layers tab, right-click the image layer, select *Cut Terrain*, then select the name of the surface with which you want to cut the image.

The image is cut and the gap is filled with the surface.



Raster Data

1. Select a raster data layer in the Layers tab while the 3D Display is active to display its properties in the Properties window.



The *Visible* property allows you to have the data open and included in calculations, without using resources to actually have it displayed. This option is set to “True” by default.

2. Click the *Visible* check box to display the selected image, if necessary.

The *Vertical Position* property allows you to adjust the elevation of the image in the display so that it lines up with the surface properly.

3. [Optional] Enter a value in the *Vertical Position* field.

The *Transparency* property allows you to make the image transparent so the surface can be seen in relation to the image.

4. [Optional] Enter a value in the *Transparency* field.

The display is updated to match the selected properties.

Draping Raster Data

Raster images can also be draped over a surface using the bathymetry of the surface, but using a slightly different method than vector data.

To drape a raster image:

1. Open a raster image.
2. Select the attribute layer in the Layers tab that you want to use to define the draping elevation.
3. Right-click the attribute layer, then select Drape Image and then the name of the raster image to be draped.

The image is draped over the surface and a sublayer is added to the Layers tab for the draped image.



Adjusting the Display

In addition to defining properties, there are various tools within the 3D View that also allow you to adjust the display of data. Refer to the following sections for information on the tools:

- “LIGHTING” ON PAGE 55
- “VERTICAL EXAGGERATION” ON PAGE 55
- “COLOUR RANGE” ON PAGE 56

Lighting

The lighting control handles shading effects by controlling the position and angle of the light. The elevation value (displayed when the tool is selected) varies from 0° to 90° starting from the middle of a sundial. The azimuth value (also displayed when selected) varies from 0° to 360° in a clockwise direction.



1. To access the Lighting Control, click the Light Control button in the Tools panel located in the top-left corner of the 3D Display.

The Lighting tool displays the current azimuth and elevation values.



2. Click and drag the ball to change the lighting.

As you drag, the values in the tool will be updated and you can see the affect on the data.

3. Release the mouse when the display has the proper lighting.
4. To close the tool, click the X in the top-right corner of the box.
5. To re-open the lighting tool, click the lightbulb.

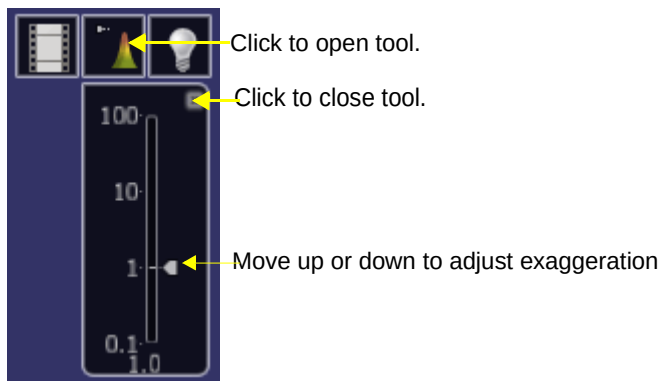
Vertical Exaggeration

Use the Vertical Exaggeration tool to increase or decrease the vertical exaggeration of the data to display seabed features more clearly.



1. To access the Vertical Exaggeration tool, click the middle button in the Tools panel located in the top-left corner of the 3D Display.

The tool activates and a slider bar is displayed below the Tools panel.



2. Click the arrow on the side of the slider and move it up or down the bar. As you move the arrow, note the change in the display.
3. Release the arrow when the data has the appropriate vertical exaggeration.
4. To close the tool, click the X in the top-right corner of the box.

Colour Range

Use the colour legend slider bar located along the right side of the 3D Display to adjust the colour range.



The legend can be turned on or off using the **Colour Legend** button in the top-right corner of the 3D View. When the button is coloured, the legend is turned on and available for use.

The arrows on the side of the legend represent the *Min* and *Max Values* of the colour range.

To change the colour range using the colour legend:

1. Select the arrow at the top or bottom of the legend.
2. Drag the arrow to the desired Min or Max value.

The colours in the display will change as you drag the arrow.

3. To reverse the colours, drag one arrow past the opposite arrow and adjust the opposite arrow as needed.



Navigate the 3D Display

In the 3D Display window, you can zoom and pan to create a flying effect over the display, which can be used to record a fly-through.

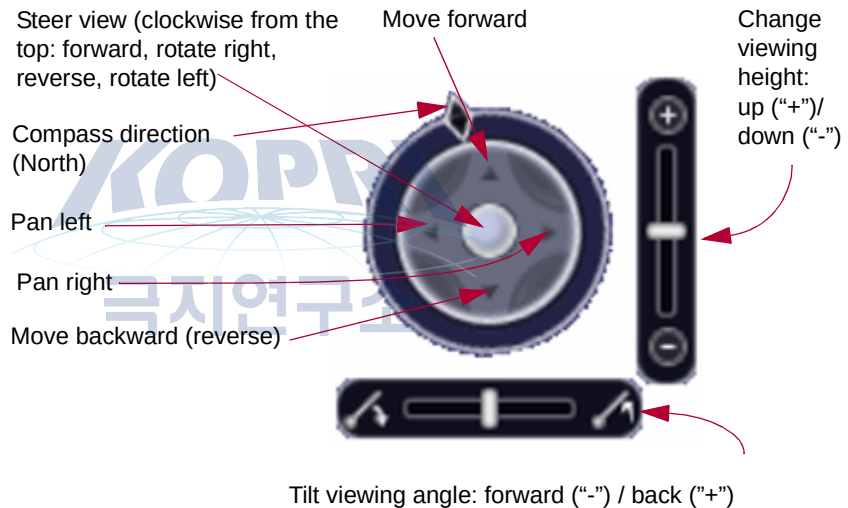
The flying effect is accomplished using the Controller panel, the mouse or the keyboard.

The Controller panel consists of a directional pad and slider controls used to modify the view and perform a fly-through.

The Controller panel can be turned on or off using the Controller Panel button in the top-right corner of the 3D View. When the button is coloured, the panel is turned on and available for use. When turned on but not in use, the panel becomes transparent so as not to obstruct the view of the data.



The Controller panel contains the following controls:



To “fly” using the mouse, press and hold one or both of the mouse buttons while simultaneously moving the mouse pointer in the direction you want to move.

To fly using the keyboard, press the <Arrow> key for the direction you wish to move the display.

When using the mouse to navigate, the speed you travel through the display or pan the view varies with the cursor’s distance from the centre (stationary) point.

The position of the cursor in the display indicates the direction you will move. The mouse button determines what operations are available.

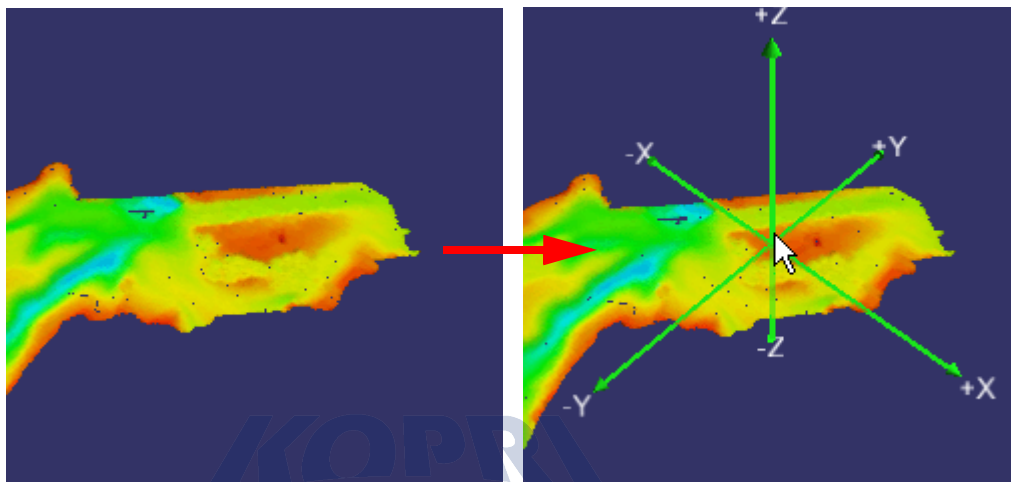
Control Axes

The Control axes, sometimes called compass controls, are displayed as an overlay to the surface, and enable you to rotate the view along the X, Y, or Z axis.

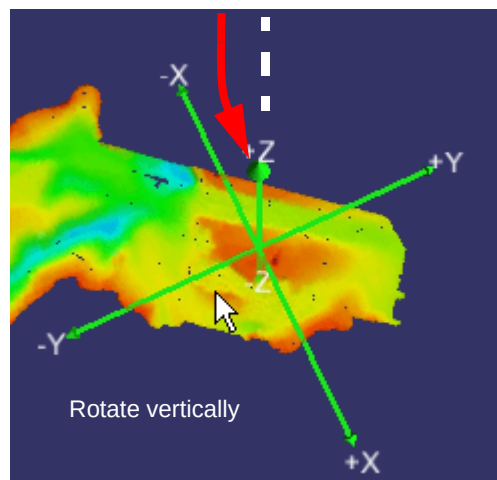
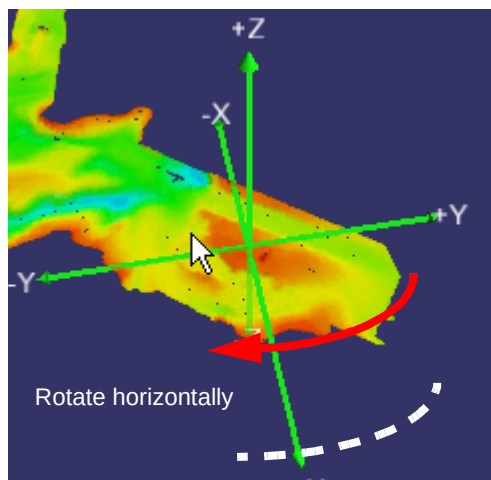
1. To show or hide the control axes, click the Axis button



on the 3D toolbar, or double-click on the surface in the Display.

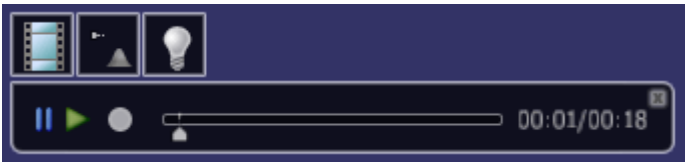


2. Select the end points of the axes to manipulate the view.
 - To rotate the view of the surface horizontally, click and hold the left mouse button on the end of the X or Y axis and move the mouse to the left or right of the Z axis in the display.
 - To rotate the view of the surface vertically, click and hold the left mouse button on the end of the Z axis and move the mouse up or down in the display.



3D Flight Path

You can make and save movies of a 3D fly-through for playback at a later time. The controls for creation and playback are located in the 3D Display Tools panel and the 3D Flight Path submenu.



Instructions for using these tools are provided in the following sections:

- “RECORD A FLIGHT” ON PAGE 59
- “PLAY A FLIGHT” ON PAGE 60
- “LOAD AN EXISTING FLIGHT” ON PAGE 60
- “SAVE A FLIGHT” ON PAGE 60
- “EXPORT A FLIGHT TO VIDEO” ON PAGE 61

Record a Flight

To record a fly-through:

1. Select a layer in the Layers tab to display in the 3D Display.
2. Adjust the view to display the starting point for your fly-through.
3. Select the **Record** command.

The Record button will change to red to indicate that you are now recording.

4. Use the controls to navigate through the 3D Display. See “NAVIGATE THE 3D DISPLAY” ON PAGE 57 for information on navigating.

All movements in the Display window are recorded.

5. To stop recording, select the **Record** command again or select the **Stop** command.

The **Record** button will return to the inactive state and your fly-through is recorded and ready for playback.

Menu	View > 3D Flight Path > Record
Tool	 , 

Menu	View > 3D Flight Path > Stop

Play a Flight

To playback a recorded fly-through:

Menu	View > 3D Flight Path > Play
Tool	 , 

1. Select the **Play** command.

The fly-through will begin to play. As it does so, the arrow on the slider bar will move from left to right and the counter at the end of the slider bar will count down, indicating the progress of the fly-through. The slider bar can also be used to go forward or backward in the recording.

2. [Optional] Click the arrow on the slider bar and drag it to the left or right to go forward or backward in the recording.

You can pause the playback if necessary without stopping it altogether.

Menu	View > 3D Flight Path > Pause
Tool	 , 

3. [Optional] Select the **Pause** command to pause the playback.

The Pause button will be coloured to indicate that playback has been paused. Both the Pause and Play commands can be used to resume playback after the Pause command has been selected.

4. To stop the playback, either select the **Play** command again, or select the **Stop** command. Otherwise, playback stops when you reach the end of the recording.

Menu	View > 3D Flight Path > Stop

Load an Existing Flight

If you have saved a fly-through to a file, that file can be loaded and played in the 3D View at anytime.

To load an existing flight:

1. Open the 3D Display.
2. Select the **Load from File** command.

A standard Windows Open dialog box is displayed.

3. Navigate to the flight file and click **Open**.

The fly-through is loaded into the 3D View and the flight path controls are available.

Menu	View > 3D Flight Path > Load from File

Save a Flight

Once you have finished recording a fly-through, you can save it to an XML file that can be viewed in HIPS and SIPS at any time.

To save a flight to an XML file:

Menu	View > 3D Flight Path > Save to File

1. Record the fly-through.
2. Select the **Save to File** command.

A standard Windows Save As dialog box is displayed.

3. Select a location for the file and enter a **File name**.
4. Click **Save**.

The flight is saved as an XML file in the selected location with the specified name.

Export a Flight to Video

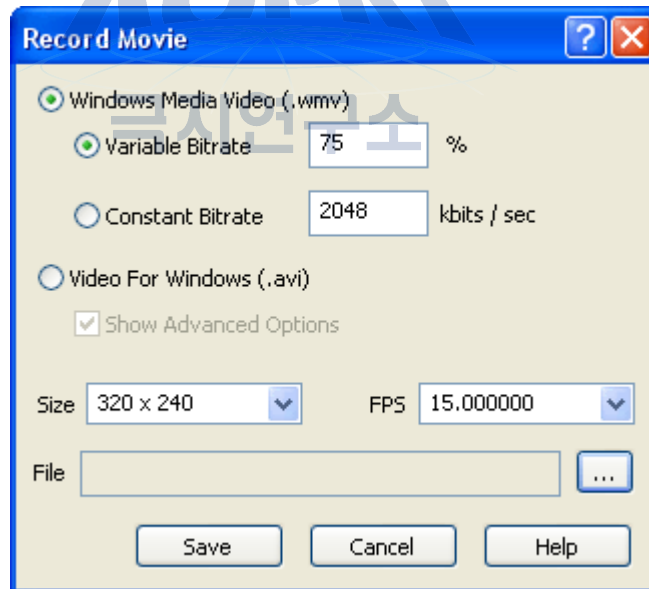
If you do not export your recording, it can only be re-opened in HIPS and SIPS, but an exported recording can be opened in any standard media player.

To record a movie of your fly-through:

Menu	View > 3D Flight Path > Export to Video

1. Open or create a fly-through.
2. Select the Export to Video command.

The Record Movie dialog box is displayed.



3. Choose the format of the video file. If you selected AVI format, go to step 6. If you selected WMV format, continue with the next step.

You may select a bitrate for the recorded data as a variable or a constant value.

- Variable Bitrate records the video using a fluctuating bitrate, which is based on a user-defined average quality level. During encoding, the bitrate will fluctuate to ensure the video

is created with the highest possible quality while maintaining the specified average.

- Constant Bitrate records the video using a user-defined number of kilo-bits per second. This option ensures that a constant bitrate is used during encoding, but may result in a lower quality video.
4. Select a bitrate option.
 5. If you selected *Variable Bitrate*, enter the average quality level for the resulting video and go to step 7.

OR

If you selected *Constant Bitrate*, enter the number of kilo-bits per second to use to record the video and go to step 7.

6. [Optional] To see the advanced playback options for your AVI movie before it is saved, select the *Show Advanced Options* option.

You must select image size and FPS (Frames-Per-Second) options for the playback of your movie.

7. Select a *Size* option.
8. Select an *FPS* option.
9. To select the save name and location for your movie file, click the Browse button (...).

A Save As dialog box is displayed.

10. Type a save name.
11. Select a save folder.
12. Click **Save**.

The Save As dialog box is closed, returning you to the Record Movie dialog box.

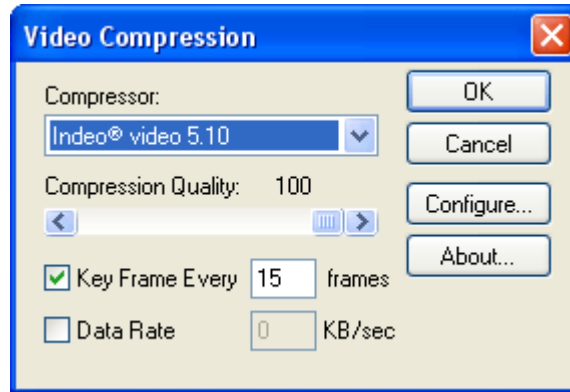
13. If you clicked the WMV format option, click **Save** and go to step 19;

OR,

if you clicked the AVI format option, click **Save** and continue with the next step.

Video Compression

The Video Compression dialog box is displayed.



14. Select a *Compressor*.

Some video compressors do not allow you to set the following options (in steps 14 to 17) for your movie files.

15. Use the slider control to select the compression quality (displayed as a value in the range of 0 and 100 percent).

16. [Optional] To insert key frames, select the *Key Frame* option and type a *frames* value.

17. [Optional] To set the data rate, select the *Data Rate* option and type a *KB/sec* (kilobits per second) value.

With some compressors, you can also choose the configuration settings to use for your AVI movie.

18. [Optional] To configure the selected compressor, click **Configure** and select from the available configuration options.

19. Click **OK**.

A message is displayed stating that the file was saved.

20. To finish, click **OK**.

The process is finished.

Cut, Copy and Paste

The Cut, Copy and Paste commands are useful for manipulating files in the Control window. These commands are similar to those used in other Windows applications.

NOTE: Line folders can only be moved or copied between Day folders and Day folders can only be moved or copied between Vessel folders.

Menu	Edit > Cut
Tool	
Pop-up	Cut
Key	<Ctrl+X>

Cut

The Cut command moves selected Vessel, Day, or Line folders to the clipboard.

1. Select the object you want to cut.
2. Select the Cut command.

The file names in the Control window are dimmed.

3. You can undo the Cut command by pressing the <Esc> key.

Menu	Edit > Copy
Tool	
Pop-up	Copy
Key	<Ctrl+C>

Copy

The Copy command reproduces the selected object without removing it from the Control window.

1. Click the object you want to copy.
2. Select the Copy command.
3. To copy data from the *Query* tab to the clipboard, use the Select All command on the right-click menu. The data can then be placed in another application.

Menu	Edit > Paste
Tool	
Pop-up	Paste
Key	<Ctrl+V>

Paste

The Paste command takes an object that has been cut or copied and places it in another location.

1. Make sure you have cut or copied an object.
2. Place the cursor at the location you want to place the object.
3. Select the Paste command.

The object is pasted into the application at the selected location.

Measure Distance

Measure the distance between two points in a survey area or in the 2-D Subset View.

The distance is shown in the units you selected in the Display tab of the Tools > Options dialog box (see “UNITS” ON PAGE 673).

Menu	Tools > Measure Distance
Tool	

1. Select the Measure Distance command.

The Measure Distance cursor icon is displayed.

2. Press and hold the mouse button and drag the cursor along the Display window.



As the cursor is dragged across the window, a line is drawn from the start point to the point where the mouse button is released. The distance between the two points is shown along the line.



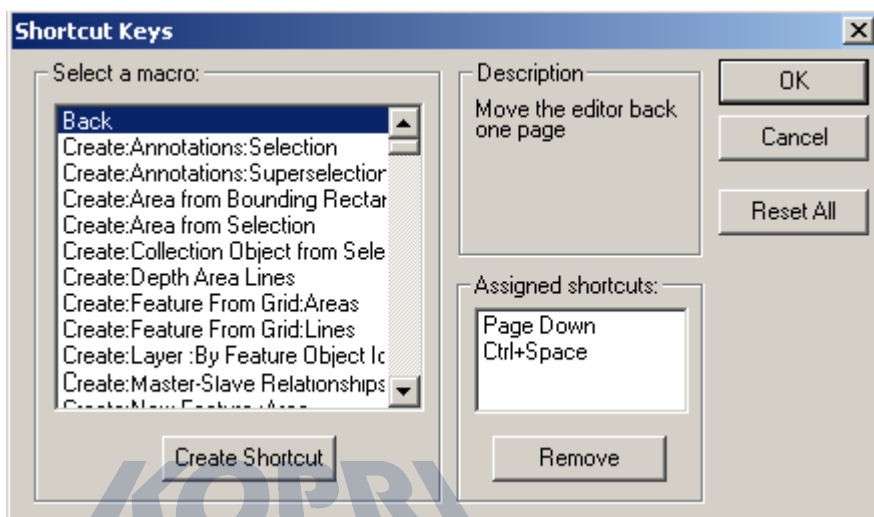
Set Keyboard Shortcuts

Menu	Tools > Shortcut Keys...

You can customize existing shortcuts, or create a new shortcut for a menu command that does not possess one. The keyboard shortcut definitions are stored in ...\\Hips\\bin\\Hips.mac.

1. Select the Shortcut Keys command.

The Shortcut Keys dialog box is displayed.



2. Click a menu command in the *Select a Macro* list box.
 - If the command already has a shortcut, the keys are displayed in the *Assigned Shortcuts* box. A brief explanation of the shortcut is displayed in *Description* field.
 - If the command does not have a shortcut then these two sections are empty.

Modify existing shortcuts

3. To delete an existing shortcut, highlight the shortcut in the *Assigned Shortcuts* area and click **Remove**.

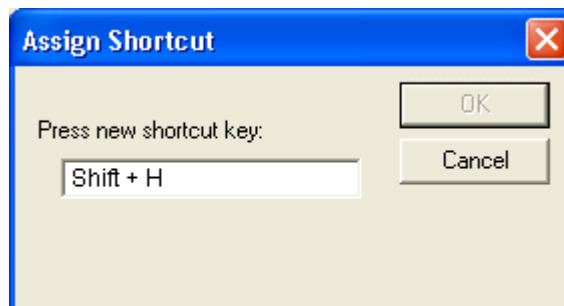
The shortcut is no longer active in the project.

Create a new shortcut

You can create a new shortcut to replace a current one or create shortcuts for commands without any.

4. Click **Create Shortcut**.

The Assign Shortcut dialog box is displayed.



You can create a shortcut using function keys, control keys or regular keys. You can also combine keys.

5. Type a new shortcut in the text area. As you type the keys are displayed in the text area. Already assigned shortcuts are displayed below the text box.

6. Once you have selected the key(s), click **OK** to close the dialog box.

The shortcut is displayed in the Shortcut Keys dialog box.

7. If you want to restore previous shortcuts, click **Reset All**.

The new shortcut is deleted and the previous default command is re-assigned.

8. Click **OK** to save the settings and close the dialog box.



Save, Close and Exit

Menu	File > Save
Tool	
Key	<Ctrl + S>

Menu	File > Close Project
Tool	
Key	<Ctrl + F4>

Close individual track lines

Pop-up	Close Lines

Menu	File > Exit
Key	<Alt + F4>

Save Projects

Save changes to data after cleaning or when the display in a session file is changed.

1. Select the Save command.

You can automatically save data-cleaning changes at regular intervals by selecting the Auto Save option (see [“GENERAL” ON PAGE 77](#)).

Close a Project

1. Select the Close Project command, or click the Windows close icon on the top right corner of the window.

You are prompted to save any changes.

2. Click **OK** to save changes.

1. Select a track line file in the Control window, or select a track line in the Display window.
2. Right-click the mouse and select a Close Lines command.

The track line closes.

Exit HIPS and SIPS

1. Choose the Exit command.
2. You are prompted to save any changes, if necessary.
3. Click **OK**.

HIPS and SIPS is closed.

3

Workflow in HIPS & SIPS

The workflow described here uses multibeam data and CUBE to illustrate a way of processing data in HIPS and SIPS. This workflow will take you through the steps from raw data to the creation of a contoured product surface and the publishing or export of cleaned data.

In this chapter...

“WORKFLOW” ON PAGE 70

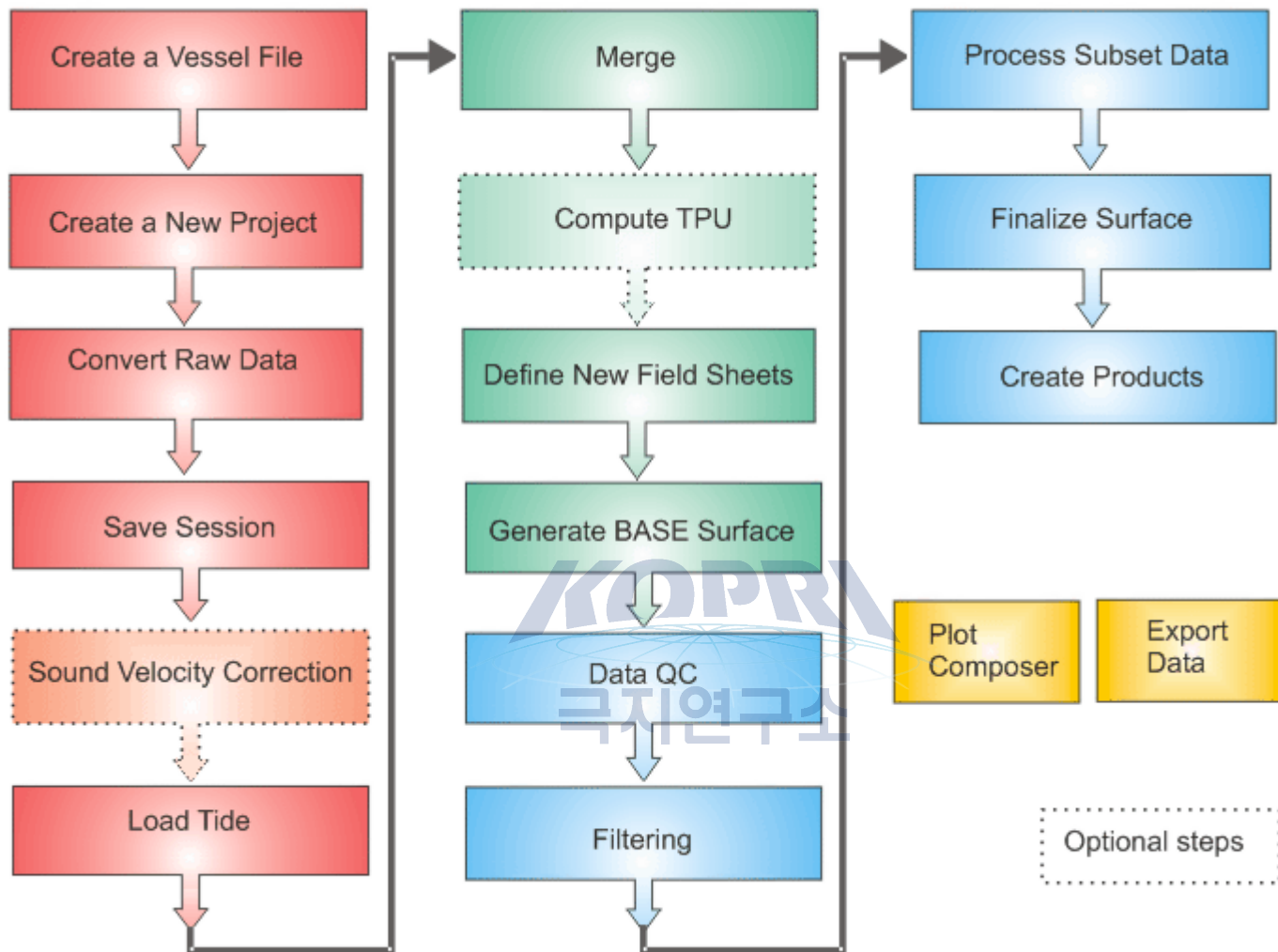
“HIPS VESSEL FILES” ON PAGE 73

“WORKING WITH PROJECTS” ON PAGE 74

“SESSION FILES” ON PAGE 75

Workflow

HIPS and SIPS Multibeam Workflow



Since some data does not require all processing steps and some can require repetition of one or more steps to produce a final product, the general workflow can be adapted to specific situations and data types.

While the order in which certain functions are performed is important, many of the functions can be automated, one at a time or with the Batch Processor (see “[BATCH PROCESSING](#)” ON PAGE 487).

Workflows to process Side Scan, Singlebeam and Lidar data are described in the HIPS and SIPS Quick Reference guides. See also :

“[USING SIDE SCAN EDITOR](#)” ON PAGE 404

“[PROCESSING SINGLE BEAM DATA](#)” ON PAGE 463

“[LIDAR DATA IN HIPS](#)” ON PAGE 479

Brief description of workflow stages

- **Create a Vessel File:** Set up or edit vessel information about sensor locations and uncertainties. See “[CREATE A NEW HVF](#)” ON PAGE 81
- **Create a new project:** Set up the Project - Vessel - Day data structure. See “[DEFINE NEW PROJECT](#)” ON PAGE 116
- **Convert raw data:** Convert data into HIPS data format using automated process. See “[CONVERT DATA](#)” ON PAGE 131
- **Save session:** Save the current workspace (data and current view). See “[SESSION FILES](#)” ON PAGE 75
- **[Optional] Sound Velocity Correction (SVC):** Load and edit sound velocity profiles and apply the correction. See “[SOUND VELOCITY CORRECTION](#)” ON PAGE 171
- **Load tide:** Load tide data from one or more tide stations to correct for tide variance. See “[LOAD TIDE](#)” ON PAGE 176
- **Merge:** Combine vertical and horizontal information to produce geo-referenced data. If changes are made to the navigation and/or motion data though the QC process further on, the Merge process is re-applied.
- **Compute Total Propagated Uncertainty (TPU):** Use uncertainty values entered in the HVF to compute the total propagated error of each individual sounding. See “[COMPUTE TPU](#)” ON PAGE 201

- Define new field sheets: Organize dataset into manageable areas with defined locations and map projection. See “[CREATE A FIELD SHEET](#)” ON PAGE 210
- Generate a Bathymetry Associated with Statistical Error (BASE) Surface: Either a Swath Angle, Uncertainty or CUBE surface from data contained in field sheet. See “[CREATE BASE SURFACE](#)” ON PAGE 226
- Generate a Combined Uncertainty and Bathymetry Estimator (CUBE) Surface: Use merged data to produce a CUBE surface.
- Data QC: Examine and edit sensor data, such as navigation, gyro, heave, if problems have been identified in the BASE (CUBE) surface.
- Filtering: Use automated or manual tools to filter soundings using swath geometry and/or according to IHO survey order accuracies.
- Process Subset Data: Validate the CUBE surface and edit geo-referenced soundings directly, on many lines simultaneously, where the CUBE surface has been adversely affected by erroneous soundings.
- Finalize BASE Surface: Update the validated BASE Surface after data has been edited, and ensure designated soundings are carried through to bathymetric products.
- [Optional] Create Product Surface: Produce a generalized product surface from the BASE Surface.
- Contours: Use automated functions with either the BASE Surface or product surface to output contours. (Contours can also be generated manually from tiles.)
- Sounding Selection: Use a height source for selection of a representative sounding set.
- Plot Composer: publish HIPS and SIPS data and product surfaces.
- Export Data: Soundings and surfaces can be exported to various formats for data transfer (e.g., S-57).

HIPS Vessel Files

All HIPS and SIPS projects must contain a HIPS Vessel File (HVF). The HVF describes the installation and calibration of equipment installed on the survey vessel. The information in the HVF is used in multiple processes including merging, mosaicking, and calculating sounding uncertainty.

A vessel file must exist prior to creating a new project in HIPS and SIPS.

The HVF can be created or modified through the HIPS Vessel Editor. The Vessel Editor is a separate application that is launched from the HIPS interface. See “[CREATE A NEW HVF](#)” ON [PAGE 81](#).



Working with Projects

Every project in HIPS and SIPS is organized in a Project-Vessel-Day folder hierarchy. New projects are created with a wizard, which generates a HIPS Project File (.hpf).

A project can be created with new Project-Vessel-Day folders, or new Vessel-Day folders can be added to an existing project. Day and Line folders can be renamed, or taken out of the active project or deleted outright. (See “[DEFINE NEW PROJECT](#)” ON PAGE 116.)

Projects can also be archived. (See “[ARCHIVE PROJECT](#)” ON PAGE 124.)

All projects must contain a vessel file. (See “[DEFINE VESSEL FILE](#)” ON PAGE 104). If your raw data files are set up in a Project/Vessel/Day/Line structure and a HIPS Vessel File exists for that data, you can skip this step and use the Conversion wizard to create the HIPS directory structure. (See “[RAW DATA](#)” ON PAGE 101 and “[RENAME DAY AND LINE FOLDERS](#)” ON PAGE 114 for more information.)



Session Files

Session files are used for re-opening all data that was processed the last time the project was open. The data types that are recorded in the session file include:

- lines
- field sheets
- background data
- last geographic view extents of the Display window

All session files have an .hsf file extension and are stored by default in ...\\Hips\\Session. The previous format of the session file (.ses) can be opened and automatically upgraded to the new session file format.

Save a session

Menu	File > Save Session/ Save Session As

1. Select the Save Session command, or select the Save Session As command if the session has not been saved before, or if you want to save an existing session under a new name.
 - If this is an already saved file, the program re-saves the existing .hsf file.
 - If this is a new file, then the Save As dialog box is displayed. Select a folder where you want to save the .hsf file and type a name in the File Name text box.

If a project contains a large number of track lines, you can make data processing more manageable and reduce the time it takes to load data into the application by selecting specific track lines for a session file.

1. Select the track lines you want to save in the session file.
2. Choose the Save Session As command and select the *Save Selected Lines Only* check box.
3. Type a name for the session file and click **Save**.

The Session file is saved.

Open a session

Menu	File > Open Session

1. Select the Open Session command.

The Open Session File dialog box is displayed.

2. Select a session file.
3. Click **Open**.

The data listed in the Session file is opened and the layers are shown in the Session tab in the Control window.

Close a session

Menu	File > Close Session

1. Select the Close Session command.

If you have made changes to the session since the last save, you are prompted to save the current changes.

2. Click **OK**.

Add Session Files

Menu	File > Add Session

1. Select the Add Session command.

While a session file is open, you can display data from another session file in the already open one.

The standard Open dialog box is displayed.

2. Select a directory and file.
3. Click Open.

The file is opened in the application.



Convert Survey Data

HIPS and SIPS files are created from survey data using the Conversion Wizard. The Conversion Wizard is a separate application that is launched from the HIPS and SIPS interface.

Survey data converted to HIPS and SIPS format is in varying stages of completion—depending on the data format options. Data may or may not have been corrected for factors like heave/pitch/roll or sound velocity.

All HIPS/SIPS data is organized in a Project-Vessel-Day-Line directory structure. If you organize the survey data according to this structure, you can convert line data from an entire Project or multiple Vessel and Day folders contained in a common Project folder. See “[PROJECTS](#)” ON PAGE 99 and “[RAW DATA](#)” ON PAGE 101 for more information.

When entire project data has been converted, a Project-Vessel-Day-Line directory is created for the converted data. If there is already a Project folder that is identical to the preprocess folder, then the line data in the existing folder is over-written with the new data.

You must organize your raw data files in a HIPS/SIPS Project-Vessel-Day structure to convert complete Project, Vessel and/or Day data files.

Menu	Import > Conversion Wizard
Tool	

1. Select the Conversion Wizard command in the HIPS and SIPS main interface.

The Conversion Wizard is displayed.

For more information on how to use the Conversion Wizard, see “[CONVERTING FILES TO HIPS/SIPS FORMAT](#)” ON PAGE 132.

Generic Data Parser

HIPS can convert almost any single beam ASCII file through the Generic Data Parser. The parser can also add or replace any sensor data in an existing project—except swath and sweep bathymetry, and side scan imagery.

For example, if high-precision positions were obtained from a source other than the original raw data files converted into HIPS, this data could be loaded into an existing project to replace the original navigation data. The new position data must have a time stamp and be in ASCII format.

The Generic Data Parser is a separate program launched from the main HIPS and SIPS interface.

1. Select the Generic Data Parser command.

The Generic Data Parser is displayed.

For more information on the Generic Data Parser, see the help file associated with the application.

Menu	Import > Generic Data Parser
Tool	



4

Create Vessel File

The HIPS Vessel file (HVF) defines the offset configurations and associated error estimates for each of the sensors, which are necessary for creating final position and depth records for survey data.

The HIPS and SIPS workflow begins with creating an HVF, and if necessary, editing the sensor configuration data.

In this chapter...

“VESSEL FILES” ON PAGE 80

“CREATE A NEW HVF” ON PAGE 81

“EDIT SENSOR CONFIGURATION” ON PAGE 92

Vessel Files

The Vessel file (HVF) in HIPS and SIPS describes the location and calibration of sensor equipment installed on the survey vessel. Written in Extensible Mark-up Language (XML), it defines the offsets and any associated error estimates for each of the sensors. The HVF is created in the HIPS Vessel Editor.

NOTE: In previous versions of HIPS and SIPS, a text file called the Vessel Configuration File (VCF) was used. VCF files can still be opened in the Vessel Editor and edited, but when the file is re-saved it is converted to HVF format.

The HVF is divided into a number of distinct sections, each describing one type of sensor. The sections are time-tagged and multiple entries can be defined for different time periods. These entries can be edited in the Vessel Editor.

During the Merge process, corrected sensor data is combined with the observed data to create a final position/depth record.

The HVF for a ship is stored in the default directory
...\Hips\HDCS_Data\VesselConfig.



Create a New HVF

A vessel file is created in the HIPS Vessel Editor, which is a separate application launched from the HIPS andSIPS interface. (For a description of the Vessel Editor and its properties, see “VESSEL EDITOR INTERFACE” ON PAGE 550.)

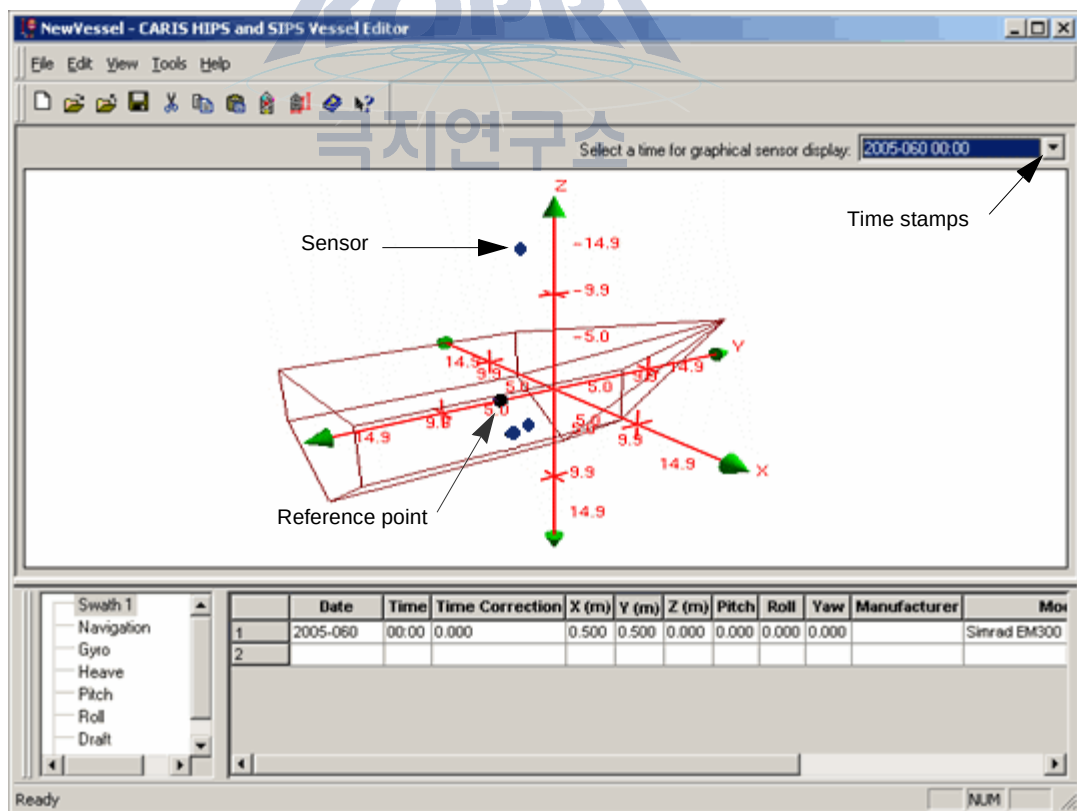
There are four main steps to creating and configuring a HIPS Vessel file in the Vessel Editor:

- Open the HIPS and SIPS Vessel wizard to enter the parameters for the file, based on the type of data being surveyed.
- Enter sensor position data using a 3D outline for the vessel. (See “CREATE VESSEL OUTLINE” ON PAGE 89.)
- Enter additional information such as the ellipsoid used in the survey. (See “DEFAULT ELLIPSOID” ON PAGE 91.)
- Enter and edit sensor configuration data. (See “EDIT SENSOR CONFIGURATION” ON PAGE 92.)

Menu	Edit > Vessel Editor
Tool	

To create a new HIPS vessel file:

1. Open the Vessel Editor from the HIPS and SIPS interface.



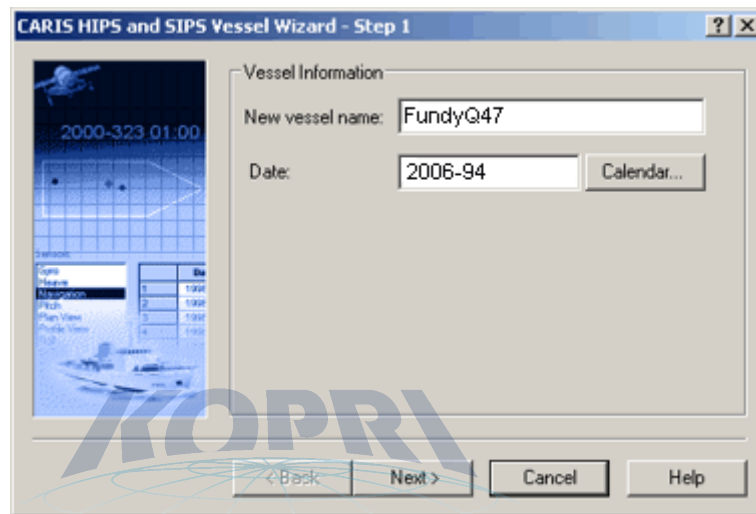
In the Vessel Editor,

2. Select the New Vessel File command.

The Vessel Wizard - Step 1 dialog box is displayed.

(The content of the dialog boxes that are then displayed is contingent on the type of sonar used in the survey.)

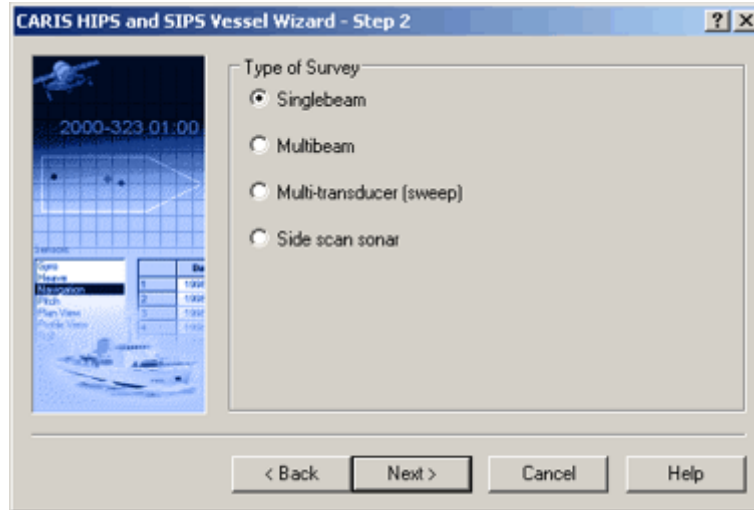
Vessel Information



1. Type a name similar to the vessel used in the survey. Make sure the name does not include any spaces.
2. Click the **Calendar** button to insert the year and date from which the vessel file is valid.
3. Click **Next** to open the next dialog box: "TYPE OF SURVEY" ON PAGE 84.

Type of Survey

The second dialog box prompts you to enter the sonar type used in the survey.



There are four sonar types:

- *Singlebeam*
- *Multibeam*
- *Multi-transducer*
- *Side Scan Sonar*

1. Select a sonar type by clicking the appropriate check box.
2. Click **Next** to go to the next step in the Vessel Wizard,

or,

if you selected *Side Scan Sonar*, click **Finish**.

Single Beam

If you select Single Beam as the type of survey data in Step 2, then the remaining steps in the creation of a new HVF are “**MOTION SENSORS**” ON PAGE 87 and “**CONFIGURATION OPTIONS**” ON PAGE 88.

Multibeam

If you selected Multibeam in the Step 2 dialog box, Step 3 will ask you for information on the sonar model and number of transducers.

The screenshot shows the 'CARIS HIPS and SIPS Vessel Wizard - Step 3' dialog box. On the left is a preview window showing a sonar plot with the text '2000-323 01.00' and a list of views: 'Default', 'Range', 'Range', 'Amplitude', 'Pitch', 'Plan View', and 'Profile View'. The main area is titled 'Multibeam' and contains the following fields:

- 'Number of Transducers:' with radio buttons for '1' (selected) and '2'.
- 'Transducer 1:' with a text box containing '0' and the label 'Beams'.
- 'Transducer 2:' with a text box containing '0' and the label 'Beams'.
- 'Total:' with a text box containing '0'.
- 'Model:' with a dropdown menu showing 'Simrad EM300'.

 At the bottom are four buttons: '< Back', 'Next >', 'Cancel', and 'Help'.

1. Select the appropriate check box to indicate that one or two transducers were used in the survey.
2. Enter the number of beams in each transducer.
3. Select the sonar model.
4. Click **Next** to continue.

Multi-Transducer

If you selected Multi-transducer in the Step 2 dialog box, you will now be asked for information on the number and types of transducers and for TPU specific parameters.

The screenshot shows the 'CARIS HIPS and SIPS Vessel Wizard - Step 3' dialog box for the 'Multi-transducer' configuration. The left preview window is identical to the previous one. The main area is titled 'Multi-transducer' and contains the following fields:

- 'Number of Transducers:' with a text box containing '2'.
- 'Fixed:' with radio buttons for 'Yes' (selected) and 'No'.
- 'Alongtrack:' with a text box containing '0' and the label 'm'.
- 'Depth:' with a text box containing '0' and the label 'm'.
- 'Model:' with a dropdown menu showing 'Simrad EM300'.
- 'TPE Specific Parameters:' section containing:
 - 'Navigation to Boom:' with x, y, and z text boxes, each containing '0' and the label 'm'.
 - 'MRU to Boom:' with x, y, and z text boxes, each containing '0' and the label 'm'.
 - 'Alignment:' section with 'Gyro' (0 deg), 'Roll' (0 deg), 'Squat' (0 %), and 'Heave' (0 %) text boxes.

 At the bottom are four buttons: '< Back', 'Next >', 'Cancel', and 'Help'.

1. Enter the *Number of Transducers* on a boom.
2. Select *Yes* if the transducers are mounted to a fixed boom or to the hull of the vessel, or select *No* if the transducers are on a movable (decoupled) boom.
3. Type the default *Alongtrack* value of all the transducers relative to the ship's reference point.
4. Type the default *Depth* of all the transducers relative to the ship's Reference Point.
5. Select the sonar model from the *Model* drop-down list.

The following parameters are necessary to calculate Total Propagated Uncertainty.

6. Type the distances from the positioning system to the centre of the boom in the *Navigation to Boom X-Y-Z* fields.
7. Type the distance from the motion recording unit to the centre of the boom in the *MRU to Boom X-Y-Z* fields.

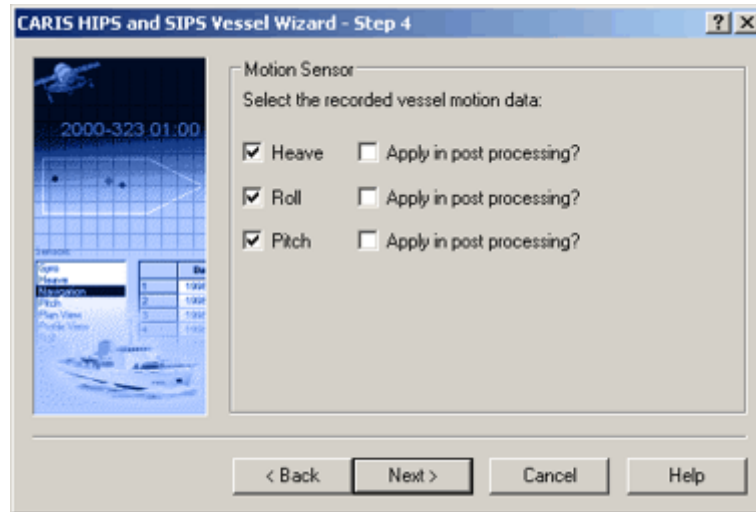
The *Roll* and *Gyro* misalignment values are needed for fixed-boom system. However, for a decoupled boom, only a *Gyro* misalignment value is needed.

The *Squat* and *Heave* percentage values are transducer responses to overall heave and squat. For fixed-boom transducers this should be 100% and less than 100% for decoupled-boom transducers.

8. Type a degree offset in the *Roll* and *Gyro* fields.
9. Type a percentage value in the *Squat* and *Heave* fields.
10. Click **Next** to open the dialog box for: "CONFIGURATION OPTIONS" ON PAGE 87.

Motion Sensors

This dialog box determines which attitude sensors are displayed in the HVF.



1. Create entries for any (or all) of the following sensors by clicking the appropriate box:

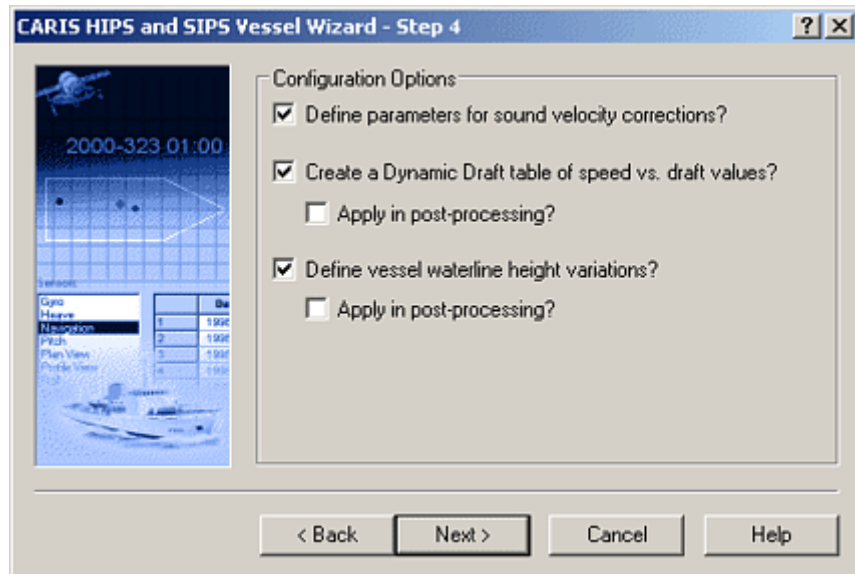
- *heave*
- *pitch*
- *roll*

The *Apply in Post Processing* option means that the data is applied during the Merge process or during Sound Velocity Correction.

2. Click any of the check boxes if you want to apply the attitude sensor data in post processing.
3. Click **Next**.

Configuration Options

The Configuration Options dialog box is displayed



This dialog box lets you enable three options:

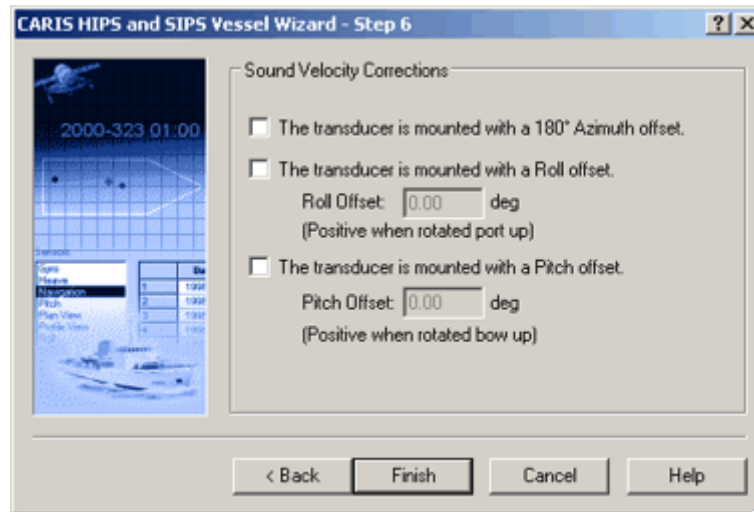
- the SVP (Sound Velocity Profile) pole parameters
 - dynamic draft values
 - waterline height variation
1. To include sound velocity corrections, click the *Define Parameters for Sound Velocity Corrections* check box.
 2. To apply dynamic draft values to vessel speeds, click the *Apply Dynamic Draft* check box.

A draft-versus-speed table is created in the Vessel Editor. You can enter values in this table once the vessel file is created.

3. If you want to apply long period variations in the waterline height in processing data, click the *Define Vessel Waterline Height Variation* check box.
4. Click the appropriate *Apply in Post Processing* check boxes, as needed.
5. If you selected the *Define Parameters for Sound Velocity Corrections* check box, click **Next**, or click **Finish** if did not select this option.

Sound Velocity Corrections

The Sound Velocity Corrections dialog box is displayed only if you selected the *Define parameters for sound velocity corrections* check box in the Configuration Options dialog box.



This dialog box records any transducer pole offsets.

Transducer head offsets must be taken into account when the SVP is applied to the data.

1. Select the 180-degree Azimuth box if the transducer is reverse mounted.
2. If the transducer is mounted with a large roll offset for use under wharves or along banks, then select the *Roll Offset* check box
3. Type the amount of offset (in degrees) in the *Roll Offset* box.
4. If the transducer is mounted with a large pitch offset such that it is pointed forward or backwards, then select the *Pitch Offset* check box.
5. Type the amount of offset (in degrees) in the *Pitch Offset* box.
6. Repeat the above steps for the second transducer if there are two poles.
7. Click **Finish**.

A new HIPS Vessel File is created. You can now create an outline for the vessel (see “[CREATE VESSEL OUTLINE](#)” ON PAGE 89).

Create Vessel Outline

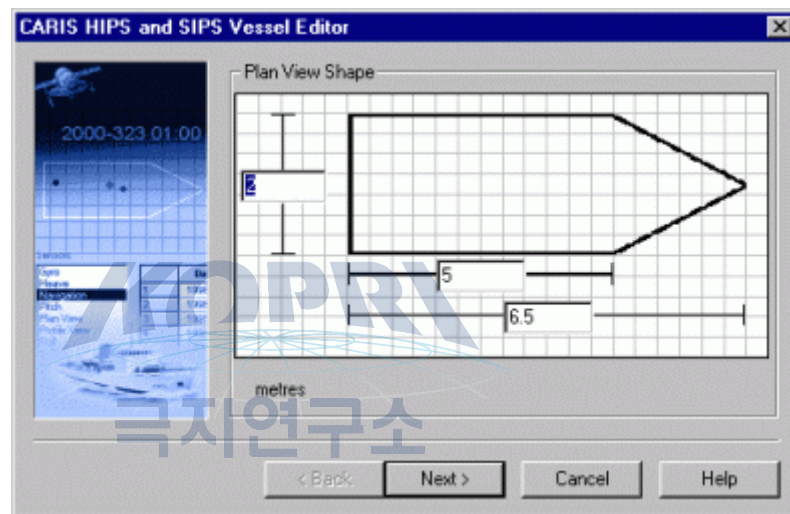
Menu	Edit > Vessel Shape
Tool	

The Vessel Shape command creates a 3-D outline of the vessel, from measurements you enter to define the length, width and height of the vessel, and the position of the reference point in the vessel.

You can also use the Vessel Shape command to revise an existing vessel outline.

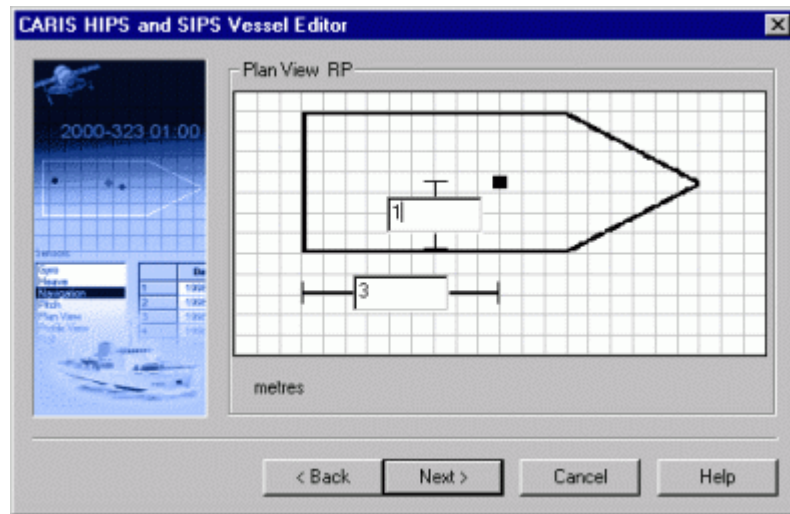
1. Open the HVF if it is not already open.
2. Select the Vessel Shape command.

The Plan View Shape dialog box is used for entering width and length of the vessel.



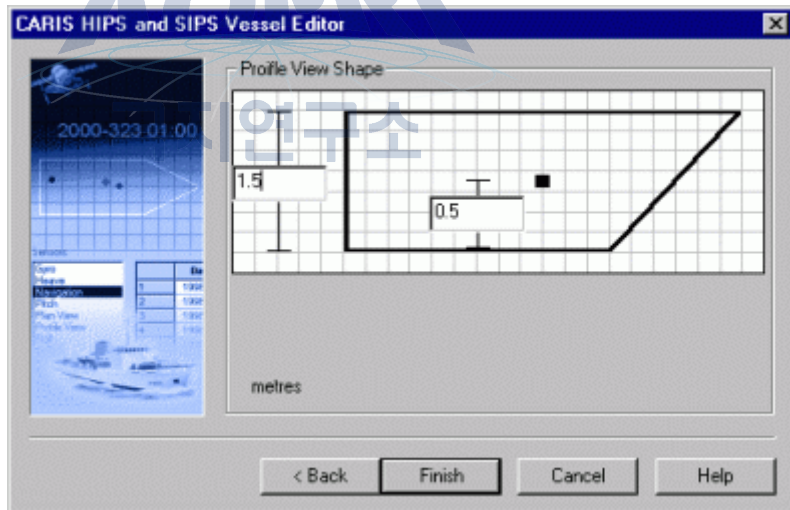
1. Enter a width for the vessel (port to starboard).
2. Enter a length for the vessel (stern to the base of the bow).
3. Enter a length for the vessel (stern to the tip of the bow).
4. Click **Next**.

The Plan View PR dialog box is displayed. It is used to set the position of the Reference Point (RP).



1. Type the distance from the stern to RP.
2. Type the distance from the starboard side to the RP.
3. Click **Next**.

The Profile View Shape dialog box sets the height measurements for the vessel.



1. Type the height of the vessel.
2. Type the height of the vessel RP from the keel.
3. Click **Finish**.

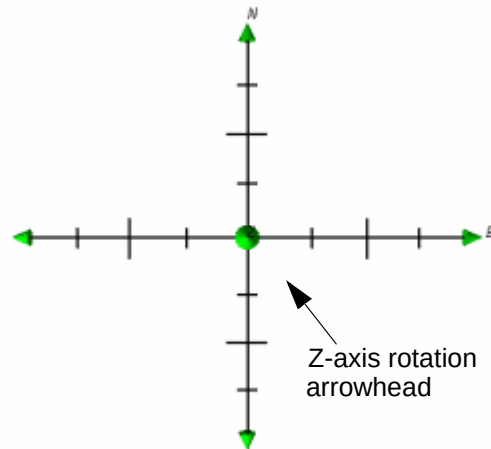
The Vessel Editor displays the vessel outline.

Vessel Shape 3-D Controls

The outline displayed in the editor can be rotated, zoomed and panned using the compass, keyboard, and mouse.

Compass

Rotation along the X-Y-Z axis is handled by moving the arrow heads at the ends of the compass.



1. To rotate the image along the Z-axis, click the middle arrow head and drag the cursor upward so that the image is rotated. The compass can be rotated 90°.
2. To rotate the image along the X-Y axis, click any of the other arrow heads and drag the arrow head in a left-right or up-down direction. The compass can be rotated 360°.
3. Alternatively, the image can be rotated in the horizontal plane by grabbing the Z-arrow, then pressing the <Ctrl> key and the left-mouse button and moving the cursor up and down in the view. Rotation around the Z-axis can be performed by pressing the <Shift> key and moving the cursor left and right in these windows.

Pan

There are three pan options:

- To pan along the X-Y axis: place the cursor in the 3-D area, press the middle mouse button and drag the display to a new location.
- To pan along the Z-axis: place the cursor in the 3-D area, press and hold both the <Shift> key and middle mouse button and move the cursor in the window.
- To centre the 3-D Display window on a selected point: position the cursor over the point and click the middle mouse button.

Zoom

The zoom option is similar to pan

1. Press and hold both the <Ctrl> key and right-mouse button while dragging the mouse up or down to zoom in or zoom out.

Options Dialog Box

Default ellipsoid

The HVF must contain the ellipsoid and datum used by the navigation system in the survey vessel, regardless of whether projection coordinates or geographic coordinates are stored in the data.

The list of available ellipsoids is maintained in the datum.dat file referenced by the uslXdatum environment variable. By default, this file is located in the System directory.

Set the ellipsoid for a new vessel file to be the same as the one used in the survey.



Menu	Tools > Options

1. Select the Options command.
- The Options dialog is displayed.
2. Select the Options - General tab.
3. Select an ellipsoid from the pull-down menu.
4. Click **OK** to close the dialog box.

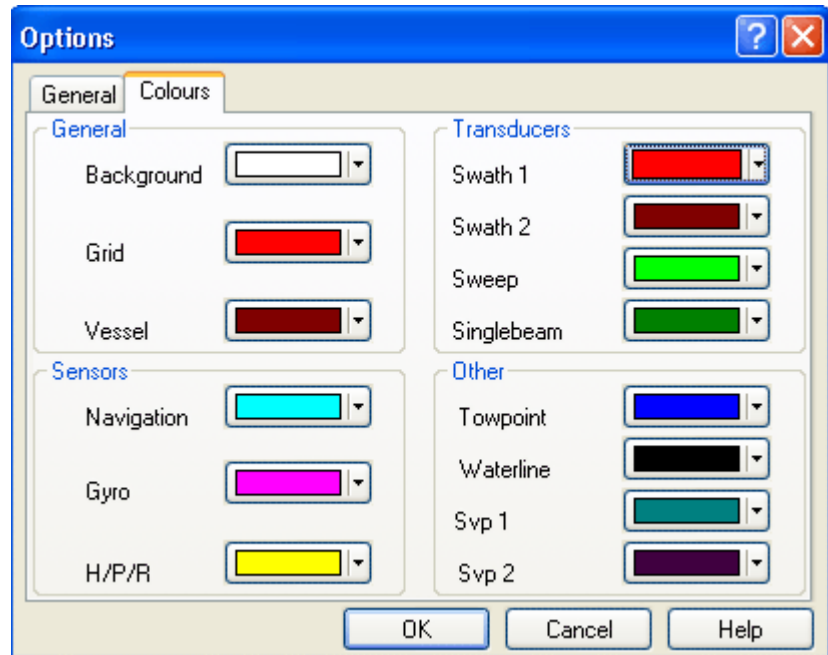
The name of the ellipsoid is displayed in the Navigation section of the editor.

Colours

The locations of sensors and other equipment are shown by colour markers. You can select another colour for a sensor marker.

Menu	Tools > Options

1. Select the Options command.
- The Options dialog box is displayed.
2. Select the Options - Colours tab.



3. Select a colour from the pull-down palette, or create a custom colour from the standard Windows colour picker.
4. Click **OK** to activate the changes and close the Options dialog.

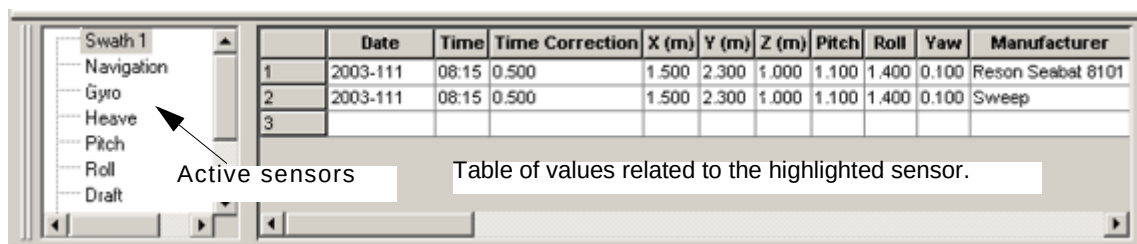


Edit Sensor Configuration

The active sensors listed in the Vessel Editor are determined by the sensor parameters you selected when creating the vessel file.

If you want to add data for a sensor not already included in the vessel file, you can add a sensor to the list and enter its data.

You can also remove a sensor and its values from the vessel file.



In general, if sensor offsets or calibration values have already been applied to logged data during data acquisition, then do not enter the same offsets and calibration parameters in the Vessel Editor.

Also, if compensation for heave, pitch, and roll has already been made to the recorded sounding data during data acquisition, for example as in Simrad data, then it must not be applied again.

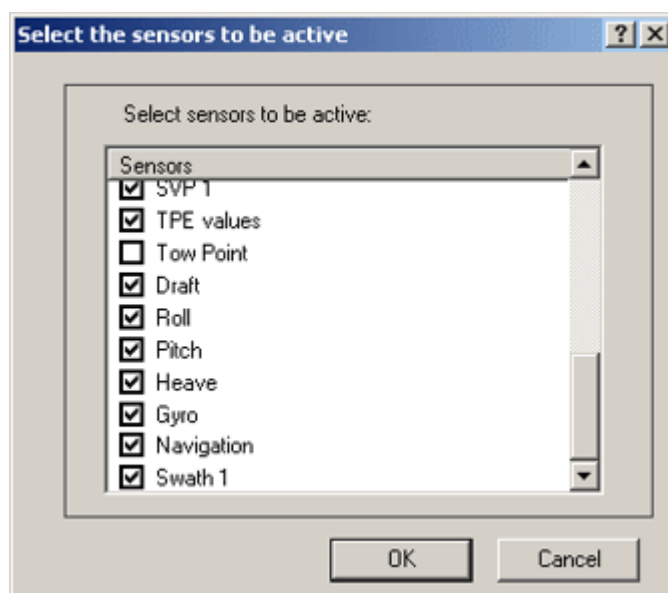
Toggle data fields

Menu	Edit > Active Sensors
Tool	

To add or remove sensors from the list of active sensors,

1. Select the Active Sensors command.

The Active Sensors dialog box is displayed.



If a box is checked, the sensor is included in the vessel file and displayed in the Editor table.

2. Make sure a sensor box is checked to enable the sensor, or cleared to remove the sensor.
3. Click **OK**.

The list is refreshed to show the selected active sensors.

Sensors

Different sensors can require specific edits applied to the parameter data. The following sections explain the individual sensor data fields.

-



Swath

The swath sonar, also known as multibeam, typically has beams that are formed in a fan shape, radiating from the centre of the transducer.

1. Click *Swath 1* in the Sensors list box so the selection is highlighted and the swath data fields are displayed.
2. Type data (as needed) in the following fields:
 - Date: The year and Julian day of current swath time stamp.
 - Time: The hour and minute of the current swath time stamp.
 - Time Correction: The time correction value.

The X-Y-Z fields set the location of the transducer from the Reference Point (0).

- X: The athwart-ship distance of the transducer, positive to starboard.
- Y: The along-ship distance of the transducer, positive to the bow.
- Z: The vertical distance of the transducer, positive into the water.

The Pitch, Roll and Yaw fields refer to misalignment of the transducer, during mounting, from the vessel coordinate system.

- *Pitch*: The offset is positive when rotating the transducer towards the bow (bow up).
- *Roll*: The offset is positive when rotating the transducer away from starboard (starboard down).
- *Yaw*: Indicates the horizontal rotational offset and is positive for a clockwise rotation.
- *Manufacturer*: The maker of the transducer.
- *Model*: The particular make of transducer. The model information is necessary for the calculation of Total Propagated Uncertainty.
- *Serial Number*: The serial number of the transducer.

Since the Simrad data read into HIPS is already corrected, the Swath values in the HVF must be set as follows:

- The X/Y/Z offsets are zero because the Simrad data acquisition has already applied static draft and shifted the swath profile to the vessel reference point.
- The Roll / Pitch / Yaw transducer mounting rotations are typically zero because the Simrad data acquisition has already applied patch test calibration results.

Navigation

The navigation section of the HVF describes the location of the navigation source (for example, antenna or motion sensor). This section is used as a link between the fixed positioning coordinate system and the instantaneous vessel coordinate system.

1. Click *Navigation* in the Sensors list box so the selection is highlighted and the navigation data fields are visible.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current navigation time stamp.
 - *Time*: The hour and minute of the current navigation time stamp.
 - *Time Correction*: The time correction value.

The X-Y-Z fields set the location of the navigation source from the Reference Point (0).

- *X*: The athwart-ship distance of the source, positive to starboard.
 - *Y*: The along-ship distance of the source, positive towards the bow.
 - *Z*: The vertical distance of the source, positive into the water.
 - *Ellipsoid*: From the drop-down list, select the ellipsoid on which the navigation is based. The ellipsoid should be the same as the one used in the survey.
 - *Manufacturer*: The maker of the navigation equipment.
 - *Model*: The particular make of navigation equipment.
 - *Serial Number*: The serial number of the navigation equipment.
-

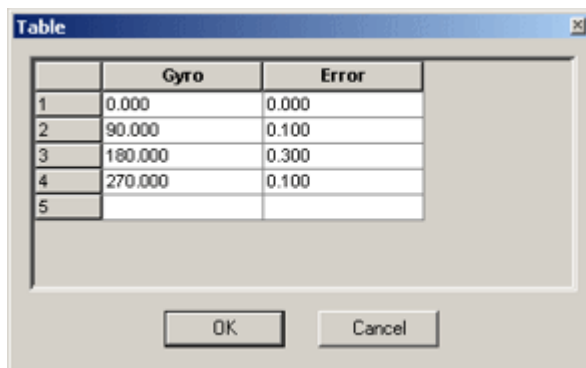
Gyro

The gyro sensor refers to any device providing a heading orientation of the vessel.

1. Click *Gyro* in the Sensors list box so the selection is highlighted and the gyro data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current gyro sensor time stamp.
 - *Time*: The hour and minute of the gyro sensor time stamp.
 - *Time Correction*: The time correction value.

The Gyro Error is measured in degrees and is the difference between the recorded sensor value and the applied heading of the vessel: $\text{Applied Heading} = \text{Recorded value} - \text{Gyro Error}$.

3. Click an **Edit** button in the *Error* column to open the Gyro Error Table.



The screenshot shows a dialog box titled 'Table' with a table inside. The table has two columns: 'Gyro' and 'Error'. There are five rows, numbered 1 to 5. The values in the 'Gyro' column are 0.000, 90.000, 180.000, 270.000, and an empty cell. The values in the 'Error' column are 0.000, 0.100, 0.300, 0.100, and an empty cell. At the bottom of the dialog box are 'OK' and 'Cancel' buttons.

	Gyro	Error
1	0.000	0.000
2	90.000	0.100
3	180.000	0.300
4	270.000	0.100
5		

4. Type new values in the **Gyro** or **Error** fields and click **OK** to close the dialog box.
5. Type data (as needed) in the following fields.
 - *Manufacturer*: The maker of the sensor equipment.
 - *Model*: The particular make of sensor equipment.
 - *Serial Number*: The serial number of the sensor equipment.

Heave

The heave sensor records the vertical motion of the vessel. Although the heave sensor has its own section in the Vessel Editor, it is usually part of the same sensor package as Pitch and Roll in most survey configurations.

1. Click *Heave* in the Sensors list box so the selection is highlighted and the data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current heave sensor time stamp.
 - *Time*: The hour and minute of the current heave sensor time stamp.
 - *Time Correction*: The time correction value.

The X-Y-Z fields set the location of the heave sensor from the Reference Position (0).

The X-Y-Z location of the heave sensor must be defined **ONLY** when you intend to apply heave data during Merge AND when remote heave compensation is necessary.

- *X*: The athwart-ship distance of the sensor, positive to starboard.
- *Y*: The along-ship distance of the sensor, positive to the bow.
- *Z*: The vertical distance of the sensor, positive into the water.
- *Error*: The applied instantaneous values for the heave sensor are computed by subtracting the appropriate errors from the recorded values:

$$\text{Applied Heave} = \text{Recorded Heave} - \text{Heave Error.}$$

- *Apply*: Select Yes to apply heave data in the merge process.
- *Manufacturer*: The maker of the sensor equipment.
- *Model*: The particular make of sensor equipment.
- *Serial Number*: The serial number of the sensor equipment.

The location of the heave sensor is shown in the Vessel Editor by a coloured dot.

Note: Simrad systems apply dynamic Heave, Pitch, and Roll values to the swath data during survey. Therefore, the HVF must be set up with the *Apply* switches for Heave, Pitch, and Roll set to "No" so these values are not applied twice.



Pitch

Pitch refers to the rotational motion of the vessel around the X (port/starboard) axis. Although the pitch sensor has its own section in the Vessel Editor, it is usually part of the same sensor package as roll and heave in most survey configurations.

1. Click *Pitch* in the Sensors list box so the selection is highlighted and the data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current pitch time stamp.
 - *Time*: The hour and minute of the current pitch time stamp.
 - *Time Correction*: The time correction value.
 - *Error*: The applied instantaneous values for the pitch sensor are computed by subtracting the appropriate errors from the recorded values:

$$\text{Applied Pitch} = \text{Recorded Pitch} - \text{Pitch Error}.$$
 - *Apply*: Select Yes to apply the pitch data in the merge process.
 - *Manufacturer*: The maker of the sensor equipment.
 - *Model*: The particular make of sensor equipment.
 - *Serial Number*: The serial number of the sensor equipment.

The location of the pitch sensor is indicated in the Vessel Editor by a coloured dot.

Note: Simrad systems apply dynamic Heave, Pitch, and Roll values to the swath data during survey. Therefore, the HVF must be set up with the *Apply* switches for Heave, Pitch, and Roll set to "No" so these values are not applied twice.

Roll

Roll refers to the rotational motion of the vessel around the Y (fore/aft) axis. Although the roll sensor has its own section in the Vessel Editor, it is usually part of the same sensor package as pitch and heave in most survey configurations.

1. Click *Roll* in the Sensors list box so the selection is highlighted and the roll data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current roll time stamp.
 - *Time*: The hour and minute of the current roll time stamp.
 - *Time Correction*: The time correction value.
 - *Error*: The applied instantaneous values for the roll sensor are computed by subtracting the appropriate errors from the recorded values:

$$\text{Applied Roll} = \text{Recorded Roll} - \text{Roll Error}.$$
 - *Apply*: Select Yes to apply the roll data in the merge process.
 - *Manufacturer*: The maker of the sensor equipment.
 - *Model*: The particular make of the sensor equipment.
 - *Serial Number*: The serial number of the sensor equipment.

The location of the roll sensor is indicated in the Vessel Editor by a coloured dot.

Note: Simrad systems apply dynamic Heave, Pitch, and Roll values to the swath data during survey. Therefore, the HVF must be set up with the *Apply* switches for Heave, Pitch, and Roll set to "No" so these values are not applied twice.

Dynamic Draft

The squat and lift of a vessel changes as the speed changes. For some vessels, if the squat/lift is not accounted for, significant errors are introduced into the soundings. In this section, you can specify up to 10 speed-draft value pairs. During merge, the difference between the instantaneous draft and the static draft is computed and the final depth compensated.

Draft is measured in metres/feet, and speed is measured in knots. All draft values entered should be relative to the same reference, but what that reference is, is not important. The first Speed-Draft pair must correspond to a state where no draft correction is necessary. The delta draft values, relative to the initial draft, are computed and used to correct observed soundings.

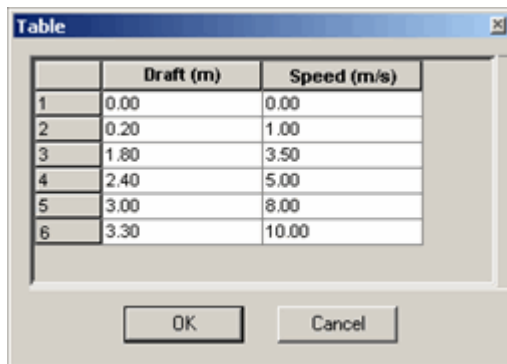
The following formula is used to correct soundings for dynamic draft:

$$\text{Depth} = \text{observed depth} - \text{waterline} + \text{delta draft}.$$

Delta draft is computed from the present vessel speed, as derived from the navigation system.

You can also create your own dynamic draft model and load Delta Draft information directly which will override the Dynamic Draft table in the HVF. (See “[DELTA DRAFT](#)” ON PAGE 189.)

1. Click *Dynamic Draft* in the sensors list box so the selection is highlighted and the dynamic draft data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current time stamp for the draft table.
 - *Time*: The hour and minute of the current time stamp for the draft table.
 - *Apply*: Select Yes to apply the table during merge (or No to not apply the table).
3. Click **Edit** in the *Error* field. A dialog box containing a table with up to 10 speed-draft pairs is displayed.



	Draft (m)	Speed (m/s)
1	0.00	0.00
2	0.20	1.00
3	1.80	3.50
4	2.40	5.00
5	3.00	8.00
6	3.30	10.00

4. Click inside the *Speed* cell and type a speed value (in knots).
5. Click inside the *Draft* cell and type a corresponding draft value.
6. Continue entering as many speed /draft pairs as needed.
7. Click **OK**.

The speed-draft table is saved in the HVF.

Single Beam

The Single beam section refers to a vertical beam echo sounder with one transducer mount. It can be a single or dual frequency sounder defined as one beam with one transducer.

1. Click *Single Beam* in the Sensors list box so the selection is highlighted and the data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current single beam time stamp.
 - *Time*: The hour and minute of the current time stamp.
 - *Time Correction*: The time correction value.

The X-Y-Z fields set the location of the transducer from the Reference Point (0).

- *X*: The athwart-ship distance of the transducer, positive to starboard.
- *Y*: The along-ship distance of the transducer, positive to the bow.
- *Z*: The vertical distance of the transducer, positive into the water.
- *Manufacturer*: The maker of the transducer.
- *Model*: The particular make of the transducer.
- *Serial Number*: The serial number of the transducer.

SVP

A sound velocity profile (SVP) records the speed of sound at various depths in the water column. One of the processes available in HIPS is the application of SVP data in sound velocity corrections. However, this procedure is not available for all types of sonars because some sonars and their data logging systems compensate for sound velocity during data acquisition.

To ensure the SVP is accurately applied in HIPS, the transducer X-Y-Z offset values must be entered.

1. Click *SVP 1* in the Sensors list box so the selection is highlighted and the SVP transducer data fields are visible. If there is a second transducer then click *SVP 2* and complete the same procedures as listed below.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current SVP pole time stamp.
 - *Time*: The hour and minute of the current SVP pole time stamp.
3. Select Yes if there are dual transducers (or No if there is only a single transducer).

The following three fields are for entering the pole's X-Y-Z coordinates. All coordinates are measured from the Reference Point

4. Type the transducer's X-Y-Z offsets in the following fields:
 - *X*: The athwart-ship distance of the transducer, positive to starboard.
 - *Y*: The along-ship distance of the transducer, positive to the bow.
 - *Z*: The vertical distance of the transducer, positive into the water.

Note: The Reference Point for Simrad data is the centre of rotation. It should be possible to retrieve offset values from the Simrad Installation Datagram.

The next three fields refer to the alignment of the transducer. The values you entered in the wizard when creating the HVF are displayed in these fields. The fields are only to be used for large transducer mounting offsets.

- *Pitch*: Pitch offsets of the transducer.
- *Roll*: Roll offsets of the transducer.
- *Yaw*: Rotation of the transducer (either 0 or 180 degrees).

For information on applying SVP in processing see Sound Velocity Processing in the HIPS and SIPS User Guide.

Sweep

Sweep systems typically contain multiple vertical beam transducers mounted on a boom and pointed straight down. The reference point for a sweep system can be anywhere on the X-Y plane, but must be on the water surface.

1. Click *Sweep* in the Sensors list box so the selection is highlighted and the data fields are visible.

	Date	Time	Time Correction (s)	Transducers	Transducer Status	TPE Status
1	2009-103	00:00	0.000	6	edit	edit
2					edit	edit

2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current sweep time stamp.
 - *Time*: The hour and minute of the current sweep time stamp.
 - *Time Correction*: The time correction value.
 - *Transducers*: Number of beams mounted on the boom.
3. Click the **Edit** button in the *Transducer Status* field to view a table for entering data for individual beams on the boom.

	Time Correction (s)	X (m)	Y (m)	Z (m)	Pitch (deg)	Roll (deg)	Gyro (deg)
1	0.000	0.000	5.000	8.000	0.000	0.000	0.000
2	0.000	0.000	5.000	8.000	0.000	0.000	0.000
3	0.000	0.000	5.000	8.000	0.000	0.000	0.000
4	0.000	0.000	5.000	8.000	0.000	0.000	0.000
5	0.000	0.000	5.000	8.000	0.000	0.000	0.000
6	0.000	0.000	5.000	8.000	0.000	0.000	0.000
7							

OK Cancel

4. Type values in the fields and click **OK**.
5. Click **Edit** in the *TPU Status* field to enter TPU values for each beam on the boom and to edit values entered in the new vessel wizard.

TPE Settings for Sweep

Navigation to Boom:

x m

y m

z m

MRU to Boom:

x m

y m

z m

	Fixed	Heave (%)	Squat (%)	Roll (deg)	Gyro (deg)
1	Yes	11.00	5.00	4.00	3.00
2	Yes	11.00	5.00	4.00	3.00
3	Yes	11.00	5.00	4.00	3.00
4	Yes	11.00	5.00	4.00	3.00
5	Yes	11.00	5.00	4.00	3.00

OK Cancel

6. Type values as needed and click **OK**.



Towed Sensors

If a towed sensor—such as a side scan sonar—is used on a survey, then SIPS can compute the sensor's position as from the ship's position by calculating the horizontal layback and a direction to the sensor.

1. Click *Towed* in the Sensors list box so the selection is highlighted and the Towed data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current towed sensor time stamp.
 - *Time*: The hour and minute of the current towed sensor time stamp.
 - *Time Correction*: The time correction value.
 - *Layback Error*: The error in the computed or recorded horizontal layback. This can be used, for example, to compensate the recorded layback data or tow cable length for the distance between the origin of the measurements and the defined tow point location in the tow cable length. This value is subtracted from the computed horizontal layback.
 - *X*: Offset of the tow point from the vessel's reference position.
 - *Y*: Offset of the tow point from the vessel's reference position.
 - *Z*: Height of the tow point (negative upwards) in relation to the datum that is referenced to the sensor depth (in most cases, this is the waterline).
 - *Manufacturer*: The maker of the towed sensor.
 - *Model*: The make of the towed sensor.
 - *Serial Number*: The serial number of the towed sensor.

Waterline

The purpose of this section is to define long-period changes in the vessel's draft due to fuel burn or other loading changes.

Specifically, you can enter the height of the waterline below the Reference Point.

If the Waterline section of the vessel configuration is not defined then the default of zero is used by the software as the height of the waterline below the RP.

The Waterline section must be present in the HVF for use in sound velocity corrections.

1. Click *Waterline* in the Sensors list box so the selection is highlighted and the waterline data fields are displayed.
2. Type data (as needed) in the following fields:
 - Date*: The year and Julian day of the current waterline time stamp.
 - Time*: The hour and minute of the current waterline time stamp.
 - Waterline*: The distance from the RP, positive when below the RP.
 - Apply*: Select Yes to apply the waterline data in the merge process.

For Simrad data, the Waterline value must be set to the same value recorded as **WLZ** in the Simrad Installation Datagram.

The Waterline value will only be used during Sound Velocity Correction.

The Apply switch must be set to **“No”**. It must not be set to **“Yes”**, because it must not be used by Merge.

Total Propagated Uncertainty

This section defines the values for calculating Total Propagated Uncertainty (TPU). TPU is derived from a combination of all individual error sources. The TPU Configuration section of the vessel file contains the following error estimates (among others):

- nav/gyro/heave/pitch/roll/tide errors
- latency error estimate
- sensor offset error estimates.

These errors are combined with individual sonar model characteristics in the DeviceModels.xml file to calculate horizontal and vertical uncertainty values for every sounding along a track line when TPU is applied.

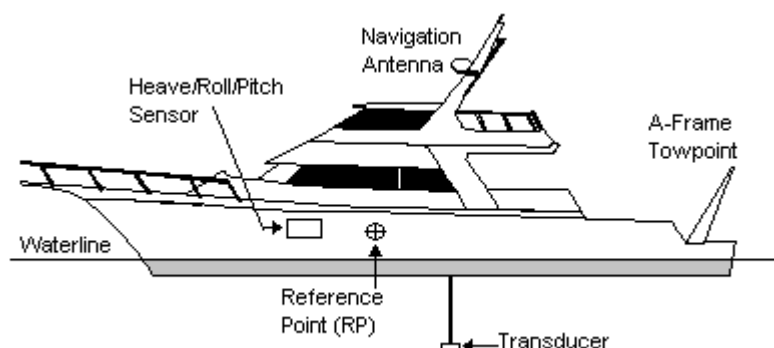
For more information on TPU, see “TOTAL PROPAGATED UNCERTAINTY” ON PAGE 200.

1. Expand the TPU section by clicking the + icon.
2. Type data (as needed) in the Offsets section:
 - *MRU to Transducer*: The physical offset in three dimensions from the motion recording unit to transducer 1 on the vessel.
 - *MRU to Transducer2*: The physical offset in three dimensions from the motion recording unit to transducer 2 on the vessel.
 - *Navigation To Transducer*: The physical offset in three dimensions from the navigation antenna to transducer 1 on the vessel.
 - *Navigation To Transducer2*: The physical offset in three dimensions from the navigation antenna to transducer 2 on the vessel.
 - *Transducer Roll*: The mounting roll offset for transducer 1. The offset is positive when rotating the transducer away from starboard (starboard down).
 - *Transducer Roll 2*: The mounting roll offset for transducer 2. The offset is positive when rotating the transducer away from starboard (starboard down).
3. Type data (as needed) in the Standard Deviation section:
 - *Motion Gyro*: The measurement standard deviation of the heading data in degrees.
 - *Heave % Amplitude*: An additional heave standard deviation component that is the percentage of the instantaneous heave.
 - *Heave (m)*: The measurement for standard deviation of the heave data. Most heave manufacturers quote heave error as being determined from StaticHeave or PercentageOfHeave depending on which value is larger.
 - *Roll*: The measurement standard deviation of the roll data in degrees.
 - *Pitch*: The measurement standard deviation of the pitch data in degrees.

- *Position Nav*: The standard deviation associated with the measurement of positions for the vessel. This is usually the error of the GPS sensor being used.
- *Timing Trans*: Standard deviation in transducer time stamp measurement.
- *Nav Timing*: Standard deviation in navigation time stamp measurement.
- *Gyro Timing*: Standard deviation in gyro time stamp measurement.
- *Heave Timing*: Standard deviation in heave time stamp measurement.
- *Pitch Timing*: Standard deviation in pitch time stamp measurement.
- *Roll Timing*: Standard deviation in roll time stamp measurement.
- *Offset X*: Standard deviation for the X measured offset on the vessel.
- *Offset Y*: Standard deviation for the Y measured offset on the vessel.
- *Offset Z*: Standard deviation for the Z measured offset on the vessel.
- *Vessel Speed*: The standard deviation for the vessel speed measurements.
- *Loading*: Vertical changes during the survey because of fuel consumption, etc.
- *Draft*: The standard deviation in the vessel draft measurements.
- *Delta Draft*: The standard deviation in the dynamic vessel draft measurements.
- *MRU Align StdDev Gyro*: This value is the uncertainty of the motion recording unit placement within the vessel fixed coordinate frame.
- *MRU Align StdDev Roll/Pitch*: This value is the uncertainty of the motion recording unit placement within the vessel fixed coordinate frame.
- *Comments*: Any additional information.

Vessel Coordinate System

Vessel configuration is based on an instantaneous three-dimensional coordinate system, which is used to record the location of sensors and other equipment.



Reference Position

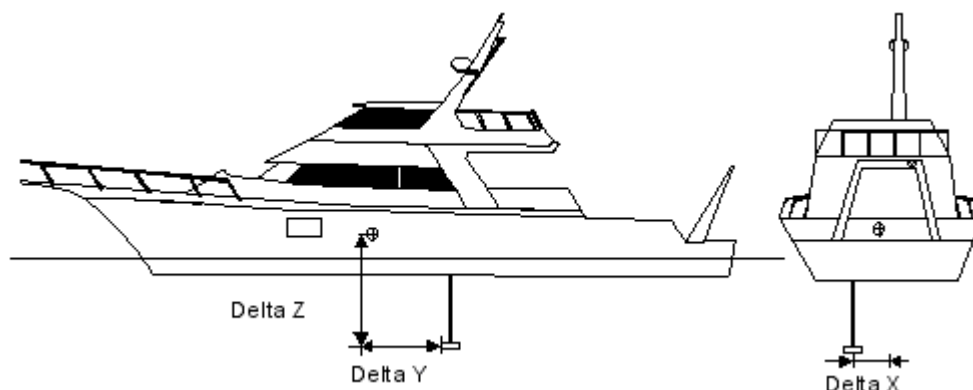
Sensor positions are described using X-Y-Z axis coordinates relative to a Reference Position (RP). The RP is a location from which all other positions are derived. (Imagine standing at the location of the Reference Position and describing how far and in what direction the sensor is away from you.)

The location of the RP depends upon the type of sonar system used in the survey. Its location is usually at the centre of the ship's gravity. This position is used as the centre of the ship's rotation when applying the pitch/heave/roll parameters, and must be applied as accurately as possible.

Coordinate definitions

The axes are defined as follows:

- The Y-axis is oriented along the vessel's fore/aft axis, positive forward.
- The X-axis is oriented along the vessel's port/starboard axis, perpendicular to the Y-axis, positive to the starboard.
- The Z-axis is perpendicular to the X-Y plane, and positive into the water.

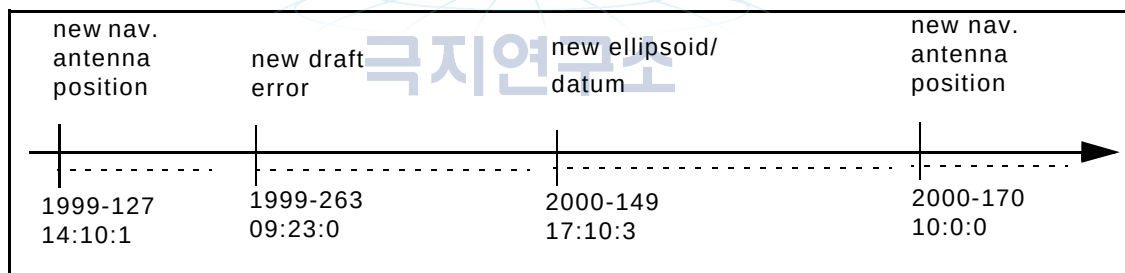


The location of the vessel's coordinate system within the local fixed coordinate system is determined by the navigation system and tide. The orientation of the coordinate system is defined by the vessel's gyro and attitude sensors (pitch and roll). Gyro, pitch and roll observations are defined as follows:

- A positive gyro observation is defined as the clockwise rotation of the vessel (from 0 and 360 degrees) within the navigation coordinate system.
- A positive pitch is observed when the bow of the vessel is down (bow down).
- A positive roll is observed when the starboard side of the vessel is up (starboard up).

Time Stamp

A vessel's configuration changes over time. Different draft settings may be used in a survey, or the position of the transducers on a boom may change, or a different ellipsoid is used. A time stamp is used to keep track of these changes. The time stamp records the time from which a configuration is valid and is recorded with each entry to the HVF. Below is an example of time stamps showing changes in vessel configuration.



NOTE: Time in HIPS is based on the recorded reference time. No distinction is made for UTC.

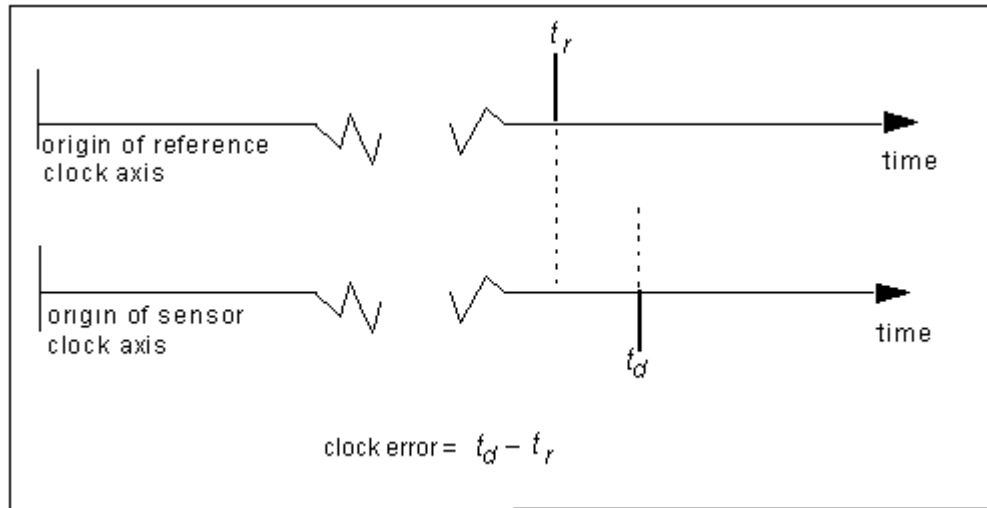
Time Correction

In the HVF, most sensors have a Time Correction field that contains the time difference between the sensor clock and the reference clock. Sensors are time tagged and all clocks are compared to the reference clock so sensor readings can be synchronized.

The Time Correction field is specified in seconds and is positive if ahead of the reference clock:

$$\text{Time Correction} = \text{Recorded Time} - \text{Reference Time}$$

The following figure illustrates the concept of time correction with respect to the sensor clock.



5

Create a New Project

All projects in HIPS and SIPS are organized in a Project-Vessel-Day folder hierarchy. New projects are created with a wizard, which generates a HIPS Project File (.hpf).

In this chapter...

“DEFINE NEW PROJECT” ON PAGE 116

“RENAME DAY AND LINE FOLDERS” ON PAGE 120

“VIEW PROJECT OR VESSEL PROPERTIES” ON PAGE 121

“RECYCLE BIN” ON PAGE 122

“ARCHIVE PROJECT” ON PAGE 124

Define New Project

If no vessel file is available, it must be defined before the new project can be created. (See “[DEFINE VESSEL FILE](#)” ON PAGE 104).

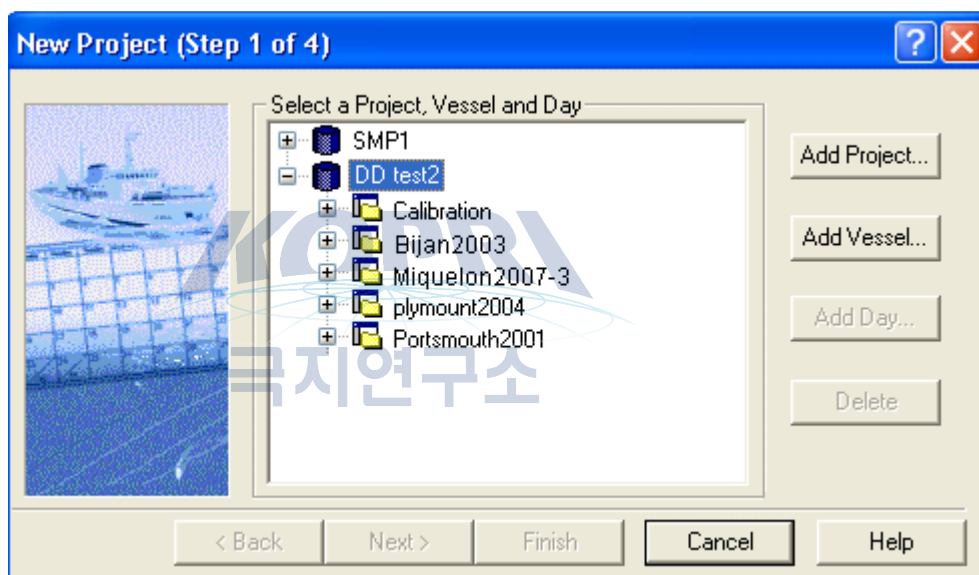
The default directory for projects is ...\\Hips\\HDCS_Data, however you can modify this setting with Tools > Options. For more information see “[PROJECTS](#)” ON PAGE 693.

Menu	File > Project > New
Tool	

1. Ensure that an appropriate vessel file has been created for this project.
2. Select the New Project command.

New Project (Step 1)

The New Project (Step 1) dialog box is displayed.



Add a new Project folder

1. To create a new project folder, click **Add Project**.

The New Project Name dialog box is displayed

2. Type a name for the new project.
3. Click **OK**.

A new Project folder is created and displayed in the dialog box.

Add a new Vessel folder

The Vessel folder contains the Day folders for the project. To add a Vessel folder to your project:

4. Select a project folder so it is highlighted.
5. Click **Add Vessel**.

The Available Vessels dialog box is displayed.



6. Select a vessel file from the list.
7. Click **OK**.

The Vessel folder is created and added to the new Project folder.

Add a new Day folder

The Day folder contains track line data. For most formats the date is typically recorded with the raw data. If not, give the Day folder the date that the survey lines were recorded.

Day folders are shown in Julian Day format, for example, April 24, 2009 is shown as 2009-114.

To add a Day folder to a Vessel folder:

8. Select the Vessel folder.
9. Click **Add Day**.

The Calendar is displayed at the current year-month-day.



10. Select a different year or month, if needed, by clicking the arrow buttons at the top of the dialog box.
11. Select a new day, if needed, by double-clicking on the date.
12. Click **Add Day** again to create the Day folder with the selected dates.
13. Click **Next** to go to Step 2.

Add to an existing project

You can add new Vessel and Day folders to an existing project instead of creating a new project.

1. Select the existing project from the list in the dialog box.
2. Add vessel and day folders as needed.

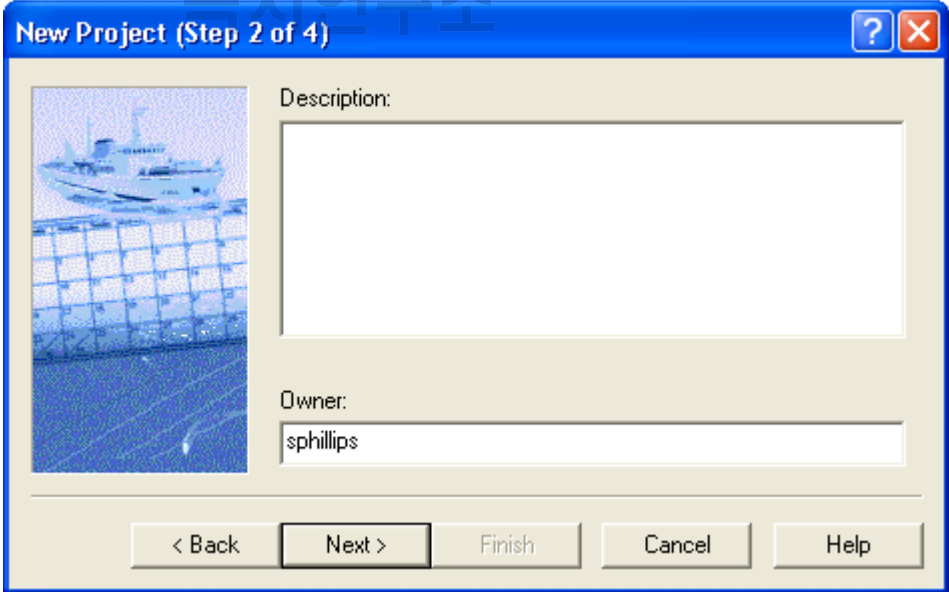
NOTE: If a HIPS Project File (HPF) already exists for a project, the **Finish** button is displayed at this point. You can enter a new Vessel or Day folder, but cannot enter information from the other wizard dialog boxes.

Delete empty folders

You can also delete an empty Day or Vessel folder by clicking **Delete**. The Delete button is disabled if a Vessel or Day folder already has data converted into it.

New Project (Step 2)

The New Project (Step 2) dialog box is displayed.



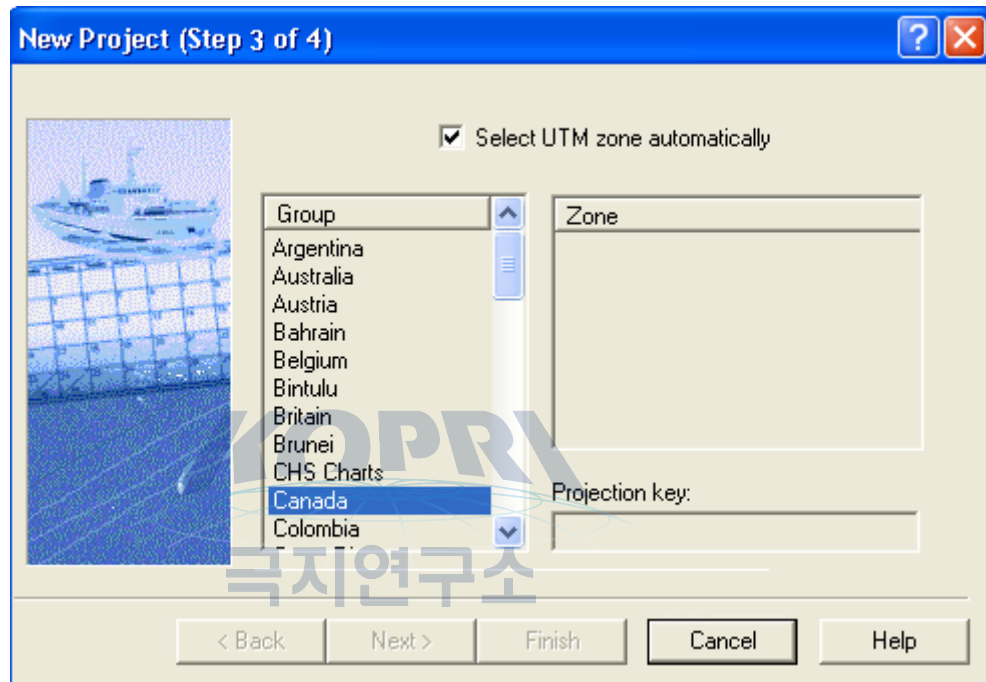
1. Type any comments about the project in the *Description* text area, if needed.
2. Enter the name of the person working with the project data in the *Owner* field. The default name that is displayed is taken from the current Windows NT logon name.

3. Click **Next**.

New Project (Step 3)

The New Project (Step 3) dialog box is displayed.

By default, HIPS and SIPS will select the appropriate UTM zone automatically. The Select UTM Zone Automatically check box is selected and the country and zone options are dimmed.



To set a different projection for your project:

1. De-select the *Select UTM Zone Automatically* check box.
2. Select a country or area from the *Group Name* list box.
3. Select a zone from the *Zone* list box.

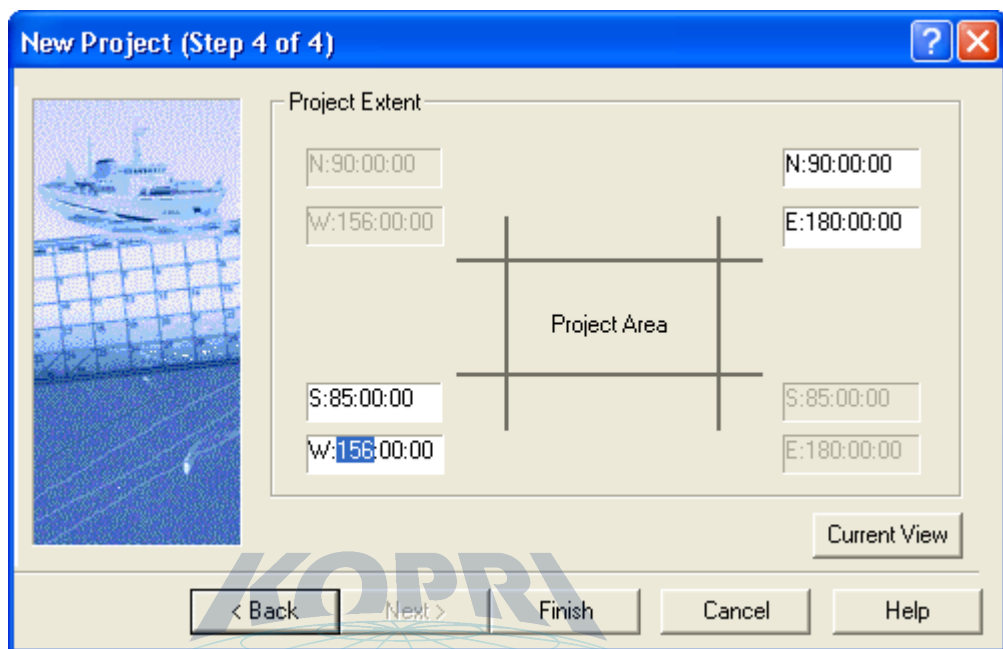
The Projection key name is automatically displayed once the country and zone have been selected.

NOTE: The world-wide map projection coordinate systems are defined in the file ...\\Hips\\System\\mapdef.dat.

4. Click **Next**.

New Project (Step 4)

The New Project (Step 4) dialog box is displayed. Use this dialog box to set the geographic coordinates (degrees-minutes-seconds) for the project area.



If you want to use the geographic coordinates of a currently open project:

1. Click **Current View**.

To manually enter the geographic coordinates for the project area:

1. Select a project extents box (e.g., N) and type the coordinates, or select the degree, minutes or second field within a project extents box, and use the arrow keys to toggle the values.
2. Click **Finish** to complete the creation of the new project.

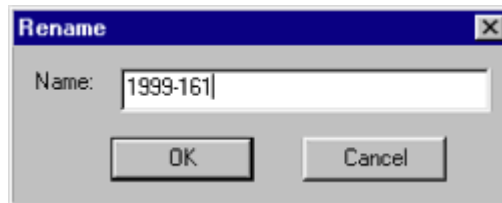
New Project-Vessel-Day folders have been created according to the options selected in the wizard. An HPF has been created and is located in the Project folder.

Rename Day and Line Folders

You can rename existing Day and Line folders after raw data has been converted to HIPS/SIPS format.

1. Select a Day folder or Line folder in the Control window, or select a track line in the Display window.
2. Select the Rename command.

Menu	Edit > Rename
Pop-up	Rename



The Rename dialog box is opened with the selected file or folder name displayed.

3. Enter a new name in the box.
4. Click **OK**.

The changed file name is displayed in the Control window.



View Project or Vessel Properties

View essential project and vessel information. You can also use this dialog box to change the coordinate system, if needed.

1. Select a Project folder or a Vessel folder from the Project tab in the Control window.
2. Select the Properties command.

The Project Properties dialog box is displayed.

Menu	View > Properties
Pop-up	Properties

Project Properties

General | Coordinate System

Name: Fundy 2709-B

Number of Lines: 8

Number of Profiles: 27015

Number of Soundings: 2728010

Geographic Extent

South West: 48.55555N, 68.75387W

North East: 48.58038N, 68.68356W

Projection Group: AUTO_UTM

Projection Zone: WGS84_19N

Created by: almacdonald

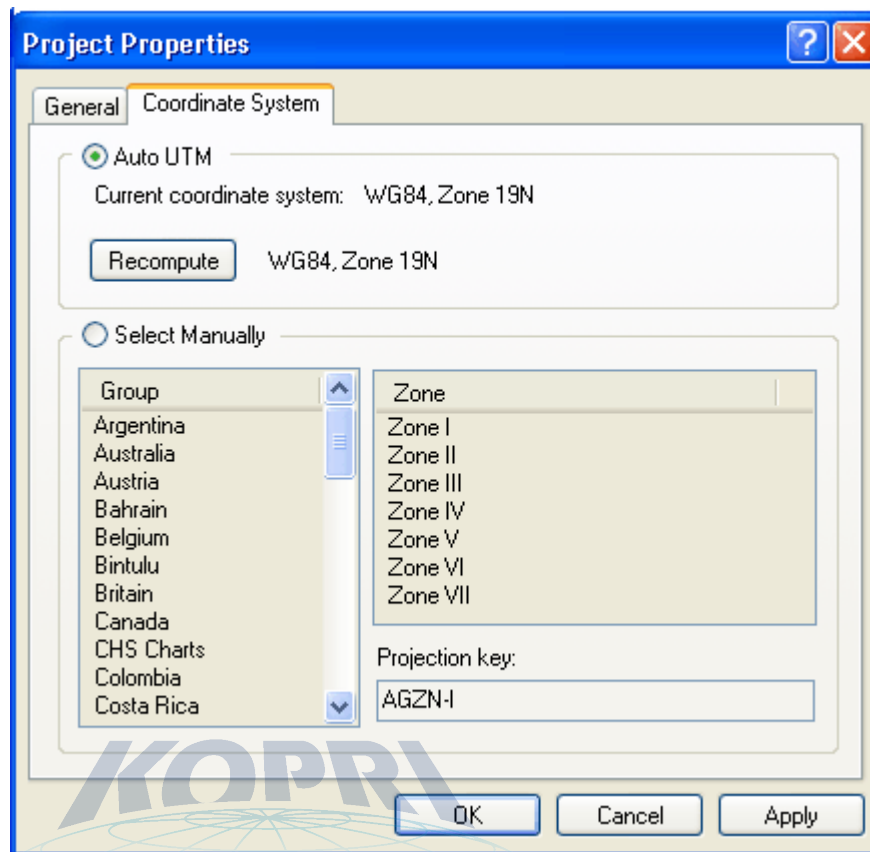
Creation Date: 15:54 05/09/2008

Comments:

OK Cancel Apply

The General tab displays information about the project or vessel. The information is read-only and cannot be modified.

If you selected to display the properties for a project, then the Coordinate System tab is included in the dialog box.



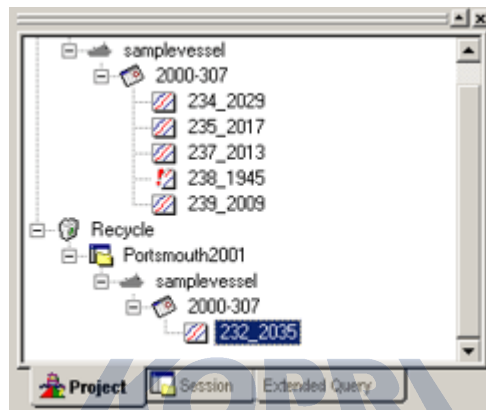
You can select another coordinate system for the project using this tab.

3. Select either the *Auto UTM* option or the *Select Manually* option.
4. If you selected Auto UTM, click **Recompute** to compute the UTM zone.
5. If you want to manually select a coordinate system, select a projection and zone.
6. Click **Apply** to assign the new coordinate system to the project.
7. Click **OK** to close the dialog box.

Recycle Bin

You can “delete” Project, Vessel, Day, or Line folders from an active project by moving them to the Recycle Bin. These folders are no longer part of the active project, but can be restored to the project or permanently deleted. All folders in the Recycle Bin are located in ...\\Hips\\Recycler.

The Recycle Bin recreates the same directory structure as the active project.



Move items

Menu	Window > Control
Tool	

1. Ensure the Control window is open and the Project tab is visible.
2. Select the folder(s) you want to delete.
3. Select the Delete command.
4. A dialog box asks if you want to delete the folder(s).
5. Click **Yes**.
6. [Optional] You can also select the folders and, while pressing the mouse button, drag them to the Recycle Bin.

The folders are moved to the Recycle bin.

Restore an item

You can move a previously deleted folder from the Recycle Bin to the active project.

Menu	Edit > Restore
Pop-up	Restore

1. Select the folders in the Recycle Bin.
2. Select the Restore command.

The folders are now restored to the active project. If all folders are removed from the Recycle Bin then the directory structure is deleted.

Empty Recycle Bin

Emptying the Recycle Bin permanently deletes the folders from the project.

You cannot restore folders that have been deleted from the Recycle Bin.

Menu	Edit > Empty Recycle Bin
Pop-up	Empty Recycle Bin

3. Select the Empty Recycle Bin command.
4. A dialog box asks you if you want to continue.
5. Click **Yes**.

The folders are removed from the Recycle Bin.



Archive Project

Archive projects and related data using the Project Archive wizard.

The projects and data are converted to a ZIP format and must be decompressed if used again. The directory structures for the compressed files are as follows:

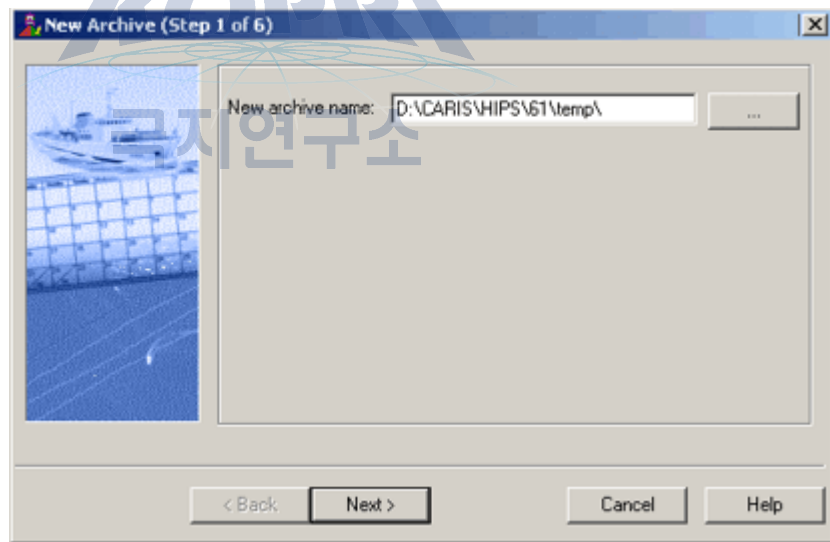
- Line files are in ../Projects/<ProjectName>/<VesselName>/<DayName>/<LineName>
- Fieldsheet files are in ../FieldSheets/<ProjectName>/<FieldSheetName>
- Other files related to data processing are in ../Preprocess/<ProjectName>
- Additional background files are in ../Background/<ProjectName>

To archive a project.

1. Select the Archive Project command.

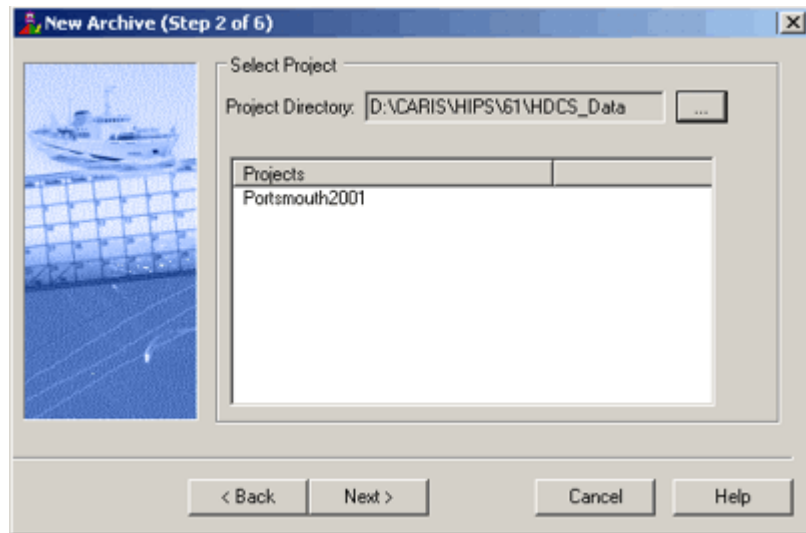
The New Archive (Step 1) dialog box is displayed

Menu	File > Project > Archive



2. Type the file path for the new archived file in the New Archive Name field or click Browse to select a directory and type the name of the archived project file.
3. Click **Next**.

The New Archive (Step 2) dialog box is displayed.



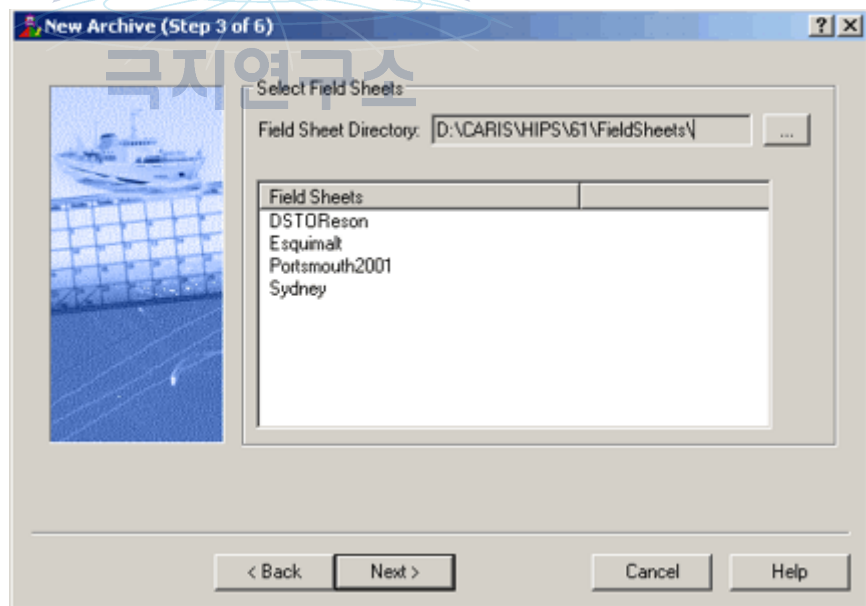
4. The directory path for the projects is shown in the Project Directory field. If necessary, click Browse and select another directory.

The projects in that directory are displayed in the *Projects* list.

5. Select a project from the list.

6. Click **Next**.

The New Archive (Step 3) dialog box is displayed.

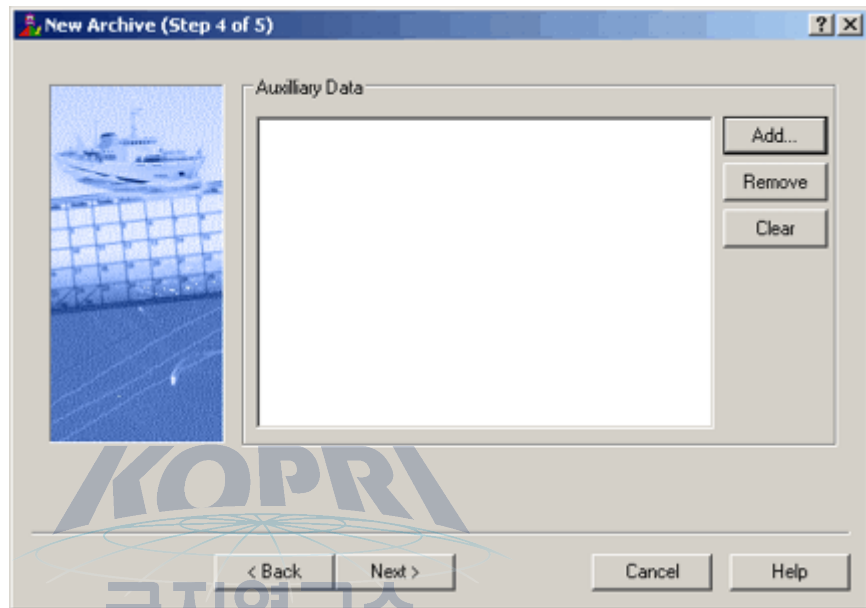


7. The directory path for field sheets is shown in the Field Sheet Directory field. If necessary, click Browse to select another directory.

The field sheets contained in the directory are displayed in the Field Sheet list.

8. Select a field sheet associated with the project using one of these three methods:

- Select a single field sheet by clicking on it.
 - Select a group of field sheets by pressing and holding the <Ctrl> key while clicking on each field sheet.
 - Select a range of field sheets by pressing and holding the <Shift> key while clicking on the first and last field sheets in the range so that all field sheets in between are highlighted.
9. Click **Next**.
- The New Archive (Step 4) dialog box is displayed



This dialog box is used for archiving related files necessary for the successful processing of data. Examples of these files would be tide files, sound velocity files, delta draft, TrueHeave files, etc.

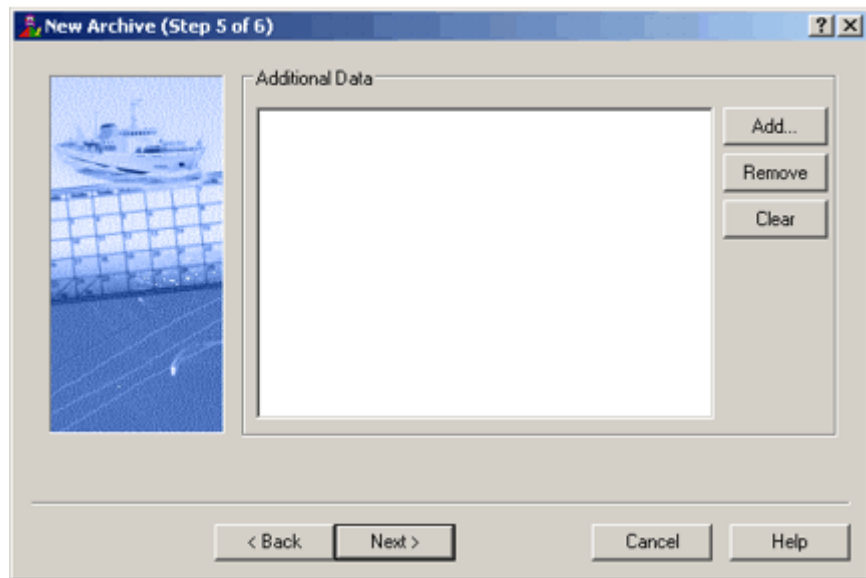
10. Click **Add** to view a standard Open dialog to select auxiliary data.

The auxiliary files are shown in the *Auxiliary Data* list.

11. To remove a file, select it and click **Remove**, or click **Clear** to remove all listed files.

12. Click **Next**.

The New Archive (Step 5) dialog box is displayed.



This dialog box is used for archiving data that is associated with the project, but is not necessary for processing data. Examples of this type of data would be background images, associated charts, etc.

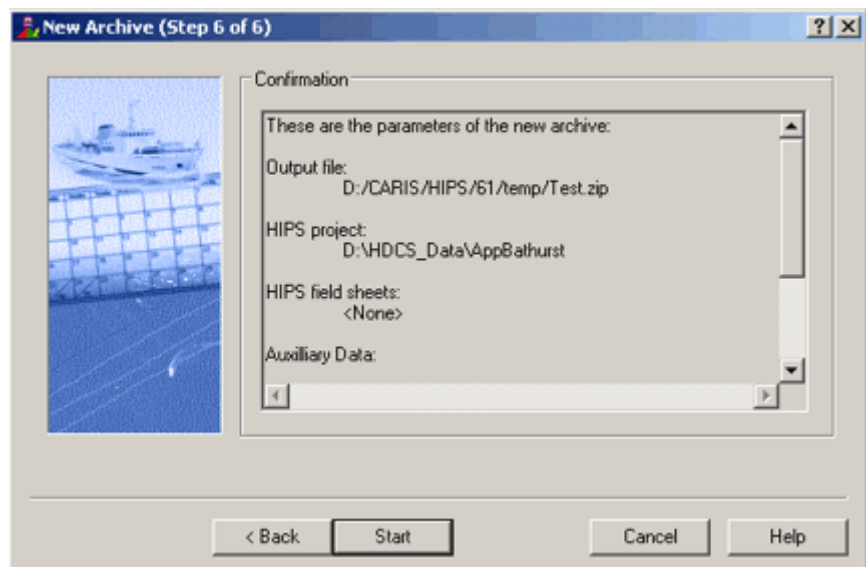
13. Click **Add** to view a standard Open dialog to select additional data.

The auxiliary files are shown in the *Additional Data* list.

14. To remove a file, select it and click **Remove**, or click **Clear** to remove all listed files.

15. Click **Next**.

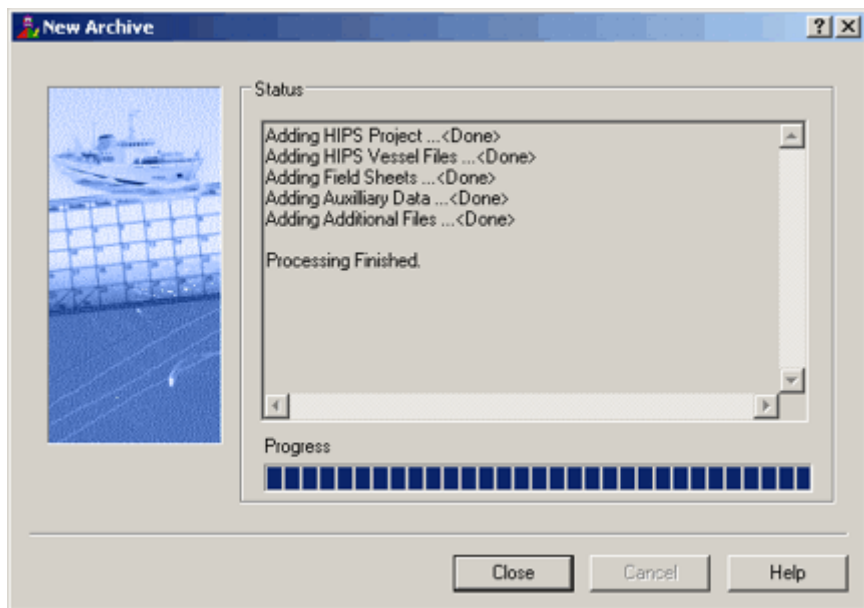
The New Archive (Step 6) dialog box is displayed.



This dialog box lists the selections you made in the previous dialog boxes.

16. Click **Back** to go to a previous dialog box to make changes, or click **Start** to begin the archiving process.

The New Archive (Final) dialog box is displayed.



The Status list displays the files that have been archived. A progress bar displays the amount of archiving that has been accomplished.

17. Click Close to exit the wizard once archiving is completed.

6

Convert Data

Use the Data Conversion wizard to convert various types of survey data into HDCS-specific format.

In this chapter... 극지연구소

“CONVERTING FILES TO HIPS/SIPS FORMAT” ON PAGE 132

“DATA FORMAT OPTIONS” ON PAGE 139

Converting Files to HIPS/SIPS Format

HIPS and SIPS files are created from survey data using the Conversion Wizard.

Data that is converted to HIPS/SIPS format may be in varying stages of completion, depending on the data format options. Survey data may or may not have been corrected for factors such as heave/pitch/roll or sound velocity. Such correction can be applied during the Merge process and SVP Correction.

All HIPS and SIPS data is organized in a Project/Vessel/Day/Line directory structure. If you organize the raw data files according to this structure, then you can convert line data from entire Project or from multiple Vessel and Day folders contained in a common Project folder. Use the File Selection Type option in Step 2 of the wizard to do this (see [“SELECT FILES FOR CONVERSION” ON PAGE 133](#)).

When entire project data has been converted, a Project-Vessel-Day-Line directory is created for the converted data. If there is already a Project folder that is identical to the preprocess folder, then the line data in the existing folder is over-written with the new data.

You must organize your raw data files in a HIPS/SIPS Project-Vessel-Day structure to convert complete Project, Vessel and/or Day data files.

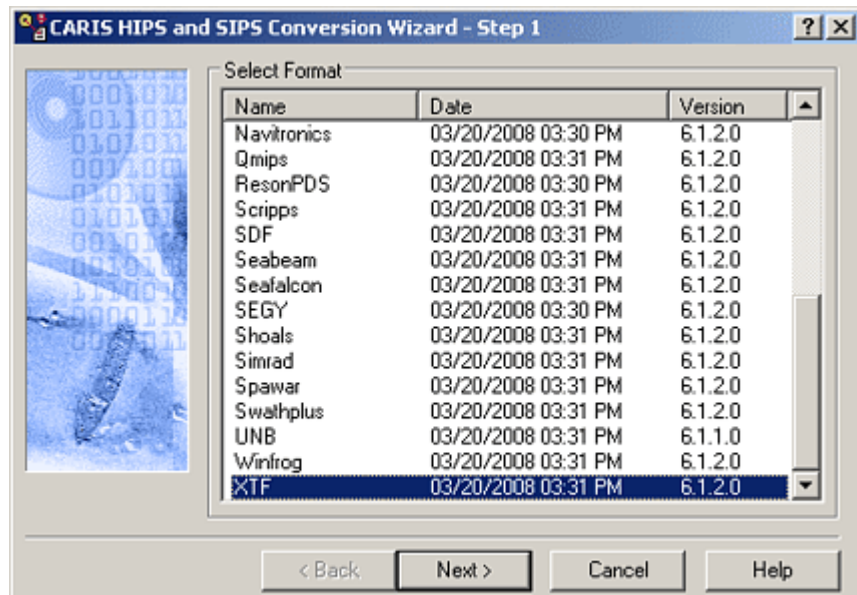
To start the conversion process, activate the HIPS Conversion Wizard.

Menu	File >Import > Conversion Wizard
Tool	

1. Select the Conversion Wizard command in the HIPS and SIPS main interface.

The first Conversion dialog box is displayed.

Select Data Format



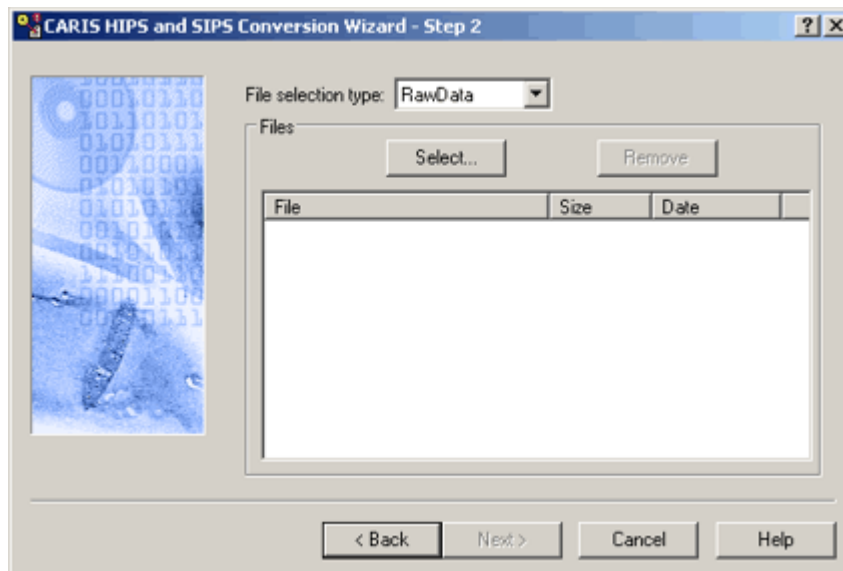
The Step 1 dialog box lists the data acquisition systems for which data can be converted to HIPS and SIPS files.

This list is created dynamically by searching the Hips\Bin directory for all format libraries with the name convert_*.dll.

1. Select the survey data type to be converted by clicking the appropriate name.
2. Click **Next**.

The next dialog box is displayed to select the files for conversion.

Select Files for Conversion



Raw data being converted into HIPS and SIPS can also be located on a read-only media such as a CD-ROM, except for Atlas SURF data, which at this time, does not support conversion from read-only files.

To convert data,

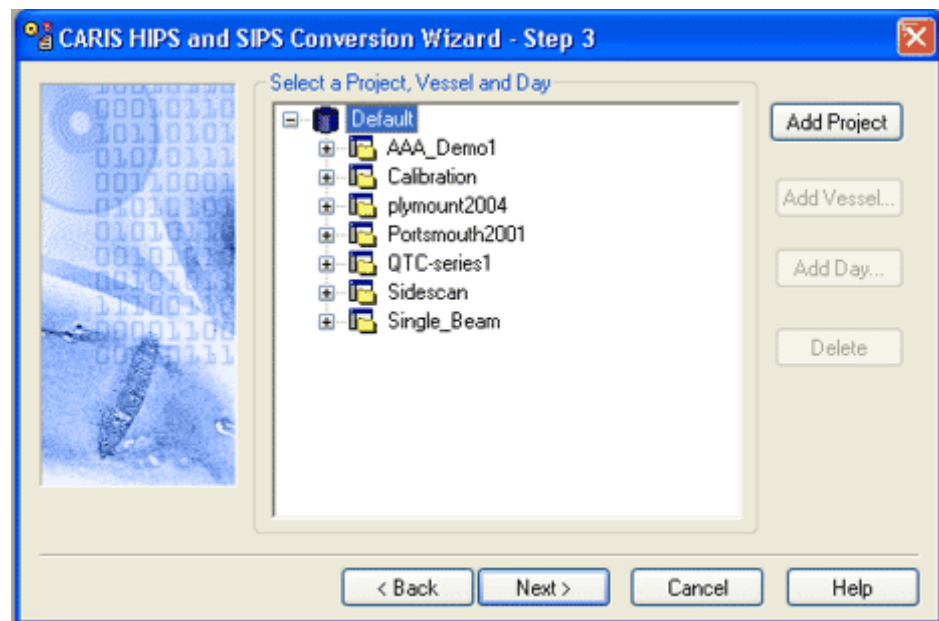
1. Select the appropriate File Selection Type from the drop-down list. The default is RawData.
2. Click **Select** to browse to the file or files you want to convert.

The selected file(s) is listed in the dialog box.

3. [Optional] To remove a file from the list, select it and click **Remove**.

Click Next to open the Select Project-Vessel-Day dialog box (Step 3 of the Conversion Wizard). Some data may already be organized into a Project/Vessel/Day structure. In this case you need only to select the folder containing the data to be converted. If you select Vessel as the data type, you will then need to indicate the project for that data. If you select Day, you will then need to indicate the vessel and project for the data. When you click **Next**, the Select Coordinate Type dialog box is displayed (see “[SELECT COORDINATE SYSTEM](#)” ON PAGE 134).

Select Project-Vessel- Day



Select a Project/Vessel/Day directory into which to save the converted data.

1. Click the Expand (+) icon on the Project file tree so it is expanded and the Day folder is visible.

If you want to add Project, Vessel or Day folders, or to delete a folder, continue with Steps 2 to 6 in this procedure, otherwise go to Step 7.

2. To add a vessel folder, make sure the project directory is highlighted and click **Add Vessel**.

The Available Vessels dialog box is displayed.

3. Select a vessel folder and click **OK**.

The new Vessel folder is displayed in the selected project directory.

4. To add a day folder, click the Vessel folder and click **Add Day**.

The Calendar dialog box is displayed.

5. Select a year/month/day from the calendar, and click **OK**.

A Day folder with the selected date is stored in the Vessel folder.

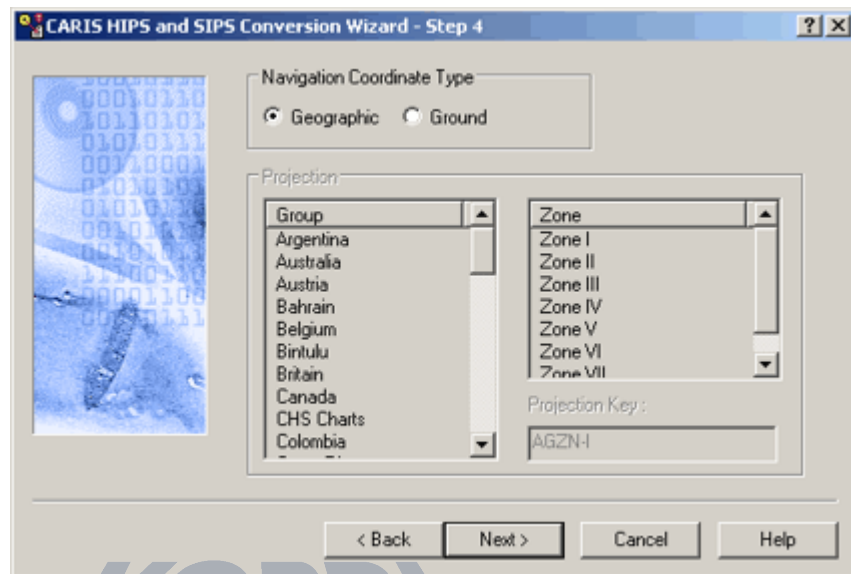
6. To remove an empty Day or Vessel folder from the wizard, highlight the folder and click **Delete**.

If a Vessel or Day folder is in a Project which already has data converted into it, it cannot be deleted using the **Delete** button.

7. Click the Day folder so it is highlighted.
8. Click **Next** to define the coordinates used when data was recorded.

Select Coordinate System

The next step is to define the type of coordinates that were used to record the navigation data in the raw data files.



To indicate the type of coordinate system that was used for navigation data during data logging,

1. Select one of the following options:
 - *Geographic*: navigation data is recorded as latitude and longitude coordinates.
 - *Ground*: navigation data is recorded as eastings and northings.

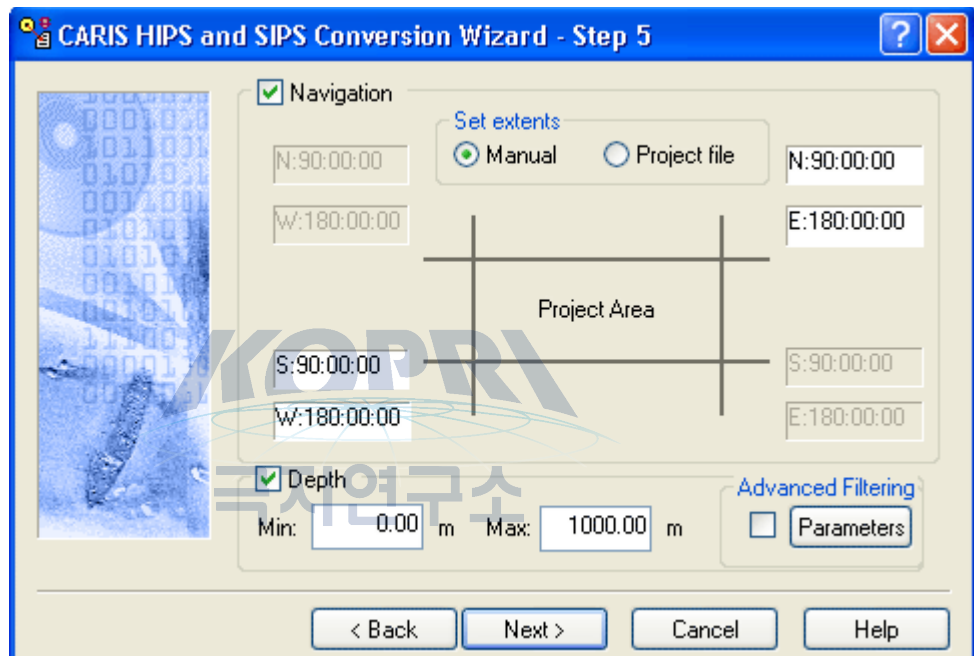
If you select *Ground*, complete the following steps:

2. Select an area from the *Group* list.
3. Select a zone.
4. Click **Next**.

Select Basic Filters

During the conversion process, some soundings may be automatically rejected due to disabled beams. This is controlled by the beam status settings in the vessel configuration. Also, several multibeam formats pre-flag some soundings as being failed detects. These soundings are also automatically rejected during conversion.

This dialog box defines basic navigation and depth filters to automatically reject extremely large errors in the recorded navigation and depth data



1. Select the *Navigation* check box to enable the navigation filter.

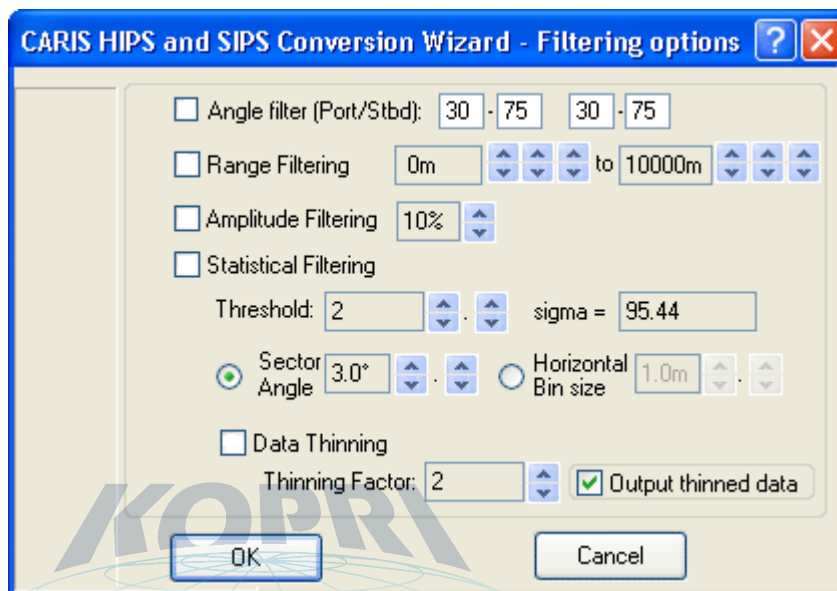
The extents of the filter can be defined either by setting them manually in the dialog box or by using the extents in the HIPS Project File (HPF). The HPF is from the project you selected in Step 3 of the Conversion wizard.

2. Select either *Manual* option or the *Project File* option.
3. If you selected the *Manual* option, enter the extents in the fields. You can use the <Tab> key to move between fields and use the arrow keys to move between values in a field.
4. Select the *Depth* check box to enable the depth filter.
5. Enter the minimum acceptable depth.
6. Enter a maximum acceptable depth.
7. For advanced filtering for multibeam or multi-transducer data select the *Advanced Filtering* check box and click **Parameters** to set advanced filtering options.

Advanced Filtering

The Filtering options dialog box is displayed, listing the filtering options.

Currently advanced filtering is only available for multibeam and multi-transducer data conversion. Any options greyed out are not available for the type of data you are converting.



Certain data can be filtered so that only the best quality data is imported to HIPS. The filter is applied to port and starboard beam angles.

1. Select *Angle filter (Port/Stbd)* and type a range of beam angles.

The *Range Filtering* option converts soundings within a specified distance (in metres). Soundings outside of this range are not converted.

2. Select the *Range Filtering* check box to implement this option.
3. Click the up or down arrow buttons to select a minimum and maximum distance.

The *Amplitude Filtering* option filters soundings according to amplitude value. For each ping (port and starboard pings are handled separately), the min/max amplitude values are obtained, and samples that fall below the selected percentage (0-50%) are rejected.

4. Select the *Amplitude Filtering* check box to implement this option.
5. Click the up or down arrow buttons to select a percentage value for rejecting soundings.

The *Statistical Filtering* option controls which soundings in each swath are considered for conversion. This option calculates the mean depth and standard deviation within a swath sector or

horizontal bin. It then prevents any soundings that fall outside a multiple of the standard deviation from being converted.

If Statistical Filtering is used, then the mean within the sector is re-computed. Ultimately, the soundings are sorted by their residual from the mean and those closest to the mean are converted. The actual number of soundings converted from within each sector is determined by the thinning factor (if used).

6. Select the *Statistical Filtering* check box to implement this option.
7. Determine a *Threshold* (multiples of the standard deviation) value by clicking the up and down arrow buttons.

The equivalent confidence value is displayed as a percentage.

The filtering and thinning methods are executed within a sector angle interval or a horizontal bin size. The sector angle option divides the swath into sectors according to degree angles while the horizontal bin size divides the swath into horizontal sectors based on a specified across-track distance.

Vessel motion and transducer mounting angles are considered when sector angle and horizontal bin locations are determined.

1. Select the *Sector Angle Interval* option and choose a degree level (to a maximum of 10°) by clicking the up or down arrow buttons.
2. As an alternate method, Select the *Horizontal Bin Size* option choose an across-track distance by clicking the up or down arrow buttons.

The thinning factor reduces the number of soundings converted on a per swath basis. The thinning factor uses a power of two reduction control (1/2, 1/4, 1/8, etc.) so that one of two, one of four or one of eight soundings can optionally be converted per swath sector.

3. Select the *Data Thinning* check box to implement the thinning option.

Select a *Thinning Factor* value by clicking the up or down arrow buttons.

4. Select *Output thinned data* to write out only non-rejected data.

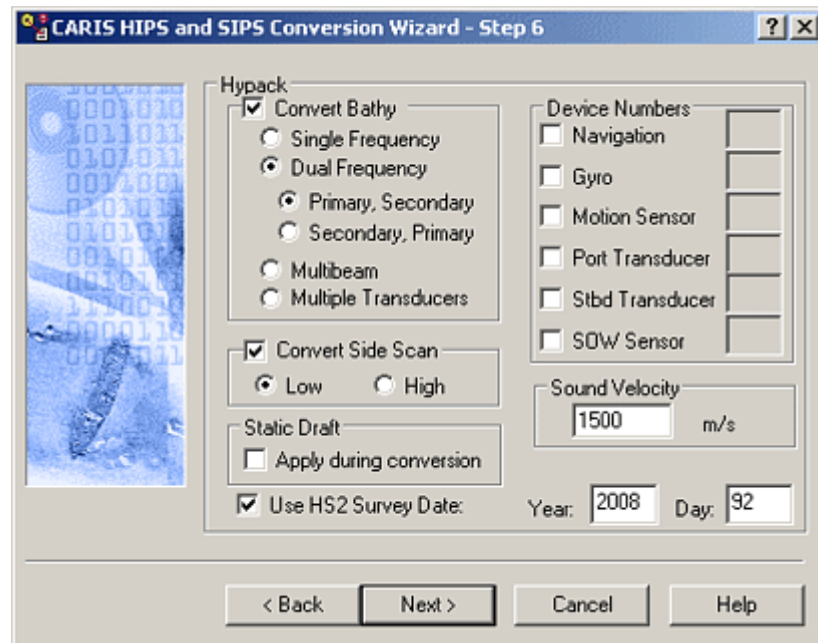
The user has the option to not write out soundings which have been eliminated because of data thinning. Although by doing so, a mismatch is created between the converted HIPS data, and the original data file. (since multi-transducer data is tied to the settings in the vessel file, full dataset is always written out).

5. Click **Next**.

Enter Data Parameters

Depending on the data acquisition format you selected in the Step 1 of the wizard, one or more dialog boxes, appropriate to the data, will now be displayed. See [“DATA FORMAT OPTIONS” ON PAGE 142](#) for more information on options for different raw data formats.

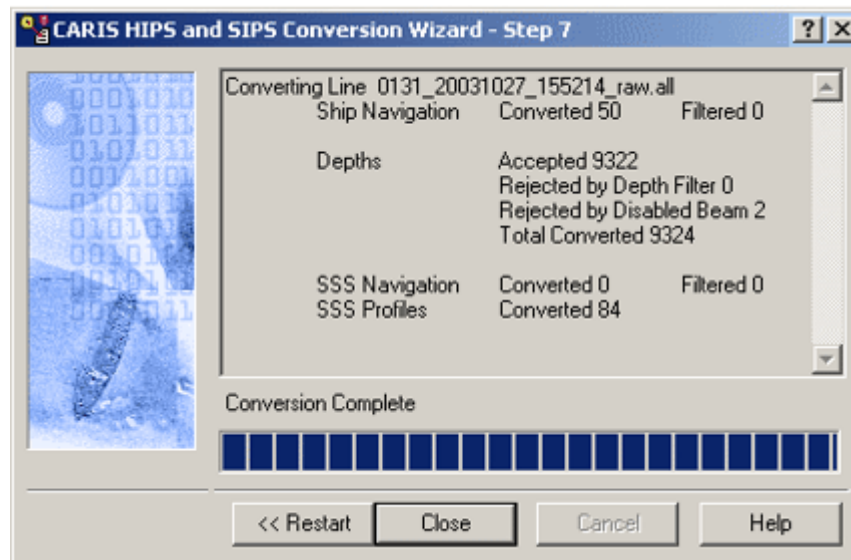
The example below shows the information for conversion of Hypack data.



1. Choose the settings appropriate to the data format being converted.
2. Click **Next**.

Convert Data

The final step is to launch the conversion process with the settings and parameters you have selected.



To convert raw data to HIPS/SIPS format,

1. Click the **Convert** button.

A progress indicator bar along the bottom of the box is activated as the files are converted. When the operation is complete the results of the conversion process are displayed in the dialog box.

The converted files are saved in the directory you selected in Step 2 of the conversion process (see “[SELECT FILES FOR CONVERSION](#)” ON [PAGE 133](#)).

2. Click **Close** to close the wizard.
3. [Optional] to return to the initial step of the conversion process click **Restart**.



Data Format Options

Beginning with Step 6 of the HIPS and SIPS Conversion Wizard, one or more dialog boxes with specific format options will be displayed. The number of options depends on the raw data format that was selected in Step 1 of the wizard.

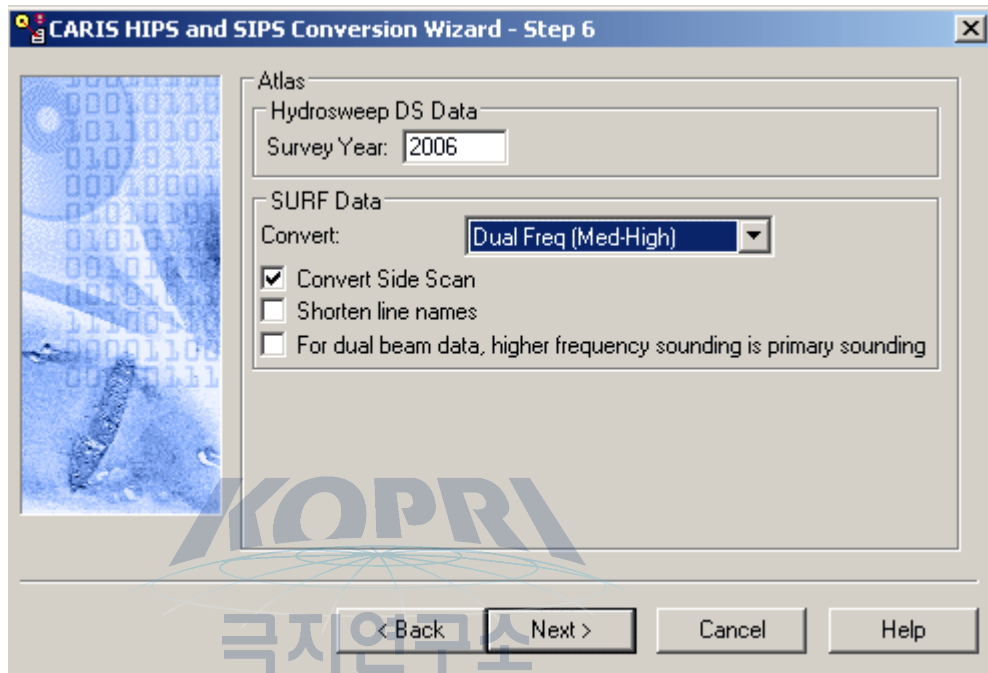
The various data acquisition formats and their conversion options are presented below.



Atlas

The ASCII versions of Hydrosweep DS files are now supported.

1. Type the correct year for the survey into the Data Survey Year field. You will not be able to enter a year prior to 1970. (The default value shown is obtained from the HIPS Day directory into which data is converted.)



2. From the pull-down menu, select one of the following SURF data types to convert:
 - multibeam
 - single beam (low frequency)
 - single beam (medium frequency)
 - single beam (high frequency)
 - dual frequency (low-medium)
 - dual frequency (low-high)
 - dual frequency (medium-high)
3. Click the *Convert Side Scan* check box to include side scan data in the conversion process.

Critical line name information can be fitted into 12 characters provided by the CARIS Source ID attribute for soundings in a CARIS map.

4. Select the *Shorten line names* check box to modify the file name to a 12-character name (YYDDD_HHMMDD).

5. Select the higher frequency data as the primary soundings (if data format is dual-frequency).

At the time of this writing, the Atlas SURF library cannot be converted from read-only files. Therefore, the Atlas files must be located on a read-write media before they can be converted into HIPS.

Chirpscan3D

There are no options for the Chirpscan3D format.

CMAX

There are no options for the CMAX format.

Coda

1. Select a sonar channel.
2. Click the *Decimate Imagery* check box to apply a decimation routine to the side scan data. Decimation reduces side scan data to 1024 or fewer intensities per side for each swath.
3. Click the *Correct Imagery* check box to increase contrast in the side scan imagery.
4. Select the *Cable Out is Horizontal Layback* option to omit sensor depth during conversion. If there is no sensor depth and the towpoint has a Z-offset of zero, the cable out value is treated as the horizontal layback value during processing.

EdgeTech

1. Select a side scan system:
 - Midas
 - 260
 - JSF
2. If Midas is enabled, select a sonar frequency channel:
 - 100 KHz
 - 500 KHz
3. If JSF is enabled, select a sonar frequency channel:
 - All data

- Low Frequency
- High Frequency

Edgetech side scan data can be imported in 16-bit format or converted to an 8-bit format.

4. Select either the *Preserve 16-bit* option or *Convert to 8-bit* option.

If the *Convert to 8-bit option* is selected, the *Scale* and *Shift* options are enabled. The *Scale* option averages the data and the *Shift* option selects a initial bit value (between 0 and 8) and includes the next seven bit values for export. For example, if you typed 8 as your initial value, then bits 8 to 15 are included in the export process.

5. Select the *Scale* option to average the data into 8-bit format, or select *Shift* and type the value for the first bit.

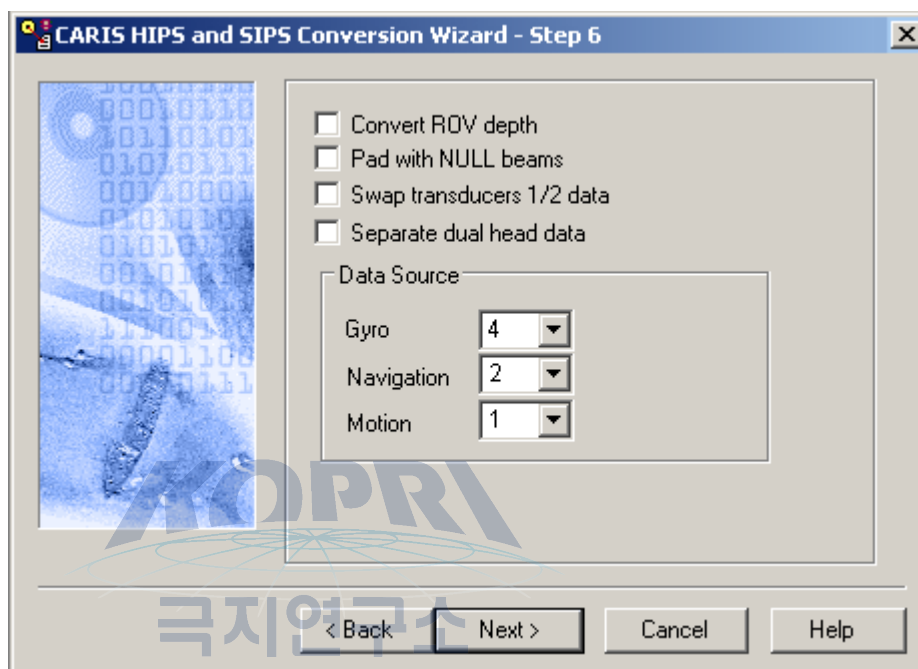


EIVA

At Step 5, you have the option of using the generic multibeam filtering functions built into the HIPS Conversion Wizard.

See “[ADVANCED FILTERING](#)” ON PAGE 135.

Step 6 offers further conversion options specific to EIVA data.



1. Select the *Convert ROV depth* option to store the EIVA sub-packets as HIPS delta draft values.
2. Select the *Pad with NULL beams* option, to replace missing data with NULL (rejected) beams in the case of dual head data where the data from head #1 is missing. This results in the beam numbers for transducer 2 data remaining consistent with fully populated profiles.
3. Select *Swap transducers 1/2 data* to exchange data between heads (in dual head set-up).
4. Select the *Separate dual head data* option to specify that soundings from the dual head transducer data are not combined into a single HIPS profile. (Soundings from transducer head #2 will be identified via status bits encoding so no changes to your vessel files are needed.)

Since EIVA allows logging of data from multiple devices, the *Data Source* option enables you to select the source for heading, attitude, and navigation data. The data for each device is tagged with a sequence number, from 0 to 4, that represents one of up to five devices collecting each type of data. (If you select a number for which no device exists, no data is converted.)

5. Select a device number from the list for Gyro, Navigation and/or Motion data to convert the data from that device.

Elac

During conversion, XSE-format beams are numbered according to the sounding's position along the swath (in relation to the vessel).

1. To number the converted beams along the swath from starboard to port, select the *Starboard to Port* check box.
2. To number the converted beams along the swath from port to starboard, select the *Port to Starboard* check box.

If a single Sound Velocity value was used during the survey:

3. Select the *Manual* option and type the sound velocity value.

If a Sound Velocity Profile was recorded and used by the logging system, then the *Interpolate* option must be selected.

4. Select *Interpolate* to read surface sound velocity values from a datagram.
5. To convert side scan data, select the *Convert Side Scan* check box.

ELAC XSE data can be recorded as 108 beams or 126 beams (depending on the survey mode). The *Pad Transducer 1 with NULL beams* writes 63 beams to Transducer 1 so that the same HIPS Vessel File (HVF) can be used for both survey modes.

6. Click the *Pad Transducer 1 with NULL beams* check box so that the soundings associated with transducer 1 are padded to have 63 beams.
7. Click **Next**.

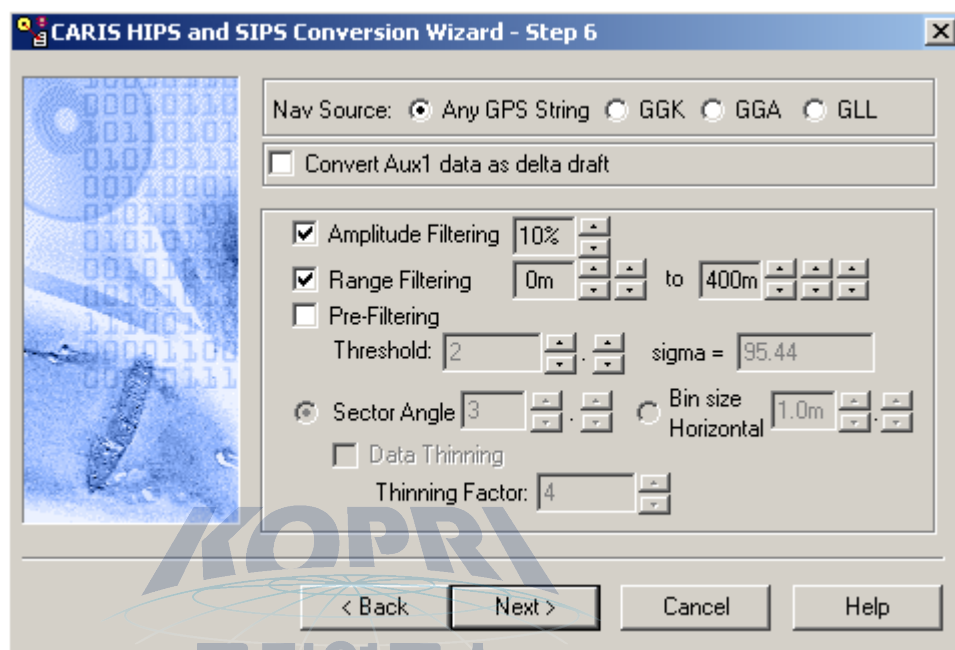
Furuno

1. Make sure the *Convert Side Scan* option is checked to include side scan data with the bathymetric data.

GeoAcoustics

If you selected the Geographic option in Step 4 of the wizard, you can obtain the latitude/longitude readings from GPS strings.

1. In the Nav Source field, select *Any GPS String*, or *GGK*, *GGA*, or *GGL*.



2. If you want to convert data from Aux1 as delta draft, select the *Convert Aux1 data as delta draft* option.

The *Amplitude Filtering* option filters soundings according to amplitude value. For each ping (port and starboard pings are handled separately), the min/max amplitude values are obtained, and samples that fall below the selected percentage (0-50%) are rejected.

3. Select the *Amplitude Filtering* check box to implement this option.
4. Click the up or down arrow buttons to select a percentage for rejecting soundings.

The *Range Filtering* option converts soundings within a specified distance. Soundings outside of this range are not converted.

5. Select the *Range Filtering* check box to implement this option.
6. Click the up or down arrow buttons to select a minimum and maximum distance.

The *Pre-Filtering* option controls which soundings in each swath are considered for conversion. This option calculates the mean depth and standard deviation within a swath sector or horizontal bin. It then prevents any soundings that fall outside a multiple of the standard deviation from being converted.

If Pre-filtering is used, then the mean within the sector is re-computed. Ultimately, the soundings are sorted by their residual from the mean and those closest to the mean are converted. The actual number of soundings converted from within each sector is determined by the thinning factor (if used).

7. Select the *Pre-Filtering* check box to implement this option.
8. Determine a *Threshold* (multiples of the standard deviation) value by clicking the up and down arrow buttons.

The equivalent confidence value is displayed as a percentage.

The filtering and thinning methods are executed within a sector angle interval or a horizontal bin size. The sector angle option divides the swath into sectors according to degree angles while the horizontal bin size divides the swath into horizontal sectors based on a specified across-track distance.

Vessel motion and transducer mounting angles are considered when sector angle and horizontal bin locations are determined.

1. Select the *Sector Angle Interval* option and choose a degree level (to a maximum of 10°) by clicking the up or down arrow buttons.
2. Alternatively, select the *Horizontal Bin Size* option choose an across-track distance by clicking the up or down arrow buttons.

The thinning factor reduces the number of soundings converted on a per swath basis. The thinning factor uses a power of two reduction control (1/2, 1/4, 1/8, etc.) so that one of two, one of four or one of eight soundings can optionally be converted per swath sector.

3. Select the *Data Thinning* check box to implement the thinning option.
4. Select a *Thinning Factor* value by clicking the up or down arrow buttons.
5. Click **Next**.

GSF

Data recorded during line turns is marked as Offline data in GSF. This data can be included or excluded during conversion. When included it can also be automatically rejected. One purpose for including the Offline data would be to maintain the same swath profile numbers in HIPS format.

1. Make sure the *Include Offline Data* box is checked to convert data recorded during turns between track lines. Otherwise select the *Reject Offline Data* check box.

When offline data is converted, it can be rejected automatically.

Horizontal and depth uncertainty values in the GSF file are also included during conversion.



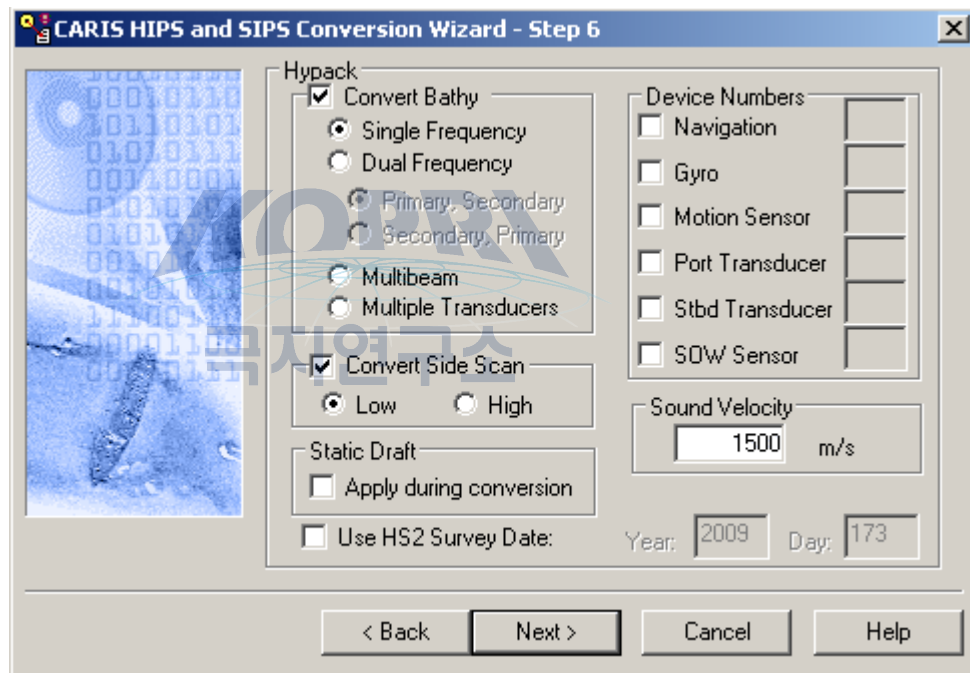
Hypack

The Hypack format supports recording bathymetry from single beam, multibeam, and multiple transducer systems. It also supports reading side scan data from Hypack Max format.

For dual-frequency single beam data, you must indicate if the data records in Hypack are recorded as primary/secondary or secondary/primary. The primary frequency, by default, becomes the selected data for use in the field sheet.

If the conversion wizard detects records containing 12-bit data, they will be converted to 16-bit format. Otherwise they are converted to 8-bit data.

To process of EDIT (dual frequency) and HS2 (multibeam) formats, select Convert Bathy.



1. Select the type of data to be converted: Bathy, Side Scan or both. (You must make a selection or the conversion process will not go forward.)
 - To process EDIT (dual frequency) and HS2 (multibeam) formats, select Convert Bathy.

Note: If *Convert Bathy* is selected, ensure that the vessel file for the data contains a Depths section, or conversion will fail.

- For side scan you can select either Low or High frequency data to be converted. If the data file contains only single frequency data then this setting is ignored and all data is converted.
2. Select a sounding data type:
 - single frequency
 - dual frequency (primary, secondary or secondary, primary)

- multibeam
 - multiple transducers
3. If you wish to apply the static draft during conversion, click the *Apply During Conversion* check box.

The *Device Numbers* section is used if sensor data was recorded from more than one device. To import data from a specific sensor, you must type the number for that device. If no number is entered then *all* sensor data is imported. The following sensors are effected by the device number setting:

- *Navigation* for positional records.
 - *Gyro* for heading records.
 - *Motion Sensor* for roll, pitch and/or heave settings.
 - *Port transducer* for port multibeam records.
 - *Starboard transducer* for starboard multibeam records.
 - *SOW Sensor* for speed over water records.
4. If data is recorded from more than one sensor device, click the sensor check box and enter a device number.
 5. Enter the sound velocity value that is used to compute the original travel time data from the recorded depths. This allows sound velocity corrections to be applied in HIPS.

The HS2 format does not store day and year values with the timestamp (it does store a time value). When the data is converted to HIPS, the Day folder is used for reading the date. If you want to include another date value, you must complete the following *Year* and *Day* fields.

6. Select the *Use HS2 Survey Date* check box to enable the *Day* and *Year* fields.
7. Type the year and day in the fields.

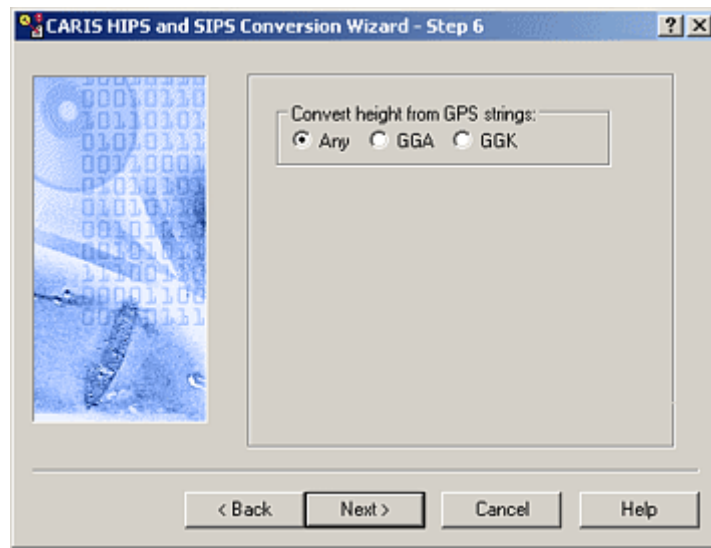
Imagenex

Navigation data can be imported from an external *.NAV file with the same name as the Imagenex *.83P file. If the HIPS converter detects that a *.NAV file exists, it will import navigation and GPS height data from the GPS strings in the *.NAV file. In this case the stored navigation data in the *.83P file is not converted.

You can choose read either the G GK or the GGA string, or have either read by selecting the *Any* option. These controls are only applied if there is an *.NAV file with the same name as the *.83P file.

To read GPS height data from Imagenex files:

1. Select the height string to be read: GGA, GGK or Any.



LADS

LADS data is contained in two files that are copied into the HIPS survey line folder: An ASCII CAF file that contains the bathymetry data, and a binary CBF file that contains the waveform data. The CAF file can contain data from more than one survey line (or “run”). When this is the case, the converter splits the file into separate line folders for each run. The .caf and .cbf prefixes are retained in the HIPS Line folder.

There are four sounding classifications in the LADS format:

- **S (Secondary sounding)**: the best soundings
- **P (Primary sounding)**: an unreliable result
- **N (No bottom found at depth)**: potentially a useful depth result
- **X (No bottom detected)**: no result

When the data is converted, each sounding is given a status flag according to its classification. The following table outlines classification and matching HIPS status flag.

LADS Classification	HIPS Sounding Flag	Definition
S	Accepted	Good soundings until they are flagged as rejected during cleaning in HIPS.
P	Rejected by disabled beam	A reject flag in HIPS that can be changed to Accepted, if necessary.

LADS Classification	HIPS Sounding Flag	Definition
N	Examined	A special flag for an Accepted sounding. The sounding can be filtered out when creating a BASE Surface or exporting. It can also be flagged as Rejected during cleaning in HIPS
X	Rejected by Depth Gate	A type of Reject flag that can be changed to Accepted, if desired.

There are no dialog box options for the LADS format.

LAS

There are no specific options for the LAS format.

MarineSonics

There are no specific options for the MarineSonics format.

Navitronics

1. Select one of the following data types to be converted:

- *Multibeam*
- *Singlebeam*
- *Multiple Transducer*

2. Select the *Convert Side Scan* check box to convert side scan data.

Navitronic side scan data can be imported in 16-bit format or converted to an 8-bit format.

3. Select either the *Preserve 16-bit* option or *Convert to 8-bit* option.

If the *Convert to 8-bit option* is selected, the *Scale* and *Shift* options are enabled. The *Scale* option averages the data and the *Shift* option selects a initial bit value (between 0 and 8) and includes the next seven bit values for export. For example, if you typed 8 as your initial value, then bits 8 to 15 are included in the export process.

4. Select the *Scale* option if you want to average the data into 8-bit format, or select *Shift* and type the value for the first bit.

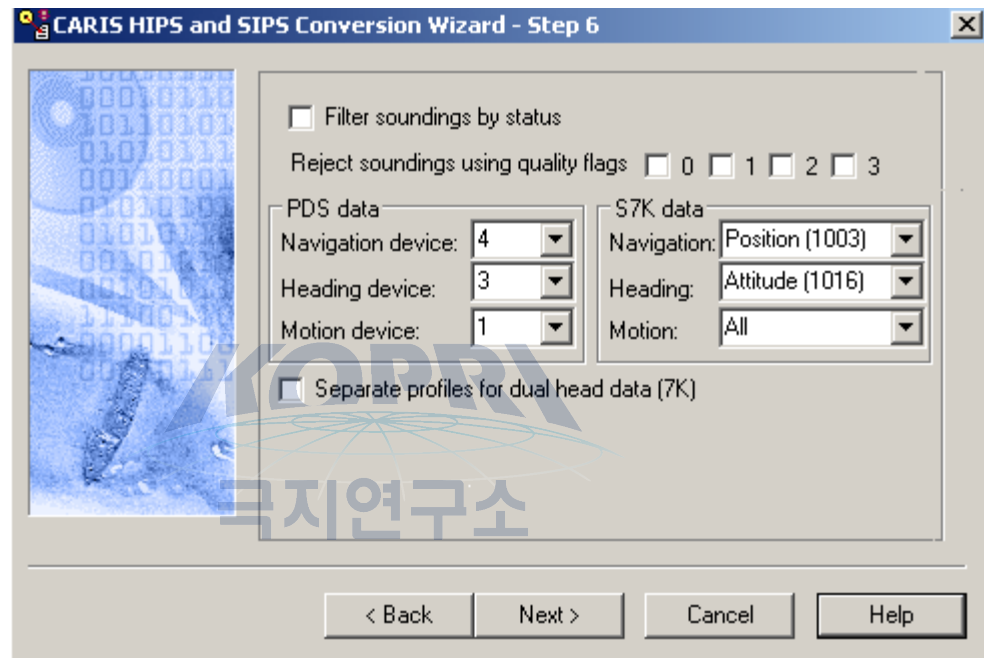
5. Click **Next**.

Qmips

1. Choose a pair of sonar channels by clicking one of two options (1,2 or 3,4).

Reson PDS

The final step of the conversion process for Reson data provides options for filtering soundings by status bits, and separating dual head data by profiles.



1. Select the *Filter soundings by status* option to filter using the status bits in the data file.
2. Select the quality bits for which soundings will be rejected when converted into HIPS format. (If you select all four check boxes all soundings will be rejected).
3. Select a number for your PDS navigation, motion and/or heading device to convert the data from that specific device.
4. Indicate the source of S7K data by selecting option from the drop-down list. The default value is "All".

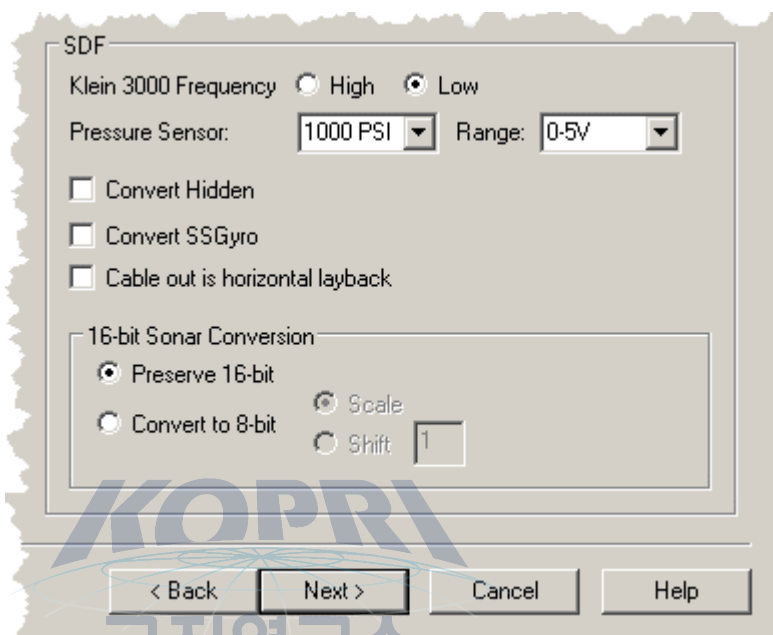
In the case of dual head data stored in the Reson 7K format, the data from transducer #1 is combined with that from #2 to form a single HIPS profile. To convert the two sets of data separately,

5. Select the *Separate profiles for dual head data* option.

Scripps

There are no options for the Scripps format.

SDF



1. Select a Klein 3000 *High* or *Low* frequency.
2. Select a *Pressure Sensor* reading from the drop-down list to set the depth of the towfish.
3. Select the *Range* of voltage for the pressure sensor, either 0-5V or 1-5V.
4. Hidden data consists of repeated pings over the same area. Select the *Convert Hidden* check box to include hidden data in conversion.
5. Select the *Convert SSGyro* check box to include side scan sonar gyro data.
6. Select the *Cable Out is Horizontal Layback* option to omit sensor depth during conversion. If there is no sensor depth and the towpoint has a Z-offset of zero, the cable out value is treated as the horizontal layback value during processing.

SDF side scan data can be in 16-bit or 8-bit format. If the data is in 16-bit format, you can choose to convert to an 8-bit format.

7. Select either the *Preserve 16-bit option* or *Convert to 8-bit option*.

If the *Convert to 8-bit option* is selected, the *Scale* and *Shift* options are enabled. The *Scale* option averages the data and the *Shift* option selects a initial bit value (between 0 and 8) and includes the next seven bit values for export. For example, if you typed 8

as your initial value, then bits 8 to 15 are included in the export process.

8. Select the *Scale* option if you want to average the data into 8-bit format, or select *Shift* and type the value for the first bit.

Seabeam

1. Make sure the *Convert Side Scan* option is checked to include side scan data with bathymetric data.
2. Select the *Shorten Line Names* check box to modify the file name to a 12-character CARIS name (YYDDD_HHMMDD).

Seafalcon

Seafalcon allows the option of importing a full-sounding dataset or a thinned dataset. The thinning options are based on reducing the number of beams per profile that are imported. All profiles are imported.

1. Select the thinning option, if needed.

The following two options are enabled if the thinning option is selected.

2. Select the amount of data to be processed.
 - half the number of beams are imported
 - one fourth the number of beams from each profile are imported
3. Select the sounding type to be imported into HIPS format.
 - shoal
 - average
 - deep

You can select the swaths per ping that you want to import. In deep water, the Seafalcon sonar produces five swaths with each firing of the transducer. These five swaths are in an along-track position to the ship—with swath 1 forward of the sonar and swath 5 aft of the vessel. In shallow water only one swath per ping is generated.

By default all five swaths are selected for import, but you can decide which swaths to import.

4. Select the swath number(s) for import.

SEGY

There are no options for the SEG Y format.

SHOALS

All soundings in the SHOALS format are given a confidence value during acquisition. These confidence values are used to flag soundings during conversion so that soundings with certain confidence values are rejected. The following status flags are assigned to soundings. These can be changed in HIPS.

- **Rejected by disabled beam:** This flag rejects soundings with a negative confidence value.
- **Rejected by depth gate:** This flag is for soundings with confidence values that range from 0 to 70. The 0 to 50 range represents soundings where no bottom was found, and the 51 to 70 represents soundings of questionable confidence.
- **Accepted:** This flag is for soundings with confidence values from 71 to 99.

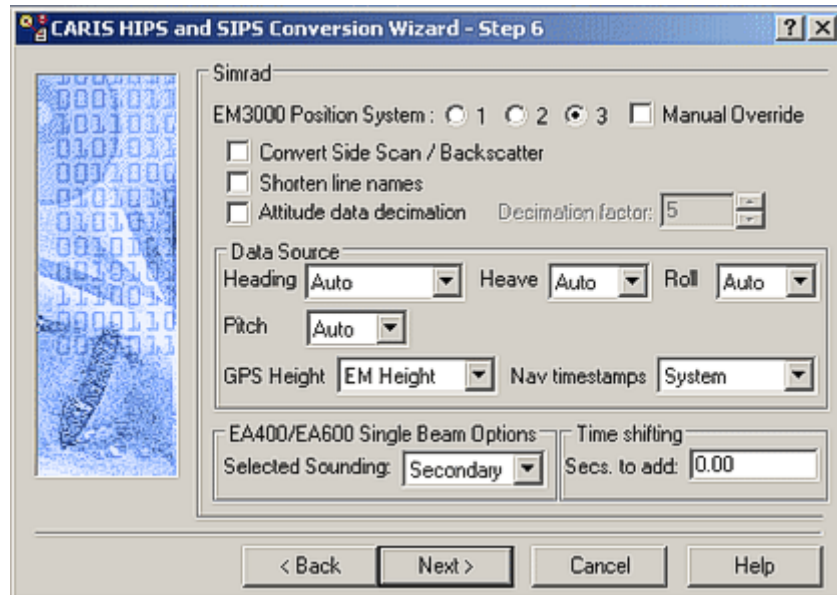
When converting to HIPS, all soundings with a confidence value less than the *Confidence Cutoff Value* will be automatically rejected. The default cutoff value is 70.

1. Use the mouse to select a cutoff value.

If the dataset contains land data, you can select the topographic format (TOF) options to convert this data too.

2. Select either the *First Pulse* check box to convert the return from the top of the vegetation canopy or the *Second Pulse* check box to convert the return from the ground.

Simrad



1. If you are using the EM3000 sonar, select the channel used for the primary position.
2. Select *Manual Override* to read from the navigation system data that is marked inactive by Simrad.
3. Click the *Convert Side Scan/Backscatter* box if you want to convert this data.

You can fit critical line information into the 12 characters provided by the CARIS Source ID attribute for soundings.

4. Select the *Shorten line names* check box to modify the file name to a 12-character CARIS name (YYDDD_HHMMDD).

Large attitude data files can result if there is a straight one-to-one import into HIPS. The *Attitude Data Decimation* option down-samples the data so that a smaller attitude dataset is converted. The *Decimation Factor* determines the ratio of attitude data. For example, if you select 10 as the *Decimation Factor*, then one out every tenth attitude record is converted.

5. Select the *Attitude Data Decimation* check box to implement this option.
6. Select a *Decimation Factor* to set the ratio for down-sampling attitude data.

Data Source

Motion data (heading, heave, roll, and pitch) is automatically read from the active motion reference unit. However, you can select another motion reference unit to read the data. Gyro data can also be read from the headings datagram.

7. For *Heading*, select the *Auto* option to read gyro data from the active motion reference unit, or select an inactive unit by selecting *MRU1/*

MRU2 options. Select the *H. Diagrams* option to read gyro from the headings datagram.

8. For *Heave*, *Roll*, and *Pitch*, select the *Auto* option to read data from the active motion reference unit, or select an inactive unit by selecting *AutoMRU1/MRU2* options.
9. For *GPS Height*, select a source from either the *EM Height* datagrams or the *GPS String* in the navigation datagrams.

Navigation time stamps can be selected from either the logging system or from a source specified by Simrad Installation datagram (the GPS string in the navigation datagram or the logging system).

10. Choose *System* to select the logging system or choose *Automatic* to select the timestamp specified by the Installation datagram.
11. If you are converting single beam data from the dual frequency EA400\600 system, select *Primary* to use the primary sounding as the selected sounding in the HIPS file, or select *Secondary* to use the secondary sounding as the selected sounding.

Time shifting

The Time shifting option lets you add a constant number of seconds to each piece of data retrieved from the simrad.all file. This time shift value can be positive or negative and it's set to zero by default.

12. Enter the value to be added as a constant.



SWATHPlus

1. Type a value in the *Speed of sound* field to apply sound velocity to the imported data.

UNB

1. Select one or two transducers.
2. Select the *Convert Sonar* option, if you want to import side scan data.

Winfrog

1. Select *Single* or *Dual Frequency*.
2. Select attitude records to be converted.
3. Specify the speed of sound, so that slant range data can be generated from the measured sounding depths.
4. Choose the navigation records to be converted.

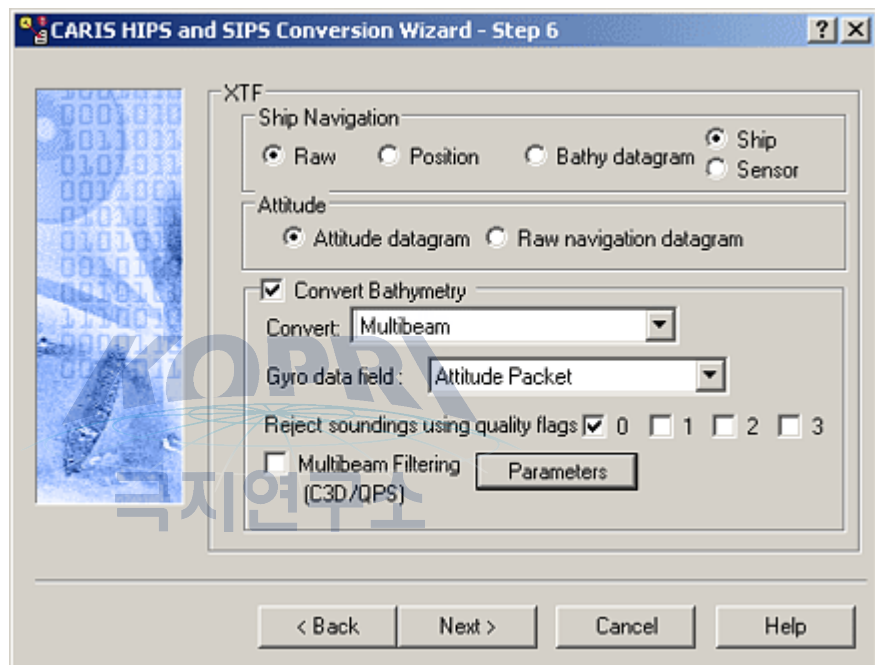


XTF

The XTF format conversion has two sections: bathymetry and side scan.

For both sonar types, you must indicate the field used as the source for navigation and gyro/heading data.

For side scan, there are additional options for converting horizontal tow fish layback or tow cable length distances. There are also options for reading the dynamic depth information for a remote operated vehicle (ROV).



1. Click one of following options to select a source for reading the navigation data fields:

- *Raw navigation datagram*
- *Position*
- *Bathy datagram*

If you select *Bathy datagram*, the *Ship* and *Sensor* fields are enabled.

2. Select either the *ship* or *sensor* as a source for reading navigation data.

Note: Navigation data for the ship can now be read from the new XTFRAWNAVIGATION datagram that is available for Reson MBES data stored in XTF format by Triton ISIS.

If you select the *Raw* navigation option, the option to read the ship attitude data from the historical XTF attitude datagram or the new XTFRAWNAVIGATION datagram is activated.

3. Select one of the following options:

- attitude datagram
- raw navigation datagram

Convert Bathymetric data

To convert bathymetry data

4. Click the *Convert Bathymetry* check box.

5. Select a bathymetric data format from the *Convert* drop-down list:

- Multibeam
- Multi-transducer
- Single beam from records *{Prim=0}* or *{Prim=1}*:
If there are two channels of data, you can identify which channel contains the primary data
- Single beam from AUX (1,2,3, or 4).

Note: Benthos C3D data will be converted to two lines: multibeam and single beam.

The singlebeam HIPS line (with the addition of *_SingleBeam* to the line name) will have the same set of navigation and attitude data as the multibeam line, but the sounding depths will be single beam data from the XTF sensor *AuxAltitude* field.

Select gyro data field

The *Gyro data field* source fields are enabled. One source is *CMG (Course Made Good) from Navigation*. Other options in the pull-down list are determined by the selections made in the previous steps.

If you previously selected the *Raw navigation datagram* option to read navigation and attitude data then the option to use the same datagram for ship gyro data is available on the drop-down list.

If you previously selected the *Attitude datagram* option then the option to use that datagram is available.

If you selected either the *Position* or *Bathy datagram* options at Step 1, you can select from the following options:

- ship
- sensor
- attitude packet
- Course Made Good (CMG) from Navigation
- Course Made Good from SSS Navigation

Set reject soundings flags

The XTF format attaches quality flags to soundings. For example, with Reson sonars, 0 represents the lowest quality and 3 represents the highest quality. You can reject soundings with a specific flag. These soundings are flagged as Rejected by Disabled Beam in HIPS.

6. Select a quality flag so the soundings with that specific flag value are rejected when converted to HIPS format.

If you are converting C3D or QPS data, you can apply filtering before moving to the next step.

If you do not want to apply filtering

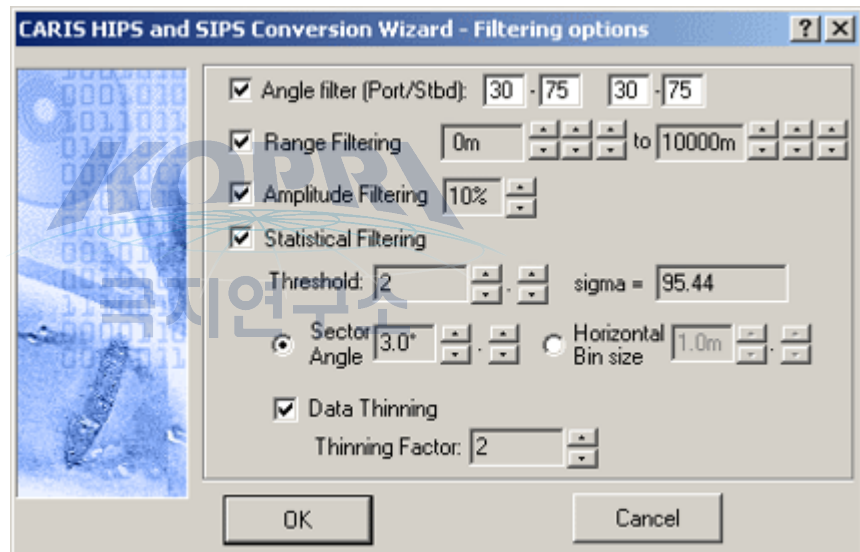
7. Click **Next** to continue with the import process.

Filtering

To apply filters for Benthos C3D or QINSy QPS data

8. Select the *Multibeam Filtering* check box and click **Parameters** to select filtering options.

The Filtering options dialog box is displayed.



Benthos C3D data can be filtered so that only the best quality data is imported into HIPS. You can apply the filter to port/starboard beam angles.

1. Type a range of beam angles to select the cleanest data from the port and starboard beams.

All other options are applied to QPS data only.

The *Range Filtering* option converts soundings within a specified distance (in metres). Soundings outside of this range are not converted.

2. Select the *Range Filtering* check box to implement this option.
3. Click the up or down arrow buttons to select a minimum and maximum distance.

The *Amplitude Filtering* option filters soundings according to amplitude value. For each ping (port and starboard pings are handled separately), the min/max amplitude values are obtained, and samples that fall below the selected percentage (0-50%) are rejected.

4. Select the *Amplitude Filtering* check box to implement this option.
5. Click the up or down arrow buttons to select a percentage value for rejecting soundings.

The *Statistical Filtering* option controls which soundings in each swath are considered for conversion. This option calculates the mean depth and standard deviation within a swath sector or horizontal bin. It then prevents any soundings that fall outside a multiple of the standard deviation from being converted.

If Statistical Filtering is used, then the mean within the sector is re-computed. Ultimately, the soundings are sorted by their residual from the mean and those closest to the mean are converted. The actual number of soundings converted from within each sector is determined by the thinning factor (if used).

6. Select the *Statistical Filtering* check box to implement this option.
7. Determine a *Threshold* (multiples of the standard deviation) value by clicking the up and down arrow buttons.

The equivalent confidence value is displayed as a percentage.

The filtering and thinning methods are executed within a sector angle interval or a horizontal bin size. The sector angle option divides the swath into sectors according to degree angles while the horizontal bin size divides the swath into horizontal sectors based on a specified across-track distance.

Vessel motion and transducer mounting angles are considered when sector angle and horizontal bin locations are determined.

1. Select the *Sector Angle Interval* option and choose a degree level (to a maximum of 10°) by clicking the up or down arrow buttons.
2. As an alternate method, Select the *Horizontal Bin Size* option choose an across-track distance by clicking the up or down arrow buttons.

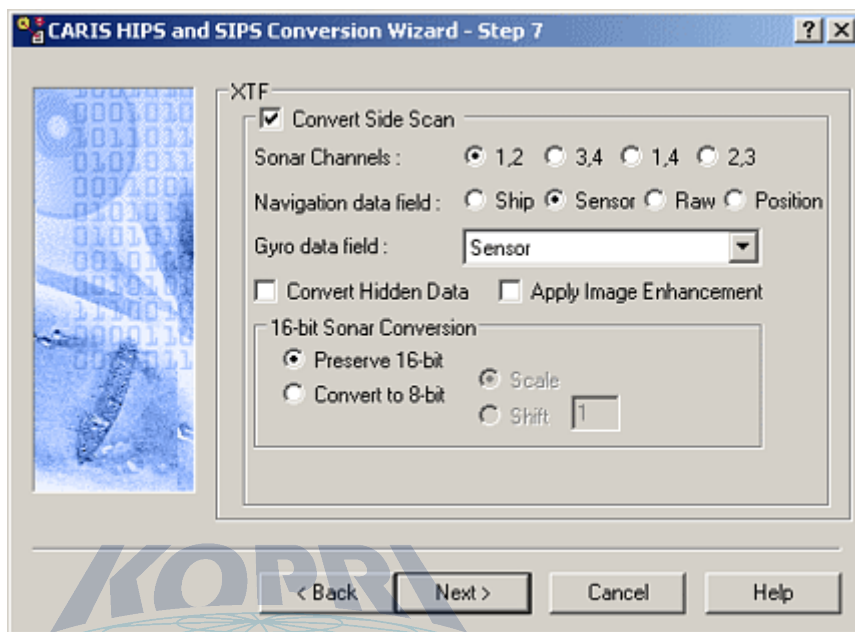
The thinning factor reduces the number of soundings converted on a per swath basis. The thinning factor uses a power of two reduction control (1/2, 1/4, 1/8, etc.) so that one of two, one of four or one of eight soundings can optionally be converted per swath sector.

3. Select the *Data Thinning* check box to implement the thinning option.
4. Select a *Thinning Factor* value by clicking the up or down arrow buttons.
5. Click **Next** to go to the Convert Side Scan Data dialog box.

Convert Side Scan data

The XTF dialog box for converting side scan is displayed.

If you do not want to convert side scan data then click **Next** and go to "CONVERT DATA" ON PAGE 137.



Note: Contact records created in Triton ISIS are also imported into HIPS when associated XTF data is imported.

To convert side scan data,

6. Click the *Convert Side Scan* check box.
7. Select one of four sonar channels by clicking an option.
8. Select one of following options to select a source for reading the navigation data for the towfish:
 - ship
 - sensor
 - raw
 - position
9. Select one of the following options from the pull-down list as a source for reading the gyro fields for the towfish:
 - ships
 - sensor
 - attitude packet
 - raw navigation
 - Course Made Good from Navigation
 - Course Made Good from SSS Navigation

The XTF format flags repeated pings over an area as hidden data.

10. Select the *Convert Hidden Data* check box to include this data type in the SIPS project.

11. To enhance the image by scaling the intensity values, click the *Apply Image Enhancement* check box.

XTF side scan data can be in 16-bit or 8-bit format. If the data is in 16-bit format, you can choose to convert it to 8-bit format.

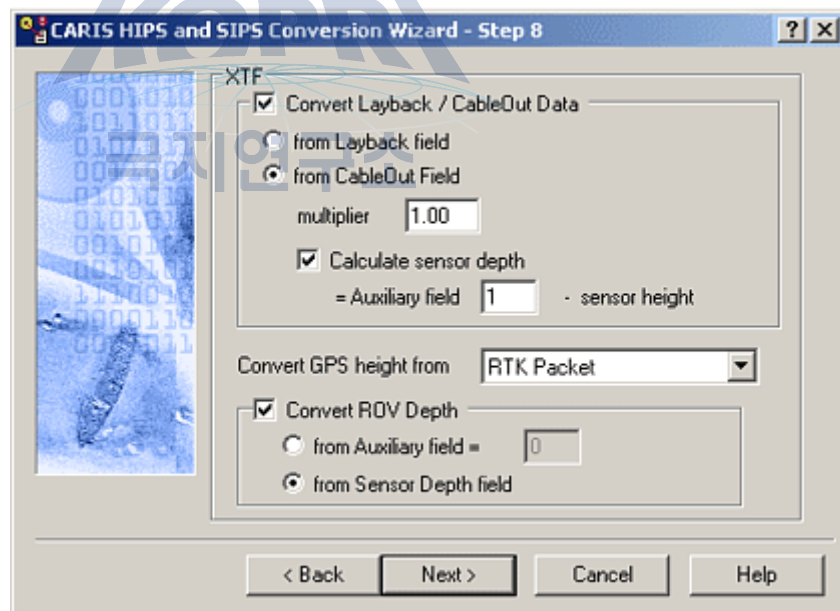
12. Select either the *Preserve 16-bit option* or *Convert to 8-bit option*.

If the *Convert to 8-bit option* is selected, the *Scale* and *Shift* options are enabled. The *Scale* option averages the data and the *Shift* option selects a initial bit value (between 0 and 8) and includes the next seven bit values for export. For example, if you typed 8 as your initial value, then bits 8 to 15 are included in the export process.

13. Select the *Scale* option if you want to average the data into 8-bit format, or select *Shift* and type the value for the first bit.

14. Click **Next**.

The third XTF conversion dialog box is displayed.



15. If you want to recompute side scan towfish positions in HIPS with the recorded horizontal layback or tow cable length data, make sure the *Cable Out/Layback* box is checked.

16. Select one of the following options:

- *from Layback field*: The distance from the vessel towpoint to the towfish.
- *from Cable Out field*: The length of the tow cable to the towfish

17. If you selected *Cable Out*, enter a number in the *Multiplier* box to correct for integer value recording, if necessary.
18. Select the *Calculate Sensor Depth* check box to enable options for calculating the depth of the towfish below the waterline.
19. Type a number of the *Auxiliary* field that contains the total measured depth.

The total measured depth and the digitized height of the towfish are used to compute the depth of the towfish below the waterline. The towfish depth can then be combined with the tow cable length data and the vessel's tow point configuration to compute the position of the towfish.

When ship navigation is being read from the bathymetry packet, then the options available for the source of GPS ellipsoid height data are the *RTK Packet* and the *Ocean Tide* field in XTF.

However, if the ship navigation is being read from the new XTFRAWNAVIGATION datagram then the GPS ellipsoid height, if available, will always come from this new raw navigation datagram.

20. Convert the GPS height of the antenna or navigation sensor from:

- RTK packet
- Ocean Tide

21. If data is being collected from an ROV (Remote Operated Vehicle), click the check box to enable the source options for measurement of vehicle depth.

The auxiliary and sensor depth fields are enabled.

22. Click the appropriate check box to select a source for reading ROV depth data:

- Auxiliary
- Sensor Depth

23. Type the number of the *Auxiliary* field (from 1 to 6), if this option is selected.

24. Click **Next** to go to the step to [“CONVERT DATA” ON PAGE 137](#) of the Conversion Wizard.

7

Sound Velocity Correction

Sound Velocity Correction contributes to a more accurate soundings file by converting travel time and angle information into across-track and depth values. The process combines transducer orientation and positioning data from the HVF with Sound Velocity Profile data and applies a ray-tracing algorithm.

In this chapter...

“SOUND VELOCITY PROCESSING” ON PAGE 170

“SOUND VELOCITY CORRECTION” ON PAGE 171

Sound Velocity Processing

Raw data formats such as XTF contain two-way travel time and beam launch angle data. The Sound Velocity Correction algorithm uses this data to calculate the length and path of the sound wave through the water column for each beam.

Sound velocity processing is not available for all types of multibeam and single beam sonar data. Only those sonar formats that provide raw travel time and angle from the transducer are currently supported in HIPS. This includes multibeam bathymetry from XTF, Hypack, XSE and Simrad EM formats.

For all other multibeam sonar formats, it is assumed that sound velocity corrections were applied during data acquisition.

HVF

For effective sound velocity correction, the Sound Velocity section of the HIPS Vessel file must be set up to define the transducer offsets. These offsets are used in Sound Velocity Correction, together with the Sound Velocity profile data. (See [“SVP” ON PAGE 570](#) for these sensor configurations.)

SVP file

A sound velocity profile contains data on the acoustic velocity of the water column, in a text file divided into sections defined by time stamps. (See

This data can be viewed and modified in the SVP Editor. (See [“EDIT SVP DATA” ON PAGE 591](#)).

It is recommended that sound velocity correction be applied to bathymetry before cleaning the data. Whenever SVC is applied, the Merge command should be applied to the data

See also

[“SVP FILES” ON PAGE 582](#)

[“CREATE A NEW SVP FILE” ON PAGE 583](#)

Sound Velocity Correction

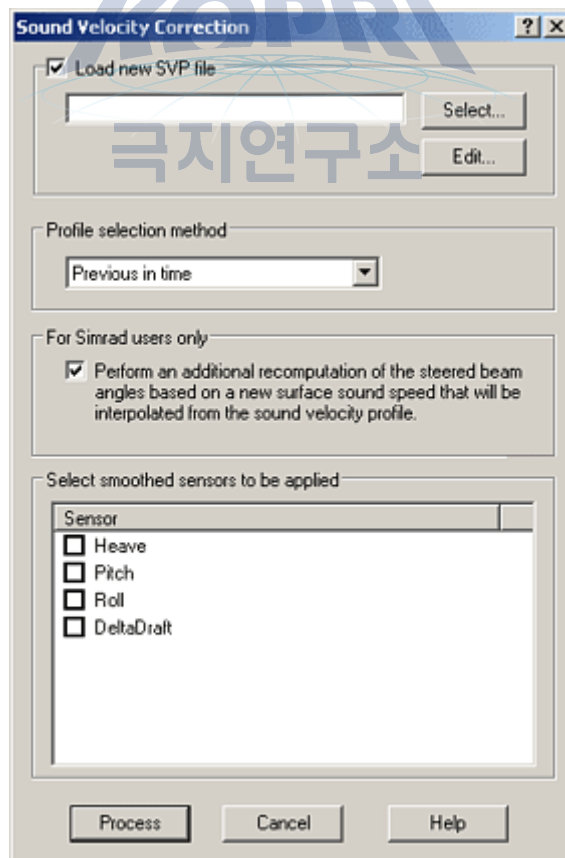
The sound velocity correction process uses a ray tracing algorithm to apply the sound velocity profiles. You can use either regular attitude data or smoothed data for applying vessel motion data to the ray-tracing algorithm (see “[SMOOTH DATA](#)” ON [PAGE 578](#)).

Menu	Process > Sound Velocity Correction
Tool	

1. Select a track line or group of track lines.
2. Select the Sound Velocity Correction command.

The Sound Velocity Correction dialog box is displayed.

3. navigation data even if the data does not cover the entire line.
4. Select the *Allow gap between records* check box to limit the interval allowed between consecutive data records in the file. If an interval exceeds the amount specified in the *Maximum* field, the data will not be loaded and the process will stop.
5. If the time stamp in the file does not match the time stamps in the project, you select the *Apply Time Offset* option and type a time value (in seconds).
6. Click **Load**.



7. Select the *Load New SVP File* check box.

8. Click **Select** to choose an SVP file.

The Open an SVP File dialog box is displayed.

9. Select the file you want, or type the file path in the File Name text box.
The default directory is ...\\Hips\\Svp.

10. Click **Open**.

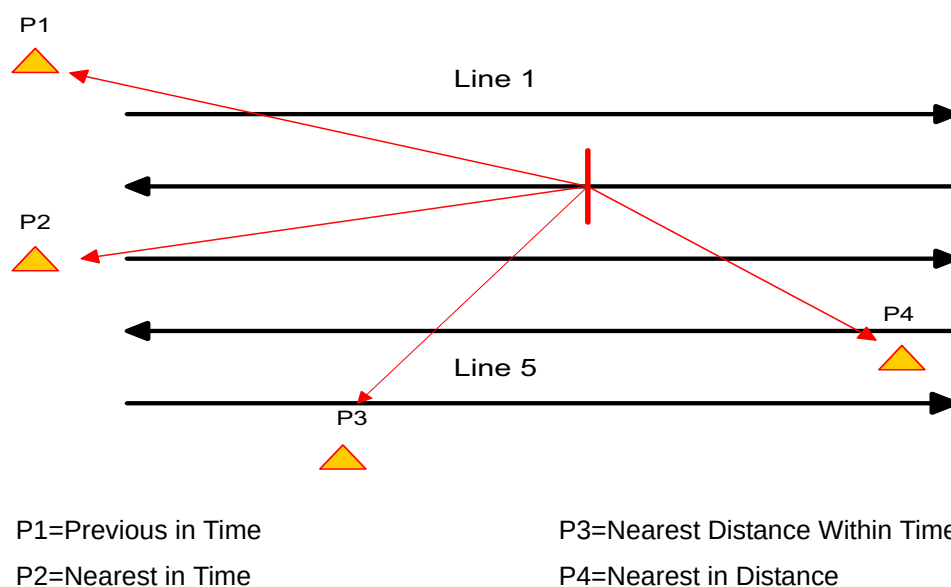
The file name and path is displayed in the text box.

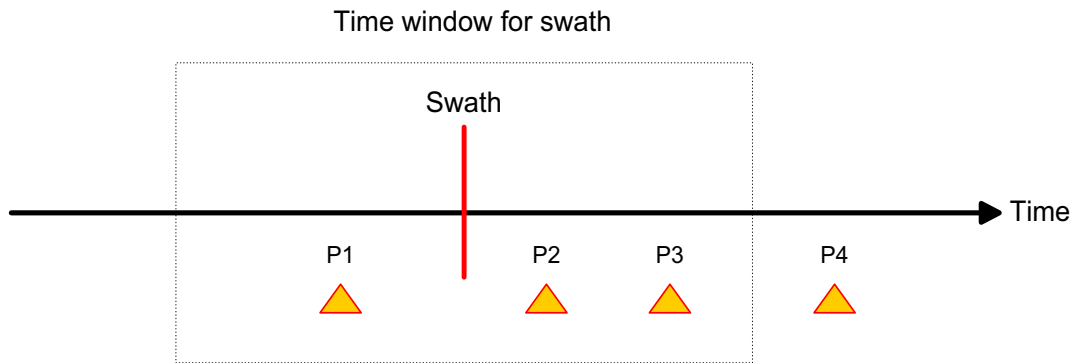
11. If you want to edit the data with the SVP editor, click **Edit** (see “[SVP EDITOR](#)” ON PAGE 577).

When there is more than one sound velocity profile, the program can use one of four options for selecting an SVP at the time of each swath:

- *Previous in Time*: Select the profile with a time stamp prior and nearest to the time of the swath.
- *Nearest in Time*: Select the profile with a time stamp nearest to the time of the swath. This can either be prior to or after the time.
- *Nearest in Distance*: Select the profile with a position nearest the position of the swath. This requires that positions be included in the SVP file.
- *Nearest Distance Within Time*: Select the profile with a position nearest to the swath and has a timestamp nearest the time of the swath within a selected range.

The following diagram demonstrates the relationship of the four SVP options to the swath.





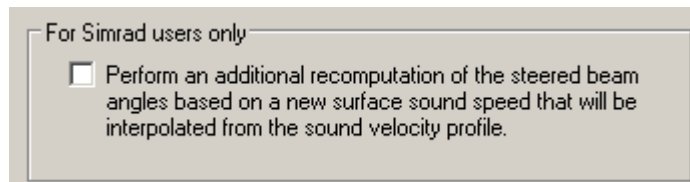
The above two graphics demonstrate the relationship of the profile options to the time/location of the swath. P1, P2 and P3 all are calculated within a time period. P4 is calculated independently of the time period.

12. Select one of above options by clicking the appropriate check box. If you select the *Nearest in Distance and Time* option, make sure you select a time range for the timestamp.

Simrad EM data

For Simrad EM data, the Sound Velocity Correction function requires the range/angle datagram to be recorded. The function, at a minimum, provides a re-computation of the across-track/along-track/observed depth solution based on the new sound velocity profile starting with the recorded range/angle data for each beam.

An additional option switch is provided on the dialog box to perform an optional re-computation of the steered beam angles when you believe the recorded surface sound velocity is not reliable. In this case, a new surface sound velocity will be interpolated for each swath from the new sound velocity profile.



13. Select this check box to perform an additional re-computation of the steered beam angles based on a new surface sound speed that is interpolated from the sound velocity profile.
14. Select which smoothed sensor data is to be applied during sound velocity correction. Sensor data can be smoothed in the Attitude Editor (see "[SMOOTH DATA](#)" ON PAGE 578).
15. Click **Process** to apply the SVP file to the selected data.



8

Correct for Tide

Tidal data must be loaded for every track line to generate final depths.
Tide files can be edited or new files created using the Tide Editor.

In this chapter... 극지연구소

“LOAD TIDE” ON PAGE 176

“TIDE FILES” ON PAGE 178

“TIDE ZONE FILES” ON PAGE 178

Load Tide

Menu	Process > Load Tide
Tool	

Tidal observation data must be loaded for every track line before the Merge process can be executed. Tide data is used to generate final depths relative to the tide datum by subtracting the tide from the sounding depth.

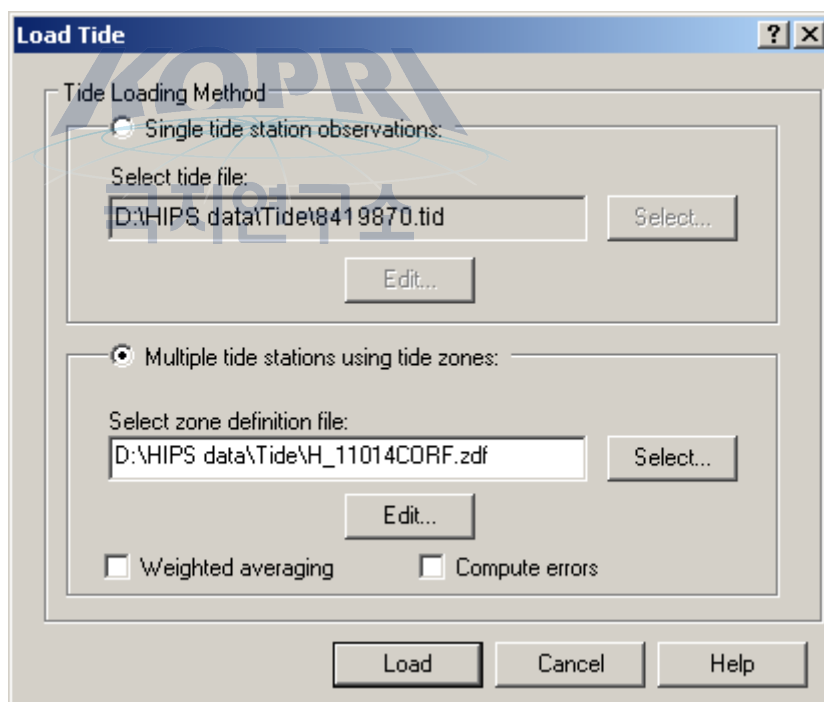
There are two options for tide loading:

- load a *.tid file to apply tide observations from a *single* station. (For information on these files, see “TIDE FILES” ON PAGE 178.)
- load a *.zdf file to apply tide observations from *multiple* tide stations to a tide zone. (For information on these files, see “TIDE ZONE FILES” ON PAGE 178.)

To apply tide observation data to selected HIPS track lines,

1. Select the track line(s).
2. Select the Load Tide command.

The Load Tide dialog box is displayed.



Select tide files

To use a tide file of observations from a single tide station for loading into the currently selected lines,

1. Choose the *Single Tide Station Observations* option.
2. Click **Select...** to choose a tide (.tid) file.

The Open Tide File dialog box is displayed.

3. Select a tide file or type the file path and name in the field.

4. Click **Open**.

The tide file name is displayed in the Select Tide File field.

5. [Optional] To revise the tide file, click **Edit** to open the Tide Editor.

6. Click **Load** to associate the file with the selected track line(s).

Select tide zone files

This option is available with or without weighted averaging from multiple tide stations. To apply a tide zone file to the currently selected lines,

1. Choose the *Multiple Tide Stations Using Tide Zones* option.
2. To select a tide zone (.zdf) file, click **Select ...**

The Load Zone Definition File dialog box is displayed.

3. Select a tide file or type the file path in the field.
4. Click **Open**.

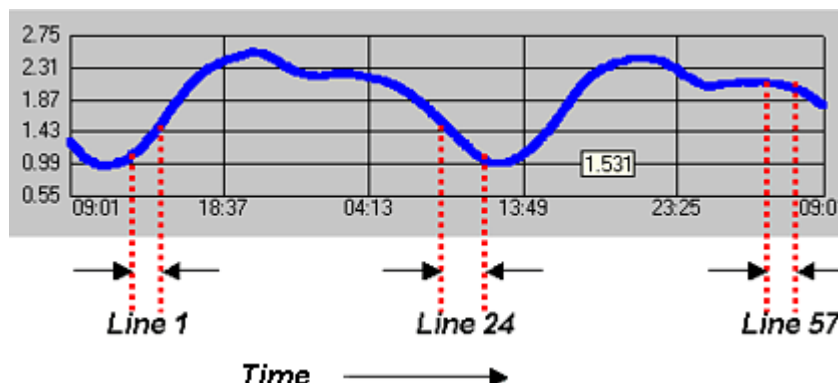
The tide zone file is displayed in the Select Zone Definition File field.

5. Select the *Weighted Averaging* check box to apply this option.
(see "[TIDE STATIONS AND WEIGHTED AVERAGE](#)" ON PAGE 179). If the selected doesn't contain any averaging options, this option is not available
6. Select the *Compute Errors* check box to apply the uncertainty value in the tide zone file. This value is used to create a tide zone uncertainty. If there are no error parameters in the file, this option is not available.
7. Click **Load**.

The tidal observation is loaded into the selected track lines using the tide zone definition file.

Tide Files

When tide observations from a *single* station are applied to a track line or lines, the time extent of the line(s) is used. The illustration below shows the tide values from a single station that would be applied to three selected lines, based on the time each line was recorded.



Tide data from a single station is loaded from files with the extension *.tid. These files can be created or edited in a text editor (such as Notepad), or with the Tide Editor.

HIPS supports a standard Canadian Hydrographic Service tide format called COWLIS as well as two NOS/NOAA formats. HIPS also supports a basic format consisting of just the required date, time, and tide values.

Track lines in areas without water level changes, such as rivers or lakes, must also have a tide file. In this case, or if tidal data cannot be obtained, a “zero tide” file—where all tide/time values are zero—is used so merging can proceed.

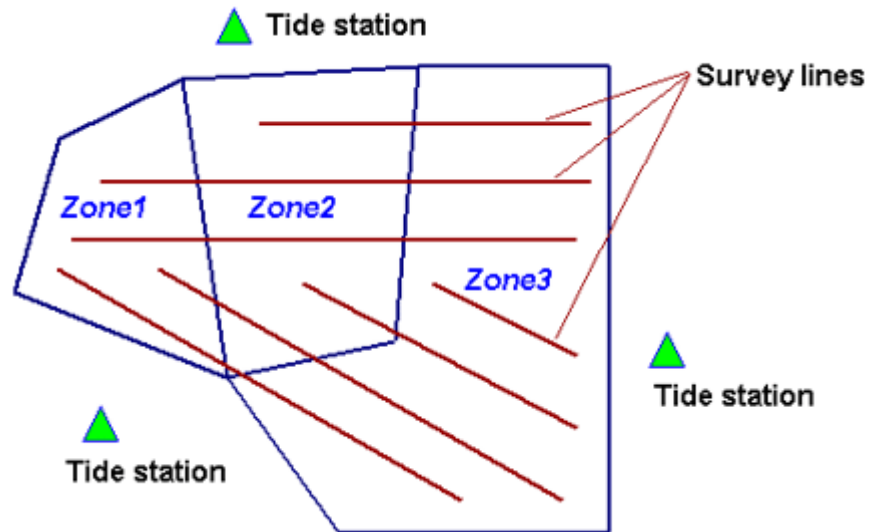
All tide files, including zerotide.tid, are located by default in...\Hips\ver\Tide.

For more detail, see “TIDE FILE FORMATS” ON PAGE 733.

Tide Zone Files

When tide observations from *multiple* tide stations are applied to a line or lines, tide zones are used.

Where a survey line falls within two or more tide zones, the tide data to be loaded for each part of a line is determined by the zone in which that part of the line falls (as illustrated below).



The tide data file must span the entire time frame of the track line. The time zone of the tidal observation data must match the time zone of the survey data to which it will be applied.

The output from the Load Tide function (see “[LOAD TIDE](#)” ON [PAGE 176](#)) attaches a binary HIPS tide-time series to each track line.

The tide zone option assigns tide observations to track lines from multiple tide stations based on the time period in defined geographic zones.

Each tide zone is defined by a closed polygon with tide, time and range corrections for a primary station, plus up to three backup secondary tide stations.

HIPS uses a Zone Definition File (with the extension .zdf) for defining tide zone data. This is an ASCII file and can be prepared with any text editor.

For complete description of the ZDF format, see “[TIDE ZONE DEFINITION FILES](#)” ON [PAGE 738](#).

Display tide zones

Menu	View > Display Tide Zones

Tide zones and station locations can be displayed. To view an outline of tide zones:

1. Select the Display Tide Zones command.

The Open Tide Zone Definition File dialog box is displayed.

2. Select a tide zone file, or type the file name and path in the *File Name* field.
3. Click **Open**.

The outlines of the tide zones, and their labels, are drawn in the Display window. The Tide Zones layer is listed in the Session tab of the Control window.

Tide stations and weighted average

When an average tide is calculated from multiple tide stations, the weight given to a tide station’s data is inversely proportional

to its distance from the vessel at that time. In other words—the further a station is from the survey line, the less weight is accorded to the data from that station.

Tide Editor

The Tide Editor presents tide file information in both graphical and tabular formats. You can use the editor to edit an existing file or to create a new tide file to apply to survey lines before the Merge process.

The Tide Editor is a separate application that launched from the HIPS and SIPS interface.

For more information on how to use the Tide Editor, see “[EDITING TIDE DATA](#)” ON PAGE 552 or the help file available in that application.

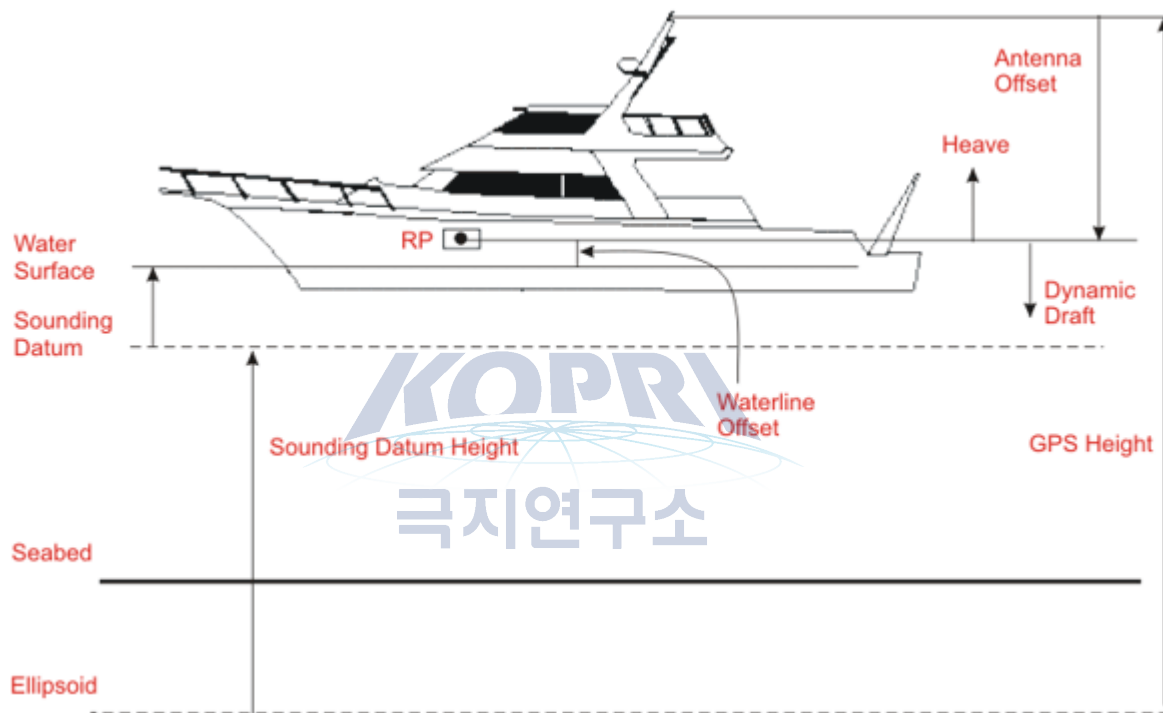


GPS Tide

The Compute GPS (Global Positioning System) Tide function provides an alternative to normal tidal observation for reducing soundings to the sounding datum

It is based on the recorded GPS ellipsoid height of the navigation antenna and uses the recorded vessel motion, if available, to reduce the ellipsoid height measurements to water level.

The following image demonstrates how GPS tide is calculated. The arrows indicate the positive sense of the values.



The full formula for GPS tide is:

$$\text{GPS Tide} = \text{GPS Height} - \text{Datum Height} + \text{Antenna Offset} - \text{Heave} + \text{Dynamic Draft} - \text{Waterline Offset}$$

The above diagram and equation show the complete formula for GPS tide where GPS Height needs to be motion corrected. However, in some systems, GPS Height may already be motion corrected. Applying sensor values (such as dynamic heave) again will only distort the final GPS Tide. The Compute GPS Tide command lets you include or omit selected sensor values.

There are two options for applying the sounding datum height(s) (distance from the ellipsoid to the sounding datum) to the track line.

- apply a single height to a track line, or
- apply a binary or ASCII text file containing a grid of sounding datum heights.

Two binary sounding datum models can be used for computation of GPS tide:

- GEOID99
- EGG97 (European Gravimetric Geoid 1997)

Alternatively, an ASCII sounding datum model can also be used. The data must be in the following format: Lat,Long,Z. Values are delimited using a comma.

An example of the file is shown below.

```
-33.848326,151.192435,20.4
-33.849484,151.192370,20.1
-33.849237,151.193173,19.7
-33.849506,151.194227,19.8
-33.848298,151.193916,20.0
-33.848402,151.193149,20.2
```

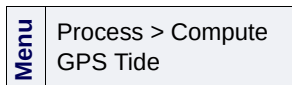
ASCII datum model files must follow a specific format:

- Latitude and longitude must be in decimal degrees.
- The hyphen symbol (-) must be used to designate coordinates in the Southern or Western hemispheres.
- All files must be saved with a TXT or XYZ file extension.

To compute GPS tide, complete the following steps:

1. Select a track line or group of track lines.
2. Select the Compute GPS Tide command.

The Compute GPS Tide dialog box is displayed.



Compute GPS Tide

Sounding Datum

☒ Single Height 0.000 m

☐ Model file: Browse...

Options

☐ Smooth height

☒ Apply Dynamic Heave

☒ Apply MRU Remote Heave

☒ Apply Antenna Offset

☒ Apply Dynamic Draft

☒ Apply Waterline Offset ☐ From Installation XML if available.

☐ Apply Height Correction

Offset: 0.000 m

Compute Cancel Help

3. Enter the *Sounding datum height* to apply a single height to a track line.
4. To apply a file containing a grid of sounding datum heights, type the path and name for the *Sounding Datum Model* file, or click **Browse** to select a file.
5. Select the *Smooth Height* check box to apply smoothed GPS heights to the track line (see "SMOOTH DATA" ON PAGE 192).

The following check boxes apply sensor values to GPS tide if GPS Height needs to be motion corrected.

6. Select *Apply Dynamic Heave* to apply dynamic heave (regular vessel heave, or true heave if exists).
7. Select *Apply MRU Remove Heave* to apply remote heave resulting from vessel roll/pitch on an offset mounted MRU.
8. Select *Apply Antenna Offset* to apply vertical offsets as a result of rotating GPS antenna by vessel roll/pitch.
9. Select *Apply Dynamic Draft* to apply dynamic draft (as a result of interpolating the draft table in HVF, or stored in HIPS as time series data).
10. Select *Apply Waterline Offset* to apply the waterline offset in the HIPS Vessel File (HVF).
11. Select *Apply Height Correction* to apply a static offset to the GPS antenna and type the value in the *Offset* field.
12. Select *From Installation XML* to apply the waterline value from the InstallationParameters.xml generated by the Simrad converter.
13. Click **Compute**.

The GPS Tide is calculated for the selected line(s). The settings in the dialog box are remembered by the application.

You can open and view the GPS tide data in the Attitude Editor (["ATTITUDE EDITOR" ON PAGE 185](#)).



9

Merge

The Merge process converts along-track/across-track depths into latitude, longitude, and depth by combining the ship navigation with the horizontal and vertical offsets from the HIPS vessel file. This produces geographically referenced sounding position and depth.

In this chapter...

“MERGE PROCESS” ON PAGE 186

“APPLY MERGE” ON PAGE 187

“DELTA DRAFT” ON PAGE 189

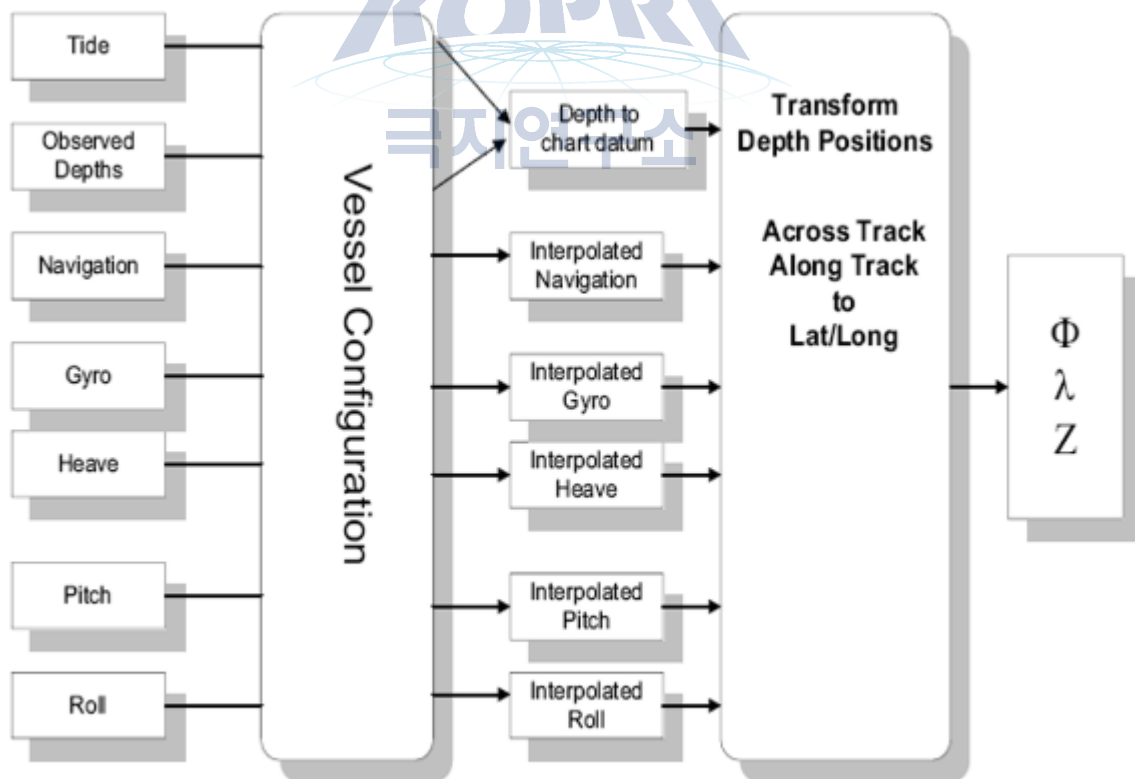
Merge Process

Once Sound Velocity Correction has been applied, (see “[SOUND VELOCITY CORRECTION](#)” ON PAGE 171) the final sounding depth and geographical position need to be calculated. This is done with the Merge process.

Tracklines must be Merged before BASE surfaces can be created and before surface cleaning can be performed.

Merge takes into consideration the following:

- Observed depth
- Navigation
- Gyro
- Tide or GPS tide
- pertinent vessel configuration offsets
- Delta draft
- Refraction coefficients
- Dynamic draft
- Smoothed sensor data
- Waterline (if not applied in the SVC process)
- Motion data: Heave, Pitch, and Roll (if not applied in the SVC process)



The following operations take place when merging:

- Recorded sensor information is compensated for constant time errors as noted in the vessel file.
- For each time-tagged depth record, the position for the centre of the swath profile is calculated based on the interpolated position fix at that time.
- For each depth record, the position of the sounding is calculated, based on the profile centre position and any gyro/heave/pitch/roll corrections that are appropriate (this is echo sounder system dependent).
- Tide is interpolated and applied to each depth record.
- Draft is applied.

A processed depths file is created for each line. This file contains the final computed geographic position for each depth record.

Apply Merge

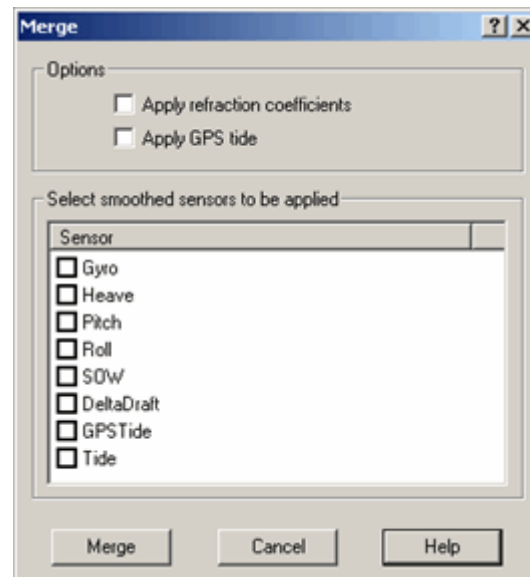
Lines must have tide loaded before they can be merged.

To apply Merge :

1. Select a line or group of lines.
2. Select the Merge command from the Process menu or toolbar.

The Merge dialog box is displayed.

Menu	Process > Merge
Tool	



3. Click the *Apply refraction coefficients* check box to apply any data created in Refraction Editor. (See [“THE REFRACTION EDITOR” ON PAGE 326](#))
4. Click the *Apply GPS tide* check box to use GPS tide data instead of tidal observation data.

If you have a SmoothedCoefficients file (see “SMOOTH DATA” ON PAGE 613) for a sensor, you can apply this file during merge to smooth selected sensor data.

5. Click the check box beside a sensor to select the appropriate data that is to be smoothed during Merge.
6. Click **Merge**.

You can view the progress of the Merge process in the Output tab of the Worksheet window.

The Merge is now complete. Other functions requiring georeferenced soundings can now be used such as the Subset Editor, Surface Cleaning, BASE Surface and others. The settings in the dialog box are remembered by the application.

If a line is merged and then changes are made to the sensor data used by merge, the track line is marked as Outdated. An Outdated track line must be remerged.



Delta Draft

The Load Delta Draft function lets you import your model for dynamic changes in draft and have these changes applied to the soundings during the Merge process. Delta Draft represents a change in draft that is positive as draft increases and negative as draft decreases. The data, which is loaded from a ASCII text file, overrides the Dynamic Draft information in the vessel file. The Delta Draft value is interpolated between timestamps in Merge and added to the Observed Depth to obtain the Final Depth.

The input format for the Delta Draft text file is similar to the COWLIS tide format. Each record is in the following format:

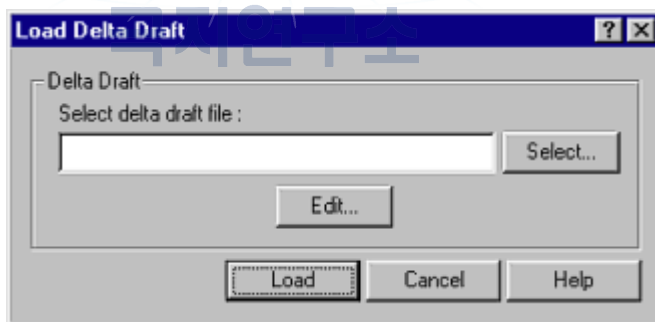
```
YYYY/MM/DD HH:MM:SS.SSS 1.234
```

The Delta Draft function can also be used to load recorded depth versus time data for an underwater platform on which the multibeam sonar is mounted, such as a ROV (Remote Operated Vehicle) or AUV (Autonomous Underwater Vehicle), or towed vehicle.

1. Select the track line(s).
2. Select the Load Delta Draft command.

The Load Delta Draft dialog box is displayed.

Menu	Process > Load Delta Draft
Tool	



3. Type the path of the file or click **Select** to locate the file.
4. To make changes to the file, click **Edit**.

The file is opened in the default text editor (such as Notepad). Make any changes and save the file.

5. Click **Load**.

The delta draft is loaded into the line folder.



10

Compute TPU

Total Propagated Uncertainty (TPU) is used to assign a horizontal error estimate (HzTPU) and a depth error estimate (DpTPU) to each sounding.

In this chapter... 극지연구소

“TOTAL PROPAGATED UNCERTAINTY” ON PAGE 200

“COMPUTE TPU” ON PAGE 201

“TPU FILTERING” ON PAGE 202

“LOAD ERROR DATA” ON PAGE 205

Total Propagated Uncertainty

Total Propagated Uncertainty (TPU) is essential for the following functions:

- creating S-44 or S-57 compliant datasets (see “TPU FILTERING” ON PAGE 202)
- calculating Bathymetry Associated with Statistical Error (BASE) Surfaces weighted by uncertainty (see “UNCERTAINTY WEIGHT” ON PAGE 224)

TPU is derived from a combination of all individual error sources. The following errors (among others) contribute to TPU:

- nav/gyro/heave/pitch/roll/tide errors
- latency error estimate
- sensor offset error estimates
- individual sonar model characteristics

Error values are located in the vessel file for the survey and the DeviceModels.xml file in ...\\HIPS\\System. Other errors are directly entered in the Compute TPU dialog box.

The following sonar error-models in the DeviceModels.xml have been tested by the University of New Hampshire (UNH).

- Simrad EM300
- Simrad EM1000
- Simrad EM1002
- Simrad EM3000
- Simrad EM3000D
- Reson SeaBat 8101
- Reson SeaBat 9001
- Reson SeaBat 9003
- Reson SeaBat 8125
- Atlas Hydrosweep DS
- Elac Nautik 1180
- Seabeam 2112

Other sonars listed in the file may make assumptions that could produce less rigorous results than the error models supplied by UNH.

Compute TPU

The Compute TPU (Total Propagated Uncertainty) command applies HzTPU and DpTPU values to each sounding along the track line.

The HzTPU and DpTPU values are stored line-by-line with indexing to profiles and beams. You can find specific error values for individual soundings by querying the soundings in the Swath, Single Beam, and Subset Editors. The HzTPU and DpTPU values are displayed in the Query View.

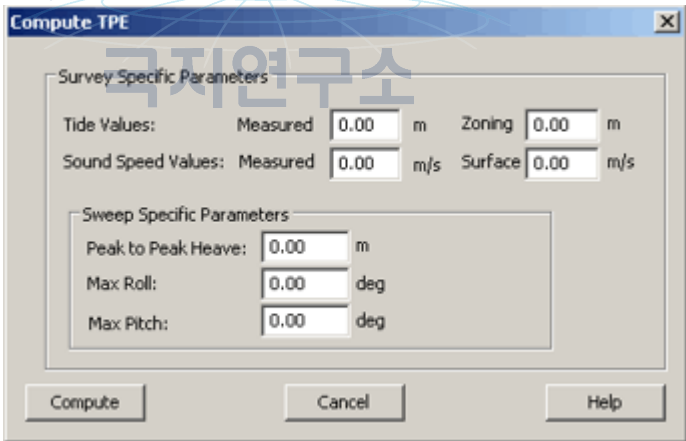
Static errors (such as those related to sensor position) that are used to compute the TPU are read directly from the project's vessel file and the DeviceModels.xml file. These errors are directly entered in the TPU computation.

Dynamic errors due to tide and sound velocity values, which can change from time to time, due to a variety of reasons, are entered via the dialogue box, to make it easy for the user to change them.

1. Select a track line in the Display window so it is highlighted.
2. Select the Compute TPU command.

The Compute TPU dialog box is displayed.

Menu	Process > Compute TPE
Tool	



3. In the *Tide Values* fields, enter the error offsets to be applied to all lines being processed.
 - The *Measured* offset is the error value for the tide station.
 - The *Zoning* offset is the error value in range calculation for a tide zone file.
4. Enter error offsets for *Sound Speed Values*.
 - The *Measured* offset value is to compensate for inaccuracies in SVP measurements.
 - The *Surface* offset value is used to account for errors in surface sound speed measurements.

Transducer motion offsets for sweep surveys are entered in the following three fields.

5. Type the estimated observed heave offset in the *Peak-to-Peak Heave* field.
6. Type the roll values for the transducers in the *Max Roll* field.
7. Type the pitch values for the transducers in the *Max Pitch* field.
8. Click **Compute**.

The results are displayed in the Output tab of the Worksheet window. A log file is also created showing the results.

The Compute TPU function must be performed after the Sound Velocity correction. Whether it is applied before or after Merge will depend on your adopted workflow. When you compute TPU it will always be done on the Observed depths, therefore tide and draught offsets will not affect the values.

You should update TPU if the observed depths have been modified.

TPU Filtering

The TPU filtering option rejects (or accepts) soundings with uncertainty values that fall outside limits set by International Hydrographic Organization (IHO) standards.

For other automated filters, see “[ATTITUDE FILTER](#)” ON PAGE 284, “[SWATH FILTERING](#)” ON PAGE 322, “[SINGLE BEAM FILTERING](#)” ON PAGE 472, and “[FILTER CRITICAL SOUNDINGS](#)” ON PAGE 297.)

These parameters can be saved in a HIPS Filter File (.hff) that can be reopened for use on another track line.

1. Select a track line.
2. Select the Set Filters command.

The Zoom To tab of the Set Filters dialog box is displayed.

Menu	Tools > Set Filters
Tool	

Set Filters

Load filter file:

Critical **TPU** **Swath/Sweep** **Single Beam** **Altitude**

Logic
☒ **Reject** ☐ **Accept**

☒ **IHO**

Standard
☒ **IHO S-44**
☐ **IHO S-57 CATZOC**

☐ **Depth Limit**
 Minimum: m
 Maximum: m

	a (m)	b	Horizontal m	%
☒ Special Order	0.250	0.008	2.000	0
☐ Order 1	0.500	0.013	5.000	5.000
☐ Order 2	1.000	0.023	20.000	5.000
☐ Order 3	1.000	0.023	150.000	5.000
☐ User defined	0.250	0.008	2.000	0

3. Select the TPU tab.
4. [Optional] Select an existing HIPS Filter File from the list or click **Browse** to select a file.

If you load a filter file, all the values used in that file are shown in the fields. You can change any of the values.

5. Select either a *Reject* or *Accept* logic command to apply to the filtered data.
6. Complete all data in the necessary fields (see below).
7. Click **Close**, or click **Clear** to remove data from the fields.
8. Click **Save As** to save the settings to a filter file.
9. Apply the filters to the data.

The filter compares each sounding's HzTPU and DpTPU values against the depth and horizontal error limits for a specific S-44 survey order or S-57 zone of confidence (CATZOC) attribute. All soundings with HzTPU and DpTPU values outside those limits are rejected (or accepted).

When you select an S-44 or S-57 CATZOC standard, the dialog box is refreshed to display the options associated with that standard. The options for the IHO S-44 survey orders and S-57 CATZOC attribute are shown below.

IHO Configuration Window (Top Screenshot):

☒ IHO

Standard: ☒ IHO S-44 ☐ IHO S-57 CATZOC

☐ Depth Limit
 Minimum: m
 Maximum: m

	Depth		Horizontal	
	a (m)	b	m	%
☒ Special order	0.25	0.0075	2	0
☐ Order 1	0.5	0.013	5	5
☐ Order 2	1	0.023	20	5
☐ Order 3	1	0.023	150	5
☐ User defined	0.25	0.0075	2	0

IHO Configuration Window (Bottom Screenshot):

☒ IHO

Standard: ☐ IHO S-44 ☒ IHO S-57 CATZOC

☐ Depth Limit
 Minimum: m
 Maximum: m

	Depth		Horizontal
	a (m)	b	m
☒ A1	0.5	1	5
☐ A2	1	2	20
☐ B	1	2	50
☐ C	2	5	500
☐ User defined	0.25	0.0075	2

Each survey order or zone of confidence contains the following fields:

- *a*: constant depth error (i.e. the sum of all constant errors)
- *b*: factor of the depth dependent error
- *m*: position limit for horizontal errors
- %: percentage of depth used to calculate horizontal error (S-44 only).

Depth error limit

To calculate the error limits for depth accuracy, the constant depth error (*a*) and the factor of the depth dependent error (*b*) are combined with depth (*d*) and the depth dependent error (*b* * *d*) in the following formula:

$$\text{Error limit for depth accuracy} = \pm \sqrt{a^2 + (b \times d)^2}$$

When the filter is run, soundings with a vertical uncertainty outside the error limit for the survey order or zone of confidence are rejected (or accepted).

Horizontal error limit

To calculate horizontal accuracy, the limit for horizontal error (m) and (if applicable) the depth percentage (%) for the selected survey order or zone of confidence are compared against

a sounding's HzTPU. Soundings with a horizontal uncertainty outside the limits are rejected (or accepted).

Run Filter

1. Select either the *ISO 2-44* or *S-57 CATZOC* options.

The IHO frame of the TPU tab is refreshed to display the S-44 survey order options or the zones of confidence (see above).

You can apply filtering to a selected depth range by entering the maximum and minimum soundings for that range. Leave these fields empty to apply filtering to every sounding along the track line.

2. Select the *Depth Limit* check box to apply the filters to a depth range.
3. Type depth levels in the *Minimum* and *Maximum* fields to set a range for the filters.
4. Select a survey order or zone of confidence option.

All fields in the *User defined* option are activated when this option is selected.

5. Type *Depth* and *Horizontal* values.
6. Run one of the Filtering commands.

Menu	Tools > Apply Filters > Selected Lines/All Lines
Tool	 



Load Error Data

Override error values in the HIPS Vessel File with real-time error values.

Applanix POS MV files and Applanix POSProc files contain real-time attitude and navigation error values recorded during the survey. This means that different error values are recorded for different conditions. This results in more precise error estimates than the static error values recorded in the HIPS Vessel File.

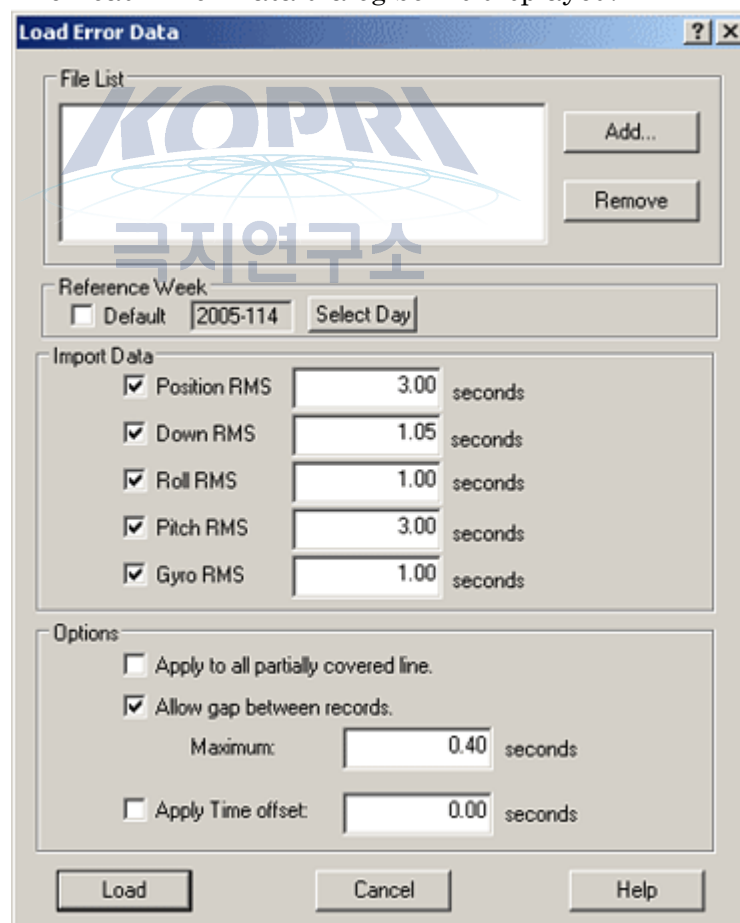
The files must be timestamped with valid GPS entries to determine the time of the data.

The imported files must contain the Julian date of the day the data was acquired in the form: YYYY-JJJ-filename or filename YYYY-JJJ

1. Select a track line in the Display window.
2. Select the Load Error Data command.

The Load Error Data dialog box is displayed.

Menu	Process > Load Error Data



3. Click **Add** to select files. You can load either POS MV files OR load POSProc files, but not both at the same time.

Reference Week	4. To remove a file from the <i>File List</i> field, select the file and click Remove .
Import Data	5. [Optional] To accommodate a GPS week rollover event, you can select the Julian date of the day the data files were created. The rollover cannot span more than 7 days.
Options	6. Choose which error records in the Applanix files you want to import into the line by clicking on the appropriate check boxes.
	7. To reduce the volume of large attitude records to a manageable level, enter an output interval (in seconds).
	8. The <i>Apply to all partially covered line</i> option will load the error data even if the data does not cover the entire line.
	9. Select the <i>Allow gap between records</i> check box to limit the interval allowed between consecutive data records in the file. If an interval exceeds the amount specified in the <i>Maximum</i> field, the data will not be loaded and the process will stop.
	10. If the time stamp does not match the time stamps in the project, you can select the <i>Apply Time offset</i> option and enter a time value (in seconds).
	11. Click Load .



11

Create Field Sheets

Field sheets in HIPS and SIPS are used to organize data products created from cleaned and processed bathymetry and side scan data.

In this chapter... 극지연구소

“CREATE A FIELD SHEET” ON PAGE 210

“OPEN AND CLOSE FIELD SHEETS” ON PAGE 213

“SET FIELD SHEET PROPERTIES” ON PAGE 215

“FIELD SHEET PROJECTION GRID” ON PAGE 216

Create a Field Sheet

Field sheets have a role in almost every process in HIPS and SIPS. They are essential for the creation of BASE surfaces. They are used to:

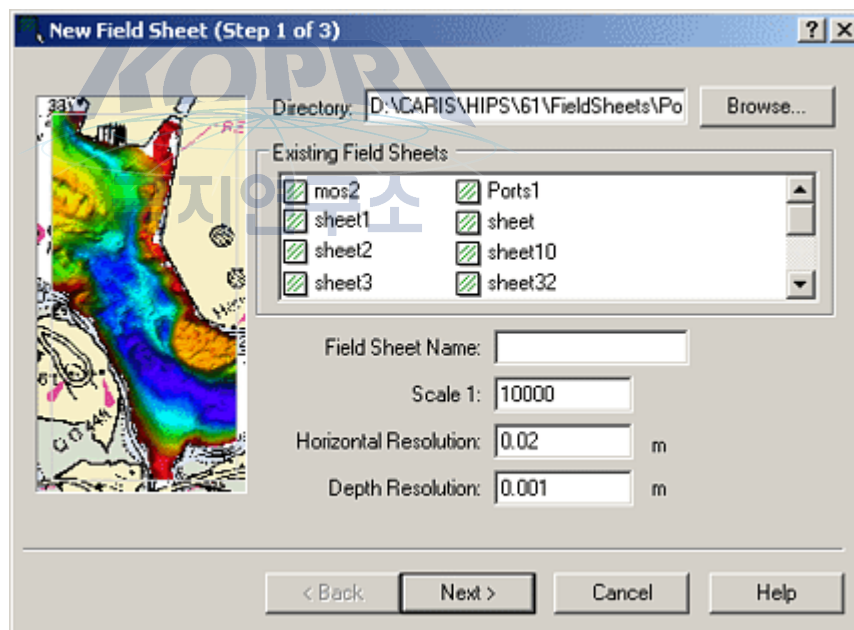
- create BASE surfaces. (“[CREATE BASE SURFACE](#)” ON [PAGE 226](#))
- create a layer of contours from a BASE surface or a layer of tiles. (“[CONTOURS](#)” ON [PAGE 348](#))
- create a layer of tiled soundings.
- generate a profile from a BASE surface.
- create a mosaic from side scan data.
- select soundings from a layer of tiles. (“[SOUNDING SELECTION](#)” ON [PAGE 359](#))

Menu	Process > New Field Sheet

To define an area for a new field sheet:

1. Select the new New Field Sheet command.

The New Field Sheet Step 1 dialog box is displayed.



2. Type a name for the field sheet in the *Name* text box. Names should be alphanumeric characters only and cannot contain any spaces.
3. Define the scale of the field sheet.

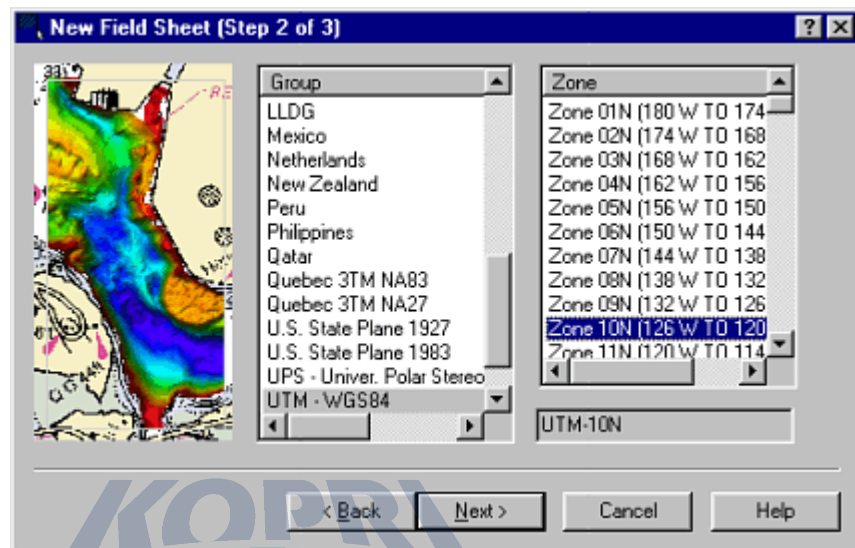
The *Horizontal Resolution* field sets the minimum distance between two adjacent coordinate values in the field sheet. The first time you create a field sheet this field will contain the default value of 0.020 (the minimum allowable resolution for S-57). You can reset this field to default to a different value.

4. Type a new value in the *Horizontal Resolution* field, if needed.

The *Depth Resolution* sets the minimum distance between two adjacent depth values. The *Depth Resolution* field contains a default value of 0.0010 (default resolution used in CARIS maps for heights/depths). Type a new value in the *Depth Resolution* field, if needed.

5. Click **Next**.

The New Field Sheet Step 2 dialog box is displayed.



This dialog box lists projections available to display your field sheet data. These are based on the coordinate systems and ellipsoid parameters as defined in the editable text file `..\Hips\System\mapdef.dat`.

6. Select a projection from the *Group* column.

The pre-defined projections specific to that projection system are listed in the *Zone* column.

7. Select a projection from the *Zone* column.

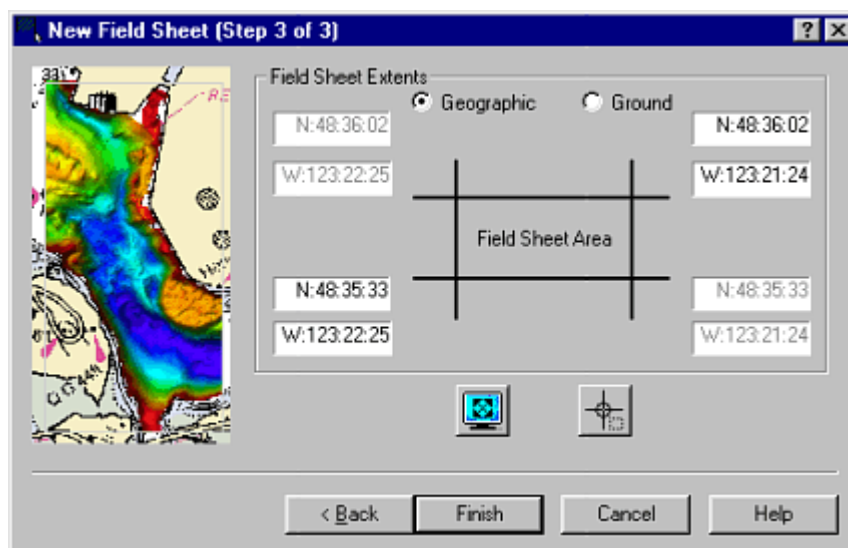
8. Click **Next**.

The New Field Sheet Step 3 dialog box is displayed.

9. Select either the *Geographic* or *Ground* coordinates option.

10. Define the field sheet extents by one of three methods:

- use the current extents of the Display window, or
- use the mouse to create a box defining the extents, or
- enter the geographic or ground coordinates.



Use current extents

1. Zoom in on the area you want to include field sheet so that it fills the Display window.
2. Click the Display Window Extents button.



OR

Draw a bounding box

1. Click the Bounding Box button.



The cursor in the Display window is shown as a cross-hair.

Press and hold the mouse button, and drag the cursor across the area where you want to create the field sheet.

A rectangular box is drawn across the area where the cursor was dragged.

- If you want to move the bounding box, position the cursor inside the box so it becomes a four-headed arrow. Press and hold the mouse button, and then drag the box to a new location.
- If you want to resize the bounding box, position the cursor on any of the box handles so the cursor becomes a two-headed arrow. Press and hold the mouse button and drag the handle to resize the box.

OR

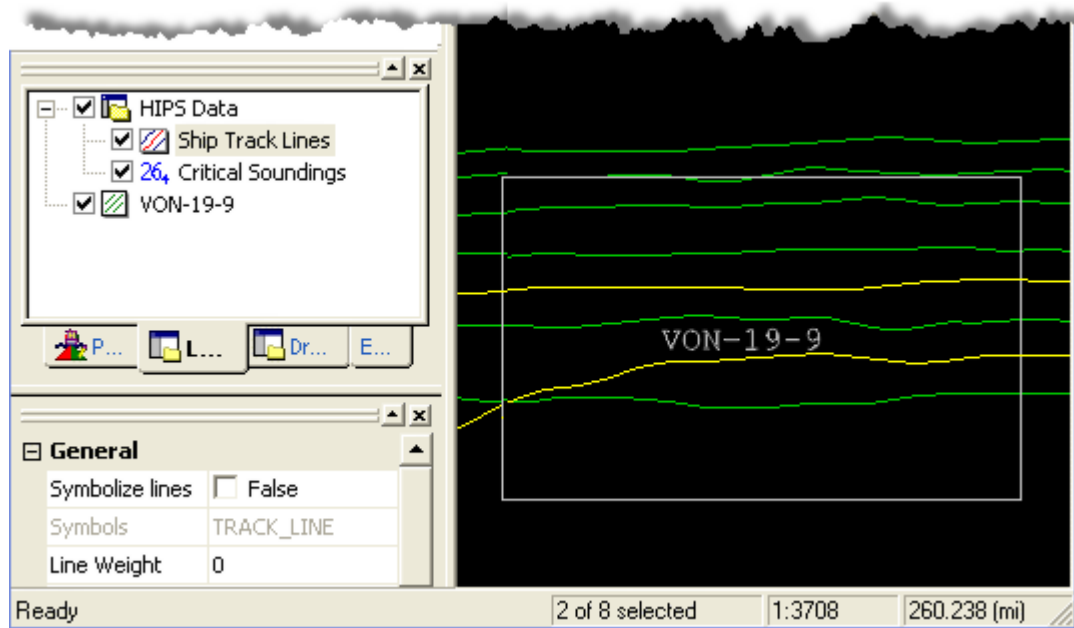
Enter coordinates

1. Enter the northeast and southwest extents by clicking in one of the appropriate fields and typing the information, or by using the arrow keys to toggle the values into the entry fields.

After the area for the field sheet has been defined,

11. Click **Finish** to create the field sheet.

The new field sheet is outlined in the Display window.



The new field sheet data and files are located, by default, in
 ..\Hips\Fieldsheets\ProjectName\FieldSheetName.



Open and Close Field Sheets

Open a field sheet in a project or session.

NOTE: Opening a session file automatically opens all field sheets that were open when the session file was last saved.

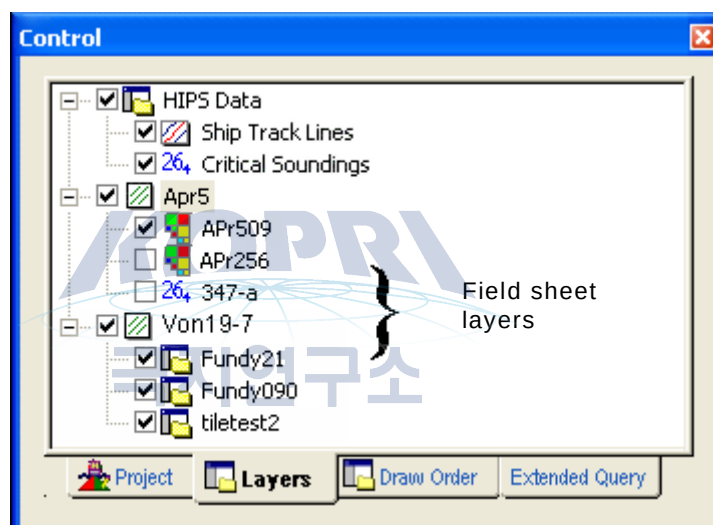
Menu	File > Open Field Sheets

1. Select the Open Field Sheets command.

The Open Field Sheets dialog box is displayed.

2. Select a field sheet from the list of available field sheets.
3. Click **Open**.

The field sheet outline is displayed in the Display window. The field sheet file tree is displayed in the Layers tab of the Control window.



Field sheet layers (for example, contours, soundings values or text), can be displayed by expanding the field sheet file tree and selecting a layer check box (you may have to select the Refresh command to view the data).

Set as active field sheet

Menu	Process > Set as Active Field Sheet
Pop-up	Set as Active Field Sheet

It is possible to create field sheets with different coordinate systems and to have them open in the same session. But only one field sheet can control the coordinate system used in the Display window.

The Set as Active Field Sheet function identifies the field sheet that controls the coordinate system in the Display window.

1. Select a field sheet file in the Control window and select the Set as Active Field Sheet command.

The field sheet is highlighted.

Turn off field sheet

Individual layers in a field sheet can be activated or turned off by clicking the check box next to the layer. To make it easier to view data when there are many layers, or when more than one field sheet is open, you can turn off an entire field sheet with one command.

To remove a field sheet from the display without closing it:

1. Highlight the field sheet in the Layers tab.
2. Select Turn Off Field Sheet from the right-click menu.

All the previously selected layers of the field sheet are de-selected. To display the field sheet or any of its layers again, select the check box beside the layer.

To remove all the attribute layers of a surface (e.g., a BASE surface) in the field sheet, while continuing to display the field sheet:

1. Highlight the surface in the Layers tab.
2. Select Turn Off Layers from the right-click menu.

The selected surface and all its attribute layers are no longer visible in the Display window.

Delete field sheet

Pop-up	Delete

1. Select the field sheet by name in the Layers tab.
2. Select Delete from the right-click menu.

The field sheet is permanently removed and does not go to the Recycle bin.

Close all field sheets

Menu	File > Close Field Sheets

1. Select a field sheet from the Field Sheets tab in the Control window.
2. Select the Close Field Sheets command.

The field sheet outline is removed from the Display window and the file name is no longer displayed in the Control window.

Close single field sheet

Pop-up	Close

1. Select a field sheet file in the Control window.
2. Right-click the mouse and select the Close command from the pop-up menu.

The field sheet is no longer open in the interface.

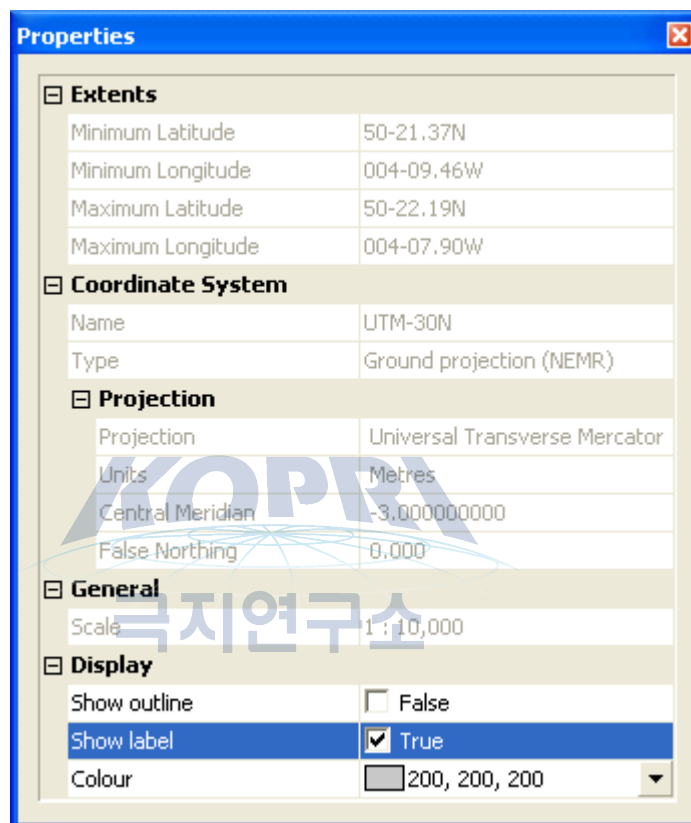
Set Field Sheet Properties

Menu	Window > Properties
Tools	
Pop-up	Properties

To set the display properties of a field sheet:

1. Select a field sheet layer in the Layers tab of the Control window.
2. If the Properties window is not open, select the Properties window command.

The Properties window for field sheets is displayed.



Properties

Extents

Minimum Latitude	50-21.37N
Minimum Longitude	004-09.46W
Maximum Latitude	50-22.19N
Maximum Longitude	004-07.90W

Coordinate System

Name	UTM-30N
Type	Ground projection (NEMR)

Projection

Projection	Universal Transverse Mercator
Units	Metres
Central Meridian	-3.000000000
False Northing	0.000

General

Scale	1 : 10,000

Display

Show outline	☐ False
Show label	☒ True
Colour	200, 200, 200

The *Extents*, *Coordinate System*, *Projection* and *Scale* fields are read-only and cannot be modified. You can modify the following properties:

3. Set the *Show outline* check box to “True” to display a border around the field sheet area.
4. Set the *Show label* check box to “True” to display the name of the field sheet in the Display window.
5. Select a border *Colour* from the colour picker, or, create a custom colour from the standard Windows Colour Palette.

Field Sheet Projection Grid

The Projection Grid feature lets you display a grid of ground projection coordinates onto a field sheet. The grid will cover the field sheet area to its extents. (To display a grid over the extents of your project, see “[PROJECTED GRID](#)” ON PAGE 666.)

The grid has grid line properties such as thickness, shape and colour. You can also annotate the grid with the coordinates of your field sheet data, and set the look and positioning of these annotations. These settings for the grid are saved with the field sheet.

Menu	Process > Products > Projection Grid

1. Select a field sheet in the Layers tab.
2. Select the Projection Grid command.

The Grid Properties dialog box is displayed.

Grid Properties

Grid Lines | Annotations

Corners

	Lower Left	Upper Right
North:	5579230.24	5579622.16
East:	418273.43	418868.69

Spacing

☐ Synchronize

North	39
East	60

Line Attributes

Colour:

Weight: 0

Type

☐ Ticks and Crosses ☒ Full

☐ Ticks

Length	1.00	Alignment Outside
Offset (mm)	0.00	

☐ Crosses

Length	1.00

OK Cancel Apply Help

3. Set the options for positioning and style of grid lines as described in the table below.
4. Click **Apply** if you want to set annotations. Click **OK** to apply the gridline settings and close the dialog box.

Property		Description
Corners		The lower left and upper right corners of the rectangular field sheet determine the corners of the grid.
	Lower Left	The latitude (North) and longitude (East) coordinates of the lower left corner of the field sheet.
	Upper Right	The latitude (North) and longitude (East) coordinates of the upper right corner of the field sheet.
Spacing		The spacing of the gridlines is calculated by adding the spacing values to the 0,0 position until the grid fills the area defined by the corners.
	Synchronize	If you wish the spacing values to be the same, enable Synchronize.
	North	Set the latitude interval (North)
	East	Set the longitude interval (East).
Line Attributes		Set a colour and line weight for the grid lines.
	Colour	Click on the Colour button and select a colour from the drop-down list.
	Weight	Units are millimetres at display scale.
Type		Select the type of grid.
	Full	The grid will be formed of solid lines.
	Ticks and Crosses	The grid will be formed of ticks and/or crosses. If you enable Ticks, you can set the following options: • Length (length of the markings in mm at display scale) • Offset • Alignment If you enable Crosses, you can set the following option: • Length (the dimensions of the crosses)

- Click the Annotations tab to set position and format of annotations for the grid.
- The Annotations tab is displayed.

Grid Properties

Grid Lines Annotations

☒ Top ☒ Bottom ☒ Right ☒ Left

Position Attributes

7,654,321.123

Digits

☒ Thousand Separator

Left 7

Right 3

Format

Font ...

☐ Superscript

☒ Normal

☐ Subscript

Position

Position to neatline Inside

Offset from neatline (mm) 6.75

Position to Grid Centre

Offset from gridline (mm) 0.00

Orientation to grid Parallel

OK Cancel Apply Help

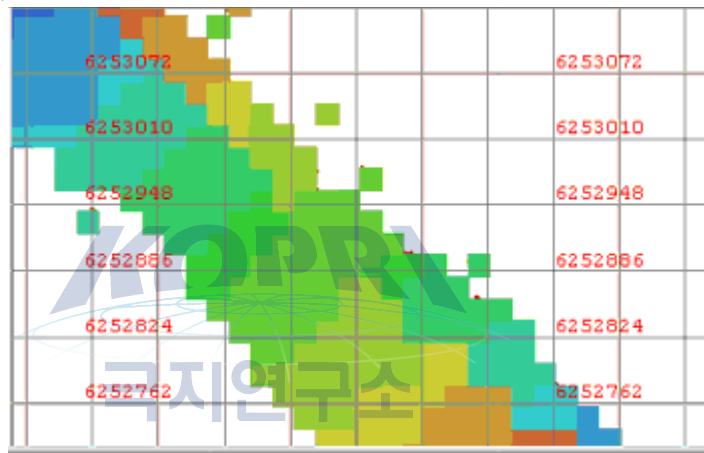
7. Use the following table to complete the fields in the Annotations tab.

Property	Description
Position Attributes	Select any combination of Top, Bottom, Right, Left positions for the annotation.
Digits	Show only the most significant digits. By default, the annotation is displayed in full. - Thousand Separator: uses a comma to separate the digits to the right of the decimal point into groups of three. - Left: The number of digits to the left of the decimal point. - Right: The number of digits to the right of the decimal point.
Format	Select a font for the digits, and choose to have it positioned above or below the normal line of digits.

Property	Description
Position	- Position to neatline: placement of annotation relative to neatline , either Inside or Outside - Offset from neatline: distance of the annotation from the neatline in millimetres - Position to Grid: Choose Above /Left, Centre, or Below/ Right - Offset from gridline: the distance between the annotation and the grid line in millimetres - Orientation to grid: Parallel to the grid or at right angles to it.

8. Click **OK** to apply the values.

A grid of coordinates is generated and displayed in the Display window. A Projection Grid layer is added to the Layers tab.



12

BASE Surfaces

The Bathymetry Associated with Statistical Error (BASE) Surface is a georeferenced image of a multi-attributed, weighted-mean surface. A BASE Surface can also contain a visual representation of horizontal and vertical uncertainty.

Three kinds of BASE surfaces can be created:

- Uncertainty
- Swath angle
- Combined Uncertainty and Bathymetry Estimator (CUBE)

In this chapter...

“OVERVIEW” ON PAGE 222

“THREE TYPES OF BASE SURFACES” ON PAGE 224

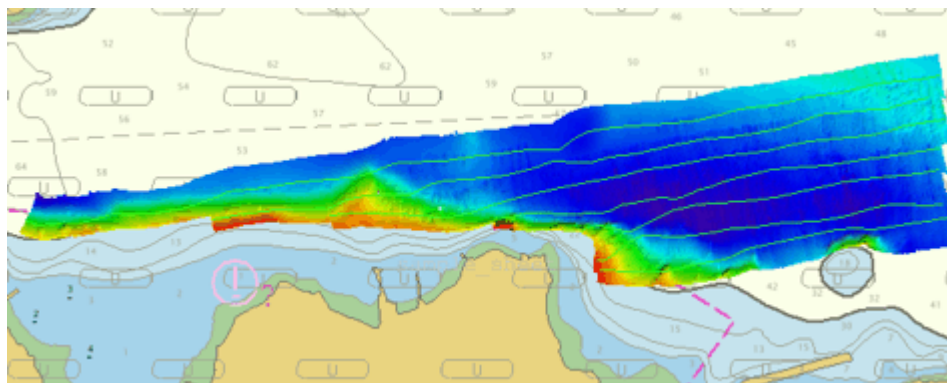
“CREATE BASE SURFACE” ON PAGE 226

“BASE SURFACE COMMANDS” ON PAGE 237

Overview

A Bathymetry Associated with Statistical Error (BASE) Surface can be generated to provide either safety of navigation or a detailed examination of the seafloor.

An example of a BASE Surface image is shown below.



The BASE Surface is used for the following purposes:

- as a background visual aid when cleaning data interactively or automatically.
- to create a georeferenced TIFF that can be exported to other software such as real-time navigation systems.
- to export data as an XYZ text file so it can be imported as soundings in a CARIS map or used to build digital terrain models in other software.
- as a Product Surface that can be used to build contours, sounding selections, profiles, and other data layers. This data can later be used to create an ENC or raster chart.
- as a quality control feature for data. By viewing the uncertainty values for nodes, you can identify bad data and determine if an area needs to be re-surveyed.

A BASE Surface file is saved with a HNS extension (HIPS Navigation Surface). An XML file with the same name as the BASE Surface is also generated when the Surface is created. This file contains the metadata for the Surface.

Range weighting

All BASE Surfaces use range weighting to determine how a sounding is applied to a node. Range weighting is based on distance—soundings close to a node are given greater weight than soundings further away. The calculated node positions are determined by the corner coordinates of the field sheet.

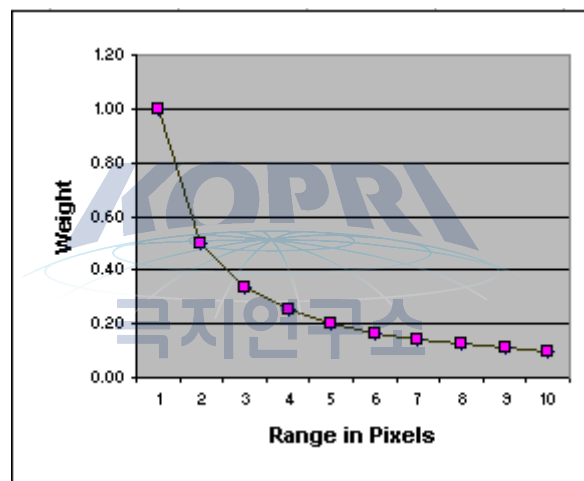
The range weight is inversely proportional to distance from the node: soundings closer to a node are given a greater weight than soundings further away.

The number of nodes each sounding is applied to is determined by the size of the beam footprint. The beam footprint is calculated using depth, sonar beam width, and the grazing angle.

The sonar that is used, with the appropriate beam width, is defined in the BASE Surface wizard.

A list of multibeam systems and corresponding beam widths is listed in `..\Hips\System\DeviceModels.xml`. You can modify this file.

The following graph demonstrates range weighting using distance from a node in units of pixels (multiples of the BASE Surface resolution).



Three types of BASE surfaces

Three different surface types can be created:

- Uncertainty uses a weighting scheme based on depth uncertainty as specified by a selected S-44 survey order.
- Swath angle uses a weighting scheme based on a beam's intersection angle with the seafloor.
- Combined Uncertainty and Bathymetry Estimator (CUBE) surface uses multiple hypotheses to represent potential depth variances along the seafloor (see “CUBE PROCESSING” ON PAGE 255).

Uncertainty Weight

The weight that a sounding contributes to a node is inversely proportional to the predicted depth uncertainty of the sounding.

The sounding's depth uncertainty is scaled as a function of the sounding's distance from the node. The propagation of the depth uncertainty to the node takes into account the sounding's distance from the node AND the sounding's horizontal uncertainty. Thus, both depth uncertainty and horizontal uncertainty play a role in determining the weight a sounding contributes to a node.

The sounding's area of influence is a radius that determines the number of nodes to which the sounding can be applied. This radius is determined by the depth uncertainty of the selected IHO S-44 survey order (see formula below).

$$\text{Depth Uncertainty} = \sqrt{a^2 + (b \times d)^2}$$

Once the depth uncertainty is propagated beyond the selected S-44 survey order requirement for depth accuracy, then it has reached its area of influence limit.

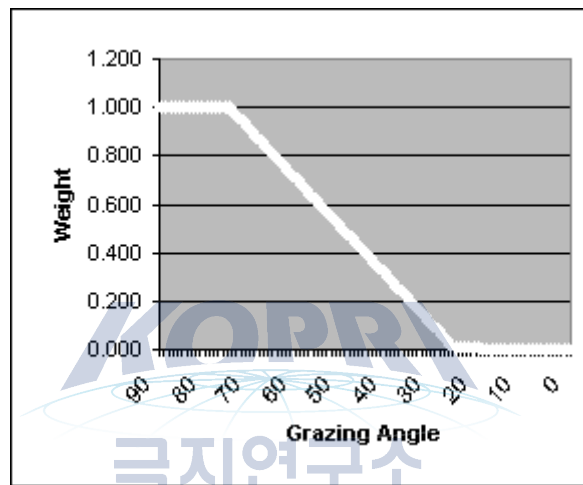
All distance computations are based on the ground coordinate system defined for the BASE Surface—they are not simplified to cell distances. All of the nodes within a sounding's area of influence are located rigorously. No simplified weight matrix scheme is used.

Swath Angle Weight

The weight a sounding contributes to the Surface also varies with the sounding's grazing angle with the seabed.

This weighting value is important in areas with adjacent or overlapping track lines. The swath angle weight ensures that higher weight is given to beams from the inner part of a swath than to outer beams from adjacent track lines.

In the following graph, beams with a grazing angle between 90 and 75 degrees are given a weight of 1.0. The weight decreases linearly to 0.01 as the angle with the sea floor decreases to 15 degrees. .



This is the default swath angle weight scheme as defined by the file `..\Hips\System\GrazingAngleWeights.txt`. The default file can be customized to other weighting scheme.

CUBE

The Combined Uncertainty and Bathymetry Estimator (CUBE) generates a surface that contains multiple hypotheses representing potential depth variances on the seafloor. Examining these hypotheses in the Subset Editor, you can determine if they are valid or not. The hypotheses can be replaced by alternative hypotheses (if necessary).

Using a CUBE filtering tool soundings that fall outside specified parameters can be rejected and another CUBE Surface generated. Thus, CUBE is used in an iterative process to filter data to produce the best-possible representation of the surveyed area.

For generation of CUBE surface and hypothesis editing see [“GENERATING CUBE SURFACES” ON PAGE 259](#).

Create BASE Surface

BASE Surfaces are created using a wizard. You can select specific track lines to include in the BASE Surface or let the wizard select them for you automatically. You can generate as many BASE Surfaces as necessary within a field sheet.

All track lines must be merged before a BASE Surface can be created.

To create a BASE Surface:

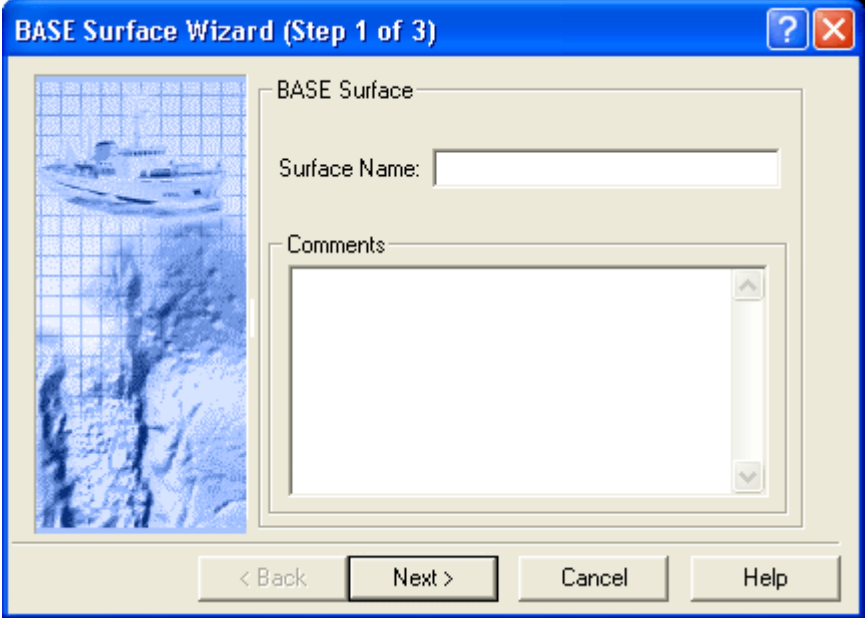
1. Open a field sheet of the area for the BASE Surface:
 - To create a BASE Surface for the entire field sheet area, select the field sheet in the Layers tab in the Control window.
 - To create a BASE Surface for a single track line, select a track line within the field sheet and then select the field sheet layer in the data tree.
2. Select the New Base Surface command.

The number of steps in the wizard is determined by the type of surface you are creating.

Menu	Process > BASE Surface > New
Tool	

BASE Surface (Step 1)

The BASE Surface Wizard (Step 1) dialog box opens.

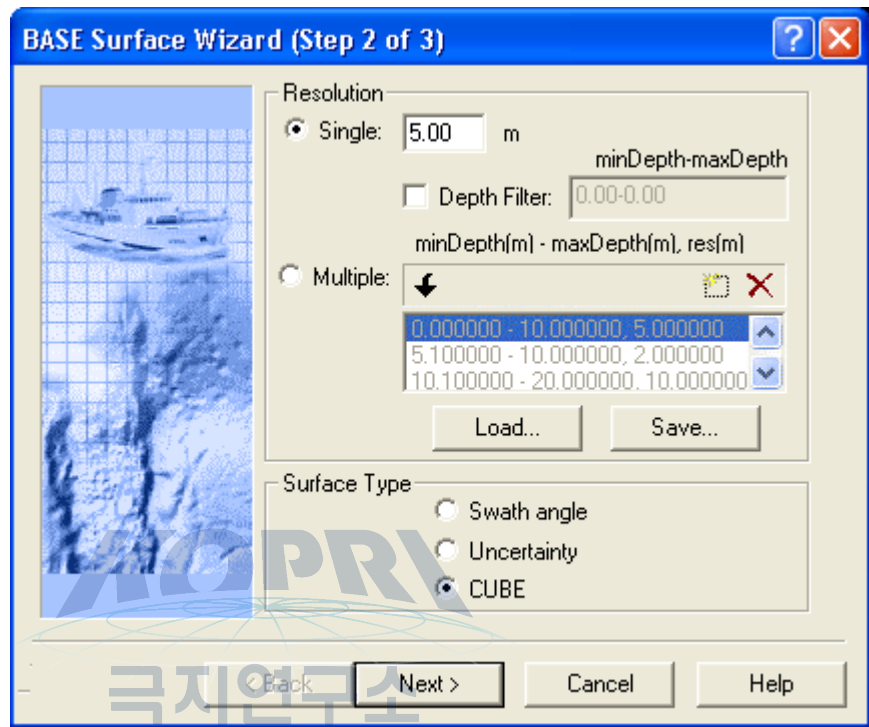


1. Type a *Name* for the BASE Surface.

2. Type any necessary *Comments* in the text box, and click **Next**.

BASE Surface (Step 2)

The BASE Surface Wizard (Step 2) dialog box is displayed.



The *Resolution* value(s) sets the distance(s) between BASE Surface nodes. You can use the same single resolution value for the entire surface, or use different resolutions for each range of depths.

1. Select *Single* and enter a resolution value, or select the *Multiple* option and enter a range of values.

If you select the *Single* option, you can determine the range of depths to include in the BASE surface by using the *Depth Filter* option.

2. Select *Depth Filter* and enter a range of depths.

If you select the *Multiple* option, the depth ranges and related resolution values can be saved as a template to apply when creating other new BASE surfaces.

3. Enter the series of depth ranges and the desired resolution in metres, and click **Save** to save the settings as a template.

OR

4. Click Load to use a saved file.

Values are entered in the following format:
minimum depth - maximum depth, resolution (all in metres. For
example, 0.0-10.0,5.0 which associates depths between zero and
10 metres with a resolution of 5 metres

5. Select a Surface Type: *CUBE*, *Uncertainty*, or *Swath angle*.

6. Click **Next**.

The content of the next dialog box is determined by the choice of
surface type made in step 5:

“BASE SURFACE (STEP 3) - CUBE” ON PAGE 260

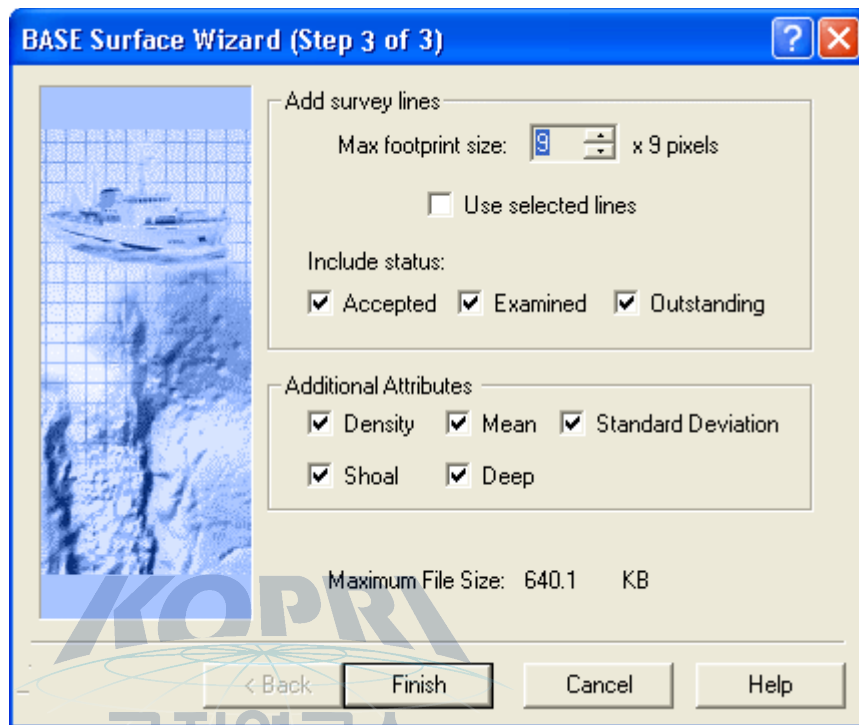
“BASE SURFACE (STEP 3) - SWATH ANGLE WEIGHTING” ON PAGE 228

“BASE SURFACE (STEP 3) - UNCERTAINTY WEIGHTING” ON PAGE 229



BASE Surface (Step 3) - Swath Angle Weighting

If you selected the *Swath Angle Weighting* option at Step 2, the following BASE Surface Wizard (Step 3) dialog box is displayed.



The *Max Footprint Size* defines the maximum area in the Surface to which a sounding is applied. Use this value to prevent over-expansion of the footprint due to large depth spikes or very shallow grazing angles.

1. Click the up and down arrow buttons in the *Max Footprint Size*.

If one or more track lines were selected before the BASE Surface process was started, the *Use Selected Lines* check box is enabled.

2. Clear this check box if you want apply a BASE Surface to the field sheet area.

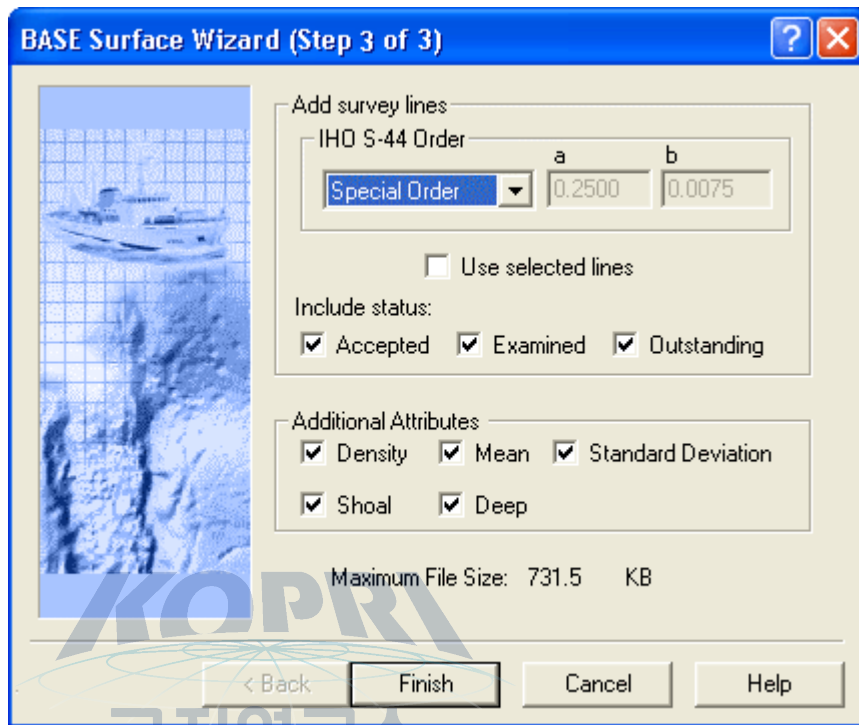
The *Accepted* check box is selected by default.

3. Select either the *Examined* or *Outstanding* check boxes to include data with these status flags in the BASE Surface process.
4. Select *Additional Attributes* to be displayed in the BASE Surface.
5. Click **Finish**.

The Swath Angle BASE Surface is created.

BASE surface (Step 3) - Uncertainty Weighting

If you selected the *Uncertainty* option, the BASE Surface Wizard (Step 3) dialog box is displayed.



1. Select an *IHO S-44 Order* from the drop-down list.

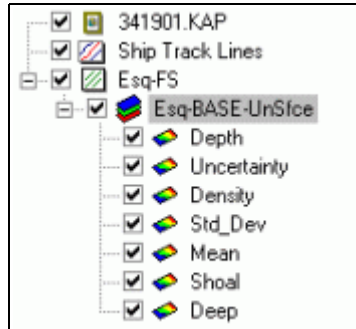
The *a* (constant depth error) and *b* (factor of depth dependent errors) fields are automatically filled when a survey order is selected. The values are read from `..\HIPS\System\IHO_Standards.xml`.

2. If one or more track lines were selected before the BASE Surface process was started, the *Use Selected Lines* check box is enabled. Clear this check box if you want to apply the BASE Surface to the entire field sheet area.
3. Select either the *Examined* or *Outstanding* check boxes to include data with these status flags in the BASE Surface process. The *Accepted* check box is selected by default.
4. Select the attributes to be displayed in the BASE Surface.
5. Click **Finish**.

The Uncertainty BASE Surface is created.

View BASE Surfaces

In the HIPS interface, A BASE Surface layer is created and displayed in the Layers tab of the Control window. Attributes are displayed as sub-layers of the BASE Surface.



1. Click Expand (+) icon beside the Field Sheet file name to expand the directory tree in the Layers tab.
2. Display the BASE Surface by selecting the check box beside the layer.

The following attributes can be displayed in the BASE Surface (depending on the weighting method you selected in Step 6 and the selected attributes in Step 7):

- **Depth:** Depth at the node.
- **Density:** The number of soundings contributing to a node.
- **Standard Deviation:** The number of standard deviations that the node is from the mean.
- **Uncertainty:** The depth uncertainty assigned to each node.
- **Mean:** The mean depth calculated from all soundings contributing to a node.
- **Shoal:** The shoalest sounding contributing to a node.
- **Deep:** The deepest sounding contributing to a node.

3. To view or hide layers, select or clear the check boxes beside the layer.

Properties

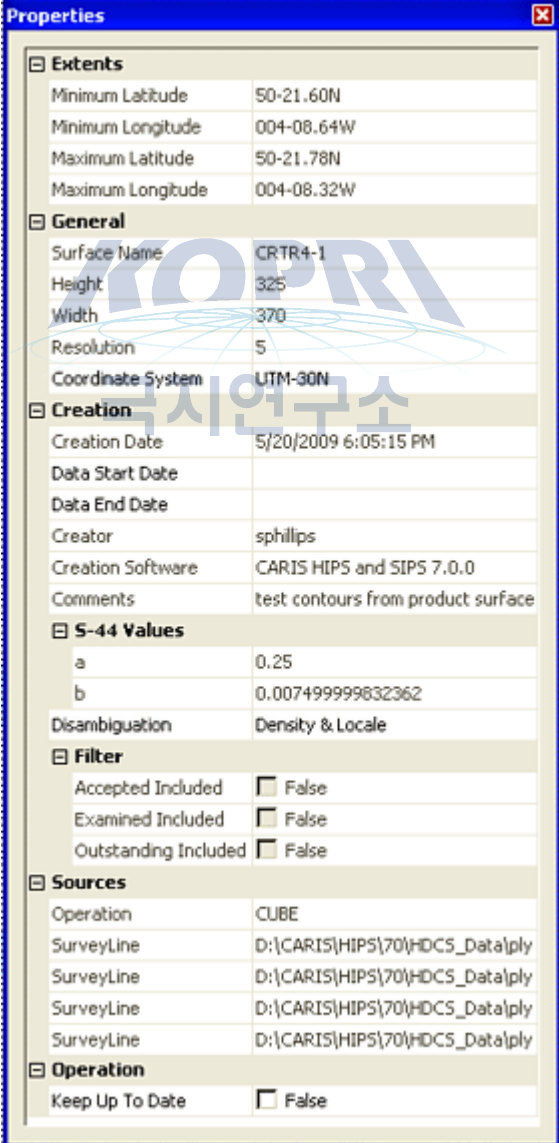
You can use the Properties window to view basic information about a BASE Surface or to set the display options for a BASE Surface attribute layer.

Menu	Window > Properties
Tools	
Pop-up	Properties

View Surface Properties

1. Select a BASE Surface layer in the Layers tab of the Control window.
2. Select the Properties window command, or right-click the layer and select Properties from the pop-up window.

The Properties window for the BASE Surface is displayed.



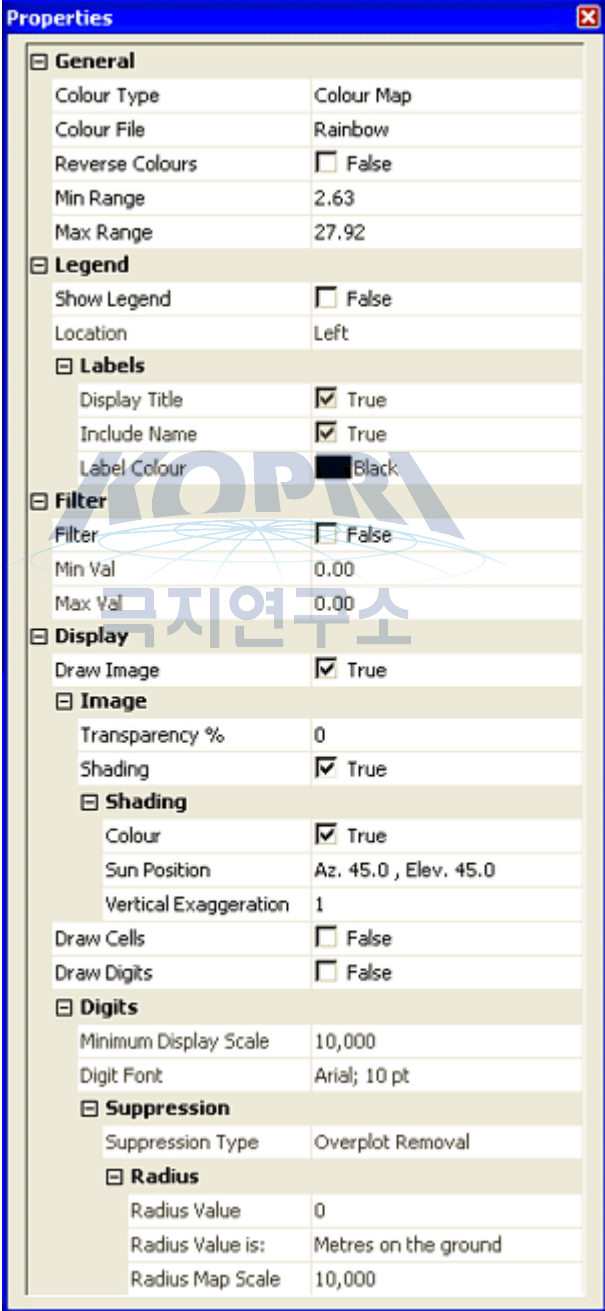
Properties	
Extents	
Minimum Latitude	50-21.60N
Minimum Longitude	004-08.64W
Maximum Latitude	50-21.78N
Maximum Longitude	004-08.32W
General	
Surface Name	CRTR4-1
Height	325
Width	370
Resolution	5
Coordinate System	UTM-30N
Creation	
Creation Date	5/20/2009 6:05:15 PM
Data Start Date	
Data End Date	
Creator	sphillips
Creation Software	CARIS HIPS and SIPS 7.0.0
Comments	test contours from product surface
S-44 Values	
a	0.25
b	0.007499999832362
Disambiguation	Density & Locale
Filter	
Accepted Included	☐ False
Examined Included	☐ False
Outstanding Included	☐ False
Sources	
Operation	CUBE
SurveyLine	D:\CARIS\HIPS\70\HDCS_Data\ply
SurveyLine	D:\CARIS\HIPS\70\HDCS_Data\ply
SurveyLine	D:\CARIS\HIPS\70\HDCS_Data\ply
SurveyLine	D:\CARIS\HIPS\70\HDCS_Data\ply
Operation	
Keep Up To Date	☐ False

Set Attribute Properties

Menu	Window > Properties
Tools	
Pop-up	Properties

1. Select a BASE Surface attribute layer (depth, density, mean, etc.) in the Layers tab of the Control window.
2. Right-click the layer and select Properties from the pop-up window.

The Properties window for the BASE Surface attributes layer is displayed.



Properties

- General**
 - Colour Type: Colour Map
 - Colour File: Rainbow
 - Reverse Colours: ☐ False
 - Min Range: 2.63
 - Max Range: 27.92
- Legend**
 - Show Legend: ☐ False
 - Location: Left
- Labels**
 - Display Title: ☒ True
 - Include Name: ☒ True
 - Label Colour: Black
- Filter**
 - Filter: ☐ False
 - Min Val: 0.00
 - Max Val: 0.00
- Display**
 - Draw Image: ☒ True
- Image**
 - Transparency %: 0
 - Shading: ☒ True
- Shading**
 - Colour: ☒ True
 - Sun Position: Az. 45.0 , Elev. 45.0
 - Vertical Exaggeration: 1
- Digits**
 - Draw Cells: ☐ False
 - Draw Digits: ☐ False
 - Minimum Display Scale: 10,000
 - Digit Font: Arial; 10 pt
- Suppression**
 - Suppression Type: Overplot Removal
- Radius**
 - Radius Value: 0
 - Radius Value is: Metres on the ground
 - Radius Map Scale: 10,000

3. Select a colour map or colour range file from the *Colour Type* drop-down list.

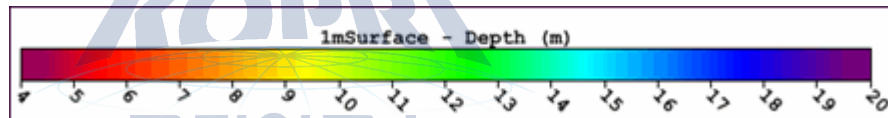
If you select *Colour Map*, the following options are available:

- **Colour file:** A list of pre-defined colour maps available for images
- **Reverse Colours:** Change the order in the colour map.
- **Min Range:** All attribute values equal to or less than this value are assigned the shallow end of the colour map.
- **Max Range:** All attribute values equal to or greater than this value are assigned the deep end of the colour map.

If you select *Colour Range*, you can use the Colour Range Editor to create custom colour ranges showing variances in attribute properties. Colour ranges can be saved as CRF files.

4. Select a colour file from the drop down list or <New...> to open the Colour Range Editor is displayed
5. If necessary, click Browse to modify existing colour maps or colour ranges, or create new ones (see “[COLOUR MAP EDITOR](#)” ON PAGE 234 and “[COLOUR RANGE EDITOR](#)” ON PAGE 235).

You can display a raster legend containing the colour map for an attribute and corresponding attribute values and set its position in the Display window. A Raster Legend is a scale of ranges in the selected colour map.



Use Labels field settings to display of the surface and attribute names in the title of the legend. Set a colour for the legend and its labels.

Display options include transparency and shading.

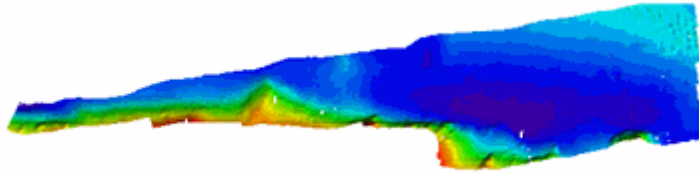
Transparency sets a percentage level for viewing other features through the Surface area.

The *Shading* option controls the lighting angles of the BASE Surface. Using this option may highlight fine scale features of the Surface that would not normally be seen.

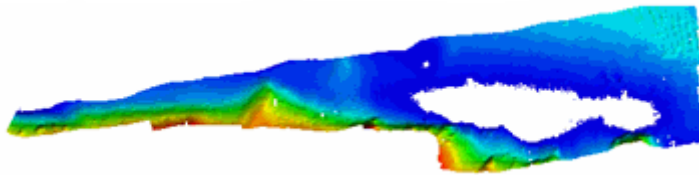
The *Sun Position* field sets the shading effect in the image. The *Azimuth* value varies from 0 to 360 degrees in a clockwise direction. The *Elevation* value varies from 90 to 0 degrees starting from the middle of sundial. Seleting the field opens the sundial control.

You can change the exaggeration of the illuminated sea floor by selecting a *Vertical Exaggeration* value. Increasing the exaggeration may improve the view of the fine scale features on the seabed.

The *Filter* option controls the value ranges that are displayed in the BASE Surface. An example of using the filter controls is displayed below.



BASE Surface before filtering. All depth values ranging from 0 metres to 24 metres are displayed.



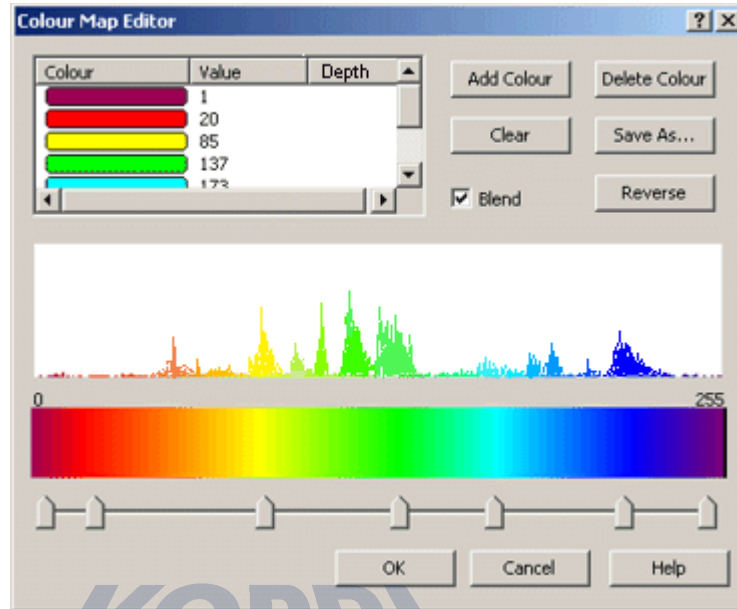
BASE Surface after filtering. Only depths between 0 metres and 18 metres are displayed

6. Select the *Filter* check box to activate the filtering options.
7. Type the range of attribute values to be displayed once the filter is applied.
8. Click **Refresh** to implement changes.

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Colour Map Editor

The Colour Map Editor dialog box allows you to modify colour maps and create new colour maps from existing maps.



The table on the top left section of the Colour Map Editor displays the colours and index values that represent the minimum depth for that the colour in the map.

The bottom part of the dialog box shows a histogram with the horizontal axis representing the colour range used in the image and vertical axis representing the number of pixels used to display the colour.

The first colour is the background and is always assigned to pixel value 1. The custom colour bar is filled from pixel values 1 to 255. Pixel value 0 is always assumed to be transparent.

Below the histogram is a slider control with each slider representing a colour in the map.

The dialog box also includes the following commands:

- **Add Colour:** Add a custom colour to the colour list.
- **Delete Colour:** Remove a newly selected colour.
- **Clear:** Remove a colour from the colour list.
- **Reverse:** Reverse the shallow and deep ends of the colour map.
- **Save As:** Save a new colour map.
- **Blend:** Merge colours together.

Change colour range

You can change the range of an individual colour using the table or the slider control.

1. To change a colour range using the table, double-click a colour in the table.

The Add Colour dialog box is displayed.



2. Type a new number in the *Value* field and click **OK**.
3. Alternately, you can position the cursor on the slider representing the colour in the histogram and use the mouse to move the slider.

As the value is changed, the histogram and *Value* column in the table are refreshed to show the new colour value and range.

Add Colour

You can add or remove colours from an existing map, or create a new colour map.

1. Click **Add Colour** or click directly on the slide bar.

The Add Colour dialog box is displayed.

The number in the *Value* field shows the pixel value of the displayed colour.

2. Select a colour from the colour palette or click **Other** to create a custom colour from the standard Windows colour picker, and click **OK**.

The selected colour is displayed in the dialog box.

3. Repeat the process to insert more colours.

As you select more colours, the colour values and the depths are displayed in a table. Each colour also has a slider control associated with it.

4. Move the slider to adjust the pixel value of that colour.

The *Value* and *Depth* data in the box adjusts as you move the sliders.

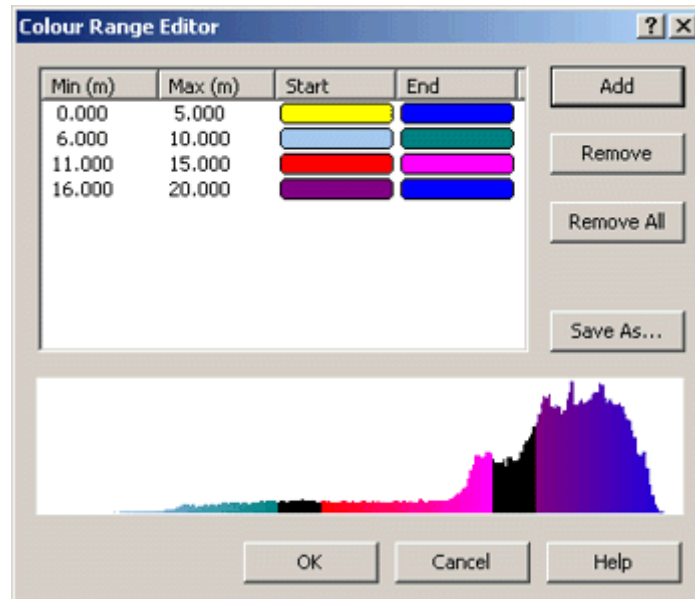
5. If you want to blend the colours, click the *Blend* check box.
6. If you want to remove a colour, click the colour value and click **Delete Colour**.
7. If you want to remove all the colours, click **Clear**.
8. Click **Save** to retain the settings as a colour map.

The Save As dialog box is displayed.

9. Type a file name for the colour map. All colour maps have a .cma extension and the directory always is ..\Hips\System.
10. Click **Save** to save the colour map to the directory.

Colour Range Editor

The Colour Range Editor dialog box allows you to modify or create new colour range files.

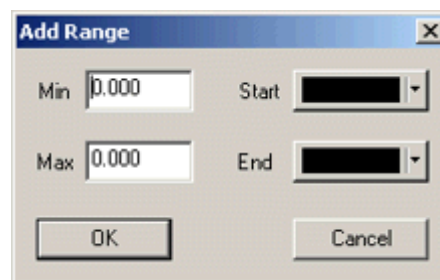


The top part of the dialog box contains a table showing the range of depths and the colours used to represent those depths.

The bottom part of the dialog box shows a histogram with the horizontal axis representing the colour range used in the image and vertical axis representing the number of pixels used to display the colour.

1. To add a colour range, click **Add**.

The Add Range dialog box is displayed.



2. Type the minimum and maximum values in the *Min* and *Max* fields.
3. Select a colour to represent the minimum and maximum values from the colour picker, or create a custom colour using the standard Windows colour palette.
4. Click **OK**.

The colour range is listed in the table and displayed in the histogram.

5. Repeat Steps 1 to 4 until all needed ranges are represented.
6. To remove a single colour range, select the range and click **Remove**.
7. To clear all colour ranges, click **Remove All**.
8. To save the ranges as a CRF for future use, click **Save As** to open the standard Windows Save As dialog box.
9. Click **OK** to close the Editor.



BASE Surface Commands

Open

To open a BASE surface you first need to open the field sheet in which it was created.

Menu	File > Open Field Sheets

1. Select the Open Field Sheets command.

The Open Field Sheets dialog box is displayed.

2. Select one (or more) field sheet files from the list.
3. Click **Open**.

The field sheet file is displayed in the Layers tab of the Control Window and the field sheet outline(s) is shown in the Display window.

4. Click the (+) icon to expand the field sheet file tree.
5. Select the BASE Surface check box.

The BASE Surface is now visible in the Display window.

Delete

Permanently delete a BASE Surface from a field sheet.

1. Select a BASE Surface layer in the Control Window.
2. Right-click and select the Delete command from the pop-up menu.

Pop-up	Delete

The BASE Surface layer is permanently deleted from the field sheet.

Add to BASE Surface

The Add to BASE Surface command applies new track lines to an existing surface without the need to regenerate the surface. You can add specific lines to the Surface or you can let the program select the lines to be added automatically.

1. Select the track line layer in the Layers tab of the Control window.
2. Select the track line(s) you want to add to the BASE Surface so it is highlighted.
3. Select the BASE Surface layer in the field sheet file tree so it is highlighted.
4. Select the Add to BASE Surface command.

Menu	Process > BASE Surface > Add to

The BASE Surface Wizard dialog box (Step Two) is displayed.

5. Fill in the fields as needed.
6. Click **Next**.

The BASE Surface Wizard dialog box (Step 3) is displayed.

7. Fill in the fields as needed.
8. Click **Finish**.

The BASE Surface is updated to include new track lines.

Remove From BASE Surface

Remove a survey line from a Swath Angle or Uncertainty BASE Surface.

1. Select the survey line in the Project tab of the Control window.
2. Select a BASE Surface layer in the Session tab of the Control window.
3. Select the Remove from BASE Surface command.

The BASE Surface is regenerated without data from the selected survey line.

Menu	Process > Remove From BASE Surface
Tool	



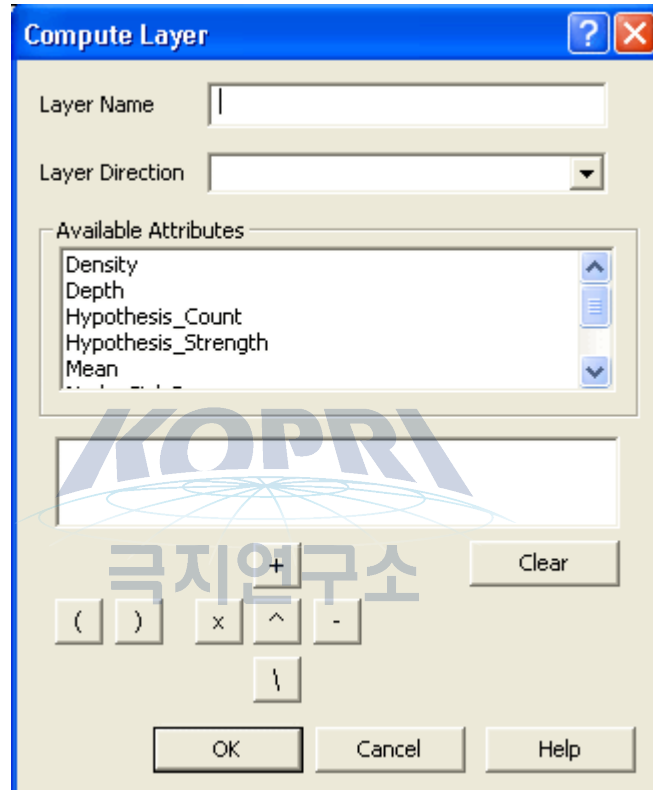
New Layer

Create a new sub-layer in an existing BASE Surface. The layer is created using existing attributes and mathematical operators to create SQL-style queries.

1. Select a BASE Surface layer in the Layers tab of the Control window.
2. Select the Add Layer command.

The Compute Layer dialog box is displayed.

Pop-up	Add Layer (Control window only)



3. Type a name for the new surface layer in the *Layer Name* field.

The following steps create the criteria for the new surface. The criteria is determined by attributes and mathematical operators. You can insert as many attributes and operators needed to create the criteria.

4. Double-click any of the attributes in the *Available Attributes* list to insert the attribute into the field below.
5. Click any of the operators to add it to the field.
6. To remove the criteria from the field, click **Clear**.
7. Click **OK**.

The new layer is drawn in the Display window and is listed as a BASE Surface sub-layer in the Control window.

Recompute surface

The recompute function rebuilds a BASE Surface and regenerates the Surface image.

1. Select a Surface name in the field sheet file tree so it is highlighted.
2. Select the Recompute BASE Surface command.

Only the track lines used previously in the Surface are processed during rebuilding.

The Recompute operation checks to see if the surface makes use of HIPS data that is no longer present.

If data is missing, a dialog box lists what is missing. You then have the option of terminating the Recompute process, or continuing without the missing data.

Menu	Process > BASE Surface > Recompute
Tool	

NOTE: If you choose to continue, the replacement surface will have the missing data lines removed from its list of contributing lines.

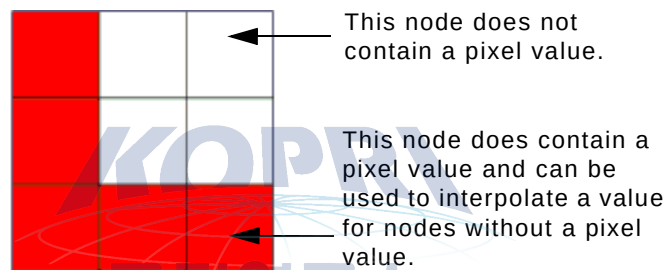


Interpolate BASE Surface

The Interpolate Surface command eliminates small holes that appear in areas of sparse data. This sometimes happens in the outermost beams along the outside edges of surveyed areas where there is little or no overlapping coverage.

This command examines each BASE Surface node to determine if it contains a pixel value. If the node does not contain a value, the neighbouring pixels are examined to determine if enough of them contain pixel values to justify interpolating a value for the hole. This limits the interpolation to holes in the BASE Surface and prevents it from expanding the surface outward from the survey area. A copy of the BASE Surface, with these gaps filled, is then created.

In the following example, in a 3 x 3 BASE Surface node area, five nodes have pixel values (shown in red).

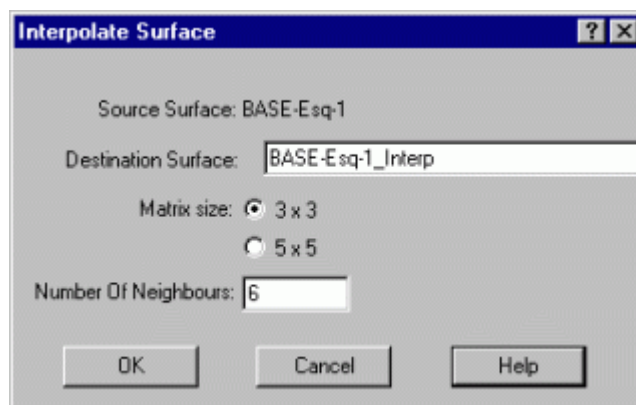


This means if you select five or less as the value for the *Number of Neighbours*, a pixel value is created for the node without a value from the neighbouring nodes.

Menu	Process > BASE Surface > Interpolate
Pop-up	Interpolate BASE Surface

1. Select a surface layer in the Control window so it is highlighted.
2. Select the Interpolate Surface command.

The Interpolate BASE Surface dialog box is displayed.



The *Destination BASE Surface* field displays the file name of the copy that is created from the original surface. The default name is the

original BASE Surface name with `_Interp` appended to it. You can change the name, if necessary.

3. [Optional] Type a new name in the *Destination BASE Surface* field.

The *Matrix Size* determines the number of nodes closest to the node that can be used to interpolate a pixel value.

4. Select either the 3 x 3 or the 5 x 5 option.

The *Number of Neighbours* field is a threshold level used to determine the minimum pixels in the matrix area that must be present to interpolate a new pixel value. The matrix size determines the maximum and minimum values for the neighbours field. For example, if you select 3 x 3 for the matrix size, then the possible maximum number of neighbouring nodes with pixels is 9 and the minimum number is 3.

5. Type the number of neighbouring nodes used to interpolate pixels.

6. Click **OK**.

A copy of original BASE Surface is created and displayed in the field sheet data tree in the Control window. Note that the interpolated BASE Surface cannot be updated with the Automatic Update command in the Options dialog box.

As you can continue to re-interpolate the Surface, the effects accumulate to remove any remaining gaps. To do this, select the interpolated surface in the Control window and select the Interpolate Surface command again. The second interpolation is applied to the selected surface layer, you cannot create a new BASE Surface layer.

Every time an interpolated BASE Surface is re-interpolated, the parameters are stored. Therefore, when using the Rebuild command (see "[RECOMPUTE SURFACE](#)" ON PAGE 240) on an interpolated BASE Surface, all interpolations are performed on the BASE Surface layer.

Finalize BASE Surface

The finalized BASE Surface is a finished version of the Surface that is ready for export or for further processing (for example, a Product Surface). The automatic update function in the Options dialog box (see [“GENERAL” ON PAGE 657](#)) cannot be applied to a finalized Surface if soundings are re-cleaned in the Swath or Subset Editors.

Any of the following three operations can be applied to finalize a BASE Surface:

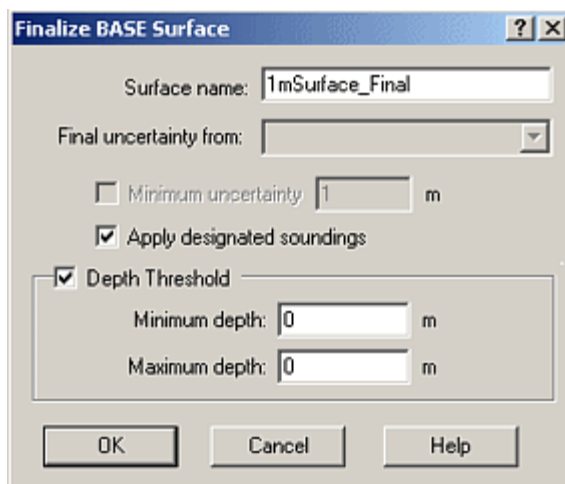
- **Minimum uncertainty:** Vertical uncertainty can fall to almost zero if a node contains too many soundings. This function applies a user-defined vertical uncertainty to each node to compensate for this situation.
- **Designated soundings:** If the dataset contains designated soundings, the Surface is regenerated and the designated soundings' depth values are applied to the nearest nodes. (See [“DESIGNATED SOUNDINGS” ON PAGE 207](#)).
- **Depth thresholds:** A Finalized BASE Surface can be modified to represent a range of depths levels in the field sheet. When the Finalized Surface is generated, only these depths are displayed.

To create a finalized BASE Surface:

Menu	Process > BASE Surface > Finalize

1. Select a BASE Surface layer in the Session tab of the Control window.
2. Select the Finalize BASE Surface command.

The Finalize BASE Surface dialog box is displayed.



3. The default name for the Finalized Surface is the name of the source BASE Surface with `_Final` appended to the end. You can change this by typing a new name.

The values for calculating the uncertainty of the finalized surface can be selected from three sources:

- *Uncertainty*: The vertical uncertainty values in the source Surface.
- *Std Deviation*: The standard deviation values from the source Surface (scaled to 95% confidence interval).
- *Greater of two*: The larger of the two above values.

4. Select the *Final Uncertainty* from the drop-down list (this option is dimmed if source Surface does not contain uncertainty values).
5. Select the *Minimum Uncertainty* check box to enable this option.
6. Type a depth value to represent the minimum uncertainty.
7. Select the *Apply Designated Soundings* check box to use this option.

When this option is selected, designated soundings take precedence over other soundings during the soundings selection process.

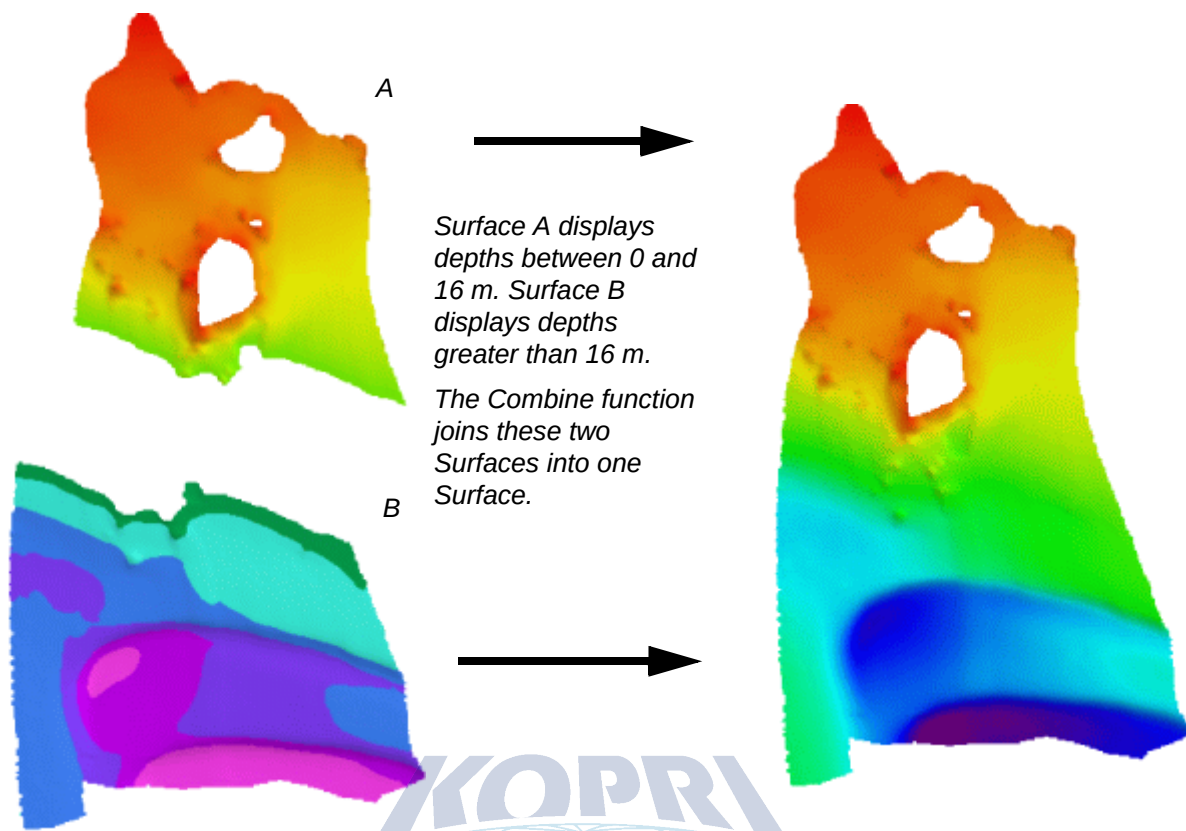
If this option remains unselected, designated soundings are processed no differently from other soundings.

8. Select the *Depth Threshold* check box to create a finalized Surface that displays only node depths between the minimum and maximum depth values.
9. Type the minimum and maximum depth values in their respective fields.
10. Click **OK**.

A finalized BASE Surface is generated and visible in the Display window. The finalized BASE Surface is listed in the Session tab of the Control window.

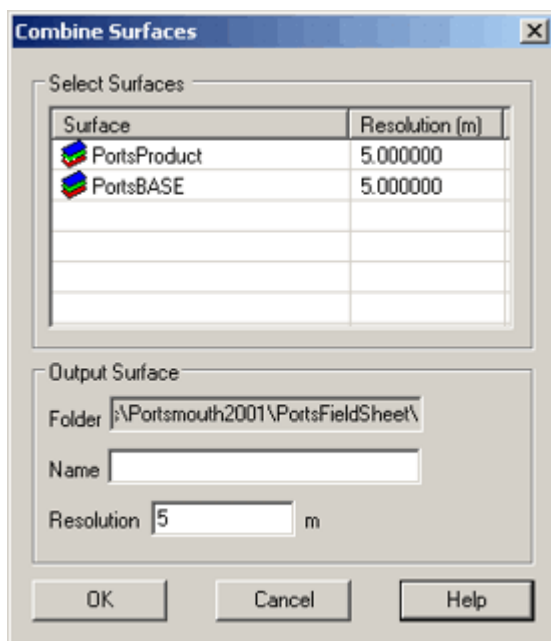
Combine

The Combine options stitches two or more BASE Surfaces together to form one surface. This option is used when you have created finalized BASE Surfaces with different depth thresholds (see “[FINALIZE BASE SURFACE](#)” ON PAGE 243), or when you have two adjacent Surfaces with different resolutions. The geographical extents for the combined BASE Surface are determined by the geographical extents of the field sheet.



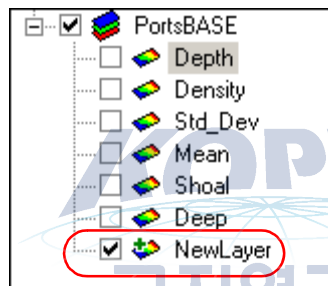
1. Select field sheet in the Session tab of the Control window that contain the BASE Surfaces you want to combine.
2. Select the Combine command.
 - The Combine BASE Surfaces dialog box is displayed.

Menu	Process > BASE Surface > Combine
Pop-up	Combine (Control window only)



3. Select the BASE Surfaces from the file tree by two methods (you may have to click the expand icon to view all the available Surfaces):
 - Press <Ctrl> and select individual surfaces with the mouse.
 - Press <Shift> and select a range of surfaces by clicking the first and last surface in the range. All surfaces between the first and last surface are selected.
4. The Output Folder field is read-only and displays the directory path of the selected field sheet. The combined BASE Surface is saved to this folder.
5. Type a name for the combined Surface.
6. Type a resolution for the combined Surface
7. Click **OK**.

A new BASE Surface that combines the selected Surfaces is generated. The combined Surface is listed in the Session tab of the Control window. The combined BASE Surface reproduces all the attribute layers contained in the source Surfaces.



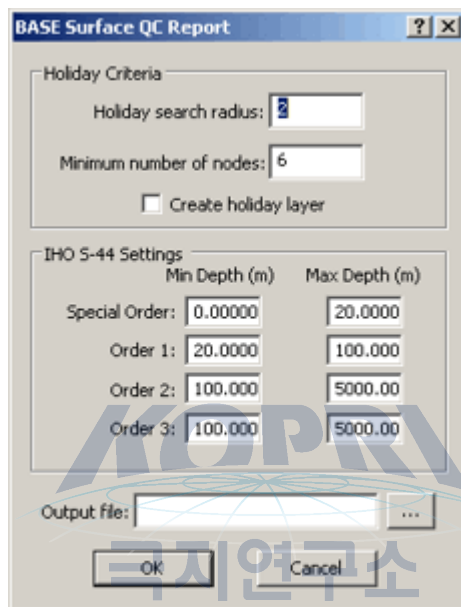
BASE Surface QC Report

Menu	Process > BASE Surface > Surface QC Report
Pop-up	QC Report (Control window only)

The BASE Surface Quality Control report lists significant data gaps (“holidays”) within the surface and analyzes how much of your data conforms to the S-44 standard for survey orders.

1. Select a BASE Surface layer in the Control window.
2. Select the Surface QC Report command.

The BASE Surface QC Report dialog box is displayed.



The top section of the dialog box sets the criteria for finding significant data gaps (known as “holidays”). A holiday is formed when enough gaps are clustered together within a specified radius. A layer that displays these holidays can also be created. This layer does not display every gap in the surface, but only those gaps that meet the criteria.

1. Type the number of nodes to use as a radius for searching for gaps in the *Holiday Search Radius* field.
2. Type the *Minimum number of nodes* that must contain data so that a holiday is not formed. For example, if the value is 6, then a node without data must be surrounded by five or less nodes with data to be included (with other empty nodes) in a holiday.
3. Select the *Create holiday layer* check box to create a layer displaying the data holidays selected by the search criteria.

The bottom section compares uncertainty values contained in the surface to the S-44 standard. This determines how many nodes within the surface meet the S-44 criteria.

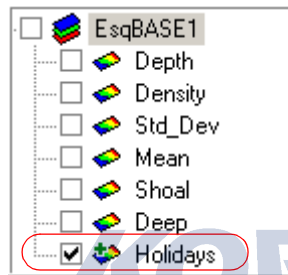
The depth levels shown in the dialog box are the minimum and maximum depth levels for each survey order. You can change these to conform with depths in your surface.

4. [Optional] Type new depth levels for any of the survey orders. You can have overlapping depth levels.

A text file of the QC report can be saved to a text format and viewed later.

5. Click **Browse** to select a directory path and name for the QC report. The path and name is shown in the *Output File* field.
6. Click **OK**.

The report is shown in the Output window and, if selected, saved to a text file. The Holiday layer is displayed in the Control window.



QC Report File example

The following is an example of a QC report file:

```

BASE Surface QC Report
-----
Date and Time: 11/9/2006 10:59:09 AM
Surface:
d:\hips\FieldSheets\HIPSTraining\smallsheet\asdfasdf.hcs
Holiday Search Radius: 1
Holiday Minimum Number of Nodes: 6
Holiday layer created: Yes
Number of nodes processed: 6,181
Number of nodes populated: 6,131
Percentage of nodes populated: 99.191
Number of holidays detected: 5
IHO S-44 Special Order:
  Range: 0.0 to 10.0
  Number of nodes considered: 620
  Number of nodes within: 0
  Residual mean: 0.307
S-44 Order 1:
  Range: 10.0 to 100.0
  Number of nodes considered: 5,511
  Number of nodes within: 0
  Residual mean: 0.035
S-44 Order 2:
  Range: 10.0 to 5000.0
  Number of nodes considered: 5,511
  Number of nodes within: 5,511
No depths within IHO S-44 Order 3
  
```

Sections of a QC report file

The first section contains information about the report file and the options the data holiday options set in the dialog box:

- The data and time that the QC report file was created.
- The BASE Surface on which the QC report is based
- The holiday search radius.
- The minimum number of nodes required to omit a node (without data) from being included in a holiday.
- If a holiday layer was created or not.

The second section contains information on the number of nodes containing data:

- The total number of nodes processed in the surface
- The total number of nodes that contained data
- Percentage of the surface that contains data.
- Number of data holidays located.

The third section contains information about each S-44 survey order:

- The depth range for the survey order (set in the dialog box).
- The number of nodes within that depth range with uncertainty values that were considered for the survey order.
- The number of nodes that fall within the depth error limits for that survey order.
- The residual mean is derived from the computed and reported uncertainty. If the value is negative, the uncertainty values meet the requirements for the selected survey order. If the value is positive, the uncertainty values do not meet the requirements for the selected survey order. Therefore, if no nodes were considered for the survey order, the residual mean would have to be above zero.

Surface Filtering

Surface filtering uses a scaled standard deviation or uncertainty threshold to reject soundings that fall outside that threshold.

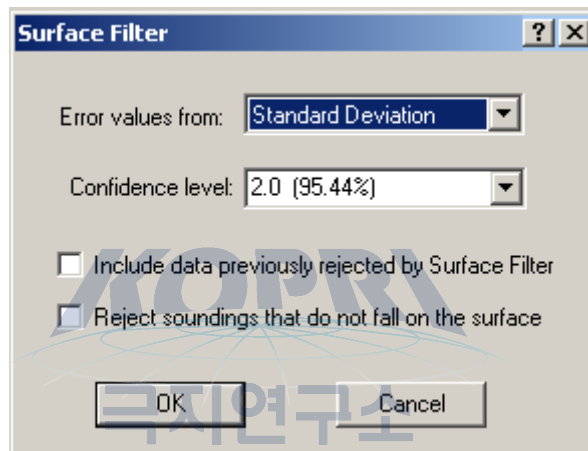
Soundings that fall outside the threshold are assigned a Rejected by Surface Filter flag and are no longer available for processing (unless they are given an Accepted flag again).

For information applying a surface filter to CUBE surface, see [“CUBE FILTERING” ON PAGE 272](#).

Menu	Tools > Apply Filters > Surface Filter

1. Select a BASE surface layer in the Layers tab of the Control window.
2. Select the Surface Filter command.

The Surface Filter dialog box is displayed.



3. Select the error values from either *Standard Deviation* or *Uncertainty* to set the threshold for the filter.
4. Select the *Confidence Level* from the drop-down list to scale the standard deviation or uncertainty thresholds.
5. Select the check box to include rejected data when running the filter.
6. Select the check box to reject soundings that are offset from the surface.

Click **OK**.

13

CUBE Processing

A Combined Uncertainty and Bathymetry Estimator (CUBE) surface uses multiple hypotheses to represent potential depth variances along the seafloor.

In this chapter...

"INTRODUCTION" ON PAGE 256

"GENERATING CUBE SURFACES" ON PAGE 259

"HYPOTHESIS EDITING" ON PAGE 266

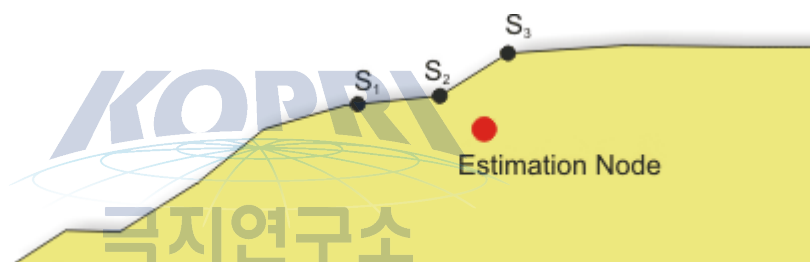
Introduction

The CUBE process uses sounding propagation along with disambiguation to create and select hypotheses.

When soundings are propagated to a grid of estimation nodes:

- Soundings with a low vertical uncertainty are given more influence than soundings with high vertical uncertainty
- Soundings with a low horizontal uncertainty are given more influence than soundings with a high horizontal uncertainty.
- Soundings close to the node are given a greater weight than soundings further away from the node.

Generally, as soundings are propagated to a node, a hypothesis (depth value) is developed at that node. If a sounding's value is not significantly different from the previous sounding then the same or modified hypothesis is used. If the value does change significantly, a new hypothesis is created. A node can contain more than one hypothesis.



In the above graphic, two soundings— S_1 and S_2 —have similar values and therefore are part of the same hypothesis at the estimation node. However, sounding three (S_3) has a significantly different value so it forms a new hypothesis.

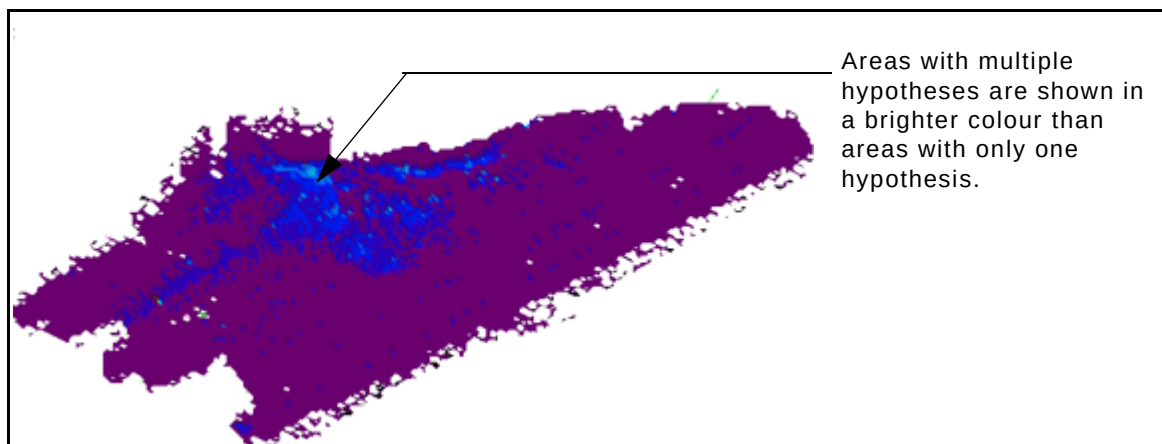
Disambiguation

The final process in CUBE is disambiguation. Disambiguation selects one hypothesis over others. There are four disambiguation options:

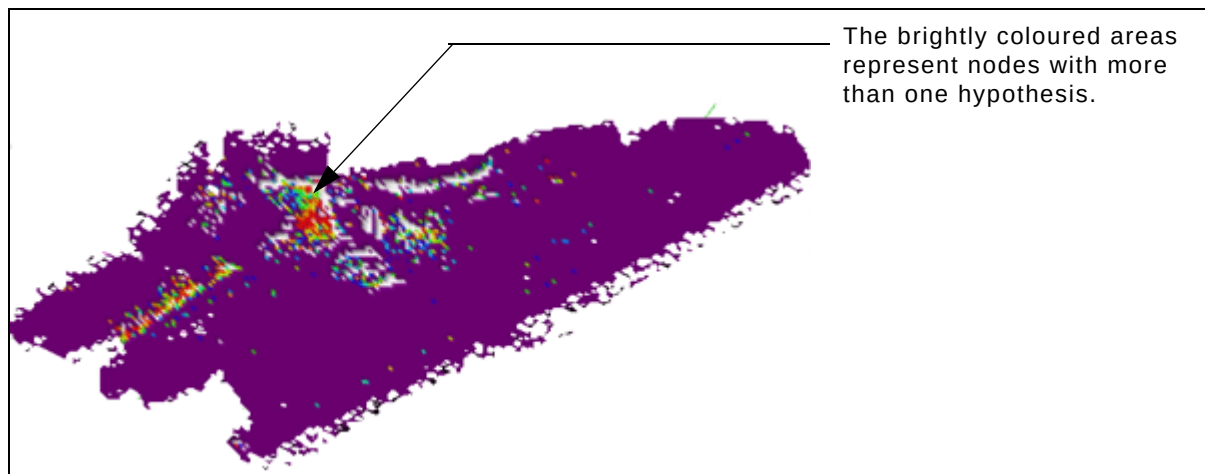
- Density: Select the hypothesis with the greatest number of sounding samples.
- Locale: Select the hypothesis that is most consistent with the surrounding nodes that have only one hypothesis.
- Locale and Density: Select the hypothesis the contains the greatest number of soundings and is also consistent with neighbouring nodes.
- Initialization: Select the hypothesis that is nearest to a node value of a previously created BASE Surface. Initialization differs from the other methods because it filters potential outlier soundings just prior to disambiguation.

When a surface using the density and locale options is generated, two layers specific to the CUBE Surface are displayed.

- The Hypothesis Count layer is a visual representation of hypothesis density at a node. A Surface with a Hypotheses Count layer is displayed below.



- The Hypothesis Strength layer is a visual representation of the mathematical confidence of a chosen hypothesis. Each node is given a value ranging from 0.0 (high confidence) to 5.0 (low confidence). Nodes with one hypothesis have a confidence value of 0.0 while nodes with multiple hypotheses will have confidence values greater than 0.0. A Hypothesis Strength layer is displayed below.



More than one hypothesis or a low confidence value does not necessarily mean an error. Uneven areas (slopes, for example) show more than one hypothesis because of the changing terrain. Nodes with multiple hypothesis should be examined in the Subset Editor. See [“HYPOTHESES CLEANING” ON PAGE 271](#).

When you select the Initialization method of disambiguation, two additional layers are created:

- Guide_Depth: Depths from the initialization surface.
- Guide_Uncertainty: Vertical uncertainty values from the initialization surface.

The User Nominated layer displays the nominated hypotheses that were chosen over the hypotheses selected by CUBE disambiguation (see “[NOMINATE ALTERNATIVE HYPOTHESES](#)” ON PAGE 269).



Generating CUBE Surfaces

CUBE Surfaces are created using the BASE Surface wizard. All track lines must be merged and TPE must be computed before a CUBE Surface can be created.

To create a CUBE Surface:

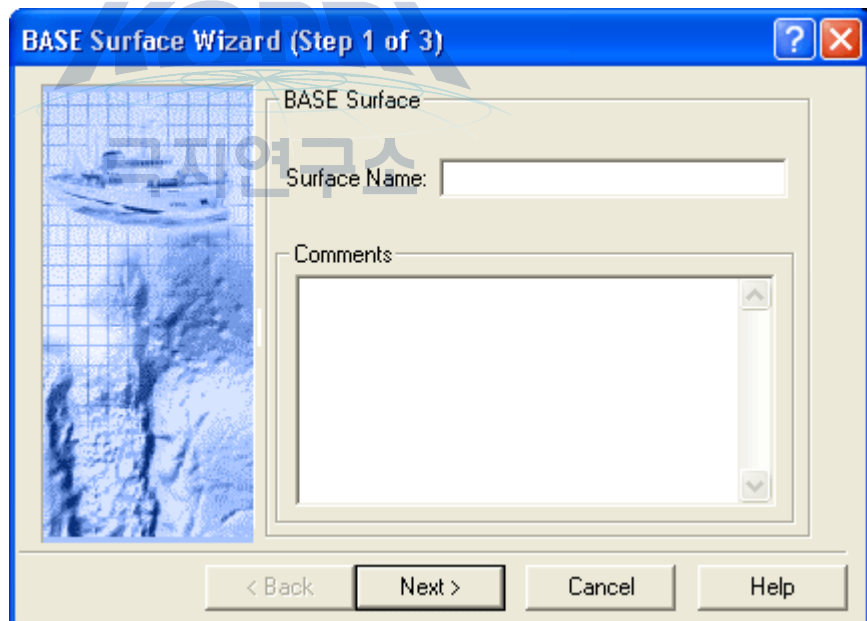
1. Open a field sheet of the area for the Surface:
 - To create a Surface for the entire field sheet area, select the field sheet in the Layers tab in the Control window.
 - To create a Surface for a single track line, select a track line within the field sheet and then select the field sheet layer in the data tree.
2. Select the New Base Surface command.

Menu	Process > BASE Surface > New
Tool	

The number of steps in the wizard is determined by the type of surface you are creating.

BASE Surface (Step 1)

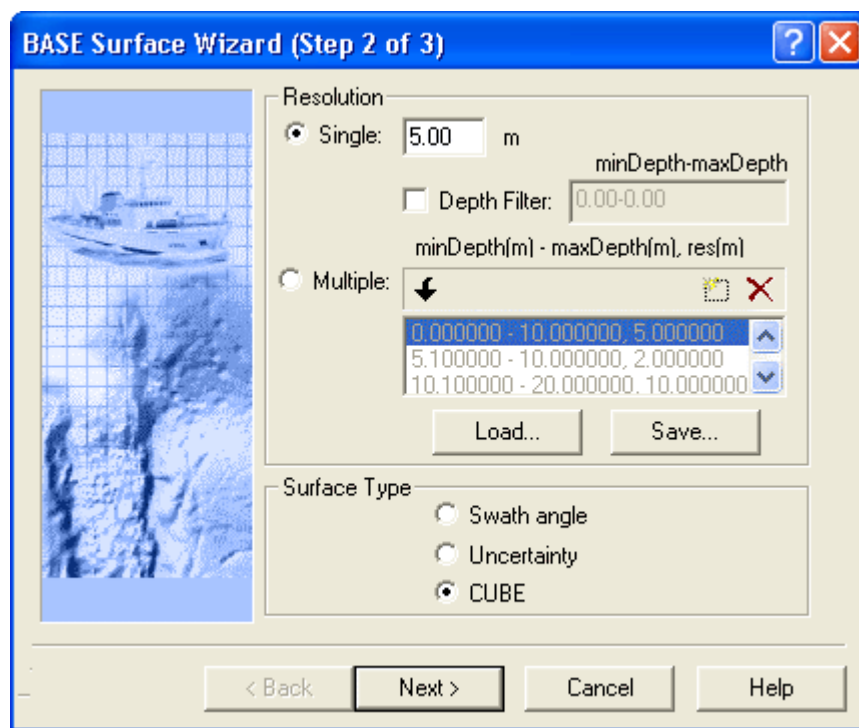
The BASE Surface Wizard (Step 1) dialog box opens.



1. Type a *Name* for the BASE Surface.
2. Type any necessary *Comments* in the text box, and click **Next**.

BASE Surface (Step 2)

The BASE Surface Wizard (Step 2) dialog box is displayed.



The *Resolution* value(s) sets the distance(s) between BASE Surface nodes. You can use the same single resolution value for the entire surface, or use different resolutions for each range of depths.

1. Select *Single* and enter a resolution value, or select the *Multiple* option and enter a range of values.

If you select the *Single* option, you can determine the range of depths to include in the BASE surface by using the *Depth Filter* option.

2. Select *Depth Filter* and enter a range of depths.

If you select the *Multiple* option, the depth ranges and related resolution values can be saved as a template to apply when creating other new BASE surfaces.

3. Enter the series of depth ranges and the desired resolution in metres, and click **Save** to save the settings as a template.

OR

4. Click Load to use a saved file.

Values are entered in the following format:
minimum depth - maximum depth, resolution (all in metres. For example, 0.0-10.0,5.0 which associates depths between zero and 10 metres with a resolution of 5 metres

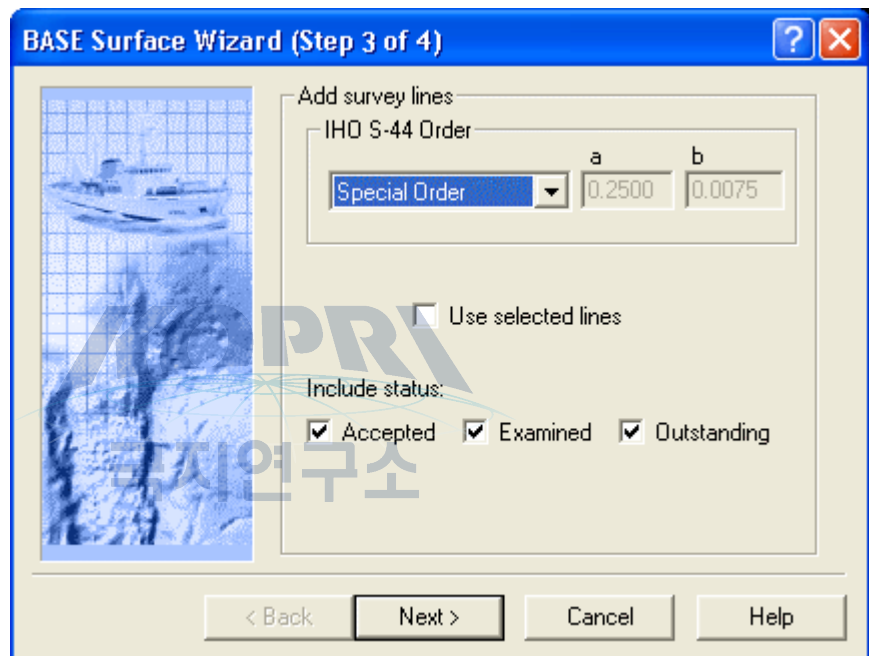
5. Select a Surface Type: *CUBE*, *Uncertainty*, or *Swath angle*.
6. Click **Next**.

The content of the next dialog box is determined by the choice of surface type made in step 5:

“BASE SURFACE (STEP 3) - CUBE” ON PAGE 260

BASE Surface (Step 3) - CUBE

A sounding's area of influence (the number of nodes to which a sounding is applied) is determined by the vertical uncertainty limit in a selected S-44 survey order. When a sounding's vertical uncertainty increases beyond the requirement for the survey order then it cannot contribute to the node.



1. Select an *IHO S-44 Order* from the drop-down list.

The *a* (constant depth error) and *b* (factor of depth dependent errors) fields are automatically filled when a survey order is selected. These values are read from
 ..\HIPS\System\IHO_Standards.xml.

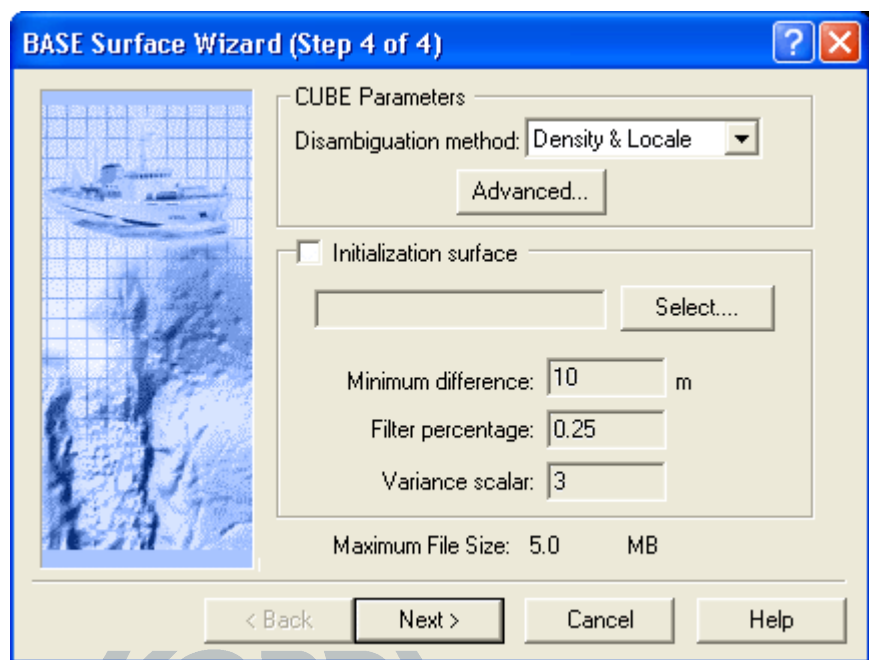
If one or more track lines were selected before the BASE Surface process was started, the *Use selected lines* check box is enabled.

2. Clear this check box if you want to apply the BASE Surface to the entire field sheet area.
3. Select either the *Examined* or *Outstanding* check boxes to include data with these status flags in the BASE Surface process.

The *Accepted* check box is selected by default.

4. If you are creating a CUBE surface, click **Next**.
5. If you are creating an Uncertainty surface, click **Finish**.

BASE Surface (Step 4) - CUBE



1. Select a disambiguation method from the drop-down list. (These methods are described in “DISAMBIGUATION” ON PAGE 256.)
2. Click **Advanced** to open the dialog for advanced settings. For more information, see “ADVANCED OPTIONS FOR CUBE SURFACE” ON PAGE 264.

The *Initialization Surface* check box activates filtering tests to remove potential outliers from CUBE Surface processing. If you select the *Initialization* disambiguation method then you must complete the following fields. Otherwise, select *Initialization Surface* as an optional filtering method used in conjunction with other disambiguation methods.

3. Select the *Initialization surface* check box to activate the optional filtering function.
4. Type the path and name of an existing BASE Surface, or click **Select...** and choose the BASE Surface.

Initialization Surface filtering uses depth and vertical uncertainty values in an existing BASE Surface (the Initialization Surface) to exclude potential outliers from the new surface. There are three filtering tests:

- *Minimum Difference* is a set distance from an existing BASE Surface node. For example, if the *Minimum Distance* is set at 10 metres, all soundings that are not within 10 metres of the node are excluded when a new Surface is generated.
- *Filter Percentage* is a percentage of depth at a node. For example, if the depth at a node is 20 metres and the

percentage value is 0.25, all soundings that are more than 5 metres from the node (20×0.25) are excluded from the new Surface.

- *Variance Scaler* is a multiplier of vertical uncertainty at a node. For example, if the scaler is set to three and depth uncertainty for a node is one metre then soundings more than three metres (1×3) from the node are excluded from the processing of the new BASE Surface.

The shoalest values from the three tests are then used as the threshold to filter outlier soundings.

5. Select any of the three tests to filter soundings during disambiguation.
6. Click **Finish**.

A CUBE Surface is shown in the Display window and the layers associated with the Surface are listed in the Control window. See [“VIEW BASE SURFACES” ON PAGE 230](#) for more information on display options.

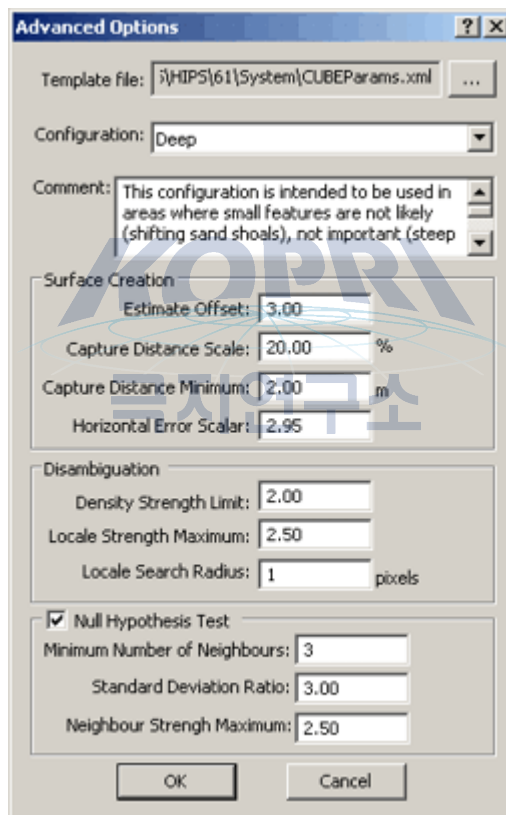


Advanced Options for CUBE surface

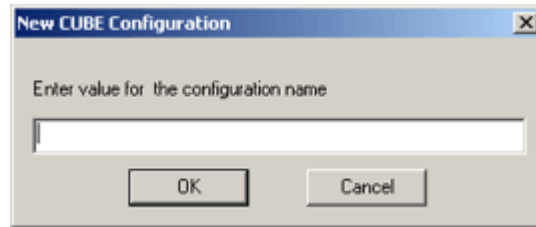
The Advanced Options dialog box displays more detailed configuration settings for the CUBE surface. These settings are contained in the CUBEparams.xml file. You can use the settings in this file or select a custom configuration file. If you use a custom file, make sure that you use the same syntax and structure as the CUBEparams.xml file.

Changes made in this dialog box are saved to the CUBEparams.xml file or to the configuration file you selected.

When the **Advanced** button is clicked in the CUBE Surface (Step 4) dialog box, the Advanced Options dialog is displayed.



1. [Optional] Click **Browse** to select another configuration file. The file path is displayed in the *Template File* field.
2. Select a configuration setting from the *Configuration* drop-down list. If you select New, the New CUBE Configuration dialog box is displayed.



3. [Optional] Type the name for the new configuration setting and click **OK**.
4. [Optional] Type any additional information in the *Comments* field.
5. Complete the following fields, as needed:
 - *Estimate Offset*: The threshold for significant offset from current estimate to warrant the creation of a new hypothesis. The value must be between 0.1 and 10.0.
 - *Capture Distance Scale*: Scale on predicted or estimated depth for how far out to accept data. Value is a percentage of depth used to limit the radius of influence a sounding may have on the grid. Value must be between 1.00 and 100.00.
 - *Capture Distance Minimum*: The minimum value (in metres) on predicted or estimated depth for how far out to accept data. This value is used in conjunction with Capture Distance Scale to limit the radius or influence of a sounding. Value must be between 0.0 and 100.00.
 - *Horizontal Error Scalar*: The value used to scale the horizontal error of each sounding when used in the radius of influence computation. Value must be between 0.0 and 10.00.
 - *Density Strength Limit*: The strength value used to switch from the 'density' disambiguation method to the 'locale' version when using the density & locale algorithm. Value must be between 0.00 and 5.00.
 - *Locale Strength Maximum*: The maximum strength value allowed as part of the mean in the locale algorithm. Value must be between 0.00 and 5.00.
 - *Locale Search Radius*: The radius of the search when computing the trimmed mean. The values are in pixels and must be greater than zero. The original system default value is 1.
 - *Null Hypothesis Test*: Flag used to control the application of the NULL hypothesis test. Value must be either True or False. Default value is False.
 - *Minimum Number of Neighbours*: During the Null Hypothesis test, this controls the minimum number of neighbours that a node must have in order to be considered for the Standard Deviating Ratio test. If the node has less the specified number, it is automatically marked as 'Null'. Values must be between 2 and 8.
 - *Standard Deviation Ratio*: During the Null Hypothesis test, this represents the cut-off limit for the standard deviation ratio including the node in question to the standard deviation of the qualified neighbouring nodes. If the computed ratio exceeds the specified

value, the node is marked as 'Null'. Values must be between 0.0 and 10.0.

- *Neighbour Strength Maximum*: The maximum strength value that is allowed to be considered as part of the standard deviation computations in the NULL hypothesis test. Value must be between 0.00 and 5.00.

Click **OK** to save and apply settings.



Hypothesis Editing

Menu	Tools > Subset Editor
Tool	
Pop-up	Tools > Subset Editor

CUBE surfaces can be displayed in the Subset Editor for examination and editing, using an iterative process to choose which of multiple hypotheses of depth values are the best ones to represent the sea floor.

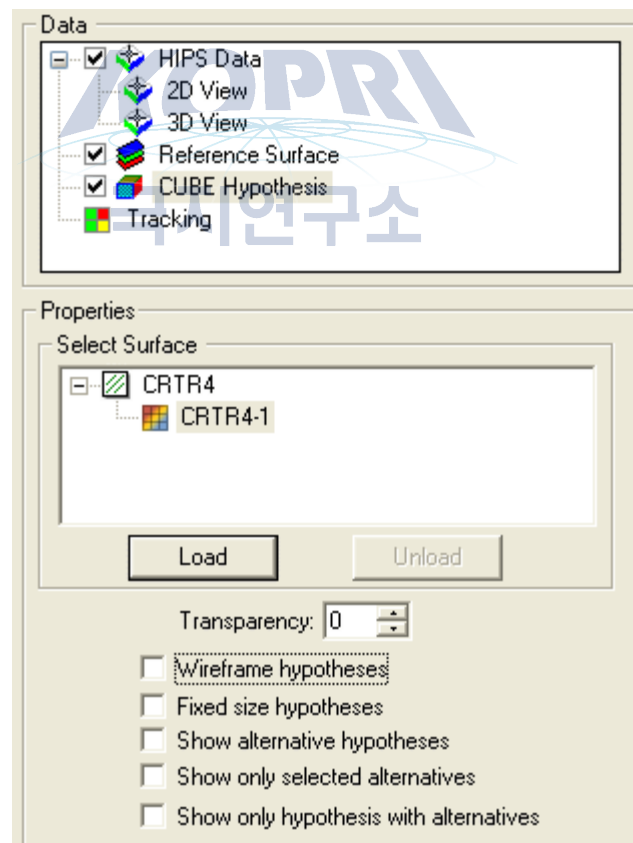
To examine the CUBE Surface in Subset Editor:

1. Select the Subset Editor command.
2. Draw a subset bounding box.
3. Use the mouse to adjust the size of the bounding box by moving the handles
4. Load the subset.

Data contained in the bounding box area is loaded into the 3-D Subset view.

5. In the Subset Editor tab, select the CUBE Hypothesis layer.

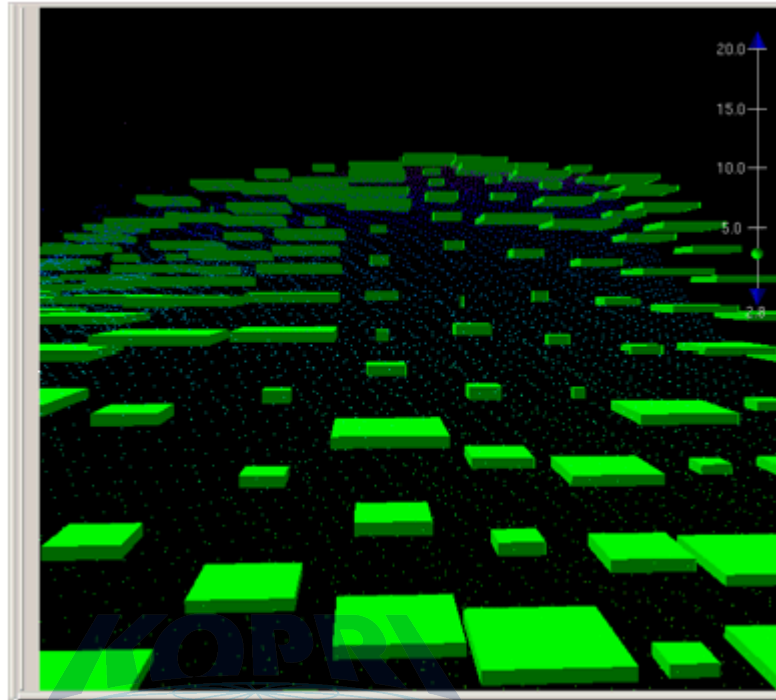
The display options for the CUBE surface are displayed in the Subset Editor tab.



6. Expand the Select Surface data tree and select a BASE Surface containing CUBE data.
7. Click **Load** to view the CUBE surface.

8. To return to the normal display in the 3-D and 2-D Views, click **Unload**.

Below is an example of a section of a CUBE surface in the 3-D View.

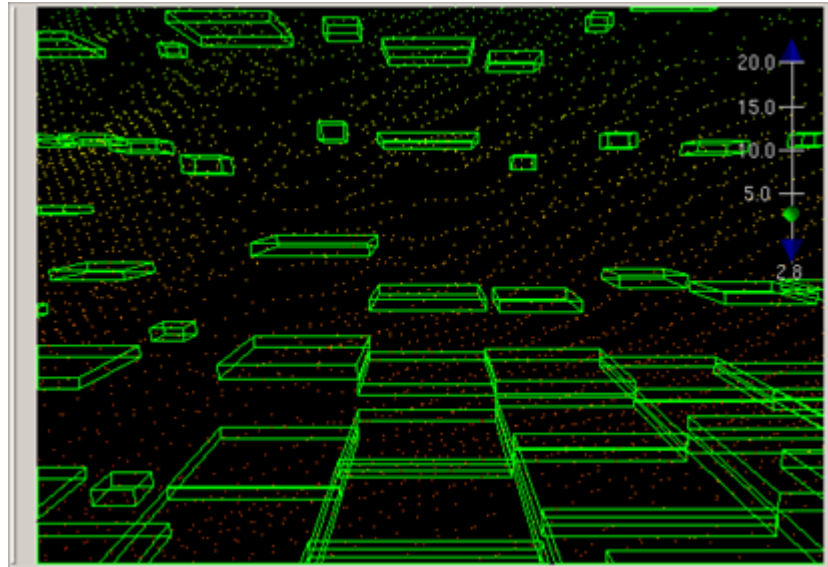


Hypotheses are represented as squares. Squares are shown with different dimensions to reflect the confidence level given to each hypothesis. These confidence levels range from 0.0 (the highest value) to 5.0 (the lowest value). The size of a square is related to the numerical confidence level: large squares represent nodes with the high confidence values while smaller squares represent nodes with low confidence values.

The thickness of the square represents the vertical uncertainty assigned a node (to a 95% confidence interval). The thicker the square, the greater the vertical uncertainty.

More than one hypothesis or a low confidence value does not necessarily mean an error. Uneven areas (slopes, for example) show more than one hypothesis because of the changing terrain.

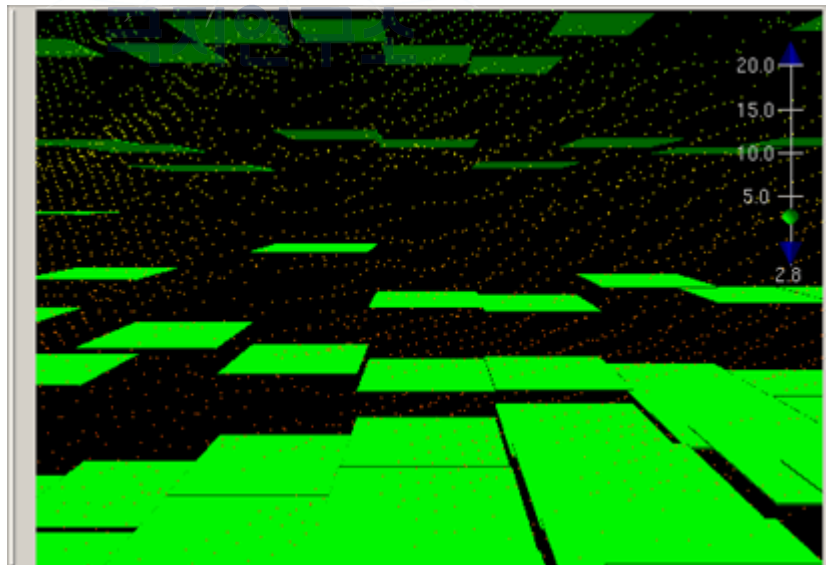
Hypotheses squares can also be displayed without a fill so that they are transparent except for the outlines of the squares.



9. Select the *Wireframe Hypotheses* check box.

The 3-D View is refreshed to display the squares without fill.

The *Fixed Size Hypotheses* option flattens the hypotheses squares and redraws them to a standard size. This option is useful if you want to examine the dataset for holes or to see the exact position of a square in the subset.



10. Select the *Fixed Size Hypotheses* check box.

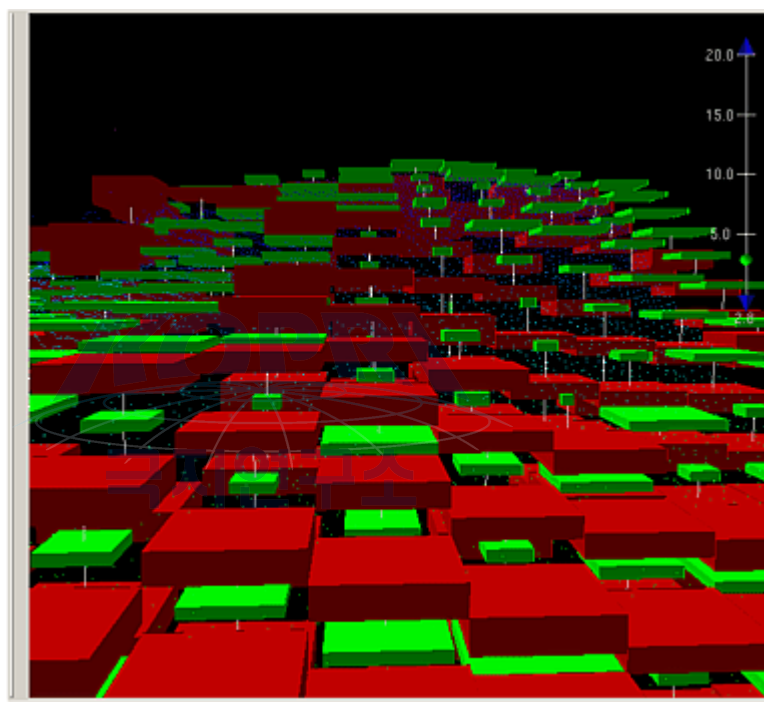
The 3-D View is refreshed to display the squares as flattened and in a standard size.

Nominate Alternative Hypotheses

Some nodes have alternative hypotheses that were not selected during disambiguation. You can view alternative hypotheses and compare them against the selected ones. If needed, the alternative hypotheses can be nominated to replace the established hypotheses.

11. Select the *Show Alternative Hypotheses* check box and click **Apply**.

The 3-D and 2-D Views are refreshed to display the alternative hypothesis. The following graphic shows the 3-D View with the alternative hypotheses displayed.



The red squares represent hypotheses that were not selected during disambiguation. The vertical lines that run between the nodes are viewing aides to match the alternative hypotheses to the selected ones.

1. To replace an hypothesis, select the alternative hypothesis.

The alternative hypothesis is highlighted. The Nominate and Clear commands are now active.

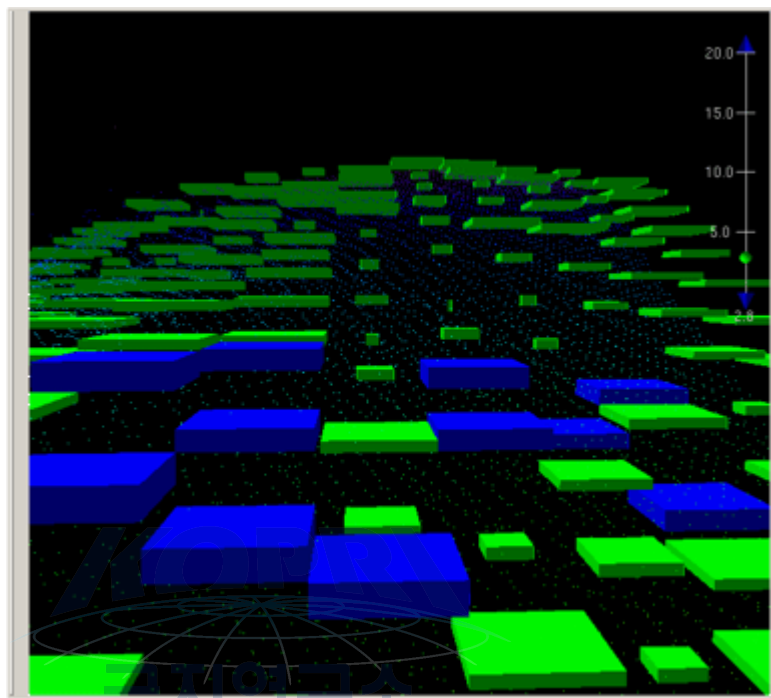
2. Select the Nominate command.

The alternative hypothesis is highlighted in blue. This means that the nominated hypothesis has replaced the established one. All nominated hypotheses are given the highest confidence value of 0.0.

Menu	Tools > Subset Editor > Nominate
Tool	

- 3. To compare nominated nodes against the existing nodes, clear the *Show Alternative Hypotheses* check box and select the *Show Only Selected Alternatives* check box.

The Views are refreshed to show only the nominated and established hypotheses. The following image shows the 3-D View with only nominated and established hypotheses displayed.



Menu	Tools > Subset Editor > Clear
Tool	

- 4. To remove the nomination flag, select the Clear command.
- 5. When you have completed nominating alternative hypothesis data, select the save command.

The User Nominated layer displays the nominated hypotheses that were chosen instead of the hypotheses selected by CUBE disambiguation.

Hypotheses Cleaning

Like soundings in the Swath and Subset Editors, hypotheses can be given a rejected flag. When a hypothesis is rejected, it is retained in the Surface but is excluded from processing when disambiguation is run again or when filtering is applied.

Reject

Menu	Tools > Subset Editor > Reject
Tool	

1. Select a hypothesis
2. Select the Reject command.

The hypothesis is now flagged as rejected.

To change rejected back to the accepted status (and therefore available for further processing).

Accept

Menu	Tools > Subset Editor > Accept
Tool	

3. Select a hypothesis.
4. Select the Accept command.

The hypothesis is now flagged as accepted and is available for further processing.

Reject Node

Menu	Tools > Subset Editor > Reject Node
Tool	

To reject all hypotheses at a node:

1. Select a hypothesis.
2. Select the Reject Node command.

All hypotheses associated with the node are rejected.

Accept Node

Menu	Tools > Subset Editor > Accept
Tool	

To return hypotheses associated with a node to their normal status.

1. Select a hypothesis
2. Select the Accept command.

All hypotheses associated with the node are flagged as accepted.

Update CUBE Surface

If changes are made, the CUBE Surface can be rebuilt to show these changes using the following methods:

- Select the Recompute BASE Surface command (see "[RECOMPUTE SURFACE](#)" ON PAGE 240).
- Select the *Automatic BASE Surface Update* check box in the Options dialog box (see "[GENERAL](#)" ON PAGE 657)

CUBE filtering

A CUBE Surface can be used as a cleaning tool in the HIPS workflow. When a CUBE surface is created, soundings are weighted and contribute to surface grid nodes based on TPU values and distance from the nodes. (See “CUBE” ON PAGE 225.)

The CUBE surface allows for multiple depth estimates or hypotheses to exist at a single grid node, depending on the variation of the sounding data. CUBE then uses “Disambiguation” to determine which hypothesis at each node is the most “correct”.

You can verify and, if necessary, override, CUBE decisions in Subset Editor. Once any necessary edits have been made to the CUBE surface, the surface is updated. (See “RECOMPUTE SURFACE” ON PAGE 240)

A surface filter can then be applied to the data. Any sounding data that is not in agreement with the selected hypotheses will be flagged as rejected.

By applying this surface filtering we can greatly reduce the number of manual edits required by the hydrographer to produce a clean sounding data set.

Note: When following a CUBE workflow, this process is performed instead of other filtering such as Swath or Subset Editor filters.

14

Data QC

Use the BASE surface to highlight problem with sensor data that may exist, and if necessary, edit problem areas.

In this chapter...

- “WORKFLOW” ON PAGE 276
- “EXAMINE NAVIGATION DATA” ON PAGE 279
- “ATTITUDE DATA” ON PAGE 284
- “TOOLS FOR EXAMINING DATA” ON PAGE 289
- “QUERY LINE DATA” ON PAGE 290
- “SET LINE CLASSIFICATION” ON PAGE 291
- “REJECT LINE” ON PAGE 292
- “DESIGNATED SOUNDINGS” ON PAGE 294
- “CRITICAL SOUNDINGS” ON PAGE 296
- “RESTART CLEANING” ON PAGE 299
- “QUALITY CONTROL REPORTS” ON PAGE 300

Workflow

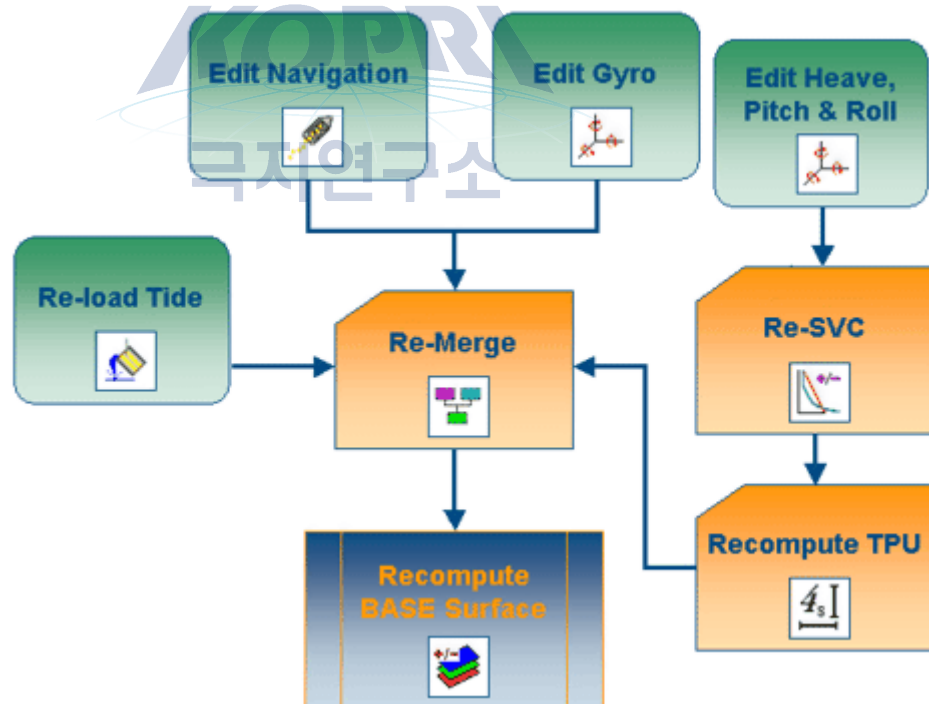
Problems with sensor offsets, auxiliary sensor data, etc. become apparent in the BASE Surface. Relying on a surface to highlight problems in the auxiliary sensors can improve processing efficiency, because the user is no longer required to investigate the motion and navigation for each survey line.

In the HIPS multibeam workflow described here, the auxiliary sensor data was not investigated prior to creating the surface. So at this point in the workflow, you can use the BASE or CUBE surface to highlight problem areas that may exist.

Certain edits will require that data be Merged again. For example, if you reload tide, edit navigation, or edit gyro, you will need to Merge the modified lines again.

If you edit heave, pitch or roll, you will need to re-apply Sound Velocity Correction. If you re-apply SVC, recompute TPU before Merging again.

If any project lines are re-Merged, the BASE surface will need to be re-generated. See “RECOMPUTE SURFACE” ON PAGE 240.



After data QC, the following processes can be applied to further clean data:

- statistical surface cleaning (see “CREATING TILES AND CLEANING DATA” ON PAGE 310)
- “SUBSET CLEANING” ON PAGE 331
- “SWATH CLEANING” ON PAGE 318
- filters
 - “FILTER CRITICAL SOUNDINGS” ON PAGE 297,
 - “ATTITUDE FILTER” ON PAGE 284,
 - “TPU FILTERING” ON PAGE 202,
 - “SINGLE BEAM FILTERING” ON PAGE 472.)



Examine Navigation Data

Navigation outliers can affect the final positions of the soundings during the Merge process. Therefore, the navigation data should be (but is not required to be) examined and cleaned for any outliers.

In Navigation Editor you can examine track lines to accept or reject, and query data, as necessary.

There are two methods for locating navigation outliers:

- Examine the track lines and time graphs that show the computed speed, distance, and course made good between navigation points.
- Find speed and time jumps using the search functions in the Control window.

Menu	Tools > Navigation Editor
Tool	

To edit lines in Navigation Editor,

1. Select a track line in the Display window.
2. Select the Navigation Editor command from the Tools menu or Tools toolbar.

The Navigation Editor time graphs open in the HIS and SIPS interface and display relevant speed, distance, and course-made-good data for the line.

3. Select data in either the Display window or the time graphs by pressing and holding the mouse button while dragging the cursor across the data.

The selected data is highlighted.

4. Release the mouse button when finished.
5. Select a reject (see [“REJECT DATA” ON PAGE 282](#)), accept (see [“ACCEPT DATA” ON PAGE 283](#)) or query (see [“QUERY DATA” ON PAGE 283](#)) option.

Speed jumps

The Speed Jump option searches the track line for changes in vessel speed that are same as, or greater than, the Speed Jump value.

Menu	Window > Control
Tool	

1. Ensure that the Control window is open and the Navigation tab is displayed.
2. Select the *Automatic Query* check box if you want to display the selected position fixes in the Query tab of the Worksheet window.
3. Enter a value in the *Speed Jump* check box.
4. Click the *List Buffer* up or down arrow keys to select the number of adjacent position fixes that are highlighted when a jump is found. For example if you choose 5, the two position fixes to the right and left of the selected fix are also selected.
5. Click **Find**.
6. Select Accept ([“ACCEPT DATA” ON PAGE 283](#)), Query ([“QUERY DATA” ON PAGE 283](#)) or one of the Reject [“REJECT DATA” ON PAGE 282](#)) options.

Time jumps

7. Click **Find** again to move along the track line.

The Time Jump option searches the track line for changes in time (in seconds) that are the same as, or greater than, the Time Jump value.

1. Ensure that the Control window is open and the *Navigation* tab is displayed.
2. Select the *Automatic Query* check box if you want to display selected position fixes in the Query tab of the Worksheet window.
3. Enter a value in the *Time Jump* box.
4. Click the *List Buffer* up or down arrow keys to select the number of adjacent position fixes that are highlighted when a jump is found. For example if you choose 5, the two position fixes to the right and left of the selected fix are also selected.
5. Click **Find**.
6. Select one of the Reject options ("[REJECT DATA](#)" ON PAGE 282), Query ("[QUERY DATA](#)" ON PAGE 283) or Accept ("[ACCEPT DATA](#)" ON PAGE 283).

Line Interpolation

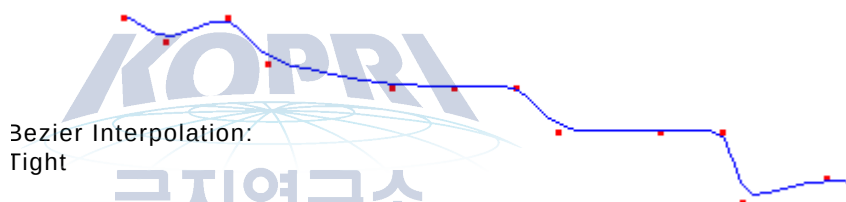
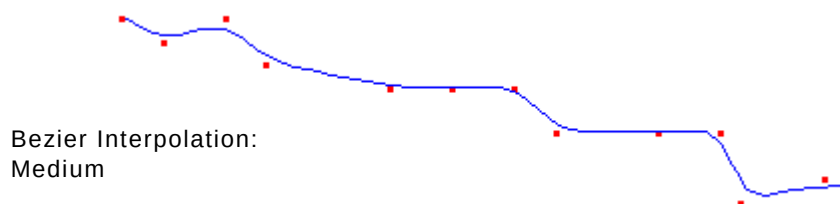
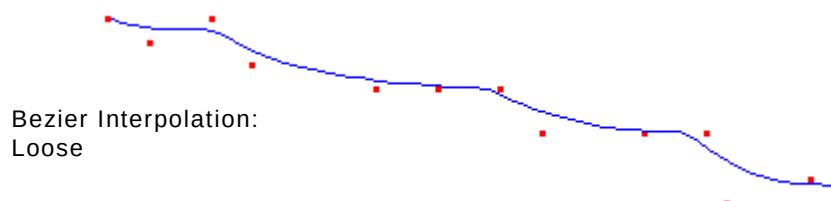
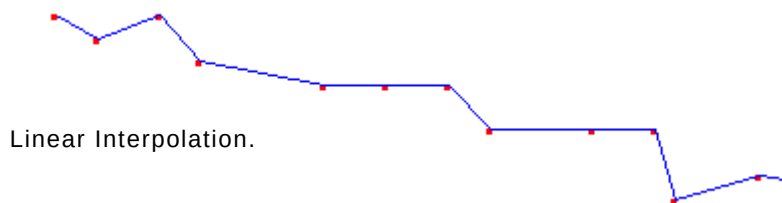
Position observations do not usually occur at exactly the same instant as a depth observation (ping). Thus it is unlikely that there is position data for every ping.

For example, positions observations may be taken every second, (1 Hz frequency), while pings may be observed 10 times a second (10 Hz frequency). So, in most cases it will be necessary to interpolate positions to match the time for each ping.

You use either linear or Bezier method of interpolation.

- **Linear:** Calculate new positions by connecting consecutive positions using straight lines.
- **Bezier:** Calculate new positions by connecting points using a Bezier curve that does not necessarily connect all navigation positions. Bezier curves are available in three types: tight, medium and loose.

If you do not select an interpolation method then the default is linear. Linear interpolation is suitable if the original navigation positions are clean and do not significantly deviate from neighbouring positions. Bezier interpolation is suitable if the original data is noisy.



In the Navigation Editor the interpolation method is set in the Interpolation method section of the Navigation Editor tab.

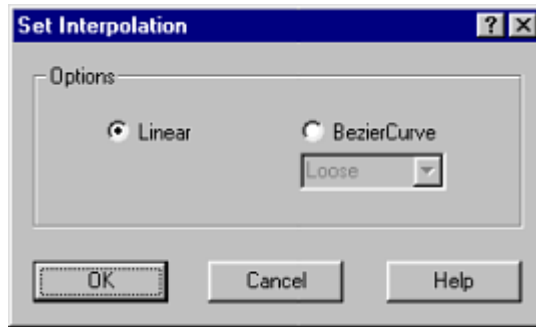
1. Select the *Navigation Editor* tab in the Control window.
2. Select either *Linear* or *Bezier Curve* by selecting the appropriate check box.
3. If the *Bezier Curve* option is enabled, select either a *Loose*, *Medium* or *Tight* format from the drop-down menu.

To set an interpolation option for one or more survey lines without opening the Navigation Editor,

Menu	Tools > Set Interpolation

1. Select a line.
2. Select the Set Interpolation command from the Tools menu.

The Set Interpolation dialog box is displayed.

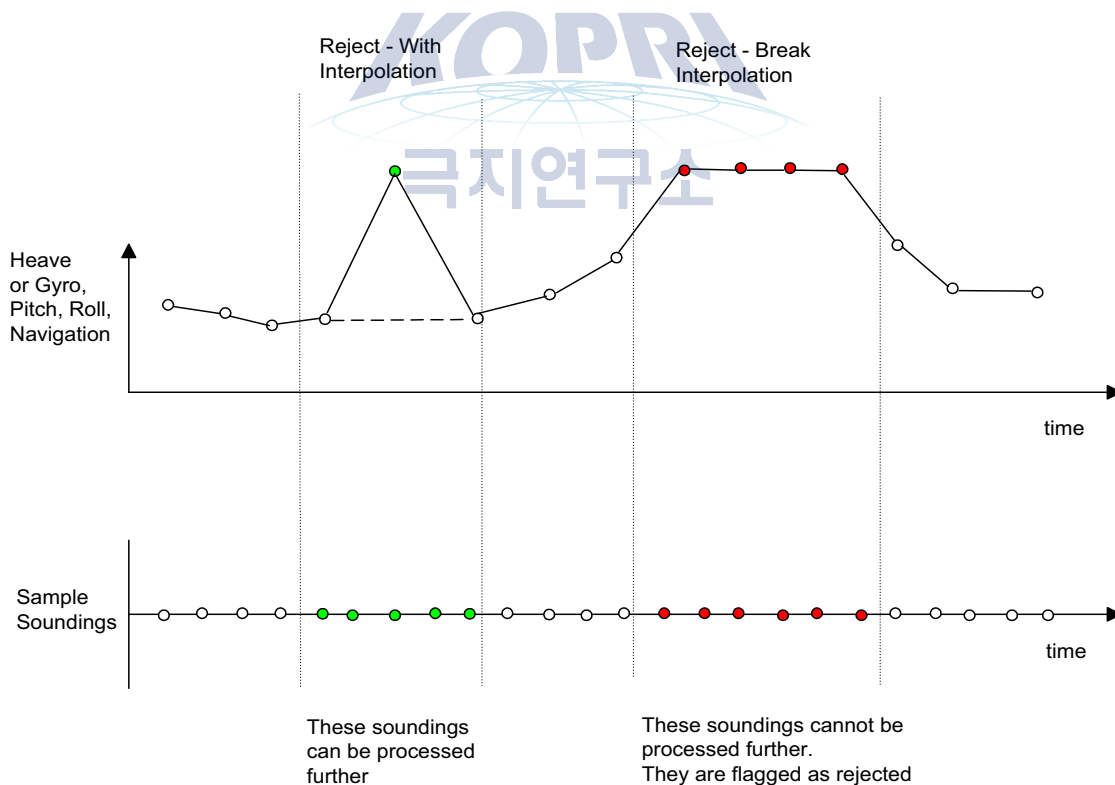


3. Select an interpolation option: *Linear* or *Bezier Curve*

Click **OK**.

Reject, Accept and Query Data

All data is marked as Accepted until flagged otherwise. Data can be queried for position fixes, and rejected using one of two alternatives: Reject with interpolation and Reject and break interpolation. These alternatives are illustrated below.



For some multibeam sonars, the data converted into HIPS has already been compensated for heave, pitch, and roll. Therefore heave, pitch, and roll are not applied during Merge as indicated

by the “Apply” options in the vessel configuration. However, it is still possible to use Reject–Break Interpolation on the recorded heave, pitch, and roll data which results in the sounding data during the same time period being rejected by Merge.

Reject Data

Select from two reject data options:

Menu	Edit > Status Flag > Reject-With Interpolation/Reject-Break Interpolation
Tool	 
Pop-up	Reject > Reject-With Interpolation/Reject-Break Interpolation

- **Reject-With Interpolation:** Soundings associated with this navigation data are processed further since they have positions interpolated for them.
- **Reject-Break Interpolation:** Soundings associated with this navigation data are flagged as rejected and cannot be processed.

1. Select the data so it is highlighted.
2. Select a Reject command.

The selected data is now flagged as rejected.

Menu	Edit > Status Flag > Accept
Tool	
Pop-up	Accept
Key	<A>
Menu	Edit > Query
Tool	
Pop-up	Query
Key	<Q>

Accept Data

All data is marked as accepted until flagged otherwise. Use this option to change the status of rejected data.

1. Select the data so it is highlighted.
2. Select the Accept command.

The previously rejected data is now flagged as Accepted.

Query Data

Examine data for further information.

1. Select the data so it is highlighted.
2. Select the Query command.

Information is displayed in the Worksheet window. Data can be rejected or accepted in this window.

Query Line

The Query Line command lets you view navigation data for an entire track line.

1. Select a track line.
2. Select the Query Line command.

Menu	Edit > Query Line
Pop-up	Query Line

Attitude Data

You can examine and clean the motion data of the vessel or towed transducer using the Attitude Editor.

The Attitude Editor is displayed within the HIPS and SIPS interface. To open the Editor:

Menu	Tools > Attitude Editor
Tool	
Pop-up	Attitude Editor

1. Select a track line so it is highlighted.
2. Select the Attitude Editor command.

The Attitude Editor is displayed

Attitude Filter

You can reject data with residual values that fall outside user-defined threshold limits, and apply these changes to attitude data across entire track line(s).

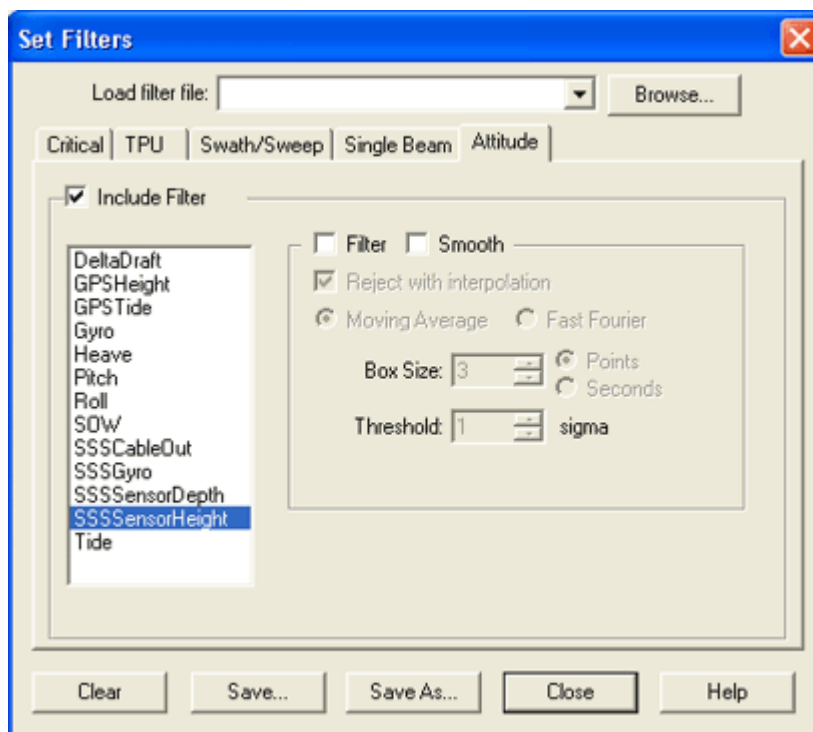
The Attitude filter can be used to accomplish two tasks:

- **Smooth data:** The Smooth function is used to smooth out localized variability. The parameters for creating the smoothed data are saved to the SmoothedCoefficients file in the HCDS_Data\Project\Vessel\Day\Line folder. This file is applied to the track line during any process that supports smoothing.
- **Filter data:** The Filter function is used to reject attitude that falls outside of defined boundaries. Soundings with the same time stamp as the rejected data are also flagged as rejected. You can choose to reject attitude data with interpolation.

These options are also found in the Attitude Editor.

1. Select a track line.
2. Select the Set Filters command.

The Set Filters dialog box is displayed.



3. Select a sensor from the list.
4. Select the *Filter* check box.

By default, the filter is set to “Reject with interpolation” so that soundings with the same time stamp as the rejected data are not also flagged as rejected.

5. Clear the Reject with Interpolation check box if you want soundings associated with the rejected sensor data to also be rejected.

There are two filtering options: Moving Average and Fast Fourier.

- The *Moving Average* calculates a mean for each data point, by calculating an average sensor value over a window of data using the Box Size parameter. The window is defined as a number of data points or seconds centred on a point. The average value for all of the values in the window is calculated and will be given to the central point.
 - *Fast Fourier* applies a common wave-smoothing algorithm to a data point. The Fast Fourier transformation performs a low-pass filter on the selected sensor. You select a Box Size in either points or seconds. This value is converted into seconds and then inverted to become the cut-off frequency.
6. Select either the *Moving Average* or *Fast Fourier* filtering option.
 7. Select the Box Size parameter by clicking the up or down arrow buttons. When using the Moving Average, the Box Size determines the

size of the window for averaging the data point. When using the Fast Fourier, the Box Size determines the cut-off frequency that is applied to all data.

8. Determine if the Box Size is in (data) points or time, by selecting the Points or Seconds option.
9. Click the Box Size up or down arrow buttons to select the number of adjacent data points.
10. Click the *Threshold* up or down arrow keys until you reach a desired value. Threshold is a multiple of the standard deviation (sigma).
11. Click Save As to save the filter settings to a HIPS filter file.
12. Select an Apply Filter command from the Tools menu.

Menu	Tools > Apply Filters > 1 Screen/To End of Line/Selected Lines
Tool	

The corresponding attitude data is rejected.

For other automated filters, see “[SWATH FILTERING](#)” ON PAGE 322, “[TPU FILTERING](#)” ON PAGE 202, “[SINGLE BEAM FILTERING](#)” ON PAGE 472, and “[FILTER CRITICAL SOUNDINGS](#)” ON PAGE 297.)

See also “[SMOOTH DATA](#)” ON PAGE 613.

Query attitude data

Querying displays information about selected data.

1. Press and hold the left mouse button while dragging the cursor across the data to be queried.

The data is selected.

2. Select the Query command.

The following data is displayed in the Worksheet window:

- time stamp
- d-time difference in seconds from last time stamp
- sensor value in either degrees or metres/feet
- d-value difference from last value
- status

The following two data values are related to the smoothing and filtering options (see “[SMOOTH DATA](#)” ON PAGE 613 and “[ATTITUDE FILTER](#)” ON PAGE 284):

- averages derived from adjacent data points
- difference between original data values and moving average or FFT value for each data point

Change data status flag to rejected or accepted.

1. Select the data in the Worksheet window so it is highlighted.
2. Select a Reject or Accept command.

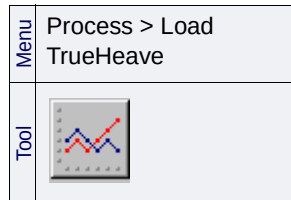
The data is marked as accepted or rejected, depending to the option you selected.

Menu	Edit > Query
Tool	
Pop-up	Query
Key	<Q>

TrueHeave Data

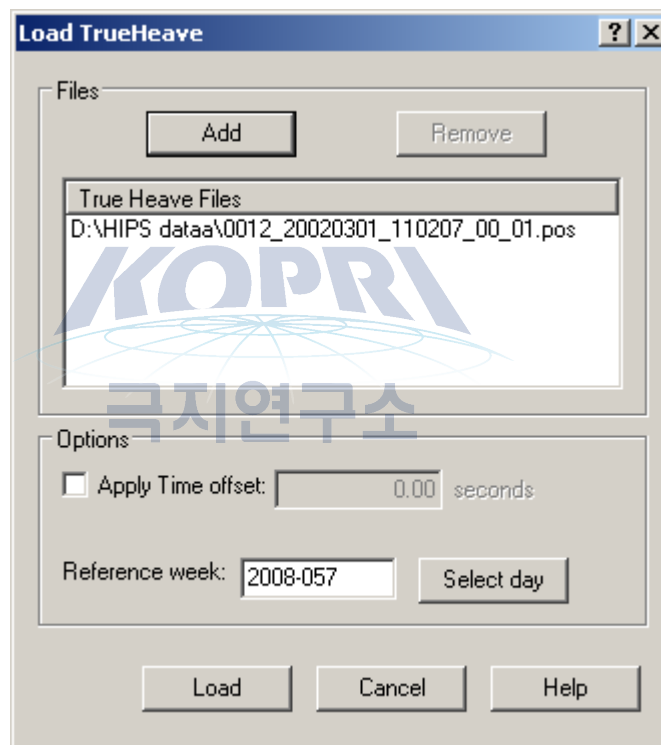
Load TrueHeave data to a survey track line.

Applanix's TrueHeave values are computed from real-time heave data and stored in a separate binary file along with the corresponding heave data. This file is not imported into HIPS during regular data conversion and has to be separately loaded to the track line. The location of TrueHeave files can be set from the Directories tab of the Options dialog box (see ["DIRECTORIES" ON PAGE 674](#)).



1. Select a track line.
2. Select the Load TrueHeave command.

The Load TrueHeave dialog box is displayed.



3. Click **Add** and select the TrueHeave file.

The file name is displayed in the dialog box.

4. To remove a file, select it and click **Remove**.
5. Select the *Apply Time Offset* if the time stamps in the TrueHeave files do not match the time stamps for the rest of the project.
6. Type the offset to synchronize the time stamps in TrueHeave files to the project.
7. If you are loading files logged over the GPS week number roll-over, use the drop-down box to select a reference date for the files to be loaded.
8. To apply the TrueHeave data to the track line, click **Load**.

Load Attitude/Navigation Data

Load attitude and navigation data from Applanix POS MV or POSProc files to selected track lines.

1. Select one or more track lines.

2. Select the **Load** command.

The Load Navigation/Attitude Data dialog box is displayed.

Menu	Process > Load Attitude/Navigation Data

3. Click **Add** to select the files by browsing to their location. You can load either POS MV files OR load POSProc files, but not both at the same time.

4. To remove a file from the *File List*, select the file and click **Remove**.

5. [Optional] To accommodate a GPS week roll-over event, you can select the Julian date of the day the data files were created. The rollover cannot span more than 7 days.

6. Click the appropriate check boxes to choose which attitude/navigation records you want to import into the track line(s) from these files.

7. To reduce the volume of large attitude records to a manageable level, enter an output interval (in seconds).

Reference Week

Import Data

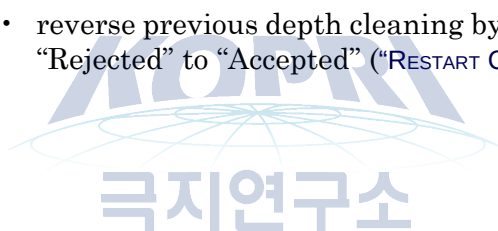
8. The *Apply to all lines that are partially covered* option will load the navigation data even if the data does not cover the entire line.
9. Select the *Allow gap between records* check box to limit the interval allowed between consecutive data records in the file. If an interval exceeds the amount specified in the *Maximum* field, the data will not be loaded and the process will stop.
10. If the time stamp in the file does not match the time stamps in the project, you select the *Apply Time Offset* option and type a time value (in seconds).
11. Click **Load**.



Tools for examining data

There are a number of tools available to assist examining data, and in tracking the progress of data cleaning. For example, you can:

- examine information about one or more selected track lines (“[QUERY LINE DATA](#)” ON PAGE 290).
- set a flag to indicate the type of survey line (“[SET LINE CLASSIFICATION](#)” ON PAGE 291).
- reject an entire track line to remove it from processing (“[REJECT LINE](#)” ON PAGE 292)
- show selected types of rejected data (“[VIEW REJECTED SOUNDINGS](#)” ON PAGE 293)
- preserve and highlight shoalist soundings (“[DESIGNATED SOUNDINGS](#)” ON PAGE 294)
- easily view Designated, Examined and Outstanding soundings when working with a large data set (“[CRITICAL SOUNDINGS](#)” ON PAGE 296)
- reverse previous depth cleaning by resetting status flags from “Rejected” to “Accepted” (“[RESTART CLEANING](#)” ON PAGE 299)



Query Line Data

Menu	Edit > Query
Tool	
Pop-up	Query
Key	<Q>

Examine information about one or more selected track lines.

1. Select track lines in the Display window or in the Project tab of the Control window.
2. Select the Query command.

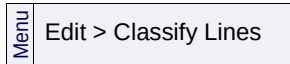
The Query view in the Worksheet window can display more than 40 different fields of data about each line. You can view all query fields by selecting *Detailed Line Query* in the General Options dialog box (see “[GENERAL](#)” ON PAGE 657) or only the most important fields by de-selecting this option. The information is read-only and cannot be modified.(see “[WORKSHEET WINDOW](#)” ON PAGE 18).



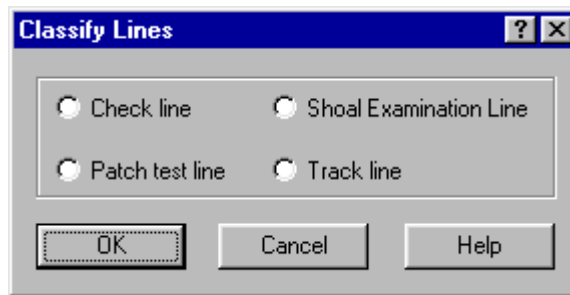
Set Line Classification

Use this command to set or change a classification flag for a track line, to help distinguish between line types and purposes.

1. Make sure the Ship Track Lines layer is selected in the Layers tab of the Control window.
2. Select a track line in the Display window or Control window.
3. Select the Classify Lines command.



The Classify Lines dialog box is displayed.



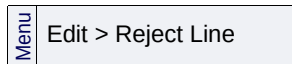
4. Select from four options for setting the line classification flag:
 - *Check Line*: A line that is run perpendicular to the survey and is used to check the validity of survey data.
 - *Patch Test Line*: A line that is run over a surveyed area to calibrate sensor and sonar offsets.
 - *Shoal Examination Line*: A line that is run over a surveyed area to re-check possible shoals on the sea floor.
 - *Track Line*: A line that is part of the main survey grid.
5. Click **OK**.

The line is now flagged according to one of four categories.

Reject Line

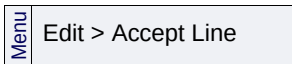
Use the Reject Line command to remove an entire track line from data processing.

When a rejected line is merged, the profiles are marked as rejected, which prevents the soundings from being used in BASE surfacing, surface cleaning, and mosaicking. However, status flags on the individual soundings are maintained. A rejected line is not processed in the tiling operations or exported to a CARIS map or ASCII file.



1. Select a track line.
2. Select the Reject Line command.

The rejected line is displayed in the Project tab in the Control window with a red **X** beside the file name.



3. To change a rejected line back to accepted, select the Accept Line command.

The line is displayed in the Project tab of the Control window with a red exclamation point (!) beside the file name. This indicates the line has been flagged as outdated. You must merge the soundings again before they are available for further processing (see "MERGE" ON PAGE 185).



View Rejected Soundings

Menu	View > Show Rejected
Tool	
Key	<F4>

You can show or hide rejected data in the Attitude, Navigation, Single Beam, Swath, and Subset Editors. Data that was rejected in the Subset Editor can also be viewed in the Swath Editor.

1. Select the Show Rejected command.

You can also control which type of rejected data is displayed in the Single Beam, Swath, and Subset Editors.

2. Select the View command.

The Rejected Flag Types dialog box opens.

Menu	View > Rejected Flag Types

3. Place a check mark beside the box with the type of rejected data you want to view.

- *Rejected by Swath/Single Beam Editor:* View sounding data rejected in the Swath or Single Beam Editors or by the Swath or Single Beam filters.
- *Rejected by Hydrographer:* View data rejected interactively in the Subset Editor by the hydrographer.
- *Rejected by TPE:* View data rejected through the Total Propagated Error filtering process.
- *Rejected by Surface Cleaning:* View data rejected through the Surface Cleaning process.
- *Rejected by Surface Filter:* View data rejected through surface filtering.
- *Rejected by Depth Filter:* View data rejected by the depth filter in the Conversion Wizard or the Generic Data Parser when it was converted to HIPS format.
- *Rejected by Disabled Beam:* View data rejected due to a disabled beam status during conversion. This occurs when the beam is disabled in the vessel configuration or if the sonar system flagged the beam as a bad detection in the raw data file.

4. Click **OK**.

The rejected data types you selected are displayed in the editors.

Designated Soundings

The Designated Sounding flag identifies the shallowest sounding on important features. For example, in a cluster of soundings surrounding an outcrop of rocks, the shallowest sounding among that cluster would be identified as Designated.

The purpose of the Designated Sounding flag is to ensure that the shallowest depths over significant seabed features are maintained for standard hydrographic products.

When these soundings are applied to a Bathymetry Associated with Statistical Error (BASE) Surface, the Surface is regenerated so that the Designated Sounding's depth value is applied to the nearest node (see "[FINALIZE BASE SURFACE](#)" ON PAGE 243).

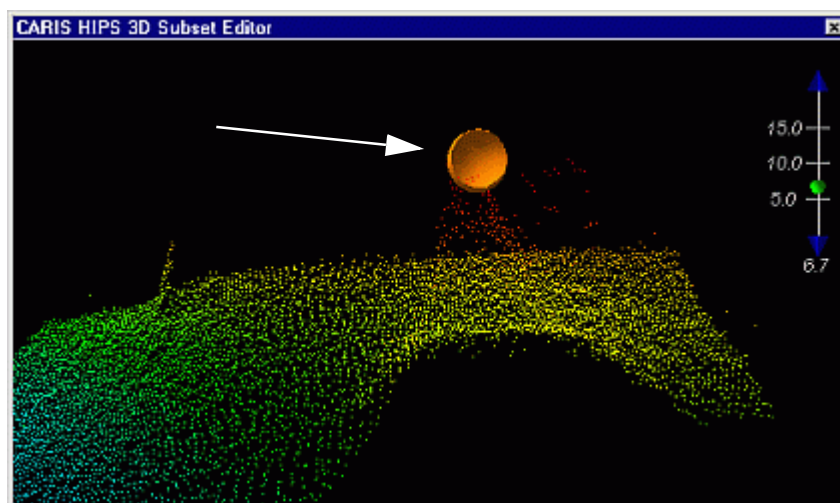
The Designated Sounding option is available in the Swath and Subset Editors. Designated Soundings can be exported to ASCII, CARIS, GSF, and HOB formats. The location of designated soundings can be viewed in the Display window. (See "[CRITICAL SOUNDINGS](#)" ON PAGE 296.)

To flag a sounding as shoalest,

1. Open either the Swath or Subset Editor, and load data.
2. Select the shallowest sounding from a cluster of soundings around a shoal feature.
3. Select the Designated command.

When a sounding is flagged as Designated, it is displayed in the Subset or Swath Editor by a special symbol as shown in the zoomed in view below.

Menu	Edit > Status Flag > Designated
Tool	
Key	<D>



Find Designated Sounding

The Find Designated Sounding command automatically selects the shallowest sounding in cluster of highlighted soundings. This feature reduces the time needed to select a Designated Sounding.

1. Use the cursor to highlight soundings in the Swath, Single Beam or Subset Editors.
2. Select the Find Designated command.

The shallowest sounding among the cluster of highlighted soundings is flagged as Designated.

Menu	Edit > Status Flag > Find Designated
Tool	



Critical Soundings

Display soundings that have been set with Designated, Examined and Outstanding status flags during subset and swath cleaning. (See “[SUBSET CLEANING](#)” ON PAGE 331 and “[SWATH CLEANING](#)” ON PAGE 318.) For more information on sounding status flags, see “[STATUS FLAGS AND VALUES](#)” ON PAGE 698.

Activating the Display Critical Soundings function reduces the time needed to locate Designated, Examined and Outstanding soundings when working with large datasets.

It does this by creating a layer of critical soundings which can be turned on or off to display the soundings.

Menu	View > Display Critical Soundings

1. Select the Display Critical Soundings command from the View menu.

When you select this command for first time, a message informs you that the file has not yet been built and that building this file might take time. This is because HIPS & SIPS is filtering the project data to collect and index all the critical soundings. These soundings are saved in a HCSIDX file that contains the line, profile, beam number and depth of all special soundings in the project.

If a file already exists, then it is automatically compiled.

A critical soundings layer is created and displayed in the Layers tab of the Control window.

2. Select the Critical Soundings layer.
3. Select the Refresh command.

The soundings are drawn in the Display window according to the colour settings for each sounding flag (see “[STATUS](#)” ON PAGE 671).

Query Soundings

To view information on specific soundings, select the soundings in the Display window and use the Query command. (See “[QUERY LINE DATA](#)” ON PAGE 290.) Information about the soundings will be displayed in the Query tab of the Worksheet window.

	Vessel	Day	Line	Profil	Bea	Depth (m)	Status
1	Reson_8125_	2004-217	0057	913	116	75.06	Examined
2	Reson_8125_	2004-217	0072	638	8	22.393	Designated
3	Reson_8125_	2004-217	0058	2,232	198	21.667	Outstanding
4	Reson_8125_	2004-217	0070	6,774	83	23.507	Designated

Below the table is a scroll bar and a tabbed interface with 'Output' and 'Query' tabs. The 'Query' tab is currently selected.

Critical Sounding Properties

The status of critical soundings can be colour-coded using the Tools > Options dialog box. To colour code soundings,

1. Select the Display tab in the Tools > Options dialog box.
2. Select Status from the list.
3. Set the colours for the various status settings using the colour picker.

Display colours can also be set in the Properties window, where you can also change the font and type size for soundings.

1. Highlight the Critical Soundings layer in the Layers tab to view and change properties in the Properties window.

To change the type face and font size of the soundings,

2. Click the Font tab in the Properties window to view the standard Windows Font dialog box.

Filter Critical Soundings

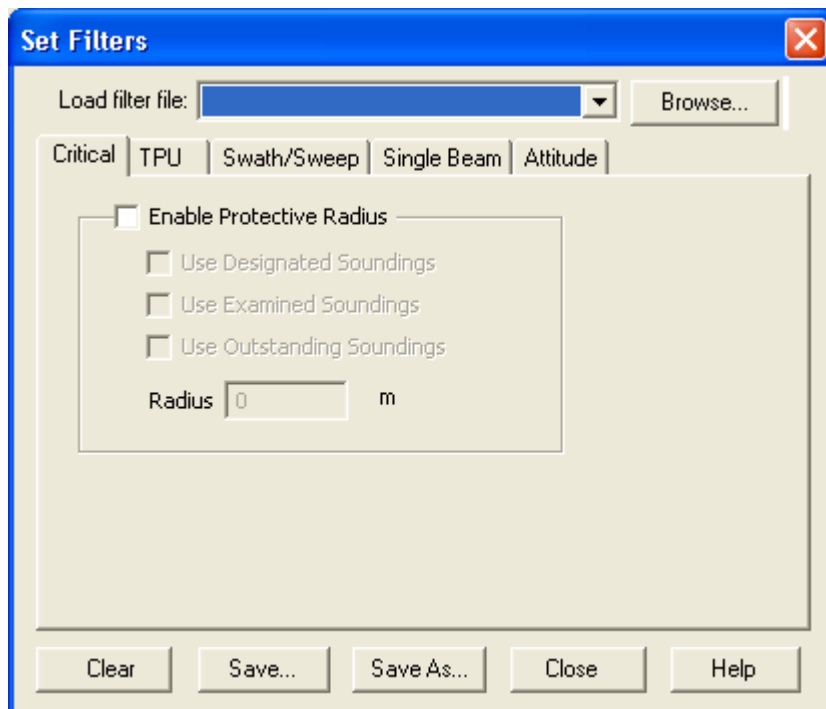
You can set a protective spherical area around critical soundings to protect any other soundings within the sphere from being rejected when you apply automated filters.

The size of this protective area is determined by setting a radius. You can also select to which type of critical soundings the protection will be applied.

Data must be merged before critical sounding filtering is applied.

To prevent the neighbours of critical soundings from being rejected during automated filtering:

1. Select the Set Filters command from the Tools menu.
2. The Set Filters dialog box is displayed.



3. Select the Critical tab.
4. Select the *Enable Protective Radius* check box.
5. Select which type(s) of soundings to apply the radius to.
6. Type the dimensions of the protective area in the *Radius* field.
7. Click **Save** or **Save As** to save your filter file so it can be applied with the Apply Filters command.

For other automated filters, see “SWATH FILTERING” ON PAGE 322, “ATTITUDE FILTER” ON PAGE 284, “TPU FILTERING” ON PAGE 202, and “SINGLE BEAM FILTERING” ON PAGE 472.)

Restart Cleaning

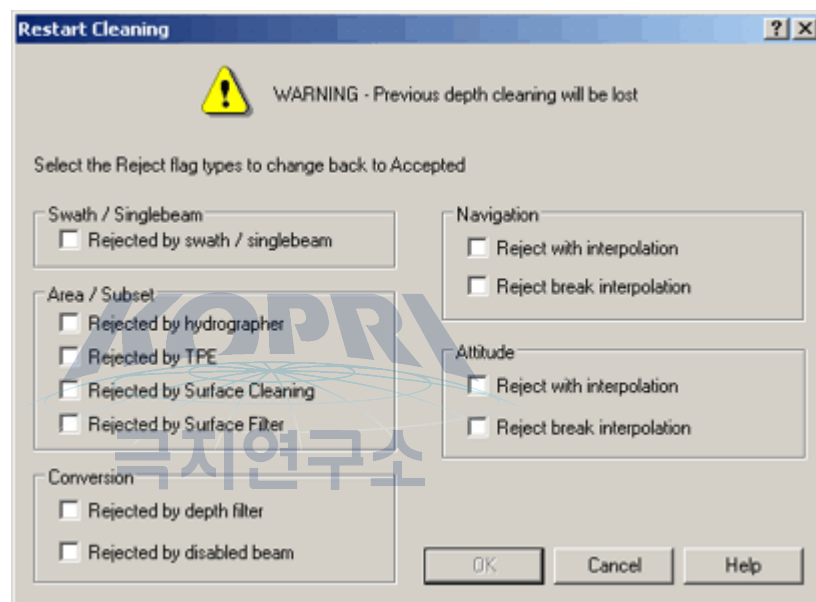
Menu	Edit > Restart Cleaning
Tool	

The Restart Cleaning function resets status flags from “Rejected” to “Accepted” for sounding, attitude, and navigation data.

Warning: All previous depth cleaning is lost once this command is implemented.

1. Select the track line(s).
2. Select the Restart Cleaning command.

The Restart Cleaning dialog box is displayed.



3. Select any of the following check boxes to select a rejected data criteria.
 - *Rejected by Swath Editor/Single Beam Editor:* Reset to accepted sounding data that was rejected in the Swath or Single Beam Editors, or by the Swath or Single Beam filters.
 - *Rejected by Hydrographer:* Reset to accepted the sounding data that was interactively rejected in the Subset Editor.
 - *Rejected by TPE:* Reset to accepted the data that was rejected during Total Propagation Error (TPE) filtering.
 - *Rejected by Surface Cleaning:* Reset to accepted data that was rejected during Surface Cleaning.
 - *Rejected by Surface Filter:* Reset to accepted data that was rejected during CUBE filtering.
 - *Rejected by Depth Filter:* Reset to accepted data that was rejected by the depth filter during conversion.
 - *Rejected by Disabled Beam:* Reset to accepted data that was rejected due to the disabled beam flag during conversion.

- *Rejected with Interpolation (Navigation)*: Reset to accepted navigation data that was rejected without interpolation.
- *Rejected break Interpolation (Navigation)*: Reset to accepted navigation data that was rejected without interpolation.
- *Rejected with Interpolation (Attitude)*: Reset to accepted attitude data that was rejected with interpolation.
- *Rejected break Interpolation (Attitude)*: Reset to accepted attitude data that was rejected without interpolation.

4. Click **OK**.

The selected data is now flagged as accepted.



Quality Control Reports

The Quality Control (QC) process in HIPS is typically used to statistically compare soundings recorded from check lines against selected attribute values from a BASE Surface in the same survey area.

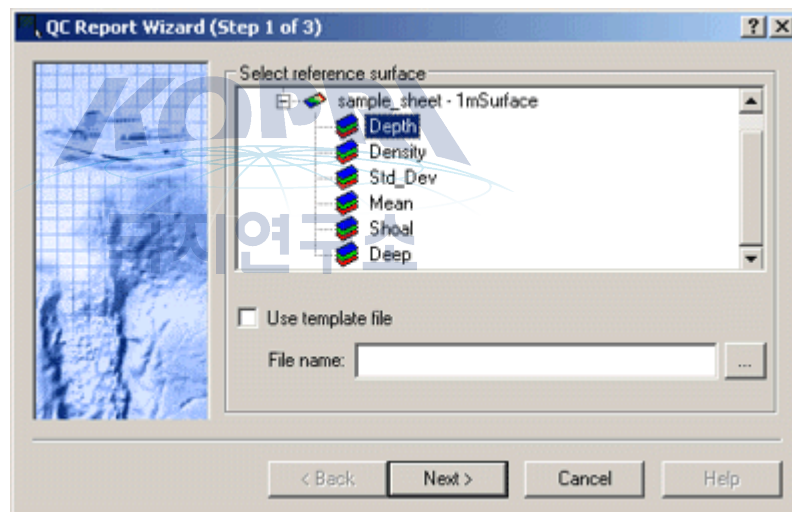
Statistical variances between the check-line soundings and the attribute values are shown in a table in the Worksheet window once the QC tool is run.

1. Make sure that the Project tab of the Control window is visible.
2. Select a survey line. You can also, if needed, select a Project, Vessel, or Day folder.
3. Select the Quality Control command.

Menu	Process > QC Report

QC Report - Step 1

The QC Report - Wizard Step 1 dialog box is displayed.



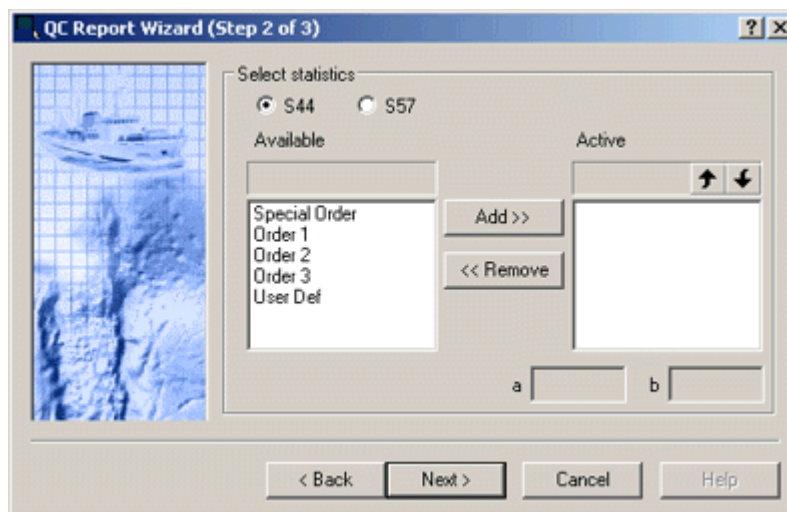
1. Select a BASE Surface attribute from the *Select Reference Surface* list.

A template file is an XML file that contains output from the Quality Report. You can save the output as a template file or open an existing template file. If you open an existing template file, the settings saved in that file are applied to the options in the other dialog boxes.

2. Select the *Use template file* check box to create or open a template file.
3. Click **Browse** to select a location and name for the file or select an existing file.
4. Click **Next**.

QC Report - Step 2

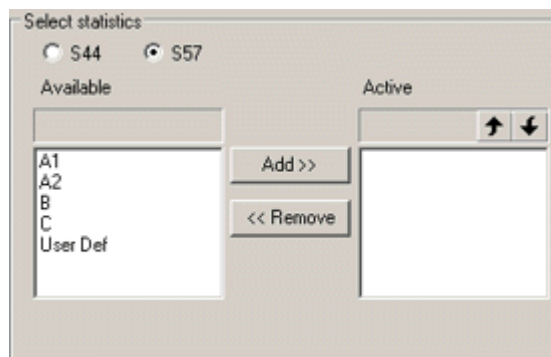
The QC Report - Wizard Step 2 dialog box is displayed.



This dialog box selects the IHO standard for determining what percentage of soundings fall within a selected error limit for depth accuracy. You can use the S-44 Ed. 4 survey orders or S-57 CATZOC zones of confidence. For more information on how error limit for depth accuracy is calculated, see “TPU FILTERING” ON PAGE 202).

1. Select either the S-44 or S-57 option.

The dialog box is refreshed to show the categories relevant to the selected option.



2. To display a category in the QC report, select it in the *Available* list and click **Add** to move to the *Active* list.

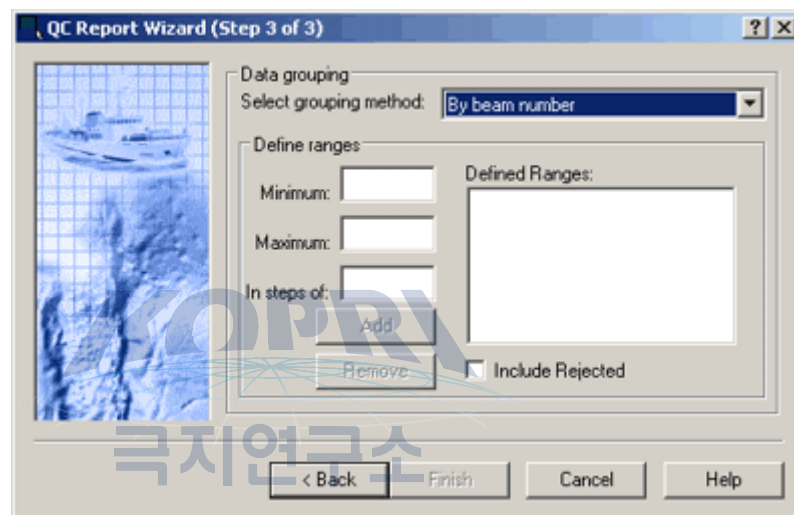
If you are using the user defined (*User Def*) category, the *a* (constant depth error) and *b* (factor of the depth dependent error) fields become active once it is moved to the *Active* list.

3. [Optional] Type the values for the user defined category in the *a* and *b* fields.

4. To remove a category, select it in the *Active* list and click **Remove** to move it back to the *Available* list.
5. Select a category and click the up or down arrow buttons at the top of the *Active* list to determine its order in the *Active* list. This will determine the order that data is displayed in the Worksheet window when the QC Report is generated.
6. Click **Next**.

QC Report - Step 3

The QC Report - Wizard Step 3 dialog box is displayed.



This dialog box defines how soundings are grouped in the QC Report. There are three options available:

- *Beam number*: Soundings are grouped according to across-track beam number.
- *Angle*: Soundings are grouped according to beam angle from nadir.
- *Distance*: Soundings are grouped according to across-track distance from nadir.

1. Select a method for grouping soundings from the drop-down list.

Soundings can be further organized by range. The range values must correspond to grouping method selected above.

2. Type the range in the *Minimum* and *Maximum* fields.

Ranges are incremented according to the value entered in the *In steps of* field. For example, for beam numbers 1 to 100 with an increment of 10, the beams are then displayed in the QC Report tab in 10 rows.

3. Type a value to increment the ranges.

4. Click **Add** to display the range in the *Defined Ranges* list.
5. To remove a range, select it in the *Defined Ranges* list and click **Remove**.
6. To include rejected soundings, select the *Include Rejected* check box.
7. Click **Finish** to complete the wizard and close the dialog box, or click **Cancel** to close the wizard without implementing changes.

Quality Control Statistics

The quality control report is displayed in the QC Reports tab of the Worksheet window.

	Beam Numb	Count	Max (+)	Min (-)	Mean	Std Dev	Special Orde
1	1 - 21	109951	1.487	1.356	0.027	0.161	61.1
2	21 - 41	212132	3.156	2.080	-0.001	0.117	72.6
3	41 - 61	221608	1.710	1.560	-0.004	0.100	75.9
4	61 - 81	209505	1.623	1.758	-0.012	0.109	76.9
5	81 - 101	89956	1.461	2.235	0.029	0.170	59.2

The fields are explained in the following table.

Field	Definition
Beam Number	Range grouping as defined in the third dialog box in the wizard.
Count	Total soundings in range.
Max	Maximum distance of soundings above surface.
Min	Maximum distance of soundings below surface.
Mean	Mean difference of soundings to surface.
Std Dev	Standard deviation of mean differences is presented at one sigma or 68% Confidence Interval.
(Selected S-44 or S-57 categories)	Percentage of soundings that fall within the selected S-44 survey orders or S-57 CATZOC zones of confidence categories.

15

Statistical Surface Cleaning

The surface cleaning function is used to perform area-based statistical data cleaning on multibeam data in HIPS.

The process uses advanced tiling technology for subdividing the entire area into variable size and density cells. It then applies rigorous polynomial regression statistics to compute the surface.

In this chapter...

“CREATING TILES AND CLEANING DATA” ON PAGE 310

“QUERY OPTIONS” ON PAGE 312

“TILE HISTOGRAM” ON PAGE 314

Process

In surface cleaning, tiling is used to subdivide the area into manageable cells where each tile is considered separately during the polynomial regression and statistical threshold testing. The tile split criteria is based either on the density of soundings within the tile, or the tile size, or both.

The Surface Cleaning function automatically creates a Starting Level Tile set (even if you do not select the tiling option). The Starting Level Tile Set is created by taking the largest dimension of the field sheet and dividing the area by 3.

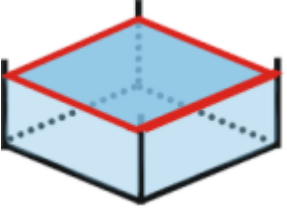
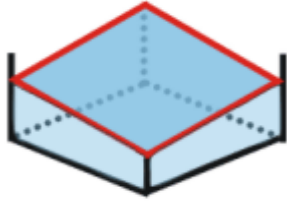
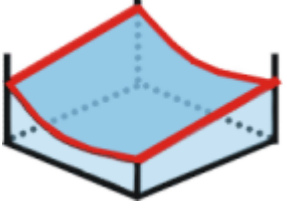
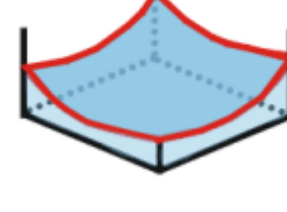
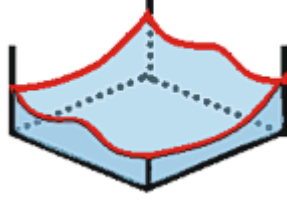
For each tile, a polynomial solution is computed using iterative least-squares re-weighted regression. The objective of the regression is to generate a surface defined by a set of polynomial terms, which closely matches most of the real depths. However, since the number of terms defining the polynomial surface are less than the number of points considered, then the points do not fit the surface exactly. Using the residual values of each point as a goodness measure, outliers can be detected by testing for high residual values.

The process is iterative within each tile, and for each new iteration the soundings are re-weighted inversely proportional to their previous residual. You can fix the re-weighting scheme to apply full weight to all soundings within a defined limit from the surface. This re-weighting limit can be based on a fixed distance or a multiple of the standard deviation of the residuals within the tile.

You can also define the maximum number of iterations. The buffer around each tile determines how much extra data is used to compute the tile polynomial surface. This helps eliminate edge effects during statistical testing.

The second stage of surface cleaning is the testing of the residuals once the surface has been computed. The relevant parameters are the rejection threshold scaling values in both the positive and negative directions (above and below the surface), and the minimum absolute residual of an outlier. The latter parameter specifies that no point within this distance (either above the surface or below) are rejected. This is an important parameter if the local standard deviation of a tile is small, because the scaling values are multiplied by a small standard deviation and may reject points which are only slightly removed from the surface. This parameter is location dependent and maybe used, for example, to prevent the rejection of rocks of a specific height. The rejection threshold values are also location dependent and surface dependent.

The following table lists each of the polynomial surface types with the corresponding equation and a graphical example of each surface type.

Polynomial Surface Types		
Surface	Equation	Example
Mean	$-f(xy) = b_0$	
Tilted Plane	$-f(xy) = b_0 + b_1x + b_2y$	
Curved Tilted Plane	$-f(xy) = b_0 + b_1x + b_2x + b_3xy$	
Quadratic	$f(xy) = b_0 + b_1x + b_2x + b_3xy + b_4x^2 + b_5y^2$	
Cubic	$f(xy) = b_0 + b_1x + b_2x + b_3xy + b_4x^2 + b_5y^2 + b_6x^2y + b_7xy^2 + b_8x^3 + b_9y^3$	

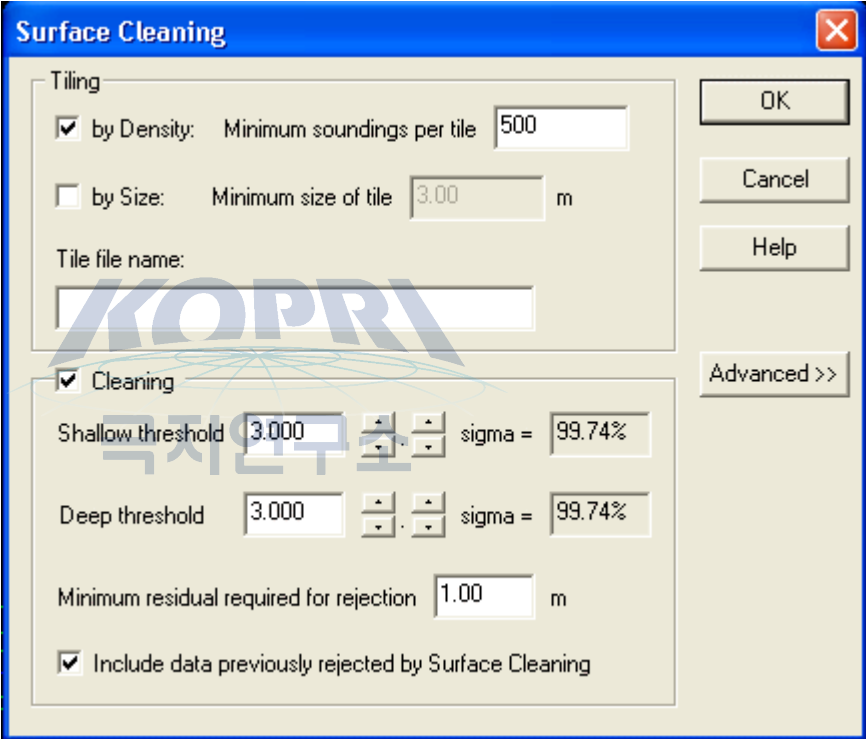
Creating Tiles and Cleaning Data

NOTE: Data must be merged before surface cleaning can be performed.

Menu	Tools > Surface Cleaning
Tool	

1. Select a field sheet.
2. Select the Surface Cleaning command.

The Surface Cleaning box is displayed.



3. Set parameters for creating tiles, as needed, in the following fields:
 - *By Density*: When this box is checked, each tile is continuously sub-divided until one of the sub-tiles has less than the minimum number of soundings.
 - *Minimum soundings per tile*: The minimum number of soundings in a tile.
 - *By Size*: When this check box is selected, each tile is continuously sub-divided until the sub-tiles reach the minimum size (this size cannot be larger than the Starting-Level Tile Set).
 - *Minimum size of tile*: The minimum size for a tile.
4. Type a name for the tile file. All tile files are assigned an .mts extension. Also created is a .mmi file that records the list of track lines used to create the tiles.

5. Select the *Cleaning* check box to enable the surface cleaning functions.
6. Enter cleaning parameters, as needed, in the following fields:
 - *Shallow threshold*: The threshold above the polynomial surface. The value is selected by clicking the up and down arrow buttons beside shallow threshold field. The sigma value is a multiple of the standard deviations of residuals in the tile.
 - *Deep threshold*: The threshold below the polynomial surface. The value is selected by clicking the up and down arrow buttons beside deep threshold field. The sigma value is a multiple of the standard deviations of residuals in the tile.
 - *Sigma*: The equivalent confidence values are displayed as a percentage.
 - *Minimum residual required for rejection*: A sounding that fails the threshold test will not be rejected if the absolute value of the residual is less than the minimum.
 - *Include data previously rejected by surface cleaning*:
7. Click **Advanced** to view more cleaning options.

The Surface Cleaning dialog expands to display more cleaning options.

Surface Cleaning

Tiling

☒ by Density: Minimum soundings per tile

☐ by Size: Minimum size of tile m

Tile file name:

Cleaning

☒ Shallow threshold sigma =

☒ Deep threshold sigma =

☒ Minimum residual required for rejection m

☒ Include data previously rejected by Surface Cleaning

Surface parameters

Degree of polynomial:

$f(xy) = B_0 + B_1x + B_2y$

Least squares parameters

Maximum iterations:

Full re-weighting threshold

☐ by residual value m

☒ by standard deviation sigma =

Other

☐ Use perpendicular to surface for the residual

☒ Tile buffer size %

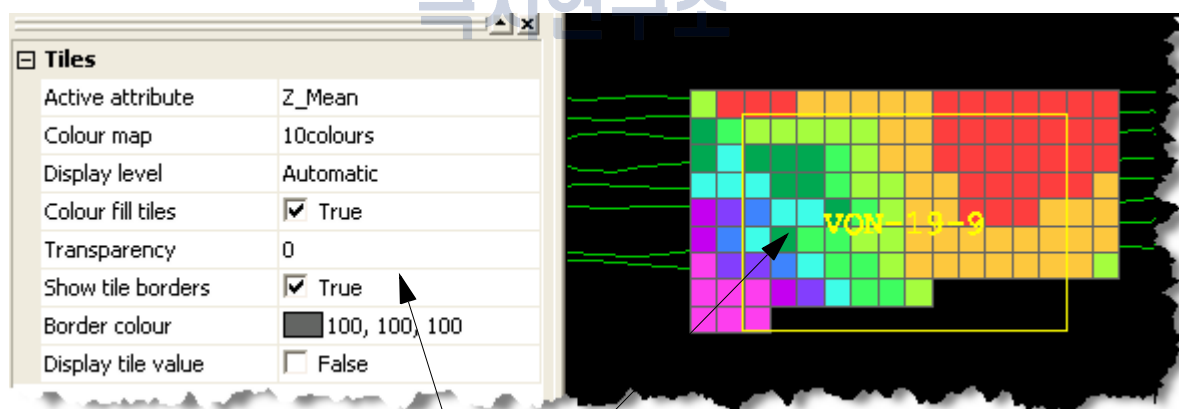
OK Cancel Help Advanced <<

8. Enter advanced tiling parameters, as needed.

- *Degree of polynomial*: Selection of available polynomials. Select the type that matches the expected complexity of the sea floor.
- *Maximum iterations*: The number of times the least squares computation of the polynomial processes the soundings. The computing continues until there are no additional rejected soundings or the maximum number of iterations is reached.
- *By residual surface*: The full re-weighting of soundings for each iteration can be fixed as a distance from the surface.
- *By standard deviation*: The full re-weighting of soundings for each iteration can be a multiple of the standard deviation of the residuals.
- *Perpendicular to surface*: When this option is checked, the residual is calculated as the perpendicular distance between the sounding and the nearest point on the polynomial surface. The default calculation for the residual uses the depth difference between the sounding and the polynomial surface at the location of the sounding.
- *Tile buffer*: The extra area around the tile that is included in the surface computation. The value is a percentage of the tile size and describes the width of the buffer around the tile.

9. Click **OK**.

The tiles are displayed in the Display window and the tile surface is listed (by the file name that was assigned in Step 4) in the Layers tab under its field sheet layer. The properties of the tiles can be viewed in the Properties window.



Properties of the displayed tiles

Query Options

You can use two query commands to view attributes of tile data.

- **Query Tile Surface:** Display the polynomial surface parameters of selected tiles.
- **Query Tile Soundings:** Display information on all the soundings plus the residuals of selected tiles.

Query Tile Surface

1. Make sure the tiles are open in the Display window.
2. Select the tile layer in the Session tab of the Control window.
3. Press and hold the mouse button while dragging the cursor over the tiles to be queried.
4. Select the Query Tile Surface command.

The tile surface information is displayed in the Worksheet window.

Menu	Tools > Surface Cleaning > Query Tile Surface
Tool	

- *Count:* number of points in the tile
- *Rejected:* the number of points rejected during surface cleaning.
- *Z Mean:* the mean depth in the tile.
- *Residual Sigma:* standard deviation for residuals.
- *Polynomial terms:* the number of terms with values depends on the degree of polynomial you selected in the Surface Cleaning dialog box.

Query Tile Soundings

1. Make sure the tiles are open in the Display window.
2. Select the tile layer in the Session tab of the Control window.
3. Press and hold the mouse button while dragging the cursor over the tiles to be queried.

The selected tiles are highlighted.

4. Select the Query Tile Soundings command.

The following data is displayed in the Worksheet window.

- *East*: easting coordinate for soundings.
- *North*: northing coordinate for soundings.
- *Depth*: depth of sounding.
- *Surface Depth*: depth of polynomial surface at the location of the sounding.
- *Residual*: difference between the sounding and the polynomial surface.
- *Shallow Threshold*: depth of rejection threshold above the polynomial surface.
- *Deep Threshold*: depth of rejection threshold below the surface.
- *Status*: status of the sounding.

Menu	Tools > Surface Cleaning > Query Tile Soundings
Tool	

Tile Histogram

The Tile Histogram dialog box displays the distribution of residuals within a tile.

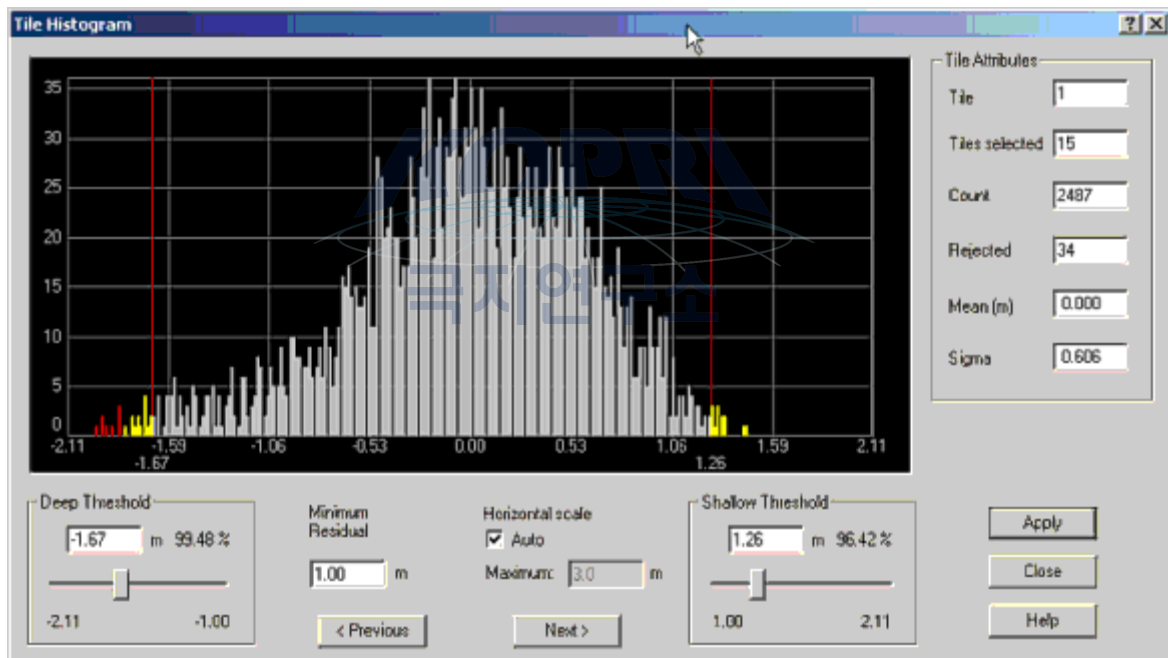
If the histogram resembles a bell curve then the selected polynomial is well suited for the area. However, if the histogram has many peaks or a wide centre, then the polynomial surface is not suited to the area. If there are severe shifts in data distribution, then the area may have to re-tiled using a higher degree of polynomial.

You can also use the histogram to change the threshold values and reject soundings.

1. Select the tiles you want to examine using the tile selection command.
2. Select the Tile Histogram command.

The Histogram dialog box is displayed.

Menu	Tools > Surface Cleaning > Tile Histogram
Tool	



Information about the tile is displayed on the right-hand side of the dialog box.

3. To view other tile data, click **Next Tile** or **Previous Tile**
1. Position the cursor over the *Shallow Threshold* or *Positive Threshold* slide bars and while pressing the mouse button move the bars to a new position.

The corresponding confidence intervals and Maximum Residual Distance values change as the bars are moved.

2. Click **Apply**.

The rejected residuals are displayed in red.

16

Cleaning Swath Data

The Swath Editor displays multiple views of the data with controls for scaling, vertical exaggeration, colours, and so on.

Data cleaning consists of interactively selecting and rejecting soundings and using proven and efficient filtering functions to automatically detect and reject outliers.

You can also use the Swath Editor to flag Designated Soundings

In this chapter...

“SWATH CLEANING” ON PAGE 318

“MANUAL CLEANING” ON PAGE 318

“SWATH FILTERING” ON PAGE 322

“FLAG DESIGNATED SOUNDINGS” ON PAGE 325

“THE REFRACTION EDITOR” ON PAGE 326

Swath Cleaning

During data conversion, the original data file is separated into a number of distinct files, each storing a different type of information. All are related by time. One of these files is the Observed Depths file. This file contains measured single beam, sweep, or swath soundings as reported by the data acquisition system.

The Swath Editor displays the contents of the file for sweep and swath systems on the screen in graphic form and lets you perform cleaning and filtering operations on the data.

For more information on the Swath Editor see “[SWATH EDITOR](#)” ON [PAGE 635](#).

Sounding outliers can be rejected interactively (see “[MANUAL CLEANING](#)” ON [PAGE 318](#)) or by applying automatic swath filters (see “[SWATH FILTERING](#)” ON [PAGE 322](#)).

Manual cleaning

1. Select a track line.

A track line must be selected before the Swath Editor editor can be opened.

2. Select the Open Swath Editor command.

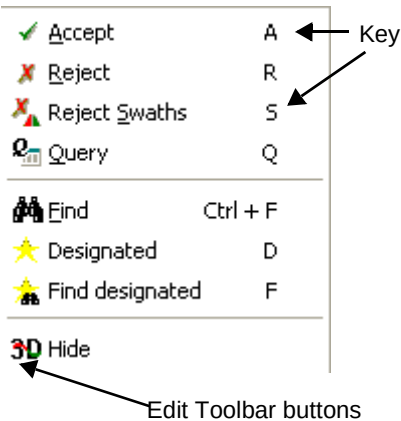
The Swath Editor opens with all views displayed.

(For a complete description of the Swath Editor Interface, display options and controls, see “[SWATH EDITOR INTERFACE](#)” ON [PAGE 636](#).)

3. Select soundings to be cleaned. When soundings are selected they are highlighted in yellow.

Apply the appropriate flag to the sounding. These flags can be activated from the Edit toolbar or from the pop-up menu in the 3-D View.

Menu	Tools > Swath Editor > Open
Tool	
Pop-up	Tools > Swath Editor



You can also use the keyboard to set the flag: Accept (or the “A” key), Query (Q), Reject (R), and Reject Swath (S).

Auto Cursor Mode

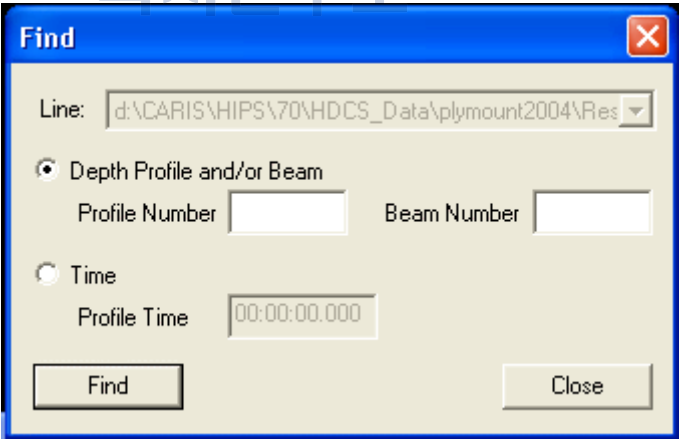
Menu	Edit > Auto Cursor
Tool	

To speed up the interactive process, use Auto Cursor Mode. This mode combines the selection and Accept/Reject/Query functions into a single procedure.

1. Select the Auto Cursor command.
2. Select a Reject/Accept/Query command.
3. Press the mouse button and draw a bounding box over the data.
4. Release the mouse button.

Search for Sounding

Use the Find function to search for a sounding(s) by beam and/or profile number.



Reject Data

Each sounding in the HIPS format carries several status flag switches that the software turns on and off as needed. Each sounding begins as an Accepted sounding and can be rejected for any reason during processing. A rejected sounding it can always be returned to the accepted status without loss of data.

Menu	Edit > Status Flag > Reject
Tool	
Pop-up	Reject
Key	<R>

A sounding rejected within the Swath Editor has the Rejected by Swath Editor flag turned on.

To reject a sounding, complete the following steps:

1. Select the data you want to reject.
2. Select the Reject command.

The Rejected by Swath Editor status flag is now on and the sounding may or may not be displayed depending if the rejected data is toggled to visible. (See “[VIEW REJECTED SOUNDINGS](#)” ON PAGE 293.)

Reject Swaths

In some instances it may be necessary to reject all soundings in one or more swaths. This can be done with the Reject Swaths function without having to select all of the data in the swaths.

1. Select some sounding in the swath you want to reject.
2. Select the Reject Swaths command.

All soundings in the swath (whether selected or not) now have the Rejected by Swath Editor status flag turned on. The sounding may or may not be displayed (see “[VIEW REJECTED SOUNDINGS](#)” ON PAGE 126).

Menu	Edit > Status Flag > Reject Swaths
Tool	
Key	<S>

Accept Data

Change rejected soundings back to the Accepted status.

1. Select the rejected data so it is highlighted.
2. Select the Accept command.

The soundings are now flagged as accepted.

Menu	Edit > Status Flag > Accept
Tool	
Pop-up	Accept
Key	<A>

Query Data

Select soundings to view status and other information.

3. Select the data you want to query.
4. Select the Query command.

The following data about the selected soundings are displayed in the Worksheet window. You can control the amount of data that is opened in the Worksheet window through the Query Fields dialog box (see “[WORKSHEET WINDOW](#)” ON PAGE 19).

- time of the swath profile
- d-time from the previous profile
- profile number
- beam number
- across track distance
- along track distance
- depth
- d-depth from the previous profile
- d-depth from the previous beam
- amplitude / phase detect
- quality value
- status flag
- horizontal error value
- vertical error value

Change sounding status

Once data information is displayed, you can change the status of the sounding.

1. Click the sounding data in the Worksheet window.

Select an Accept or Reject command.

Menu	Edit > Query
Tool	
Pop-up	Query
Key	<Q>

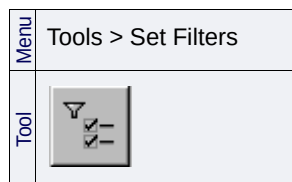
Swath Filtering

When dealing with high-volume bathymetric datasets, it is advantageous to be able to reject outliers automatically. Using Swath filters can be an effective way to reduce the time it takes to clean large volumes of data. (For other automated filters, see “[FILTER CRITICAL SOUNDINGS](#)” ON PAGE 297, “[ATTITUDE FILTER](#)” ON PAGE 284, “[TPU FILTERING](#)” ON PAGE 202, and “[SINGLE BEAM FILTERING](#)” ON PAGE 472.)

There are three basic types of swath filters:

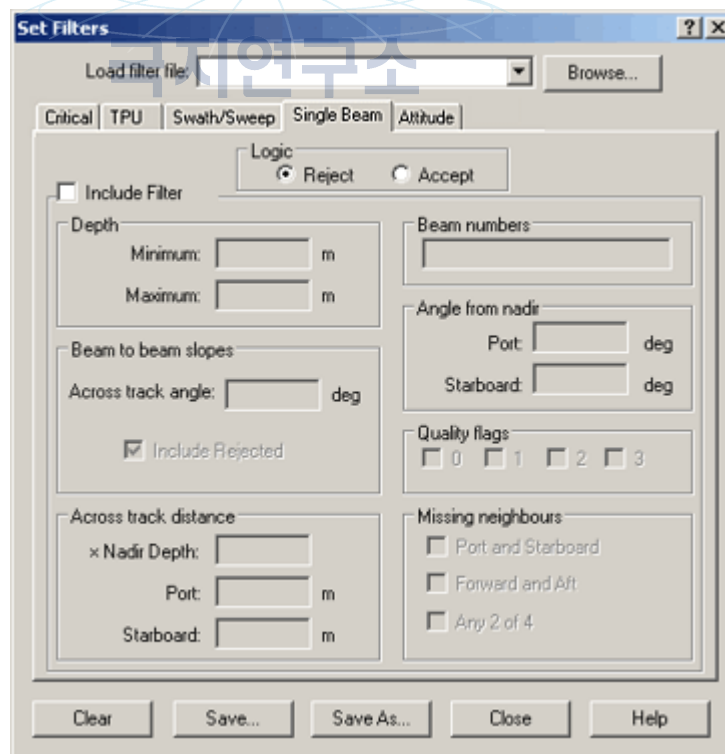
- **Spike detection:** The minimum and maximum depth filters and the beam-to-beam slope filters.
- **Swath reduction:** Across-track distance filters and nadir angle filters.
- **Sonar quality:** Quality values set by the sonar and missing neighbours.

The parameters for filtering are set through the Set Filters dialog box. These parameters can be saved in a HIPS Filter File (.hff) that can be reopened in the Set Filters dialog box for use in another track line.



1. Select the Set Filters command.

The Swath/Sweep tab of the Set Filters dialog box is displayed



1. [Optional] Select an existing HIPS Filter File from the list or click **Browse** to select a file.

If you chose to load a filter file, all the values used in that file are shown in the fields. You can filter data or change any of the values in the fields.

2. Set the logic to *Accept* or *Reject*.
3. Select the *Include Filter* check box to activate the filtering options.
4. Select the filter parameters used to flag data (see below).

You can define and apply more than one filter test. The filters are applied in sequence. Any data rejected by one filter is not considered in the next filter test.

5. Click **Close**, or click **Clear** to remove data from the fields.
6. Click **Save As** to save the settings to a filter file.

The following filters are available.

- *Minimum Depth*. Reject any soundings that are shallower than the depth specified (e.g., 10 m).
- *Maximum Depth*. Reject any soundings that are deeper than the depth specified (e.g., 50 m).
- *Across Track*. Beam-to-beam slopes, across-track. For each beam on the same swath, calculate the slopes in degrees to the prior and post beams, and if both slopes exceed the defined value and are of opposite sign then reject the beam. The *Include Rejected* option includes previously rejected soundings when recalculating the slopes during multiple runs of the filter.
- *Across track distance: X Nadir Depth*. Any soundings with an across-track distance, from the centre beam, greater than the nadir depth times this number (e.g., 3.0) are rejected. For example, in 30 metres of water, with a setting of 3.0, all soundings with an across-track distance greater than 90.0 metres are rejected.
- *Across track distance: Port*. Filter a sounding if the across track distance on the port side is greater than the value entered in this field.
- *Across track distance: Starboard*. Filter a sounding if the across track distance on the starboard side is greater than the value entered in this field.
- *Beam Numbers*. Specify beams to be rejected. Separate individual beams with a space and specify a range of beams with a hyphen. For example, entering 12 32 56-60 72 rejects beams 12, 32, 56, 57, 58, 59, 60, and 72.
- *Angles from Nadir: Port and Starboard*. Filter beams that are outside of the designated angles (e.g., 60 degrees). Angles are computed from the nadir using depths and across-track distances (roll corrected).

- **Quality Flags.** If your system attaches quality codes to soundings, and those codes are transferred to HIPS during conversion, a sounding can be rejected according to its value.

Quality flags are currently supplied by Reson, Elac, Hypack, and GSF multibeam systems/formats.

Missing neighbours are beams rejected during the conversion process into HIPS. This occurs if the beam is disabled in the vessel configuration or if the sonar system flags the beam as a bad detect in the raw data file.

- **Port-Starboard.** Beams are rejected if beams on each side of the swath are rejected.
- **Forward-Aft.** Beams are rejected if the adjacent beams in the previous and next swath are rejected.
- **Any 2 of 4.** Beams are rejected if two of the four neighbouring beams are rejected.

During filtering, only accepted soundings are used; therefore, the soundings rejected after one pass are not considered in the next.

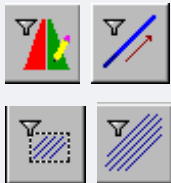
Apply Filters

The last step is applying the automatic depth filter to the swath data.

1. Select an Apply Filter command to apply the criteria set by the Set Filters dialog box.

You have four options for applying the filters.

- **Filter 1 Screen:** Apply the filters only to the swaths that are currently visible in the Plan View of the Swath Editor.
- **To End of Line.** Apply the filters to the track line currently open in the Swath Editor, from the first swath currently visible in the Plan view to the end of the line.
- **Selected Lines.** Apply the filters to all of the currently selected track lines. This function does not require that the Swath Editor be open.
- **All Lines.** Apply the filters to all track lines currently open in the Display window. This function does not require that the Swath Editor be open.

Menu	Tool > Apply Filters > 1 Screen/To End of Line/Selected Lines/ All Lines
Tool	

Flag Designated Soundings

The Designated Sounding flag identifies the shoalest sounding in a feature. The purpose of the Designated Sounding flag is to ensure that the shoalest depths over significant seabed features are maintained in charts and other standard hydrographic products.

.Soundings can be designated in both Swath Editor and Subset Editor.

Menu	Edit > Status Flag > Designated
Tool	
Key	<D>

For more information, see “[DESIGNATED SOUNDINGS](#)” ON PAGE 294.

1. Select the shoalest sounding from a cluster of soundings around a feature in the Swath Editor.

For example, in a cluster of soundings surrounding an outcrop of rocks, the shoalest sounding among that cluster is identified as Designated.

2. Select the Designated Soundings command.

The sounding is flagged as Designated.



The Refraction Editor

Since it is not possible to completely control the sound speed variations in water we apply sound velocity profiles to correct for this. However, refraction artifacts may still remain, especially if incorrect or insufficient sound velocity profiles are applied either during acquisition or during post processing.

To correct for this, you could choose to limit the usable swath angle (and therefore survey more lines), or you can use the Refraction Editor, which simulates the effects of altering the SVP to derive a better refraction solution.

Since refraction errors are most pronounced in the outer parts of the survey line coverage, they tend to create characteristically curved (upward or downward) refraction artifacts.

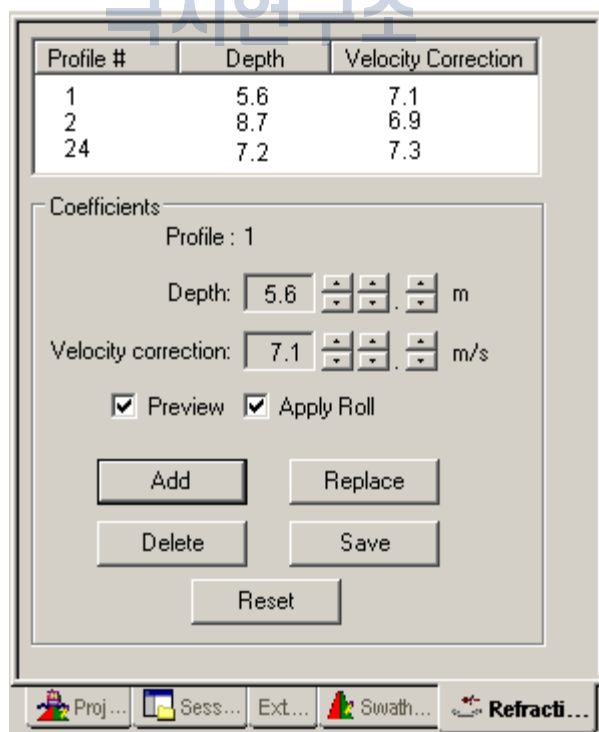
Apply the velocity correction at a user-defined depth. As you adjust the values, you can observe the changes in the shape of the swath profiles. When you arrive at the values which give you the desired correction, you can save these coefficients. Later, during the Merge process, you can apply these Refraction Editor coefficients that are recorded here.

To open the Refraction Editor,

1. Open the Swath Editor, then select the Refraction Editor command.

The Refraction Editor tab is displayed in the Control window.

Menu	Tools > Swath Editor > Refraction Editor
Tool	



As you change the values in the dialog box you will be able to see the effects of these changes in the Swath Editor display.

2. Select the *Preview* check box to view the effects of your changes.

If the *Preview* option is selected, you can also enable the *Apply Roll* option. When you first open the Refraction Editor, this control is set to be the same as the setting in the Roll section of the Vessel file (HVF). This control allows you to quickly observe the effects of applying (or not applying) dynamic roll to the sounding data.

NOTE: If there is no roll data, or if the appropriate Roll section cannot be found in the HVF, or if the survey line has already been sound velocity corrected, toggling the "Apply Roll" switch will have no effect.

3. Select the Apply Roll check box to see the effects of roll on the data.
4. Adjust the values for velocity correction and depth until the desired effect is observed.
5. Click **Add** to add the new entry to the list of coefficients.
6. To change an existing coefficient, adjust the settings and click **Replace** to update the list.
7. To remove an entry from the list select it and click **Delete**.
8. Click **Save** to save your entries.

The velocity correction and depth are recorded with the current swath profile number. While paging through the track line during cleaning, new swath/correction/depth values can be recorded.

Interpolation

When you add the first Refraction Coefficient, the correction starts at that profile and goes to the end of the line with that same correction. If you add a second Refraction Coefficient after the first, the correction applied between the two profiles is actually interpolated. This is done so that there is no "jump" in the profile when the correction at the second Refraction Coefficient is applied to the data.

This interpolation is linear. That is, if the selected profile is between two refraction entries, the depth and delta velocity are both interpolated from these entries.

Querying

Querying the data in the Swath Editor will always give the results from the display, so if you change the display with the Preview option of the Refraction Editor turned on, the query will return the results of the change. The Observed Depth data (across-track, along-track and depth) does not change.

The effects of the Refraction Editor can be turned on or off using the Calibration Module (see "[CALIBRATION](#)" ON PAGE 371). The effects on the final merged depths can be modified any time by editing the coefficients and re-merging, or the effects can be removed by re-merging and choosing not to apply the coefficients.



17

Process Data in Subsets

Create subsets to efficiently visualize and clean data from multiple track lines at the same time, and use subset tiles to track the progress of processing.

In this chapter...

“DATA CLEANING WORKFLOW” ON PAGE 330

“SUBSET CLEANING” ON PAGE 331

“TRACK PROGRESS WITH SUBSET TILES” ON PAGE 334

“SUBSETS AND BASE SURFACES” ON PAGE 339

Data Cleaning Workflow

A subset is a user-defined rectangular area that contains some of the soundings of a survey project. Dividing the area of the survey into subsets makes the cleaning of a large data set more manageable.

The following workflow is a suggested method for cleaning data with the Subset Editor.

1. Open a field sheet with a BASE surface.
(See “[CREATE A FIELD SHEET](#)” ON PAGE 210)
2. Create Subset Tiles in the field sheet area.
(See “[TRACK PROGRESS WITH SUBSET TILES](#)” ON PAGE 334)
3. Open the Subset Editor and create a subset area using the subset bounding box in the tiled area.
(See “[SUBSET EDITOR INTERFACE](#)” ON PAGE 619 and “[SIZE AND RESIZE SUBSET](#)” ON PAGE 621)
4. Use the 3D View Controls to adjust the view of the data.
(See “[THE 3D VIEW](#)” ON PAGE 626, “[THE 2D VIEW](#)” ON PAGE 630)
5. Clean subset data.
(See “[SUBSET CLEANING](#)” ON PAGE 331)
6. Classify data in subset area.
(See “[TRACKING CLEANING STATUS](#)” ON PAGE 337)
7. Define another subset and repeat the process.

If you are processing a small amount of data, using subset tiles to track progress can be omitted (Steps 1 and 2), and the Subset Editor can be directly opened into the track lines.

However, if you are processing large areas of data, the subset tiling method is a useful way to track changes.

Subset Cleaning

Menu	Tools > Subset Editor
Tool	
Pop-up	Tools > Subset Editor

Soundings in the 2D and 3D Views can be interactively examined and their status flags can be modified.

To open Subset Editor,

1. Select the Subset Editor command.
2. Define a subset bounding box:
 - Press and hold the left mouse button, and drag the cursor across the area that contains the data you want to include in the subset.

As the cursor is dragged across the Display window, a bounding box is drawn to show the area that will be included in the subset.

3. Select the Load Subset command to load the data into the Subset Editor windows. (If the data will not load, check to ensure that your data has been Merged. See [“MERGE” ON PAGE 185](#) for more information.)

The subset is generated and displayed in the Subset Editor windows.

Menu	Tools > Subset Editor > Load Subset
Tool	

When selecting data in the 3D View, remember that all data in the highlighted area is selected, not just the visible data.

Reject

Each sounding in the HIPS format carries several status flags that the software turns on and off as needed. Each sounding begins as an Accepted sounding and if rejected, for any reason during processing, it can always be returned to the accepted status without loss of data.

A sounding rejected within the Subset Editor has the Rejected by Hydrographer status flag turned on.

1. Select the data you want to reject so it is highlighted.
2. Select the Reject command.

The sounding status flag, Rejected by Hydrographer, is now on and the sounding may or may not be displayed depending if the rejected data is toggled to visible.

Menu	Edit > Status Flag > Reject
Tool	
Pop-up	Reject
Key	<R>

Menu	Edit > Status Flag > Accept
Tool	
Pop-up	Accept
Key	<A>

Accept

Change rejected soundings back to the accepted status.

1. Select the rejected data that you want to accept.
2. Select the Accept command.

The soundings are now marked as accepted.

Menu	Edit > Status Flag > Outstanding
Tool	
Pop-up	Outstanding

Outstanding

Flag a sounding as requiring further examination.

1. Select the data that you want flag as Outstanding.
2. Select the Outstanding command.

Examined

Menu	Edit > Status Flag > Examined
Tool	
Pop-up	Examined

Flag questionable soundings as having been examined and verified.

1. Select the data that you want to flag as Examined.
2. Select the Examined command.

Menu	Edit > Query
Tool	
Pop-up	Query
Key	<Q>

Query

View information on selected data.

1. Select the data that you want to query.
2. Select the Query command.

The data is displayed in the Worksheet window.

Designated Soundings

The Designated Sounding flag identifies the shoalest sounding in a feature. The purpose of the Designated Sounding flag is to ensure that the shoalest depths over significant seabed features are maintained in charts and other standard hydrographic products. For example, in a cluster of soundings surrounding an outcrop of rocks, the shoalest sounding among that cluster is identified as Designated.

For more information, see "[DESIGNATED SOUNDINGS](#)" ON PAGE 294.

1. Select the shoalest sounding from a cluster of soundings around a feature in the Subset Editor.
2. Select the Designated Soundings command.

The sounding is flagged as Designated.

Shoalest soundings can also be designated in Swath Editor.

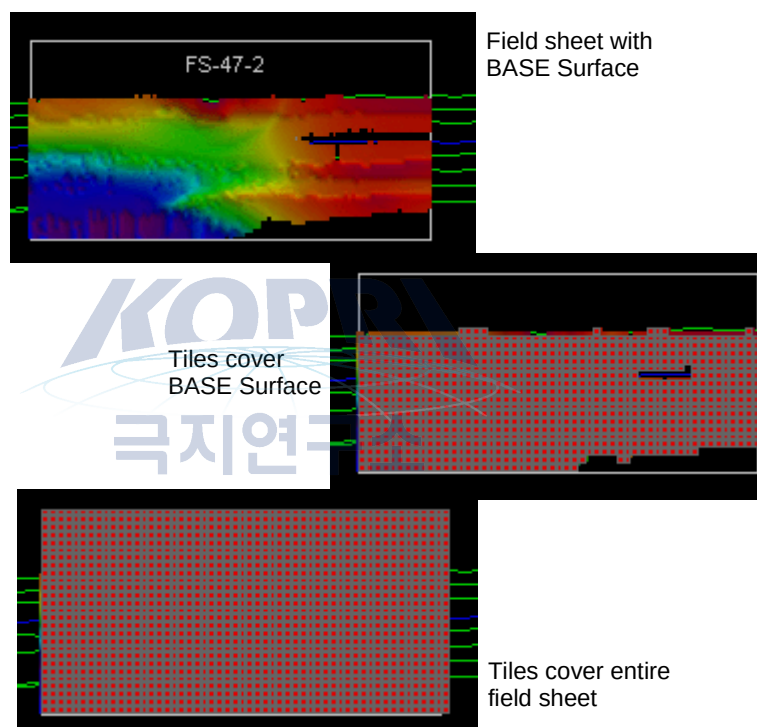
Menu	Edit > Status Flag > Designated
Tool	
Key	<D>

Track Progress with Subset Tiles

Subset Tiles are used to track the process of examining and cleaning areas within the survey project. Each tile within a Subset Tile layer has one of three tracking settings: Incomplete, Partially Complete, or Completed (see [“TRACKING CLEANING STATUS” ON PAGE 337](#)).

The extents of the subset tile area can be determined in two ways:

- the tiles cover the entire field sheet area, or
- the tiles cover the area of the field sheet that contains a height source, such as a BASE Surface.



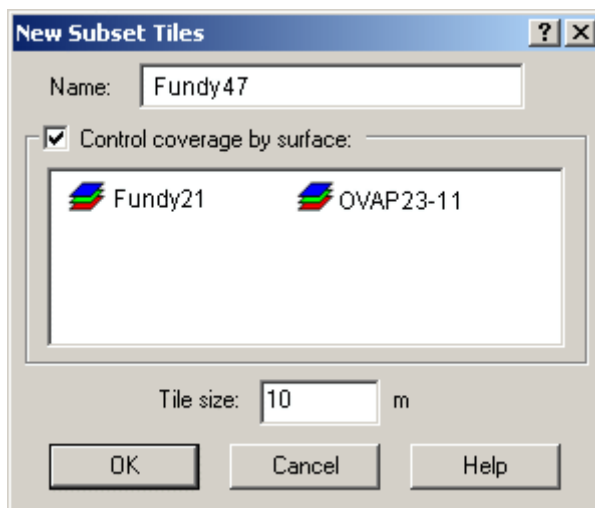
The option to cover the entire field sheet area is useful if you are cleaning newly acquired data with the Subset Editor while the area is being surveyed. You would not have to create a new subset tile layer because of additional data in your project.

Subset tiles are produced in field sheets. To create subset tiles for tracking,

Menu	Tools > New Subset Tiles
Pop-up	New Subset Tiles

1. Create a field sheet in your project.
2. Select the field sheet in the Layers tab of the Control window.
3. Select the New Subset Tiles command.

The New Subset Tiles dialog box is displayed.



The *Control Coverage by Surface* option constrains the new subset tile area to a selected BASE Surface. When this check box is cleared, the subset tiles will cover the entire field sheet area.

To tile the entire field sheet,

4. De-select the *Control Coverage by Surface* check box.
5. Type the tile size.
6. Click **OK**.

A Subset Tile layer is created and displayed within the extents of the field sheet area.

To tile the area of a specific BASE surface,

1. Select the *Control Coverage by Surface* check box to apply the subset tiles to a BASE Surface.
2. From the list, select the BASE surface to be used as the template for subset tiles.
3. Type the tile size.
4. Click **OK**.

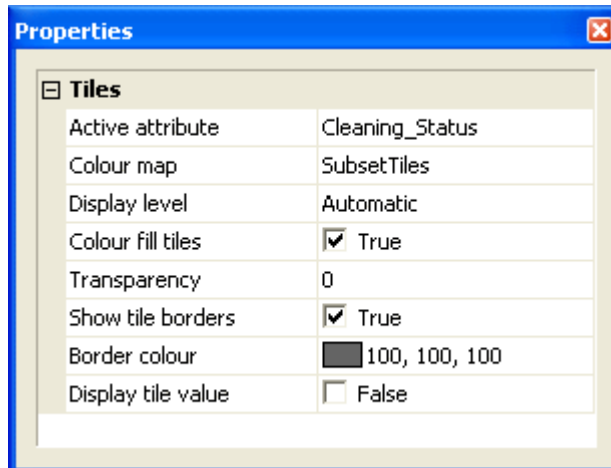
The Subset Tile layer name is added to the Layers tab. The names are automatically generated beginning with SubsetTiles1. You can show or hide the layer with the check box beside the Subset Tile file name in the Layers tab.

Subset tile properties

You can set display properties for tiles in the Properties window.

1. Select a tile layer in the Layers tab of the Control window.
2. Select the Properties window command, or right-click the layer and select Properties from the pop-up menu.

The Properties window showing the display options for tiles is opened.



The *Active Attribute* list contains all attributes included in the tile (such as cleaning status and last modified date). When you select an attribute, the tile is displayed according to the attribute values.

1. Select an attribute from the drop-down *Active Attribute* list.
2. Select a colour map from the *Colour Map* drop-down list.
3. Change how tiles are rendered to the Display Window by selecting the *Display Level*, either:
 - *Maximum*: Draw all tiles
 - *Automatic*: Draw tiles to fit the current extents of the Display window.

The *Colour Fill Tiles* check box determine how attribute values are drawn in the Display window.

- If the *Colour Fill* check box is set to “True”, the tiles are drawn according to the selected colour map.
 - If the check box is unchecked and set to “False”, the tiles are drawn in outline only.
4. Select a *Transparency* percentage to make features visible through the tiles.

The *Show Tile Borders* check box determines how the border lines dividing the tile areas are displayed.

- If the *Show Tile Borders* check box is checked, the value is set to “True” and the lines are colour coded according to the colour selected in the *Border colour* field.
 - If the *Show Tile Borders* check box is clear, the value is set to “False”, and the borders of the tiles are not displayed.
5. [Optional] Select an alternative colour for the border lines from the colour picker in the *Border colour* field.

Use the Display tile value field to turn the display of the attribute value on or off. For example, the cleaning status attribute has three values: 0, 1 and 2.

6. Select the Display tile value check box to set the value to “True” so the appropriate value is displayed in each tile.

View subset data in a tile

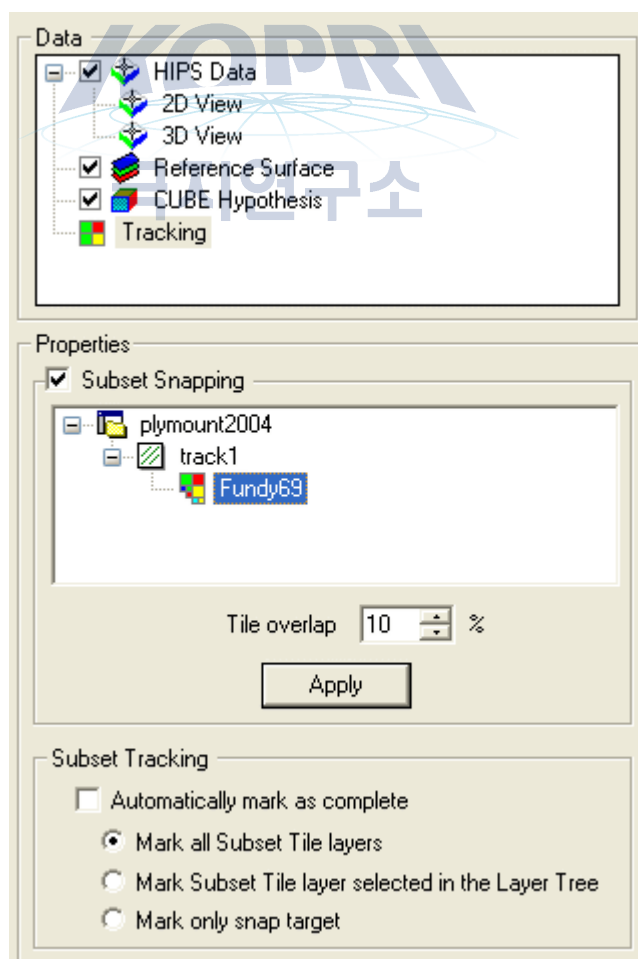
Once the tracking tiles are created, you can examine and edit the data by opening Subset Editor and defining a subset. (See “[OPEN SUBSET EDITOR](#)” ON PAGE 619). You can clean data from the open subset (see “[SUBSET CLEANING](#)” ON PAGE 331).

Tracking Layer Properties

The layer containing the tracking tiles has options which can be set in the Subset Editor tab of the Control window (see “[SUBSET EDITOR TAB](#)” ON PAGE 623).

1. Open the Subset Editor and select the Subset Editor tab.
2. Select the Tracking layer.

The tab is refreshed to display the tracking options.



3. Select the Subset Snapping check box to activate the snapping options.
4. Select the *Tile Overlap* check box so that the subset bounding box overlaps the tile by a selected percentage. This option is useful when you have data that overlaps the tile area.
5. Click **Apply**.
6. Select the *Automatically Mark as Complete* check box to flag the data as examined and cleaned. This can be changed later (see “[TRACKING CLEANING STATUS](#)” ON PAGE 337).

When the *Automatically Mark as Complete* check box is selected, two other options are made active.

7. Select the *Mark all Subset Tile layers* option to flag the tiles in ALL tile layers as completed, or select *Mark only snap target* to select tiles only in the selected tile layer as completed.

Tracking Cleaning Status

Once you have examined and cleaned a subset of the data, the subset area can be assigned one of three classifications:

- **Complete:** All data in the selected area is clean and ready for further processing or export.
- **Partially Complete:** Not all the data within the area has been viewed and verified as clean in the Subset Editor.
- **Reset:** Data has not been verified or cleaned.

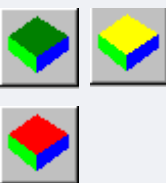
The area is colour-coded in the Subset Tile according to the selected cleaning status classification:

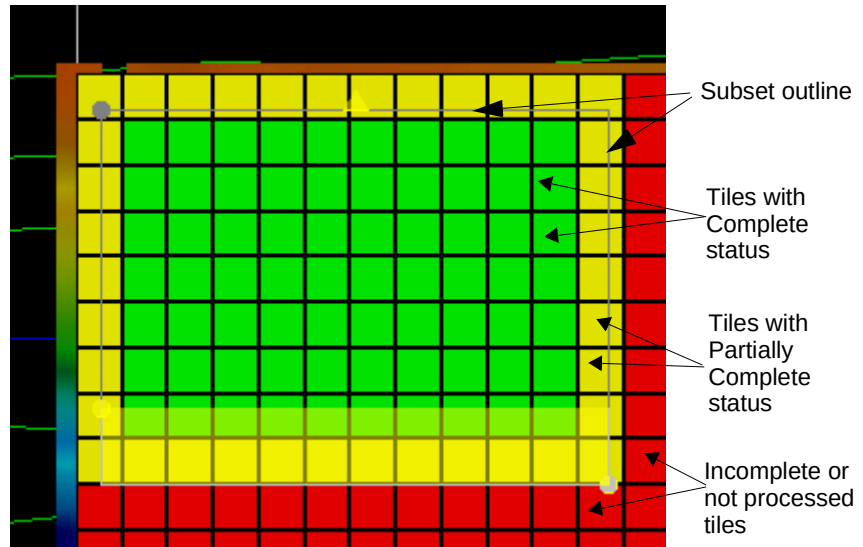
- Complete = green
- Partially Complete = yellow
- Incomplete or not processed = red.

To assign a cleaning status to a subset area,

1. Select the appropriate status from the Subset Editor toolbar or from the Tools >Subset Editor submenu.

The flagged tiles will be displayed with the colour appropriate to their status. Only tiles totally encompassed by the subset bounding box are flagged with the selected status command. Tiles partially covered by the bounding box are flagged as Partially Complete, as in the example below.

Menu	Tools > Subset Editor > Complete/Partially Complete/Incomplete
Tool	



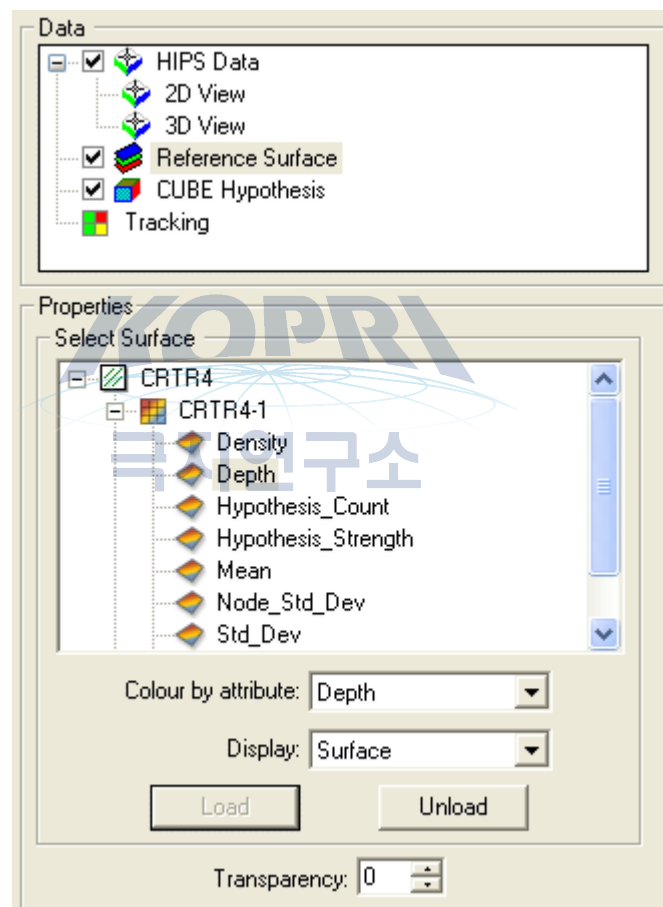
Subsets and BASE Surfaces

BASE Surfaces can be shown in the 3-D View. This feature can be used to:

- determine the position of Designated soundings against an existing BASE Surface.
- determine if Designated soundings have been correctly applied to a Finalized BASE Surface.

1. Select the *Reference Surface* layer in the Subset Editor tab.

The Subset Editor tab is refreshed to show the property options for the Reference Surface layer.



2. Select the BASE Surface from the *Select Surface* file tree.
3. Although the Depth attribute is used to display the surface, you can colour the surface by another attribute by selecting that attribute from the *Colour by Attribute* drop-down list.
4. Display the surface as a points, wireframe or a complete surface by selecting an option from the *Display* drop-down list.
5. Select a transparency level for the Surface, by moving the up or down arrow buttons.

6. Click **Load**.

The BASE Surface is displayed in the 3-D View according to the above options.

7. [Optional] Click **Unload** to remove the BASE Surface from the 3-D View.



18

Create Product Surfaces

Product surfaces can be created from finalized BASE surfaces. They maintain the designated soundings from the finalized BASE Surface and can be used to create more cartographically correct contours. Product surfaces can also be created from tile layers.

Use product surfaces for building contours, sounding selections, profiles, and other data layers.

In this chapter...

"PRODUCT SURFACES" ON PAGE 344

"CONTOURS" ON PAGE 348

"PROFILES" ON PAGE 354

"SOUNDING SELECTION" ON PAGE 359

"COLOUR OPTIONS FOR SOUNDINGS AND CONTOURS" ON PAGE 368

"TILING" ON PAGE 370

Product Surfaces

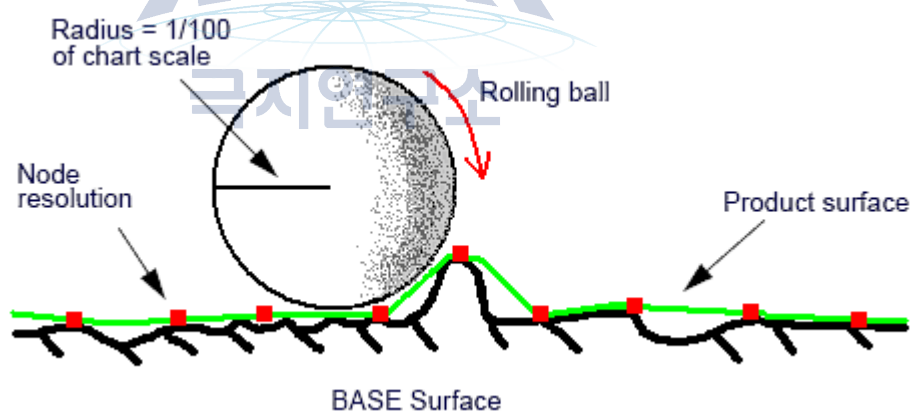
A Product Surface is a shoal-biased surface that can be used for creating more cartographically correct contours for navigation aids (for example, Electronic Nautical Charts).

The Product Surface is down-sampled so that some of the finer surface details are no longer visible, while the shoals are preserved. This surface can be used to directly generate contours and selected soundings (instead of generating contours or selected soundings from tiles).

Process

A Product Surface is created through the process of 3D Double Buffering. This process smooths the surface to reduce clutter and highlight significant shoals.

Double buffering is like rolling a ball over the surface at an interval determined by the surface's node resolution. The radius of the ball is determined from the chart scale (radius = 1/100 of chart scale). As the ball is rolled over the surface, the surface is smoothed, but the shoals are retained.

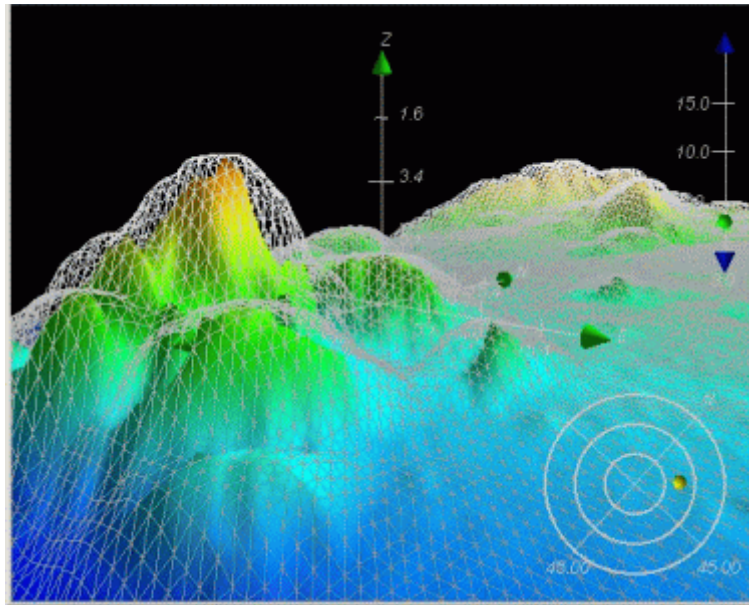


Defocusing

This optional process can also be applied to the generalization process. Defocusing spreads each shoal depth over an area defined by the horizontal error. The process uses an ellipsoid of rotation around each node with the horizontal error as the semi-major axis. Nodes within the ellipse are adjusted up to the surface of the ellipsoid.

In the following image, the webbed surface overlaying the BASE Surface represents the Product Surface area after defocusing

has taken place. The shoals are preserved, but without the sharply defined detail of the original BASE surface.



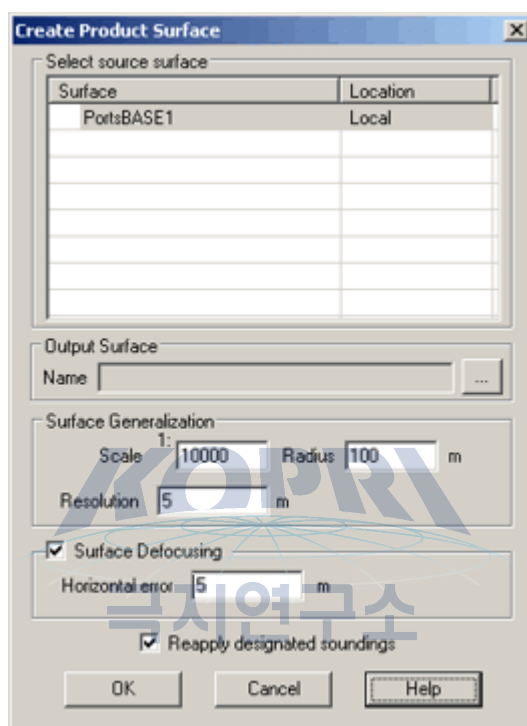
Create a Product Surface

Menu	Process > BASE Surface > Product Surface

To create a Product Surface from a finalized BASE surface:

1. Open the BASE surface.
2. Select the field sheet layer for the BASE surface.
3. Select the New Product Surface command.

The Create Product Surface dialog box is displayed.



4. Type a name for the new Product Surface.
5. Type the scale that best suits the type of chart.

The scale of the Surface should match the scale of the product being created. For example, if you are creating a Product Surface that is going to be used for an ENC approach to a harbour, then use the appropriate scale for an approach.

The scale determines the radius used for generalizing the contours of the Surface. The *Radius* value changes as the *Scale* value is changed.

The *Resolution* value sets the node spacing of the generated Product Surface.

6. Type a *Resolution* value, if needed.

7. [Optional] Select *Surface Defocusing* to implement this option.

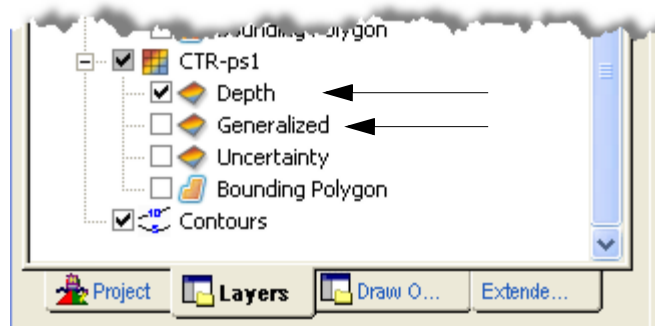
The defocusing operation requires you to apply a horizontal error value. This value must be derived from the errors values associated with the data.

8.Type a *Horizontal Error* value.

9.Select the *Reapply Designated Soundings* check box to make sure that designated soundings are applied to the surface.

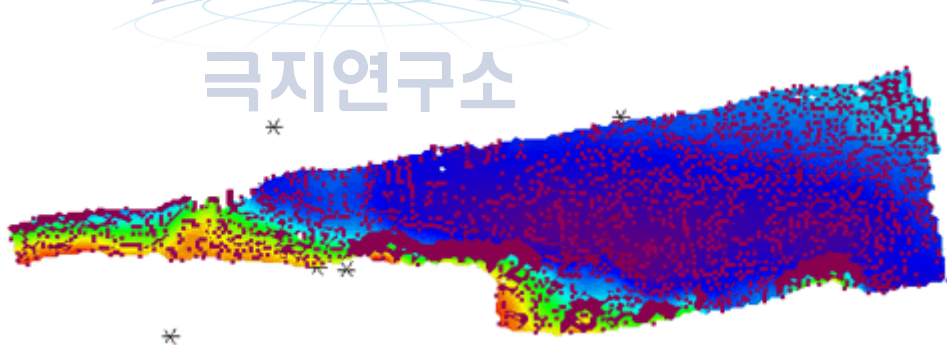
10.Click **OK**.

When the Product Surface is created it is listed in the Layers tab, with a Generalized layer which displays the nodes that were affected during the product surface-creation process.



The Product Surface layers are shown in the Display window when the check boxes are selected in the Layers tab.

In the following example, the brown dots belong to the Generalization layer and show which nodes have been modified by the Product Surface.



Nodes that have been modified are given a status flag of 1; nodes that retain their original values are given a status flag of 0.

When you create selected soundings from the Generalization layer, you can use SQL-type filters to omit nodes that have been modified. For more information on Selected Soundings, see [“SOUNDING SELECTION” ON PAGE 359](#).

Contours

Contours can be generated from a Product Surface, a finalized BASE surface or a tile layer.

Contour smoothness is related to the amount of detail in your depth source. A finely detailed depth source will result in rougher contour lines. For smoother contour lines, use a smoothed Product Surface as a source for contouring.

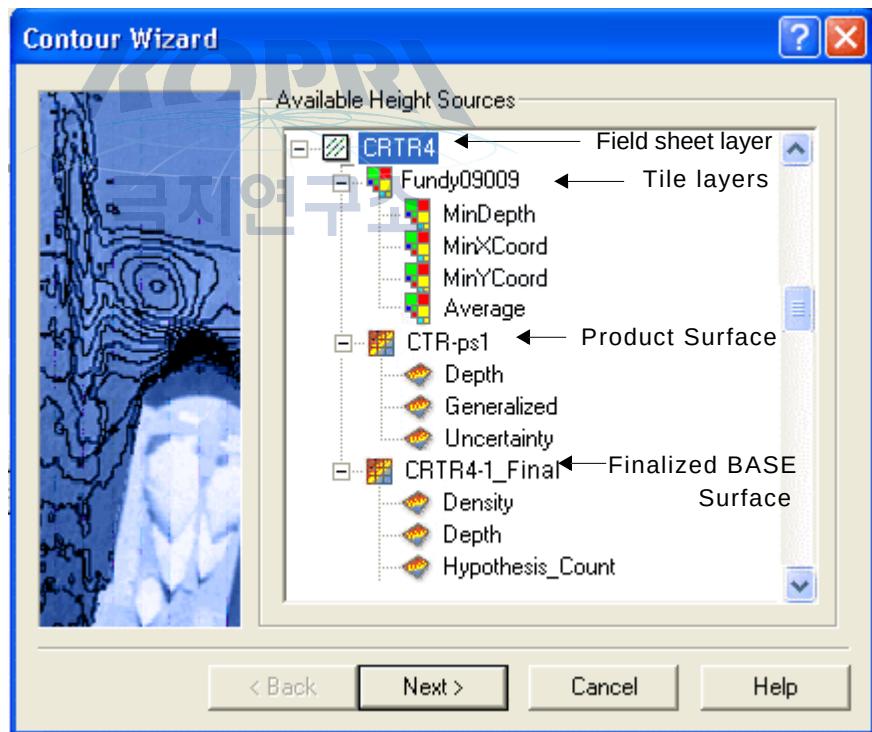
You can label contours with depth values, adjust the size and colour of contours, and mask the lines behind the contour label.

Create Contours

Menu	Process > Products > Contours > New Contour Layer
Pop-up	(Layers tab) New > Contours...

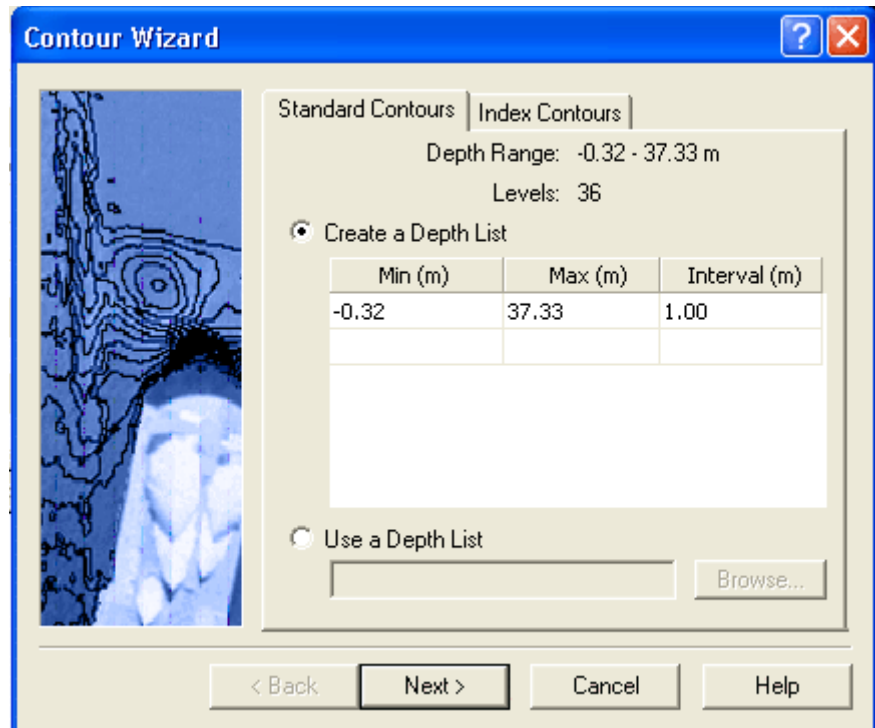
1. Open a Project and a Fieldsheet containing a BASE surface.
2. Select the field sheet layer in the Layers tab.
3. Select the New Contour Layer command.

The Contour Wizard - Step 1 dialog box is displayed.



4. Expanding the layer tree and select a tile, Product Surface or BASE Surface attribute layer to be the height source for the contour interpolation.
5. Click **Next**.

The Contour Wizard - Step 2 dialog box is displayed.



This step lets you enter the intervals for standard and index contours.

You can create a single contour level over the entire range of depths or create multiple contour intervals for different depth levels. If you use this dialog box to set the depth intervals, the settings are saved in field sheet directory as `DepthSource_ContourLayerList.txt`.

You can index contours to visually emphasize certain contour levels, for example, at 5 metre intervals. These index contours are optional.

The dialog box contains two read-only fields:

- The *Depth Range* field shows a range of depth values derived from the contour source (BASE Surface, bin or tile). The depth range values also provide an indicator of spikes in the source.
- The *Levels* field shows the number of contour levels produced at the current contour interval.

Create a Depth list

1. Select the *Create a Depth List* option to manually set a series of depth intervals (or go to *Use a Depth List* to select an existing list of depth intervals).

The depth list table is enabled.

2. Type the *Minimum* depth level for the contour interval.
3. Type the *Maximum* depth level for the contour interval.
4. Type the contour interval between the maximum and minimum values.

5. Press <Enter> to input the settings.

The *Levels* field changes to show the number of intervals produced by the above settings.

6. Repeat Steps 2 to 5 to enter another range of intervals.

Use Depth List

Depth range files are text files that set a range of depths for tiling and contouring data, where values are:

- Negative when representing heights above the datum, and
- Positive when representing depths below the datum.

These files are automatically generated during the contouring process.

7. Select the *Use Depth List* option to use a Depth Range File containing a range of depths.

8. Type the name and path of the text file, or click **Browse** to locate it.

Index Contours

9. If you want to create index contours, select the Index Contours tab and select the *Enable* check box.

This activates depth list fields identical to those in the Standard Contours tab.

10. Complete Steps 1 to 8, as needed, and click **Next**.

The Contour Wizard - Step 3 dialog box is displayed.



You can save the contours as a field sheet layer or save the contours to a new or existing HOB file.

1. Select either the *Contour to Field Sheet* option or the *Contour to HOB File* option. (See “[CONTOUR TO HOB FILE](#)” ON PAGE 351.)

Contour to field sheet

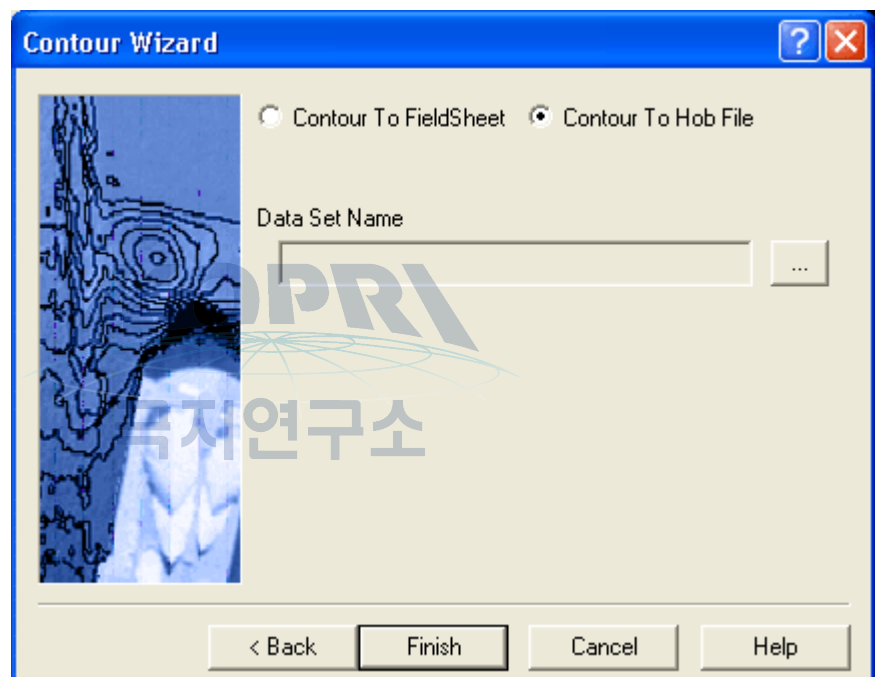
The next step is to describe the various CARIS attributes for the new contours.

2. Enter the following information for standard and index contours:
 - Name
 - Theme Number
 - Feature Code
3. Click **Finish**.

Contours are created for the selected field sheet and shown in the Display window. The standard and index contours are listed in the Control window.

Contour to HOB file

If you selected the *Contour to HOB* option, the dialog box is refreshed to display the Contour Wizard - Step 3 (HOB) dialog box.



1. Click **Browse** and select an existing HOB file, or type the path and name for the file. You can also enter the name of a new file.
2. Click **Finish**.

An existing HOB file now includes a contours layer, or a new file with contours has been created. The contours can be opened in the Display window by choosing the File Open command and selecting the HOB file.

Contour Labelling

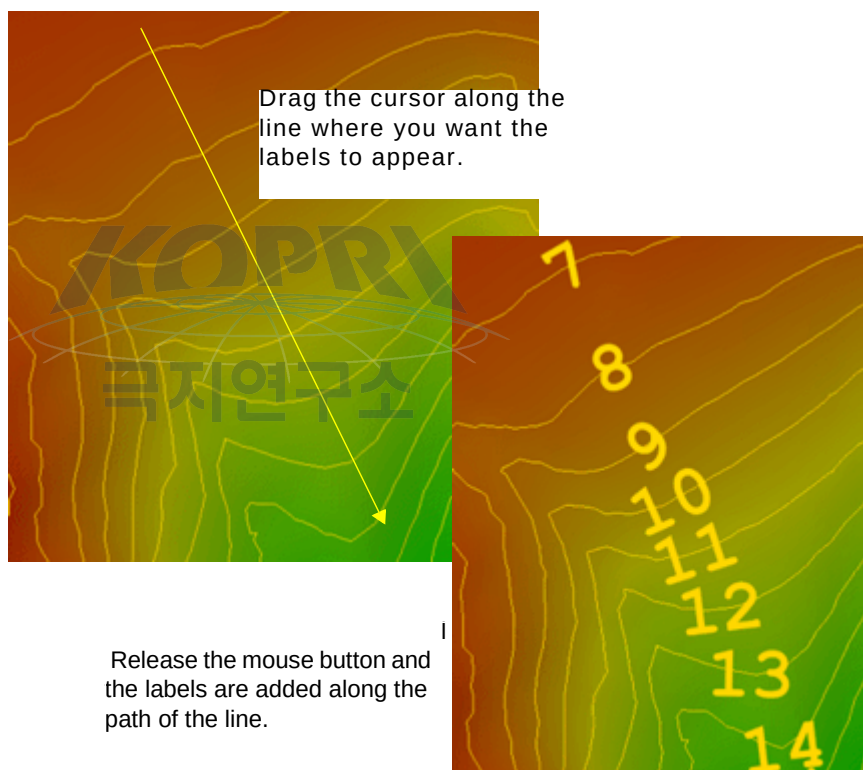
Menu	Process > Products Contours > Add Labels
Pop-up (Layers tab)	Add Labels

You can label contour lines with their associated depth values. You set the path for the labels by drawing a line across the contours where you want the depth values to appear. Labels are added at the point where the line intersects the contours.

1. Select the Contours layer in the Layers tab of the Control window.
2. Select the Add Labels command.

Your cursor changes to a digitizing tool so that you can set the path for the labels.

3. In the Display window, click on the part of the field sheet where you want to start the line and drag the cursor to the part of field sheet where you want the line to end.



Labels are now added to the contours.

You can change the size and colour of contour labels. To set the size of the labels in mm,

1. Select the contour layer.
2. Select Set Label Size from the pop-up menu.
3. Type the new value in mm.
4. Click **OK**.

The colour of the labels can be changed from the default (black) by checking the *Override Colour* option in the Properties window and selecting a colour from the drop-down menu.

Labels can also be removed from the display.

1. Select the Remove Labels command.

Menu	Process > Product Contours > Remove Labels
Pop-up	(Control window) Remove Labels

Masking Lines Behind Contour Labels

Concealing the part of the contour line behind a label can make a map area easier to read.



Contours with labels

Contours lines masked behind labels

1. Make sure all previous work is saved.
2. Select the Contour Masking command.

The parts of the contour lines that intersect the labels are now hidden.

This masking process can be reversed with the Unmask contours command.

Menu	Process > Product Contours > Mask Contours
Pop-up	(Control window) Mask Contours

Profiles

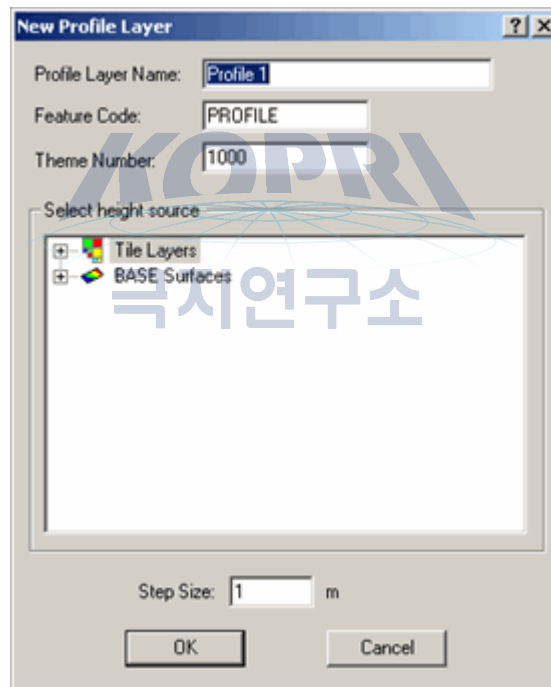
A profile is a cross-sectional view of a BASE Surface or tile. The profile contains two axes: the vertical axis is the attribute values from the surface etc. and horizontal axis is distance. While in digitizing mode, the view can be rotated, zoomed or panned. Profiles are saved as field sheet layers.

Create Profile

1. Make sure that a field sheet is open and a BASE Surface or tile is visible in the Display window.
2. Select the field sheet layer in the Layers tab of the Control window.
3. Select a New Profile command.

The New Profile Layer dialog box is displayed.

Menu	Process > Products > Profile > New
Pop-up	New Profile... (Control window)



4. Type a name for the profile layer.
5. Type a CARIS feature code for the profile. The default code is PROFILE.
6. Type a layer number.
7. Select a BASE Surface attribute or tile layer as a height source. To expand the file tree, click the + icon beside the layer.
8. Enter a *Step Size* value so that depth data is extracted at regular increments along the profile.
9. Click **OK**.

Digitize the profile

Pop-up	Edit Line > Point-to-Point Line/Cubic Spline/B Spline

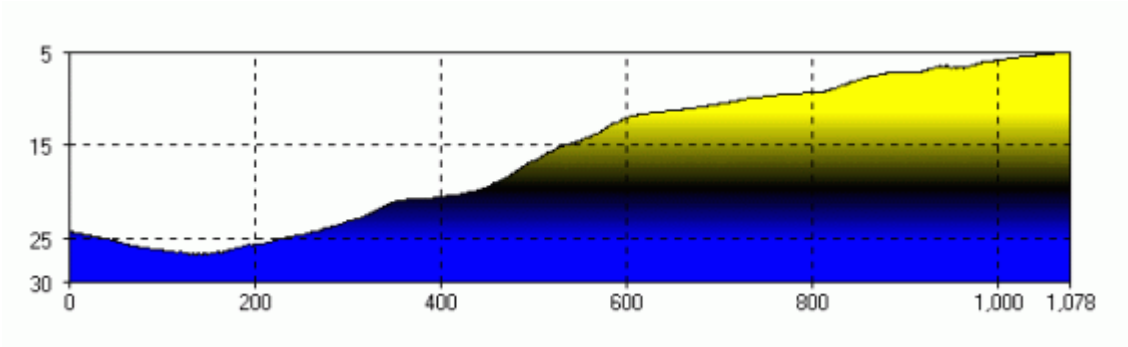
The cursor changes to digitizing mode so you can digitize a two-point profile or multi-point profile in the Display window using the Edit Line options.

- 10. Click in the Display window where you want to start your profile.
- 11. Right-click and from the pop-up menu determine the type of line to be drawn:
 - **Point-to-Point:** Connect the points as a straight line. This is the default option.
 - **Spline:** Connect more than two points with a slightly curved line.
 - **Stream Line:** Connect more than two points by dragging the cursor to draw a line.
 - **Fitted Curve:** Connect points in a curve based on polynomials.
- 12. Click in another section of the BASE Surface or tile to join the points with a line.
- 13. Continue entering as many line segments as needed.
- 14. Right-click in the Display window and select End Line from the Edit Line menu to complete the profile line.

The profile line is drawn in the Display window and can be selected.

The Profile tab in the Worksheet window displays the graphed attribute and distance data between the points. The attribute values (vertical axis) and distance levels (horizontal axis) are measured in metres or feet. You may want to expand the Worksheet window to get a better view of the data.

The profile expands as more points are entered.



Display Properties

Once a profile is created you can modify its properties, including vertical and horizontal exaggeration, display a legend and vertical reference, etc., using the right -click menu in the Profile tab.

Exaggeration

Setting the vertical and horizontal scale renders a clearer display of the profile.

1. Right-click in the Profile tab and select Set Chart Scale from the pop-up menu.

The Chart Scale dialog box is displayed.

2. Type the horizontal and vertical exaggeration scales and click **OK**.

The Profile tab is refreshed to display the profile at the new scale.

Axis Settings

Select the display for the X and Z axes.

1. Right-click in the Properties tab and select Graph Axis from the pop-up menu.

The Axis Settings dialog box is displayed.

Axis Settings

Axis labels

X-axis label: ☒ Display X scale

Z-axis label: ☒ Display Z scale

Tick marks

X-axis: ☒ Automatic ☐ User defined

Z-axis: ☒ Automatic ☐ User defined

Step size:

Axis range

X-axis: ☒ Display min / max values ☒ Display min / max values

☒ Automatic ☐ User defined

Minimum value: Minimum value:

Maximum value: Maximum value:

2. Type the labels for the X and Z axes in the X-Axis and Z-Axis fields.
3. Select the X-axis and Z-axis increments as *Automatic* (derived from the maximum and minimum values in the profile) or as *User Defined*.
4. If you selected *User Defined*, type the *Step Size* value in the field.
5. Select the *Display Min/Max Value* check boxes to show the minimum depth value (Z-axis) or maximum distance value (X-axis).

6. Select *Automatic* to scale data according to the minimum and maximum values in the profile, or select *User Defined* to enter scale data according to selected depth and distance values.
7. If you selected *User Defined*, type the *Minimum* and *Maximum Values* for the data range.
8. Click **OK**.

Legend

Display a legend and set the location of the legend.

1. Right-click in the Profile tab and select Show Legend from the pop-up menu.

The Show Legend dialog box is displayed.



2. Select the *Show Legend* check box.
3. Select the location of the legend: either to the left or the right of the profile.
4. Type the width of the legend.
5. Click **OK**.

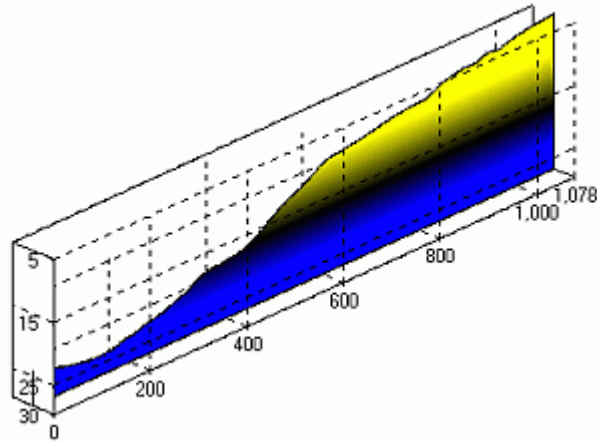
The legend is displayed in the Profile tab.

Zoom/Pan/Rotate

You can rotate, zoom, and pan the profile. These options are available while in digitizing mode from a pop-up menu in the Profile tab of the Worksheet window. The profile can be rotated to a maximum of 180°.

1. Right-click in the Profile tab and select Mouse Mode > Trackball from the pop-up menu.
2. Press and hold the mouse button while dragging the cursor in Worksheet window up or down, or sideways to rotate the profile.

The profile display is rotated according to the position where you release the mouse button.

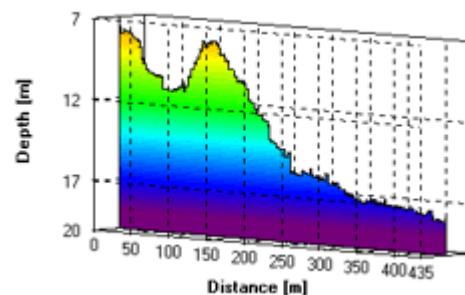
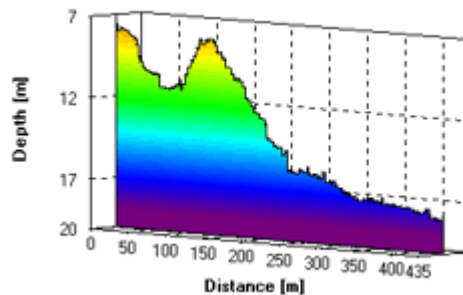


3. Zoom in or out of the profile by right-clicking in the Profile tab and selecting Mouse Mode > Zoom from the pop-up menu.
4. Pan the profile by right-clicking in the Profile tab and selecting Mouse Mode > Pan from the pop-up menu.

The zoom and pan operations require you to press and hold the mouse button while dragging the cursor in the Worksheet window.

You can view the profile with vertical and horizontal grid lines in front of profile.

5. Right-click in the Profile tab and select Wall Lines > Show Horizontal Front Line or Show Vertical Front Line from the pop-up menu.



Show Vertical Front line is on

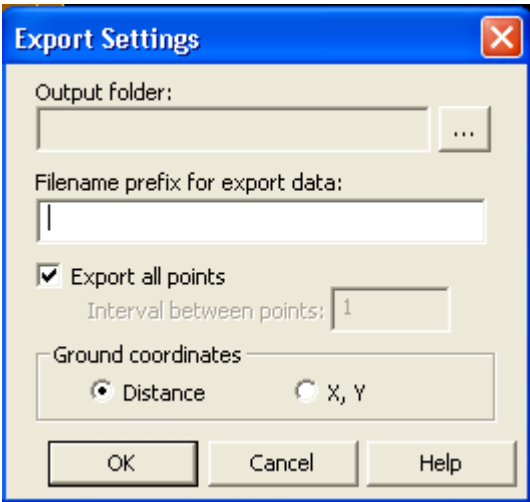
6. Select *Snap to 2D* from the pop-up menu to return the profile to its original position.

Export Profile

Create a text file containing position and depth data from a selected profile.

1. Right-click in the Profile tab and select Export Graph to ASCII from the pop-up menu.

The Export Settings dialog box is displayed.



2. Click **Browse** to select a directory for the file.
3. Type the file name prefix in the *Filename* field. All files will have the profile name appended to the end of it.
 - For example, a text file for Profile 21 with the prefix HBC4 will be named HBC4-Profile21.txt.
4. Select the *Ground Coordinates*:
 - *X, Y* (values are derived from the reference coordinate system in the field sheet)
 - *Distance* (from the start of the profile), *Z*
5. Click **OK**.

The profile data is exported to a text file in the selected directory.

Display Profile

Display an existing profile in the Worksheet window.

1. Make sure that the Worksheet window is open.
2. Select a profile layer in the Control window.
3. Select the Display Profile command.

The Display Profile dialog box is shown

4. .Select a height source by expanding the list and selecting the layer you want to use.
5. Type a *Step Size* to extract position and depth data from the profile line.
6. Click **OK**.

The profile is loaded into the Profile tab of the Display window.

Menu	Process > Products > Profile >Display
Pop-up	Display (Control window)

Sounding Selection

A selection of soundings for display can be created as a sub-layer of a field sheet. The sounding selection is generated from a tile, grid or BASE Surface attribute layer. The selection mechanism is shoal- or deep-biased and allows control over the final density of the selected sounding layer. The sounding layer can be written to a CARIS file or to a Hydrographic Object Binary (HOB) file.

You can colour code the selected soundings according to depth, if necessary. See “[COLOUR OPTIONS FOR SOUNDINGS AND CONTOURS](#)” ON [PAGE 368](#).

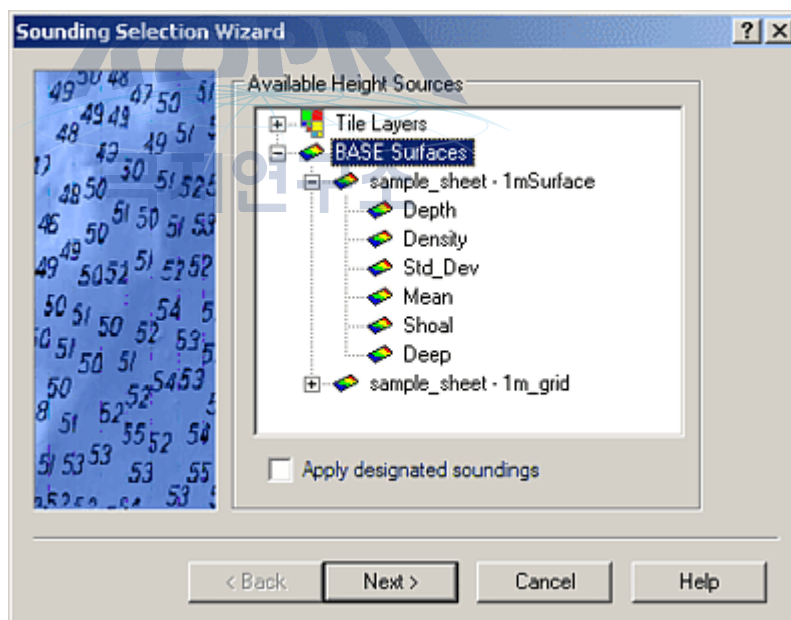
To create a layer of selected soundings:

1. Choose the Selected Soundings command.

The Sounding Selection Wizard is displayed.

Menu	Process > Products >Selected Soundings
Pop-up	New > Selected Soundings...

Step 1



The Selected Soundings function uses tile layers (including bin layers) and BASE Surface attribute layers as data sources.

From the chosen layer, one value from each tile/bin or attribute layer node is used to represent all of the soundings from that cell. In the case of a bin layer, there is only one value present, so it is used. In the case of a tile layer, each tile contains a number of attributes and a primary sounding. The primary sounding is the value that is used in the Selected Soundings operation.

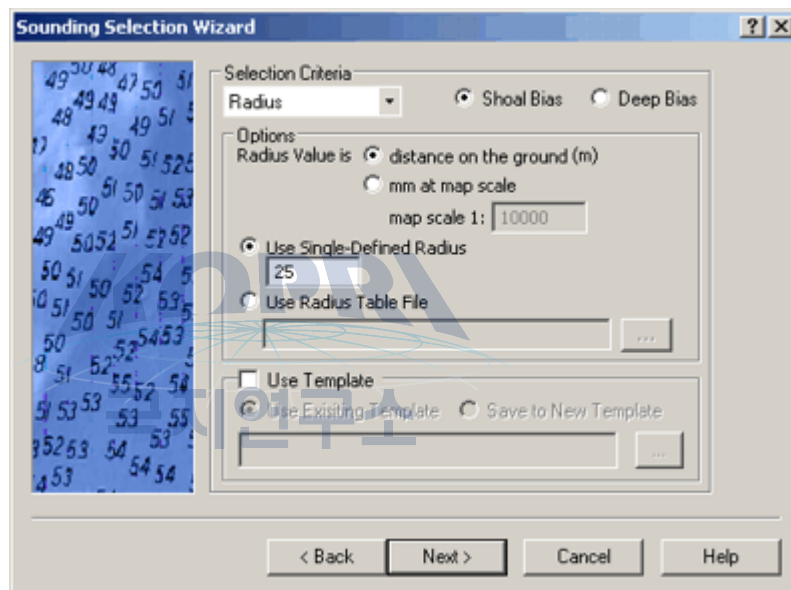
2. Select a BASE Surface attribute layer or tile layer. You can view all layers by clicking the + icon to expand the file tree.

The “Apply designated soundings” option lets you choose how soundings are treated in the selection process.

3. Select the check box to have designated soundings processed first.
4. Leave the check box un-selected to all soundings processed in the same way.
5. Click **Next**.

Step 2

The Sounding Selection - Step 2 dialog box is displayed.



Selection criteria

You have three criteria for sounding selection:

- *All* selects soundings from three sources:
 - node values from the BASE Surface attribute layer
 - the primary sounding from every tile
 - the sounding stored in every bin
- *Radius* selects values from a designated area.
- *Overplot Removal* selects soundings to fit on a field sheet so that there is no overlap.

6. Select one of the three criteria from the *Selection Criteria* drop-down list.

If you selected *Radius* or *Overplot Removal*, the dialog box is refreshed to display the options associated with those criteria.

7. Select the shoalest or deepest values for the selected soundings by choosing the *Shoal Bias* or *Deep Bias* options.

Settings in the wizard can be saved to a Sounding Selection Template (CSST) file. This file can be opened and reused again.

8. Select the *Use Template* option to open or create a template file that contains criteria options.
9. Select the *Use Existing Template* to open a template file, or select *Save to New Template* to create a new template file from the settings in the wizard.
10. Click the browse button to open a file, or create a new file.

Radius

If you choose *Radius* option from the *Selection Criteria* list, the dialog box is refreshed to show the following options.

11. Set the *Radius Value*. (If you select *mm at map scale*, type a scale value in the *Map Scale* field.)
12. To set a standard minimum distance between soundings, select the *Single User Defined Radius* and enter the interval.
13. If you are using a radius table to set the minimum distance between soundings, select the *Use Radius Table File* option and click **Browse** to select the file.

Sounding Radius Table

The sounding radius table sets the minimum suppression radius between soundings when generating a soundings layer. The radius table can be applied to more than one depth range. Each depth range can contain its own radius value. The table contains three columns:

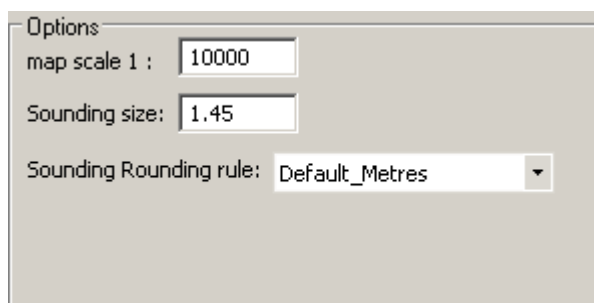
- minimum depth of the range
- maximum depth of the range
- suppression radius for the depth range.

The suppression radius field is set according to the radius value selection in the dialog box. An example of a radius table is shown below.

```
0.0 10.0 1.0
10.0 20.0 2.0
20.0 50.0 5.0
50.0 500.0 10.0
```

Overplot Removal

14. If you choose the *Overplot Removal* option from the *Selection Criteria* list, the dialog box is refreshed to show the following options.



Options

map scale 1 : 10000

Sounding size: 1.45

Sounding Rounding rule: Default_Metres ▼

Overplotting occurs when soundings overlap or are so close together that they are plotted on top of each other. Two soundings with depths of 11 and 22 might look like 1212 if they are overplotted.

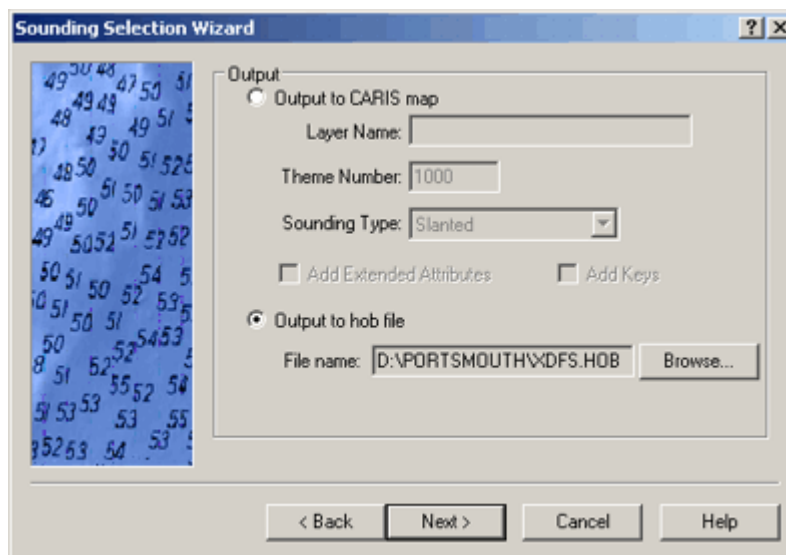
The *Overplot Removal* option suppresses certain soundings in a dense set of soundings so that the dataset can be plotted at a certain scale without overplotting. *Overplot Removal* places a buffer zone around each sounding then suppresses either the deepest or shoalest soundings which overlap these buffer zones.

Suppression or overplot removal does not physically remove the soundings from the HIPS file. Excess soundings have a compilation status of suppressed while the rest have a compilation status of background.

15. Type the map scale in the appropriate field.
16. Type the size of the soundings (as they appear in the Display window) in the *Sounding Size* field.
17. Select a *Sounding Rounding Rule* from the drop-down list.
18. Click **Next**.

Step 3

The Sounding Selection - Step 3 dialog box is displayed.



The soundings can be exported to two formats: a CARIS map or a HOB file. The HOB file is stored in the same directory as the field sheet. The default directory is ..\Hips\Fieldsheets\ProjectName. CARIS files are directly opened as a layer.

CARIS map

To place soundings in a CARIS file, complete the following steps:

1. Select the *Output to CARIS Map* command.
2. Type a name for the layer in the *Layer Name* field.

The *Layer Number* is used to organize information in the CARIS file. It is important to maintain each layer on a separate theme, therefore be sure to change it from the default number each time you create a new sounding selection.

3. Type a number in the *Layer Number* field.

Soundings can be displayed in two formats.

- *Slanted*: This format displays the sounding in a slanted format with the value to the right of the decimal point shown in subscript.
- 4. *Engineer*: This format displays the sounding in regular text with the depth values separated by a decimal point.
- 5. Select either *Engineer* or *Slanted* sounding styles from the drop-down menu.

18₂

Slanted

18.2

Engineer

The *Add Extended Attributes* option adds useful additional information to each sounding. The *Add Keys* option gives each

sounding a unique identifier or key. This key provides a link back to the original sounding in the HIPS file and is required to open a specific sounding in the HIPS Swath/Single Beam or Subset Editors.

6. Select the *Add Extended Attributes* option if you want to include time stamp, launch ID, accuracy value, and tidal reduction value with the soundings.
7. Select the *Add Keys* option to give each sounding a unique identifier. The key format is XXXBBBBBBPPP where XXX is a random value, BBBBBB is the beam number and PPP is the profile number.

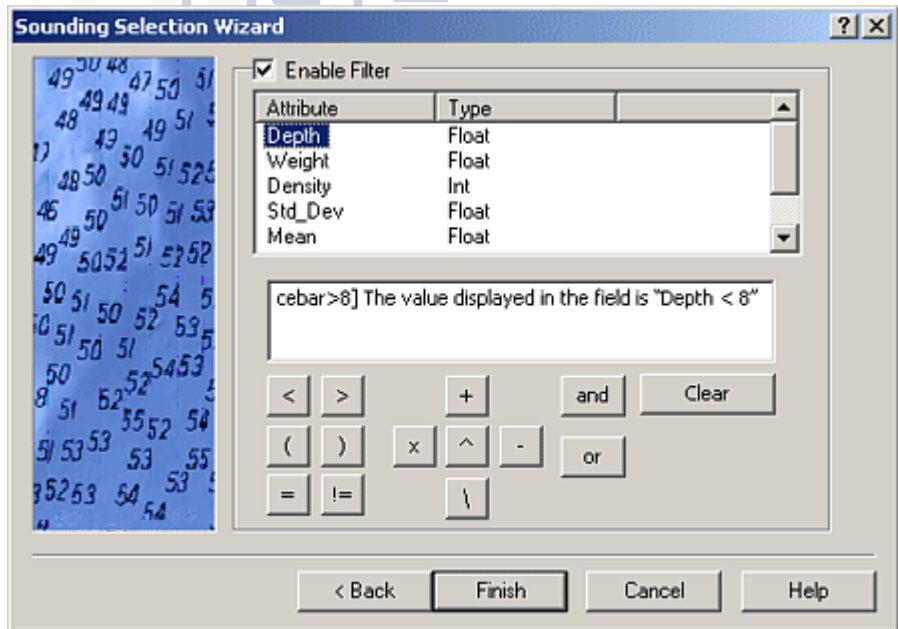
HOB file

A HOB file contains S-57 feature objects. Additional tile attributes to help identify the soundings are also included in the HOB file. The wizard lets you map these tile attributes to corresponding S-57 attributes.

1. Select the *Output to Hob File* option.
2. Select a *Navigational Purpose* to set a scale for the HOB file.
3. Type a name for the *Data Set Name* field (a minimum of five characters).
4. Click **Finish** if you selected the CARIS map option in the first dialog box, or click **Next** if you selected the HOB file option.

Step 4

The Sounding Selection - Step 4 dialog box is displayed.



You can use filters to display the soundings you want in your selection. The *Enable Filter* option allows you to extract the soundings that meet the conditions you set for the filter.

For example, with the depth units set to *Metres*, if you only want soundings with a Depth value of less than eight metres, select *Depth* from the available *Attributes* list and type the following in the *Enable Filter* field:

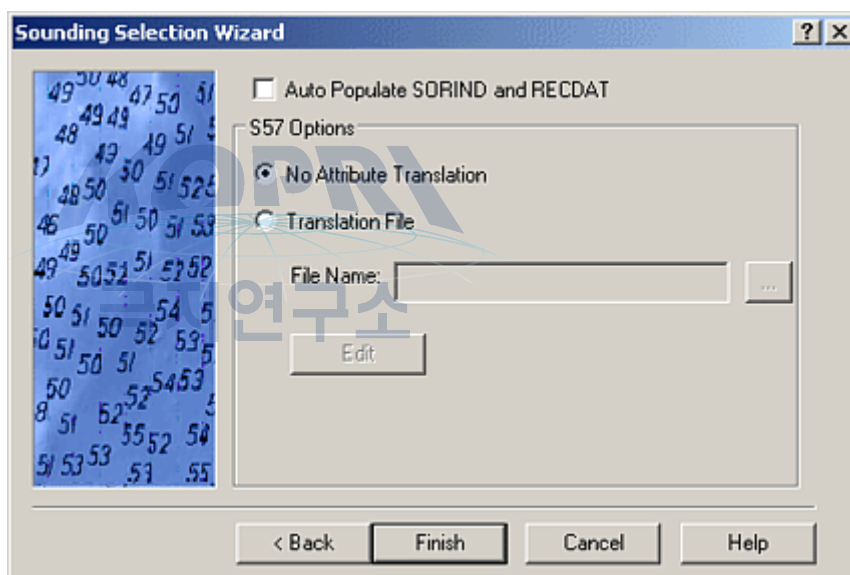
[Type: Depth<spacebar>, click "<" button or Shift+"<" key,
type: <spacebar>8]

The value displayed in the field is "Depth < 8"

5. [Optional] To apply filters to the surface data, select the *Enable Filter* option and enter the filter conditions to apply.
6. Click **Next** if you selected HOB file in Step 3 of the wizard, or click **Finish** if you selected CARIS Map in Step 3 of wizard.

Step 5

The Sounding Selection - Step 5 dialog box is displayed (if you selected HOB file in Step 3).

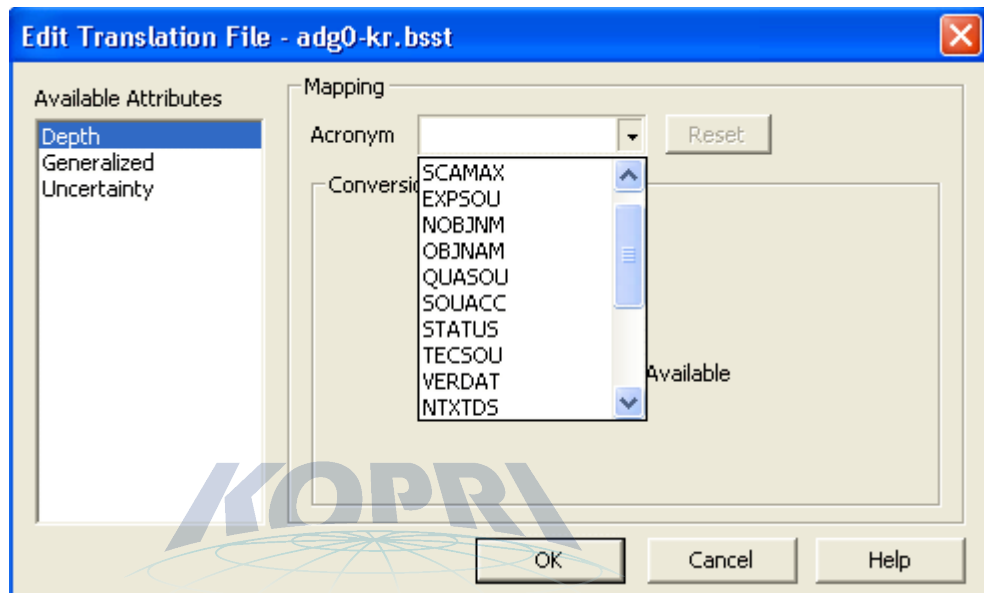


The sounding selection process generates S-57 SOUNDG objects that can have certain attributes populated. These attributes — SORIND (information about the source of the sounding) and RECDAT (date the object was captured, edited or deleted)—do not have information populated unless you select the *Auto Populate SORIND and RECDAT* check box.

Note: autopopulating the SORIND and RECDAT attributes can have a negative impact on save times, export times as well as file size, particularly with large, high-density datasets.

The other S-57 option is to map the BASE Surface attributes to S-57 attributes, via a translation file. The translation file has a BSST file extension and is in XML format.

7. To apply a translation file, choose the *Translation File* option, or
8. To finish, select the *No Attribute Translation* option.
9. Click the Browse button (...) to select an existing translation file (with a .bsst extension) or to specify a name for a new translation file.
10. Click **Edit** to manually map BASE Surface attributes to S-57 attributes. The Edit Translation File dialog box is displayed.



11. Select a mapping acronym from the drop down list.

The mapping dialog box is refreshed so you can enter values in the editing fields. The fields shown depend on the acronym selected. If there are no attributes associated with the acronym, the dialog box is empty.

The following is an example of a translation file where the value of SCAMIN is multiplied by 2.

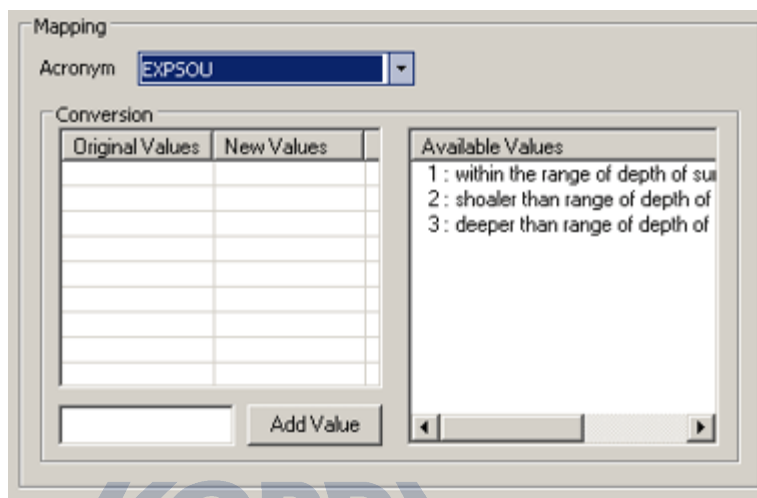
```
<?xml version="1.0" encoding="UTF-8"?>
<Selected_Sounding_Conversion>
  <Depth New_Acronym="SCAMIN">
    <Conversion_Factor><value>*2</
Conversion_Factor>
  </Depth>
</Selected_Sounding_Conversion>
```

12. If the selected attribute acronym are enumerated or numeric types, the dialog box is refreshed to show the options for those types. See [“ENUMERATION ATTRIBUTES” ON PAGE 366](#) and [“NUMERIC ATTRIBUTES” ON PAGE 366](#).

Enumeration attributes

Some S-57 object attributes are of the Enumerated type which means they contain numerical codes that more precisely define the attribute. You can map these codes to the object attribute.

If the selected Object Attribute is a enumerated type, the dialog box is refreshed to show the following options.



The Mapping dialog box shows the Acronym 'EXPSOU'. The Conversion section contains a table with two columns: 'Original Values' and 'New Values'. Below the table is an 'Add Value' button. To the right is a list of 'Available Values' with three items: '1 : within the range of depth of sui', '2 : shoaler than range of depth of', and '3 : deeper than range of depth of'.

Original Values	New Values

Available Values

- 1 : within the range of depth of sui
- 2 : shoaler than range of depth of
- 3 : deeper than range of depth of

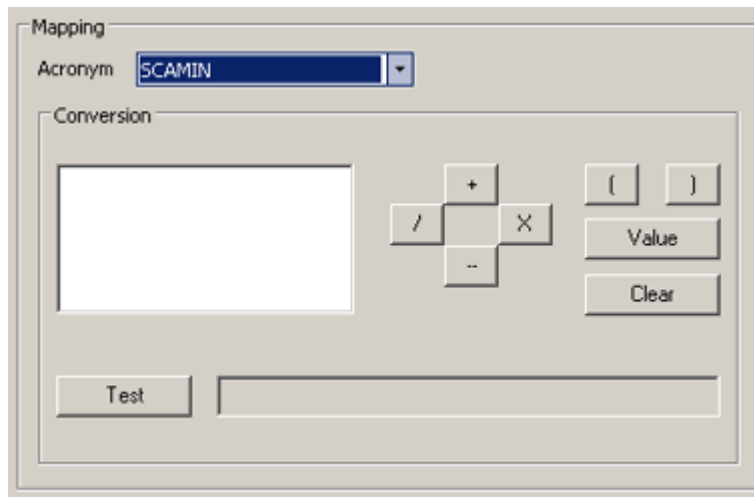
Add Value

13. Type the existing tile attribute values in the *Add Value* field.
14. Click **Add Value** to add the tile values to the *Original Values* field.
15. Double-click an S-57 attribute value in the *Available Values* list.
The S-57 value is displayed in the *New Values* field.
16. Click **OK**.

Numeric attributes

Some S-57 object attributes are Integer, Float or Double types.

If the selected Object Attribute is a numeric type, the dialog box is refreshed to show the following options.



Numbers are typed into the area provided to display the formula. Mathematical operators are inserted by clicking the appropriate button on the right side of the dialog box. The **Value** button inserts value of the attribute in the formula.

1. Create a conversion formula by typing any appropriate numbers and inserting mathematical operators.
2. If you want to remove the formula, click **Clear**.
3. Click **Test** to view an example of the formula
4. Click **OK**.

When the selected soundings are saved to the HOB file, the tile attributes are converted to the values determined by formula that was created in the previous steps.

View HOB soundings

The display settings in the S-52 tab of the Options dialog box must be set prior to displaying the soundings stored in a HOB file. (See “S-52 DISPLAY” ON PAGE 678.)

5. Open the Options dialog box and select the S-52 tab.
6. Select *Base and Other* or *Standard and Other* from the *Category* drop-down menu.
7. Select the *Soundings* check box.
8. Select the File Open command and select the HOB file where the soundings are stored.
9. Click **Open**.

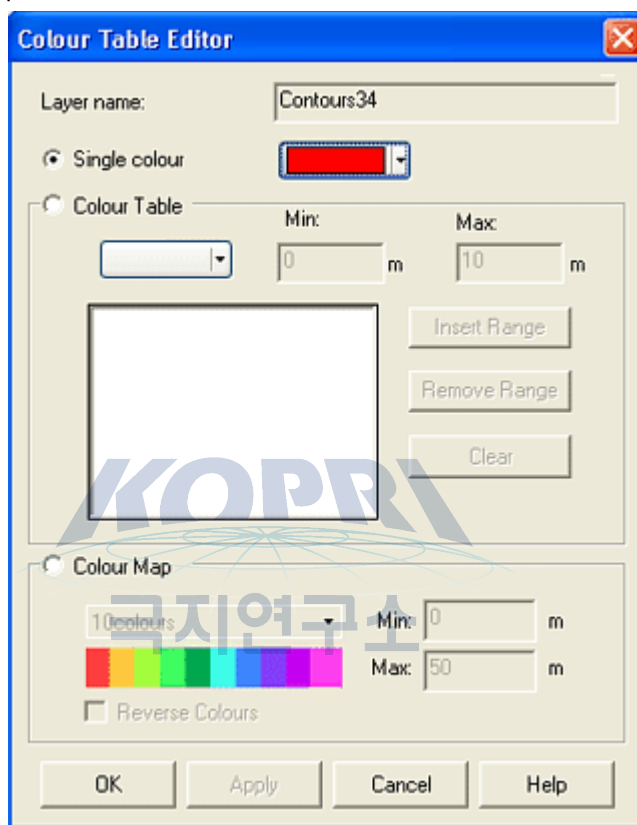
The soundings are listed in the file tree in the Control window, and are opened in the Display window.

Colour Options for Soundings and Contours

The Colour Table Editor lets you colour code soundings and contours for easier display and interpretation.

1. Select a sounding or contour layer in the Control window.
2. Select the Edit Colours command from the right-click menu.

The Colour Table Editor dialog box is displayed.



Single colour

Use this option to display a soundings or contours in a single colour.

1. Select the *Single Colour* option.
2. Select a colour from the colour picker, or create a custom colour from the standard Windows colour palette.
3. Click **OK** to save and apply settings.

Colour table

To apply different colours to different depth ranges:

1. Select the *Colour Table* option.
2. Select a colour from the colour palette, or create a custom colour from the standard Windows colour picker.
3. Type a minimum range depth in the field beside the palette.
4. Type a maximum range depth in the next field
5. Click **Insert Range**.

The colour and range values are displayed in the Colour Table dialog box.

- 6.Repeat Steps 2 to 5 to continue adding a colours for each range.
- 7.To remove a single colour range, select a range so it is highlighted and click **Remove Range**.
- 8.To remove all selected ranges, click **Clear**.
- 9.Click **OK** to save and apply settings.

The soundings or contours are colour-coded according to the range values you selected earlier.

Standard colour map

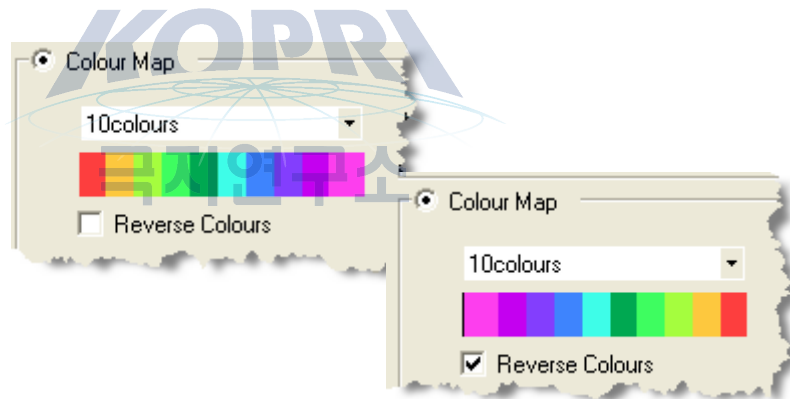
Use this option to select a standard colour map.

- 1.Select the *Colour Map* option.
- 2.Select a colour map from the drop-down menu.
- 3.Type the minimum and maximum range values for the colour map.
- 4.Click **OK** to save and apply settings.

The layer objects are displayed according to the colour map settings.

Reverse colours

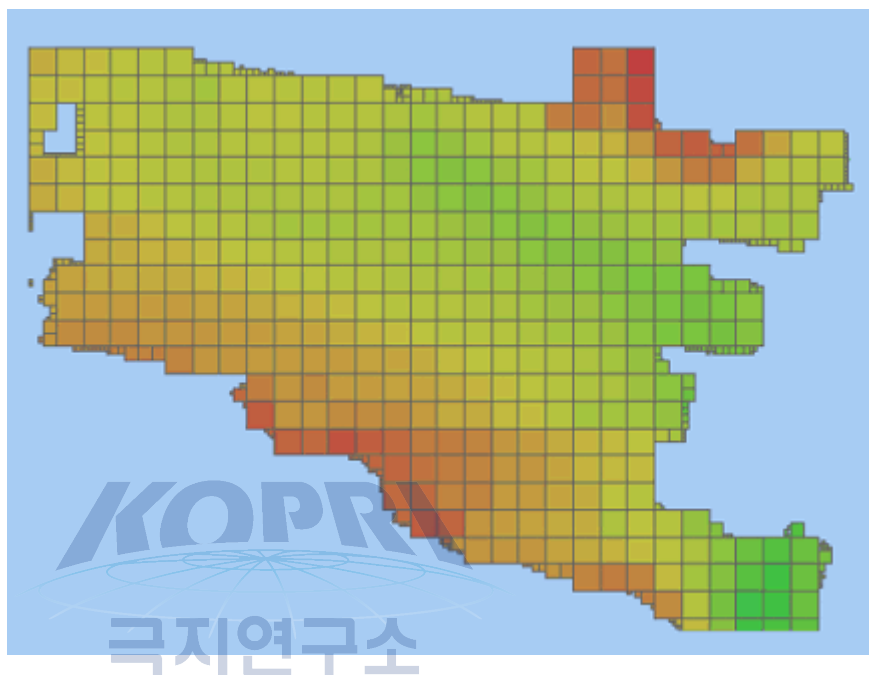
Select this option to reverse the order in which the colour map is applied (see illustration below).



Tiling

Tiling divides a data display into manageable parts based on selected criteria. Generally, the tiling process splits a selected area into sections (tiles) and continues sub-dividing until a network of squares cover the data.

Below is an example of a tiled field sheet in the Display window.



A special type of tiling is used to track the progress of subset data cleaning, (see “TRACK PROGRESS WITH SUBSET TILES” ON PAGE 334) and for performing statistical surface cleaning on sounding data (see “STATISTICAL SURFACE CLEANING” ON PAGE 305).

Tiling a field sheet

There are three methods of tiling a field sheet: tiling, binning and QTC tiles. If you need to examine the data for more detailed statistical information then the tiling option should be selected.

Tiling

The field sheet tiling process divides a field sheet into four sections (tiles) and continues sub-dividing each section by four until the criteria for creating the tile is reached. The result is a network of tiles covering the data. These tiles can vary in size.

Binning

Binning splits the surface of a field sheet into squares or “bins” based on a user-defined size. Within each bin, the shallowest or deepest sounding can be selected. This option is very fast and

should be selected if you want to generate only soundings and contours from the data.

QTC Tiles

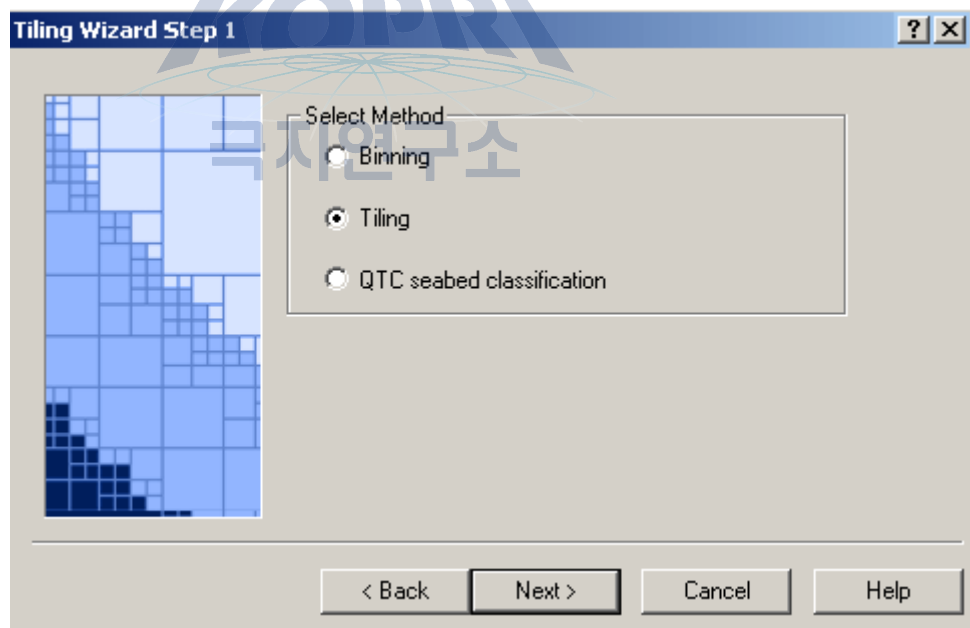
Seafloor classification is a procedure in which the amplitude and shape of the reflected acoustic signal is used to interpret the physical nature of the bottom. Quester Tangent Corporation has developed a program called QTC View to perform this analysis. The analysis in QTC View groups the return signals into classes which correspond broadly with physical properties of the seafloor. The results are summarized in a text file (.seabed). HIPS and SIPS generalizes these results by creating tiles based on the class values in the .seabed files.

Menu	Process > Products > Tiles
Pop-up	New > Tiles

Create Tiles

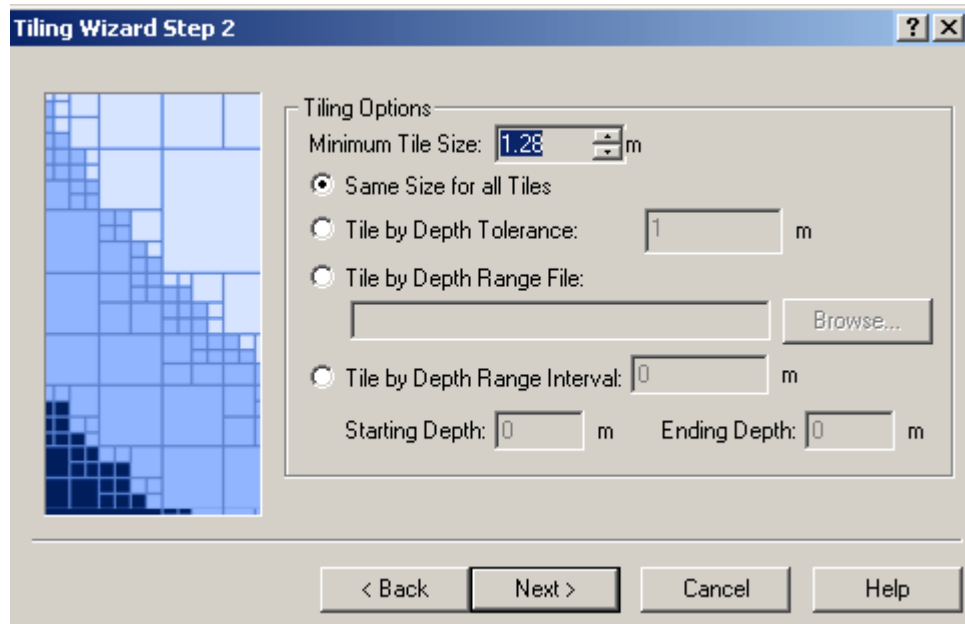
1. Make sure a field sheet is open.
2. Select the field sheet layer in the Layers tab.
3. Select the Tiling command.

The Tiling Wizard - Step 1 dialog box is displayed.



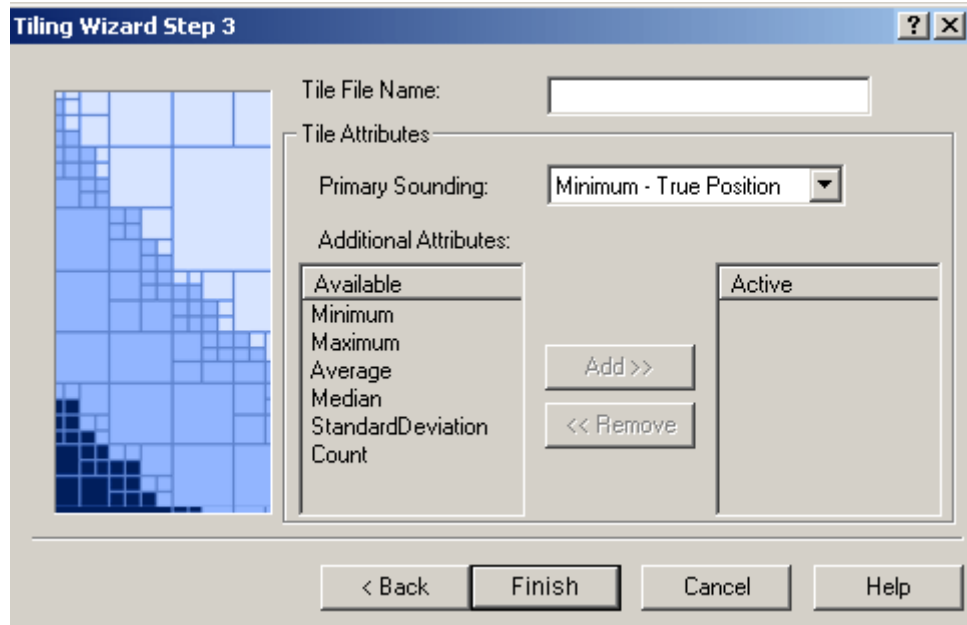
4. Select the method of tiling, in this example, select tiling.
5. Click **Next**.

The Tiling Wizard - Step 2 dialog box is displayed.



6. Set the minimum tile size by clicking the up or down arrow buttons. As you increment upwards, the tile size is doubled.
7. Select from the following four options to set a tiling criteria:
 - *Same Size For All Tiles*: Set all tiles to the minimum tile size.
 - *Tile by Depth Tolerance*: Select a depth level for creating new tiles. For example, if you enter five then new tiles are created as the depth changes by five metres (or feet, if you are working in imperial units).
 - *Tile By Depth Range File*: Type the file name and path of the Depth Range File with a list of depths, or click **Browse** to select the file. The tiles are created according to the listed depths. (See “[USE DEPTH LIST](#)” ON PAGE 350.)
 - *Tile By Depth Range Interval*: Use interval levels between a set depth range for creating new tiles. Type the depth interval and the start and end depths. For example, for a depth interval of five metres, a start depth of zero metres and end depth of 20 metres, a tile is created for every five metres between 0 metres and 20 metres.
8. Click **Next**.

The Tiling Wizard - Step 3 dialog box is displayed.



9. Type a name for the tile file.
10. Select a primary sounding as the starting point for the tiling process. Choose from five options:
 - *Minimum - True Position*: Use the shoalest sounding at its actual position.
 - *Maximum - True Position*: Use the deepest sounding at its actual position.
 - *Average - Tile Centre*: Use the mean value of the soundings as the centre of the tile.
 - *Minimum - Tile Centre*: Use the shoalest sounding as the centre of the tile.
 - *Maximum - Tile Centre*: Use the deepest sounding as the centre of the tile.
11. Choose other tile attributes by selecting an attribute in the Available list and clicking **Add** to move it to the Active list. You can move the attribute from Active list by clicking **Remove**.
12. Click **Finish** to complete the tiling process.

A progress indicator on the status bar shows how much of the tiling process has been completed. Once the tiling is completed, it is shown in the Display window and the tile layer is listed in the Control window.

Create Bins

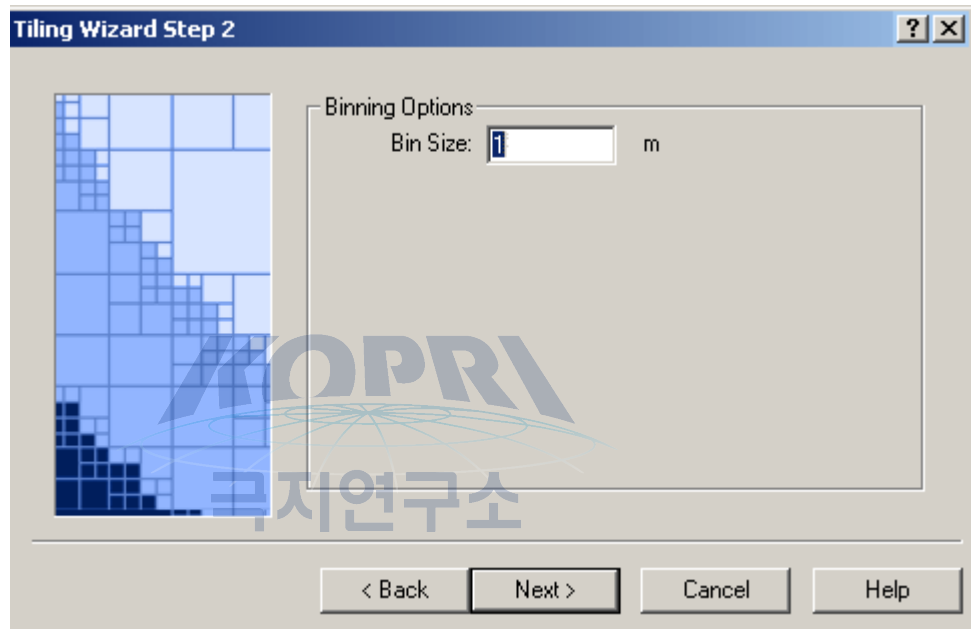
Menu	Process > Products > Tiles
Pop-up	New > Tiles

1. Select the field sheet.
2. Select the field sheet layer in the Layers tab.
3. Select the Tiles command.

The Tiling Wizard - Step 1 dialog box is displayed.

4. Select the Binning option.
5. Click **Next**.

The Tiling Wizard - Step 2 dialog box is displayed.



6. Type a size for the bin tiles.
7. Click **Next**.

The Tiling Wizard - Step 3 dialog box is displayed. The *Available Attributes* section is dimmed.

8. Type a name for the file
9. Select a minimum or maximum sounding position as the starting point for the binning process.
10. Click **Finish**.

A bin file is created and displayed in the Display window. A bin layer is also added to the Layers tab.

Create QTC Tiles

Menu	Process > Products > Tiles
Pop-up	New > Tiles

1. Select the field sheet.
2. Select the field sheet layer in the Layers tab.
3. Select the Tiles command.

The Tiling Wizard - Step 1 dialog box is displayed.

4. Select the QTC Seabed Classification option.
5. Click **Next**.

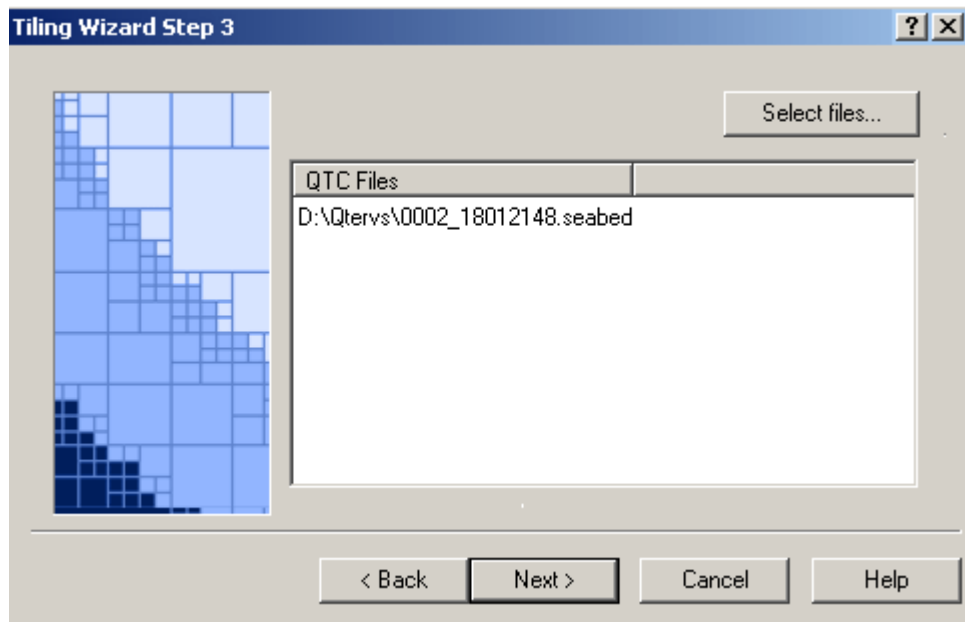
The Tiling Wizard - Step 2 (QTC) dialog box is displayed.

6. Type a name for the QTC tile layer.
7. Set the minimum tile size by clicking the up or down arrow buttons. As you increment upwards, the tile size is doubled.

The *Percent Value Used to Split* option continuously splits the tiles until the total amount of a specific class value in a tile meets or exceeds the entered percentage. For example, if the percentage is set at 50, then a tile is continuously sub-divided into smaller tiles until one of the tiles contains at least 50 per cent of a class value.

8. Type the percent value.
9. Click **Next**.

The Tiling Wizard - Step 3 (QTC) dialog box is displayed.



10. Click **Select files** to browse to the .seabed file used to create the tiles.

The selected file is displayed in the *QTC Files* text area.

11. Click **Finish**.

A progress bar displays the percentage of tiles created.

The tiles are drawn to the Display window. You can use the Tile Display Query (see "TILE DISPLAY QUERY" ON PAGE 378) functions with the tile set.

Open and Close Tiles

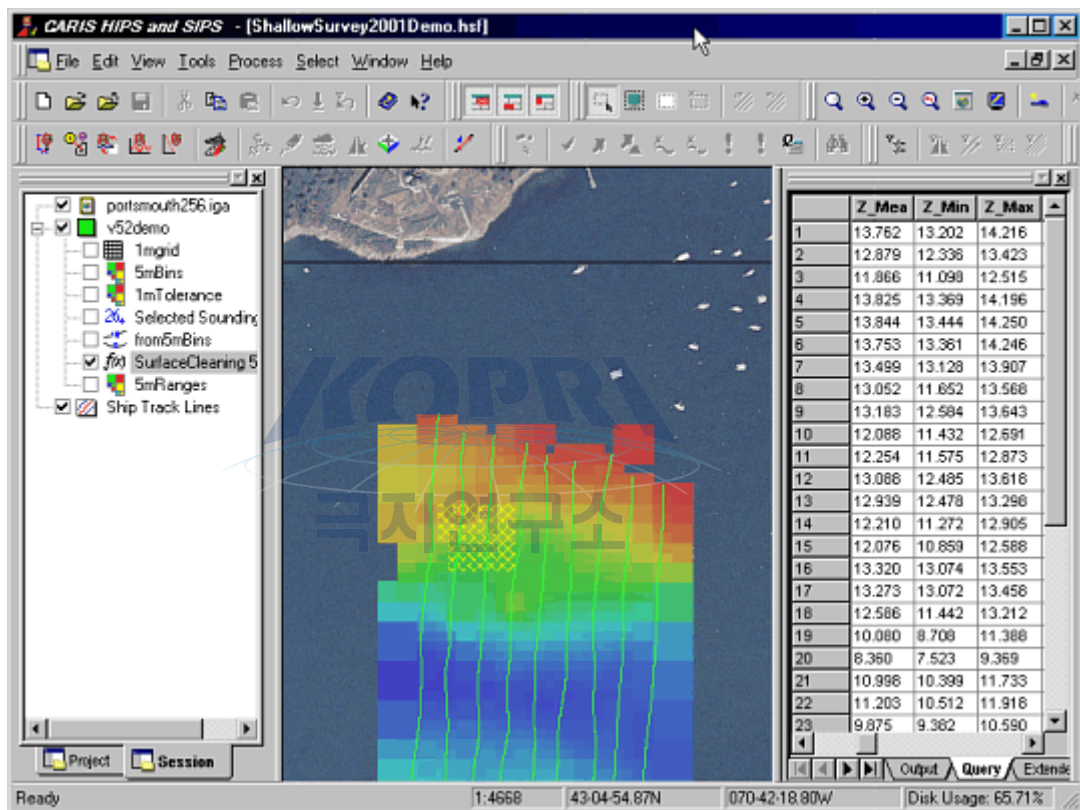
Menu File > Open Field Sheets

1. Select the Open Field Sheets command.

The field sheet file name is displayed in the Layers tab of the Control window.

2. Expand the field sheet file tree by clicking the Expand (+) icon beside the field sheet so the tile file name is visible
3. Select the check box beside the field sheet file name, to make the tile visible in the Display window.

Below is an example of a tiled area.



Menu File > Close Field Sheets

Close a tile file in the Display window.

1. Select the Close Field Sheets command.

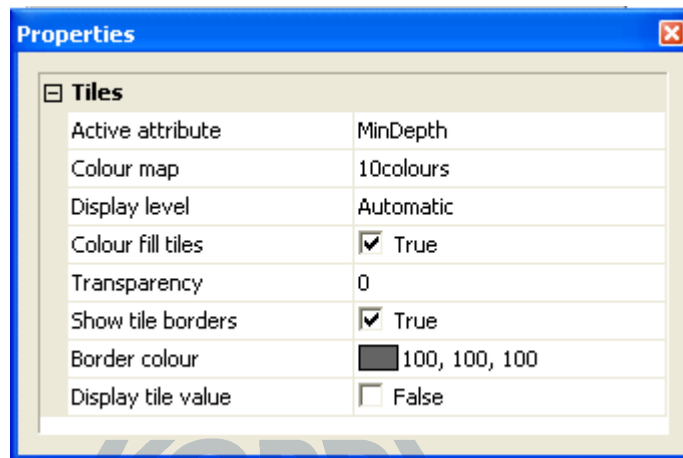
All tiles associated with the field sheet are closed.

Set Tile Properties

Set the display properties for tiles.

1. Select a tile layer in the Layers tab of the Control window.
2. Select the Properties window command, or right-click the layer and select Properties from the pop-up menu.

The Properties window displays the tile layer properties.



The *Active Attribute* list contains all attributes included in the tile (such as the Profile number). When you select an attribute, the tile is displayed according to the attribute values

1. Select an attribute from the drop-down *Active Attribute* list.
2. Select a colour map from the drop-down list. A preview of the colour map is displayed below the list.

Change the display of tiles in the Display window.

3. Change how tiles are rendered to the Display Window by selecting from three *Display Level* options:
 - *Maximum*: Draw all tiles
 - *Size*: Draw all tiles at the selected tile size level or higher. Select a minimum tile size by clicking the arrow buttons
 - *Automatic*: Draw tiles to fit the current extents of the Display window.

The *Colour Fill* check boxes determine how attribute values are drawn in the Display window.

- If the *Colour Fill* check box is cleared, these values are drawn according to the selected colour map, but the tiles are left blank.
- If the *Colour Fill* check box is selected, then the individual tiles are filled according the colour map, but the attribute values are shown in black.

4. Select *Colour Fill* to colour code tiles according to the colour map.

5. Select a *Transparency* percentage to make features visible through the tiles.
6. Select the *Show Tile Border* check box to choose a single colour to display tile border lines.

The *Show Tile Border* check box determines how the border lines dividing the tile areas are displayed.

- If the *Show Tile Border* check box is cleared, the lines are colour coded according to the colour map and attribute values.
 - If *Border Colour* is selected, then choose a single colour to display tile border lines.
7. Select the *Display Tile Value* check box to draw the selected attribute values.



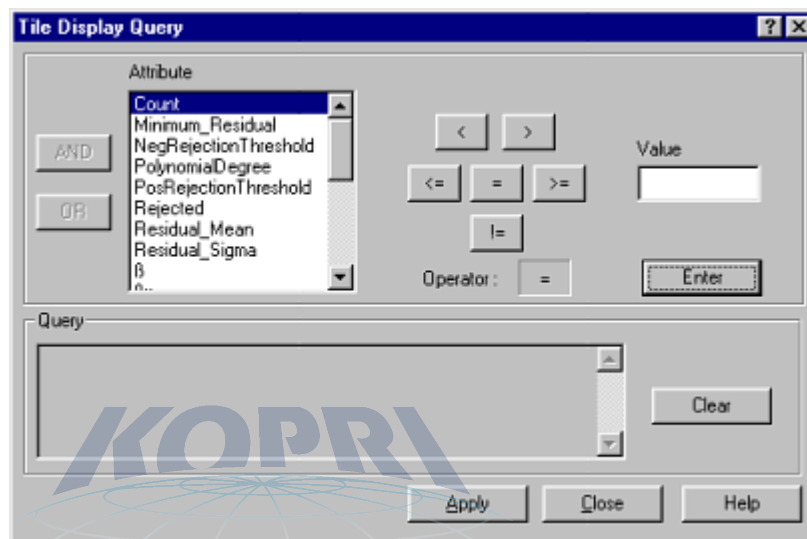
Menu	View > Tile Display Query

Tile Display Query

Using the Tile Display Query dialog box you can create an SQL-type query based on selected tile attributes and defined values. Only those tiles that meet the search criteria are displayed.

1. Select the tile layer in the Layers tab.
2. Select the Tile Display Query command.

The Tile Display Query dialog box is open.



3. Select an attribute from the list.
4. Click one of the following operator buttons:
 - less than (<)
 - greater than (>)
 - less than or equal to (<=)
 - equals (=)
 - greater than or equal to (>=)
 - not equal to (!=)
5. Type a value for the attribute in the *Value* field, and click **Enter**.

The search criteria you selected in the dialog box are displayed in the *Query* section.

6. To add other search criteria, click either of these logic operators:
 - **AND**: This operator combines two queries together so the results of both are shown in the Display window.
 - **OR**: This operator searches and displays either one of two search criteria in the Display window.
7. Repeat Steps 3 through 6 to add as many search criteria as needed.
8. Click **OK**.

Query Tiles

1. Make sure the tiles are open in the Display window.
2. Select the tile layer in the Layers tab of the Control window.
3. Select the tiles to be queried.

The selected tiles are highlighted.

4. Select the Query Tiles command.

The following tile data is displayed in the Worksheet window (from left to right):

Menu	Edit > Query Tiles
Tool	

- **East:** easting coordinate for the centre of the tile.
- **North:** northing coordinate for the centre of the tile.
- **Z_Mean:** mean depth value for tile.
- **Z_Min:** minimum depth value for tile.
- **Z_Max:** maximum depth value for tile.
- **Residuals_Mean:** mean value for residuals from polynomial.
- **Residuals_Sigma:** standard deviation for residuals.
- **Count:** number of points in the tile.
- **Rejected:** number of points rejected during surface cleaning.
- **NumberOfCoefficients:** the number of polynomial coefficients used.

19

Processing in SIPS—Mosaic Editor

Side scan and backscatter imagery data can be processed directly into mosaics, which can then be examined for anomalies and corrected.

Mosaic Editor is used to create and edit mosaics, and analyze the sediment properties of the create imagery.

In this chapter...

“SIPS WORKFLOW” ON PAGE 386

“INTRODUCTION” ON PAGE 387

“CREATE GEOBARS” ON PAGE 391

“CREATE MOSAIC” ON PAGE 397

“EDIT MOSAICS” ON PAGE 400

“SEDIMENT ANALYSIS” ON PAGE 405

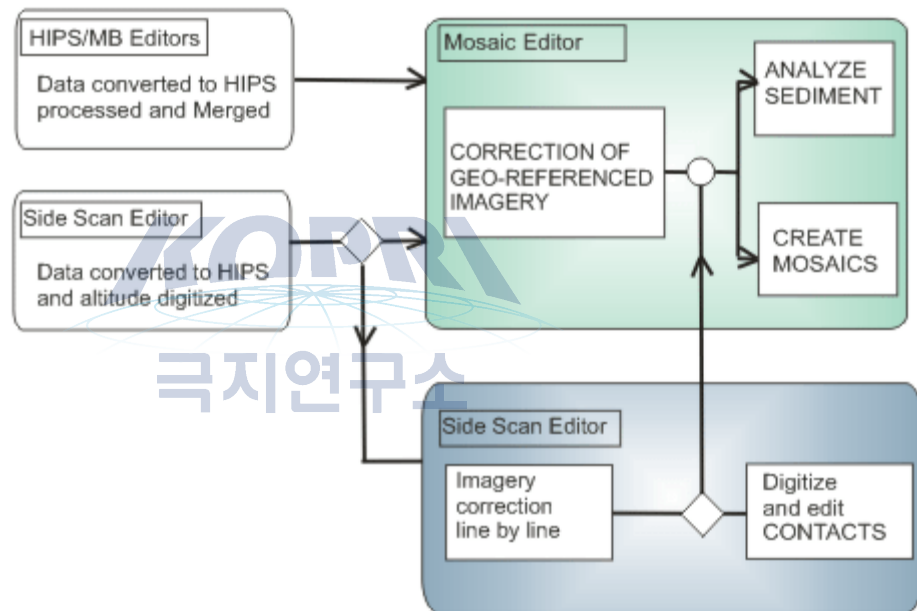
SIPS Workflow

Most users will be able to perform all their imagery processing directly in Mosaic Editor. However, if you:

- need to edit altitude data for side scan data, or
- will be digitizing and editing contacts, or
- prefer to use a waterfall display for editing, or
- intend to apply advanced TVG controls

then these functions must be performed in Side Scan Editor.

Imagery corrected in Side Scan Editor can also be georeferenced and composited in Mosaic Editor. (See “[PROCESSING IN SIPS—SIDE SCAN EDITOR](#)” ON PAGE 403.)



Introduction

Mosaic Editor uses the accurately modelled backscatter correction algorithms of the Geocoder engine to process source data. Geocoder-processed data is stored in SIPS as **Georeferenced, Backscatter Rasters**, or GeoBaRs.

GeoBaRs are the basis for all mosaics created in SIPS.

From the GeoBaRs, you can create an initial mosaic which can be examined and edited in Mosaic Editor. Once imagery has been corrected a full mosaic can be compiled from the data, or sediment analysis applied.

With GeoBaRs you can generate mosaics with data from various surveys in the same geographic area.

Mosaic Editor has two processing engines: Geocoder Engine and SIPS Engine.

Geocoder Engine

Geocoder was purpose-build to process multibeam backscatter, both beam- averaged and the higher resolution time series returns as well as side scan sonar data.

Multibeam data must be converted to HIPS format, processed with the bathymetric editors (Sound Velocity Correction, Apply Tide etc.— see Multibeam “**WORKFLOW**” ON PAGE 70), and Merged (see “**MERGE**” ON PAGE 185) before the imagery can be corrected in Mosaic Editor.

SIPS Engine

Side scan data can still be processed on a line-by-line basis in Side Scan Editor. However, with the SIPS engine in the Mosaic Editor, survey data can be corrected and geo-referenced on a “whole survey” basis, by creating a mosaic and then examining it for anomalies that may require closer attention.

Side scan data must be converted to HIPS format, and if it is necessary to digitize altitude or recompute towfish navigation, this should be applied before image correction is done in Mosaic Editor (see “**DIGITIZING SONAR ALTITUDE**” ON PAGE 407 and “**RECOMPUTE TOWFISH NAVIGATION**” ON PAGE 406).

Open Mosaic Editor

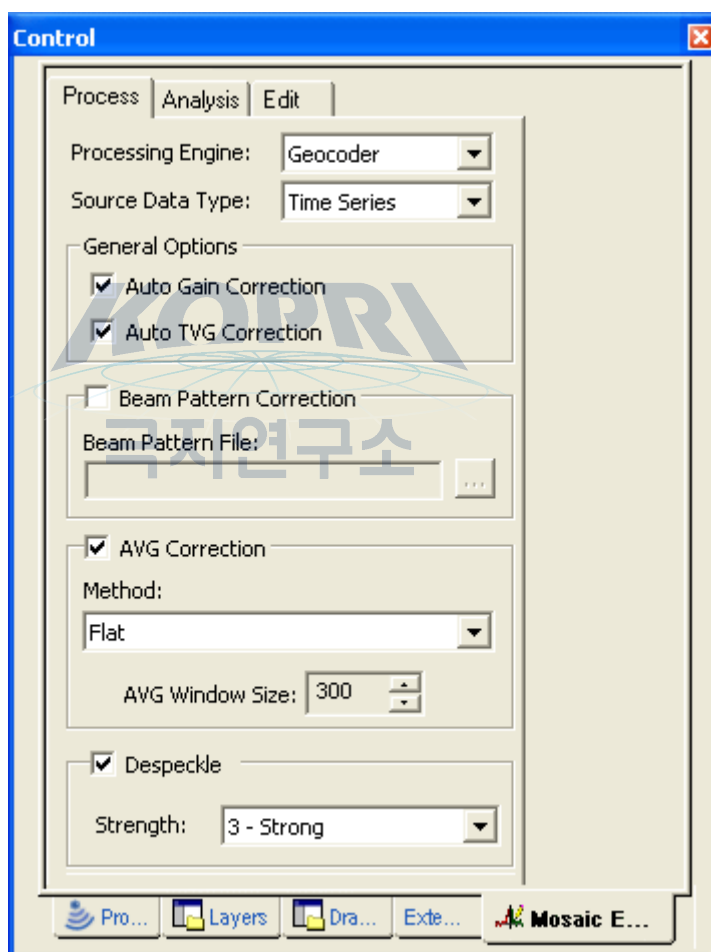
Menu	Tools > Mosaic Editor > Open
Tool	

1. Open Mosaic Editor with the command on the Tools menu or toolbar.

The Control Window is refreshed to display the three control tabs of the Mosaic Editor. The tabs are:

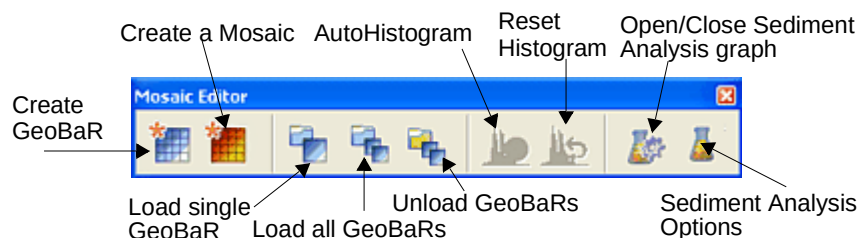
- Process - used to set the options for the creation of GeoBaRs
- Analysis - used to perform sediment analysis on backscatter
- Edit - used to edit the display of mosaics or GeoBaRs “on-the-fly” and change the draw order of the GeoBaRs

The image below shows the Mosaic Editor tabs in the Control window.



The Mosaic Editor and Beam Pattern toolbars are also displayed.

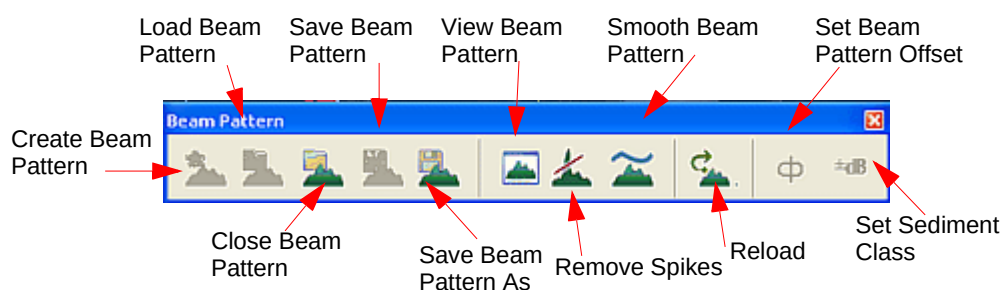
Mosaic Editor toolbar



The Mosaic Editor toolbar contains the following controls:

- **Create a GeoBaR:** based on options selected in the Process tab.
- **Create a Mosaic:** from available GeoBaRs.
- **Load a single GeoBaR** for the selected trackline(s): the user will be prompted to choose which GeoBaR(s) are loaded for each line.
- **Load all GeoBaRs** for the selected trackline(s)
- **Unload all GeoBaRs** for the selected trackline(s)
- **Sediment Analysis Options:** choose when to create a sediment analysis file for a line
- **Open/Close Sediment Analysis Graph**

Beam Pattern toolbar



The Beam Pattern toolbar has the following controls:

- **Create Beam Pattern:** create a Geocoder beam pattern file.
- **Load Beam Pattern:** open an existing Beam Pattern File for use during Beam Pattern Correction.
- **Close Beam Pattern.**
- **Save Beam Pattern.**
- **Save Beam Pattern As....**

- **View Beam Pattern:** open the Beam Pattern graph window to display the average beam pattern intensity as a function of angle from nadir. With the Geocoder processing engine backscatter dB is displayed, and with SIPS engine, intensity values.
- **Remove Spikes** -removes anomalies from the Beam Pattern Graph (not available with the Geocoder processing engine).
- **Smooth Beam Pattern** - uses a moving average filter to reduce noise in the beam pattern (not available with the Geocoder processing engine).
- **Reload:** restore the beam pattern file to the point just after you last saved it.
- **Set Sediment Class:** choose the sonar frequency (Hz) and mean grain size and set it for the selection (not available with the SIPS processing engine.)
- **Set Beam Pattern Offset** (dB) for the selection (not available with the SIPS processing engine).

Mosaic Editor Display Options

Options for the display window while Mosaic Editor is active are set in the Display tab of the Tools > Options dialog box.

1. Set the display colours for four types of backscatter in the Sediment Analysis graph.
 - Total Backscatter
 - Interlaced Backscatter
 - Volume Backscatter
 - Kirchkov Backscatter
2. Select the Auto-Adjust GeoBaR Histograms check box to allow the same range of intensity values (min/max) to be used for all GeoBaRs created.
3. Select the Show All Sediment Analysis Patches check box to allow display of the patches within the selection area along the line, when the sediment analysis tool is activated.

Create GeoBars

GeoBaRs are created with the Create GeoBaR command or toolbar button, using the options selected in the Process tab. Different options are available, depending on which processing engine is selected.

You can create multiple GeoBaRs on a survey line to:

- Correct multiple sources of data (i.e., time series, beam averaged, and/or side scan) from the same file, if applicable.
- Have different resolutions per GeoBaR.
- Visually compare data.

Create GeoBaR with the Geocoder Engine

The simplest way to create a GeoBaR is to use the default values for options displayed on the Process tab, and then view and correct the GeoBaR imagery by adjusting these values. Then can the settings from the created GeoBaR to other tracklines.

To create a GeoBaR:

1. Select a line in the Display window.
2. In the Process tab, select Geocoder from the *Processing Engine* drop-down list.
3. Select the type of data being processed: Side Scan, Beam Average, or Time Series.
4. By default, the *General Options* of *Auto Gain* and *Auto TVG* correction are selected. These options should be left on.
5. Select the Beam Pattern Correction check box, and select a Geocoder Beam Pattern Correction file (*.bpt). If none is available it will need to be created. See [“BEAM PATTERN CORRECTION” ON PAGE 393](#).

Angle Varying Gain (AVG) Correction removes the angular gain artefacts of sediment from the imagery, normalizing the mean angular intensities.

6. Set the AVG Correction check box and select a method from the drop-down list. Set the AVG window size using the arrow buttons.

Imagery may have isolated pixels with intensity levels that are inconsistent with neighbouring pixels. It is possible to remove or filter the isolated light and/or dark pixels through the Despeckle process. This will produce smoother, more consistent imagery.

7. Select the Despeckle check box and select a strength of adjustment to filter out pixels with intensity values inconsistent with their neighbours.
8. Select the Create GeoBar command from the Tools > Mosaic Editor menu, or from the Mosaic Editor toolbar.

Menu	Tools > Mosaic Editor > Create GeoBar
Tool	

The new GeoBaR will be displayed in the Display window correction, and listed by name in the Layers tab, with its child layers:

- Intensity layer displays the current intensity (including edits).
- Original Intensity displays the intensity when the GeoBaR was created (before edits to GeoBaR).
- Weights displays the computed weights based on sonar geometry. These values are used when compiling a mosaic based on the Auto-Seam method.

Create GeoBaR with the SIPS Engine

You can create GeoBaRs from the default settings in the Process tab, or adjust the values of the correction options and apply to the line or lines to create GeoBaRs.

1. Select a line in the Display window.
2. Select SIPS from the *Processing Engine* drop-down list.

If you have already corrected your data, using Side Scan Editor or the SIPS Template Wizard.

3. Select the Create GeoBar command.

If you have not corrected data, use the tools on the Process tab as follows:

1. Select SIPS from the *Processing Engine* drop-down list.
2. Select the type of data being processed: Side Scan, or Beam Average.
3. Select the Slant Range Correction check box if you want to apply this to your data. The default settings are listed. Click **Change...** to change these values. (For information on slant range correction, see [“SLANT RANGE CORRECTION” ON PAGE 413.](#))
4. Select the Beam Pattern correction check box to apply this correction, and browse to select a Beam Pattern Correction file to apply. (For information on creating and applying a Beam Pattern file, see [“BEAM PATTERN CORRECTION” ON PAGE 416.](#))
5. Select the AVG Correction check box to apply this correction and select the method and AVG window size. (For information, see [“ANGLE-VARYING GAIN” ON PAGE 419.](#))
6. Select the Despeckle check box to apply this option. Default values are displayed. Click **Change...** if you want to change these values.
7. Select the Create GeoBar command.

The new GeoBaR will be displayed.

Beam Pattern Correction

Beam Pattern Correction can be applied to remove angular artifacts caused by the transducer. Depending on the processing engine you are using, Beam Pattern different functions are available.

First a Beam Pattern file must be created.

1. Make sure the Ship Track Lines layer is active in the Layers tab.
2. In the Display window, superselect an area of trackline by holding down the down arrow key on the keyboard while range-selecting a homogenous area of the GeoBaR.

The selected area will be highlighted blue at nadir of the GeoBaR.

3. Select Create Beam Pattern from the Beam Pattern toolbar, name and save the .bpt file.

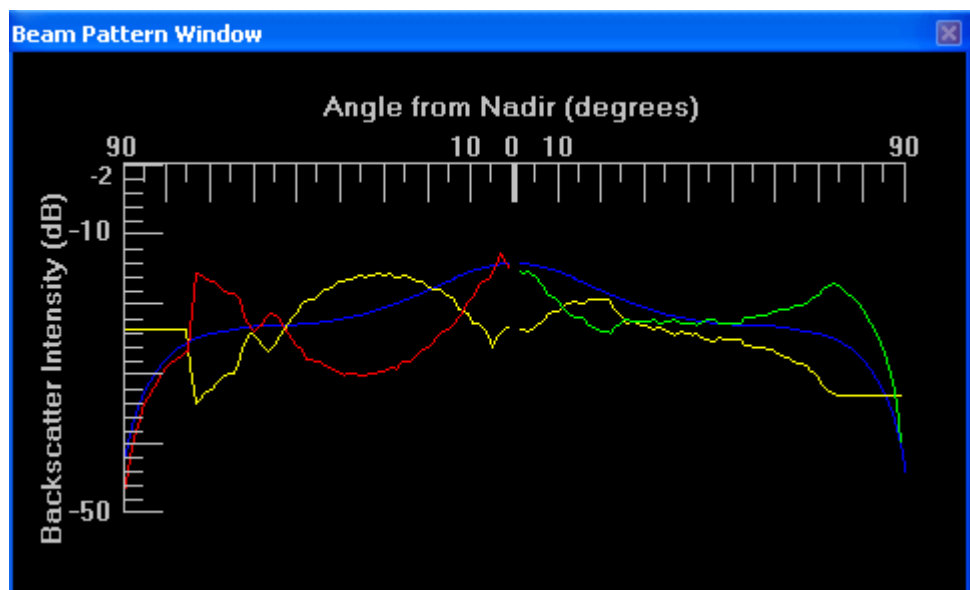
The Beam Pattern file is saved and loaded.

4. Select View Beam Pattern to open the Beam Pattern window.

With the Geocoder engine selected, this graph displays the beam pattern information in a waveform display as backscatter intensity and angle from nadir. (The SIPS engine will display the graph as done in Side Scan Editor. See [“VIEW BEAM PATTERN” ON PAGE 417.](#))

Four types of waveforms are displayed:

- Total Backscatter
- Interlaced Backscatter
- Volume Backscatter
- Kirchkov Backscatter

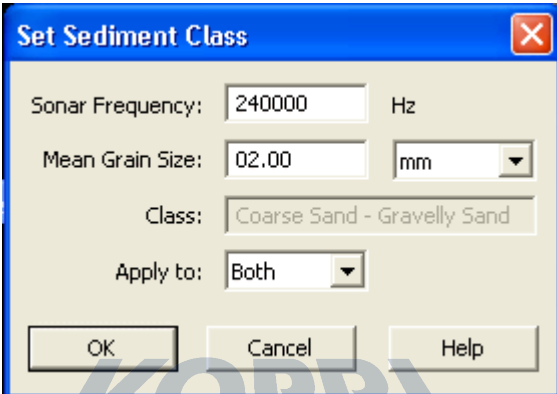


The display colours for these waveforms can be adjusted in the Mosaic Editor option on the Tools > Options > Display dialog box.

You can manually adjust this Geocoder Beam Pattern with the Set Sediment Class and Set Beam Pattern Offset tools on the Beam Pattern toolbar. These tools are only available when using the Geocoder processing engine.

5. Select the Set Sediment Class button  from the Beam Pattern toolbar.

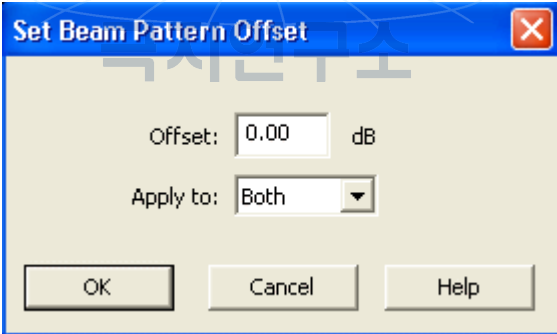
The Set Sediment Class dialog box is displayed.



The 'Set Sediment Class' dialog box has a blue title bar with a close button. It contains the following fields and controls:

- Sonar Frequency:** A text box with '240000' and a unit dropdown set to 'Hz'.
- Mean Grain Size:** A text box with '02.00' and a unit dropdown set to 'mm'.
- Class:** A text box with 'Coarse Sand - Gravelly Sand'.
- Apply to:** A dropdown menu set to 'Both'.
- Buttons: 'OK', 'Cancel', and 'Help' at the bottom.

6. Select the Set Beam Pattern Offset button.



The 'Set Beam Pattern Offset' dialog box has a blue title bar with a close button. It contains the following fields and controls:

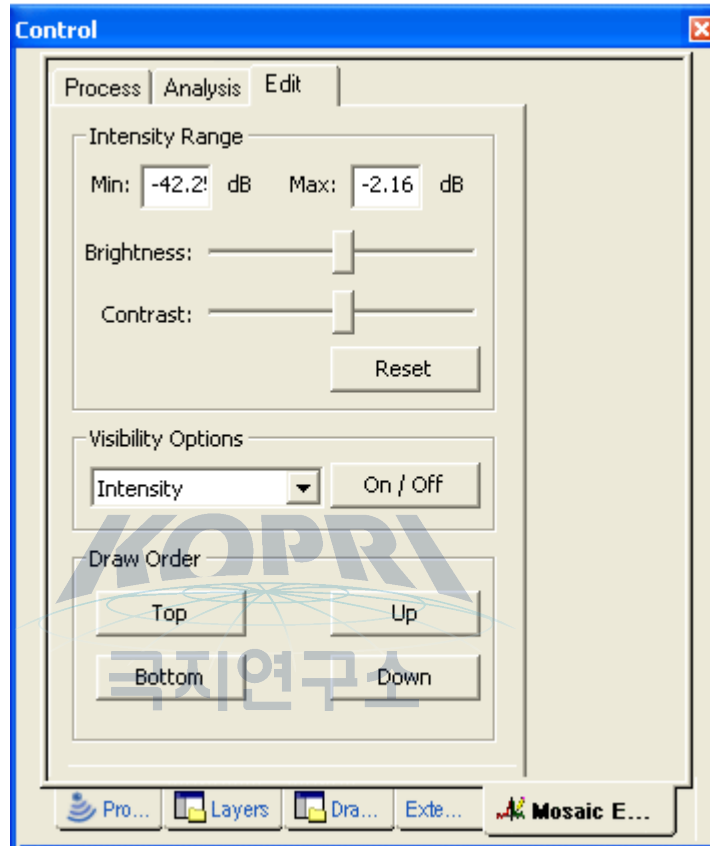
- Offset:** A text box with '0.00' and a unit dropdown set to 'dB'.
- Apply to:** A dropdown menu set to 'Both'.
- Buttons: 'OK', 'Cancel', and 'Help' at the bottom.

7. Adjust the offset value to apply to port, starboard or both sides.

Edit GeoBaR

Editing GeoBaRs includes adjusting brightness, contrast, visibility options and the draw order of GeoBaRs. These corrections are done with the tools on the Edit tab.

1. Select the GeoBaR layer to edit. This will activate the Edit function.



1. To adjust brightness, slide the sliders to the right or left to change the intensity of the image.
2. To adjust contrast, slide the Contrast slider to the right for more contrast and to the left for less contrast.

As you change these values with the slider, new values are displayed in the Intensity Range fields. These fields show the minimum and maximum intensity values for the GeoBaR.

Use **Reset** to restore the GeoBaR to the original intensities it had when it was created.

3. Use the Visibility Options to turn on or off the various child layers of the GeoBaR.
4. Manipulate the Draw Order of the GeoBaRs using the Top, Bottom, Up and Down buttons. (This function is important if you intend to make your final mosaic using the *Overwrite* method.)

Delete GeoBaR

To delete a GeoBaR:

1. Right-click on the GeoBaR layer in the Layers tab.
2. Select Delete GeoBaR from the pop-up menu.

This deletes the GeoBaR permanently from your disk.



Create Mosaic

A mosaic can be composited from two or more GeoBaRs. Like other HIPS and SIPS surfaces, a mosaic is created in a field sheet.

To create a mosaic in from GeoBars in Mosaic Editor:

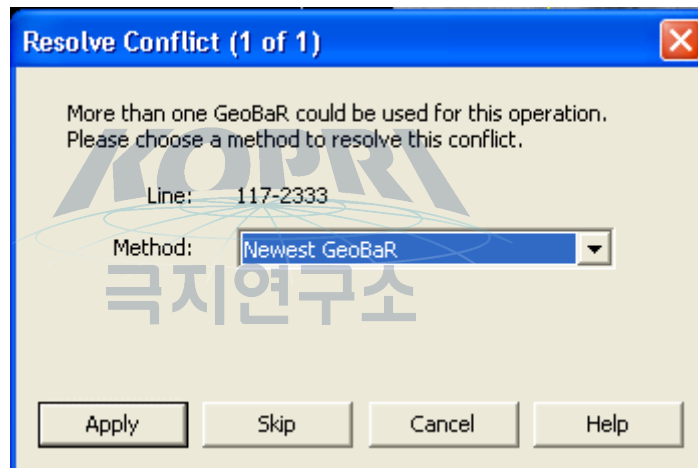
1. Open or create a field sheet to encompass the area you want to mosaic.
2. Make sure the Ship Track Lines layer is active in the Layers tab.
3. Select two or more track lines.

The Create Mosaic command and toolbar button are activated.

4. Select a Create Mosaic command.

If there is more than one GeoBaR for a line, the Resolve Conflict dialog box will appear so you can choose which GeoBaR will be in the mosaic.

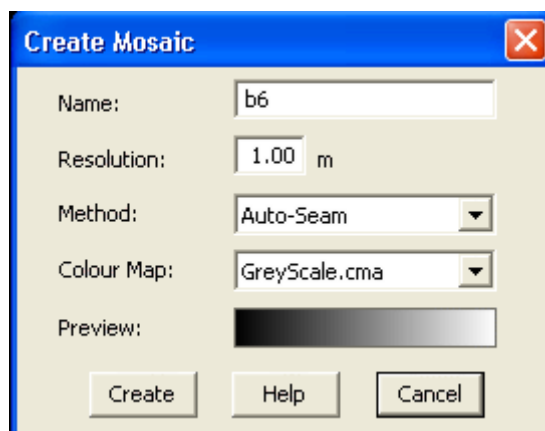
Menu	Tools > Mosaic Editor > Create Mosaic
Tool	



There are three methods to resolve a conflict: Newest GeoBaR, Finest Resolution, and Manual. (For more information on conflict resolution, see “[CONFLICT RESOLUTION](#)” ON PAGE 403.)

5. Select a method to resolve the conflict.

The Create Mosaic dialog box will be displayed.



6. Type a name for the mosaic.
7. Enter a resolution value.

If one or more of the GeoBaRs to be included in the mosaic have a lower resolution than what you have set for the mosaic, the Resolve Conflict dialog boxes will display.

8. Select a method to process the overlapping data from the drop-down list.

There are five methods to choose from:

- **Auto-Seam:** This method determines which pixels have higher significance when there is overlap. A weighting function is constructed that assigns lower significance to pixels at the edge of the swath than to pixels near the centre. The first few pixels near the nadir are assigned low significance due to the low resolution in that region.
 - **Full Blend:** This method uses Geocoder's blend operation to smooth pixel values. It also relies on a weighting scheme.
 - **Overwrite:** Uses the draw order to decide which pixel will be used in an overlapped area.
 - **Shine Through:** The highest intensity pixel will be used.
 - **Underlay:** The opposite of Overwrite. The pixel is added only if no other point exists.
9. Select a colour map from the drop down list. The range of colours will be displayed in the Preview fields below.
 10. Click **Create**.

The mosaic that is created will appear in the Layers tab, with its child layers: Intensity, Original Intensity and Weights (as for GeoBaRs) plus a layer called Contributor. When this layer is selected, the contributor GeoBaRs are colour-coded in the Mosaic display.

Delete Mosaic

To delete a Mosaic:

1. Right-click on the Mosaic layer in the Layers tab.
2. Select Delete Mosaic from the pop-up menu.

This will permanently delete the mosaic from your disk. (It does not delete the component GeoBaRs.



Edit Mosaics

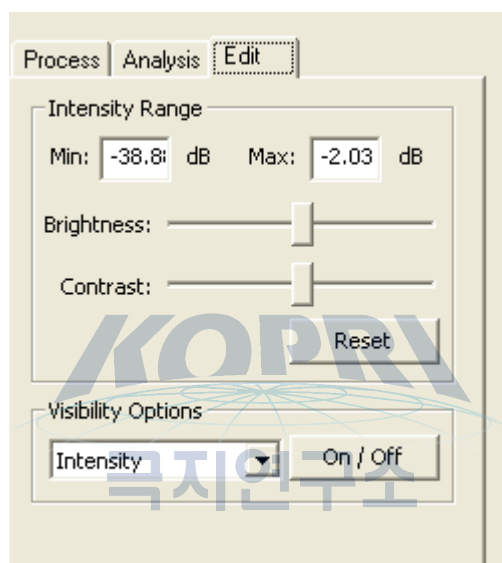
Mosaics can be edited for brightness, contrast, and visibility. As well, component GeoBaRs can be added, modified or removed.

While you may have more than one mosaic open in the display, only one mosaic can be edited at a time.

To edit a mosaic:

1. Right-click on the mosaic layer in the Layers tab of the Control window.
2. Select Edit Mosaic from the pop-up menu.

The functions on the Edit tab are displayed.



1. To adjust brightness, slide the sliders to the right or left to change the intensity of the image.
2. To adjust contrast, slide the Contrast slider to the right for more contrast and to the left for less contrast.

As you change these values with the slider, the new values are displayed in the Intensity Range fields.

3. Use **Reset** to restore the values of the Original Intensity layer. (Removes the effects of the adjustments made with the sliders.)
4. Use the Visibility Options to turn on or off the various child layers of the mosaic.

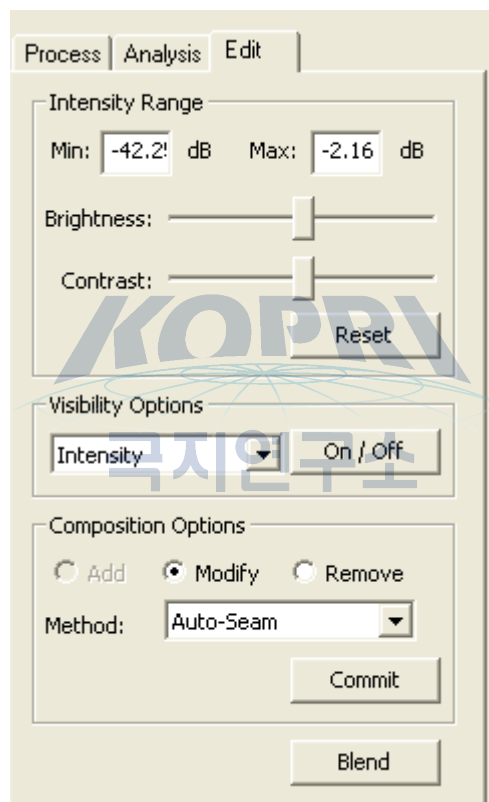
Edit Mosaic Components

The way in which a component GeoBaRs contributes to a mosaic can be modified. GeoBaRs can be removed from a mosaic, and other GeoBaRs added.

The methods available to add or modify GeoBars are the same as used to create the mosaic: Auto-Seam, Shine Through, Overwrite, Underlay and Fully Blended.

To edit mosaic components:

1. With the mosaic open and the Edit tab activated, select a GeoBaR from the mosaic.
2. The Edit tab now displays Component options.



Modify Components

To modify the method by which a component contributes to the mosaic:

1. Select *Modify*
2. Select the preferred method from the drop-down list.
3. Click **Commit**.

Remove GeoBaR from mosaic

To remove a component from a mosaic,

1. Select *Remove*.
2. Select an option from the drop-down list:

Remove Complete will re-mosaic the portion of the mosaic covered by selected GeoBaR, without any contributions from the selected GeoBaR.

Remove Explicit will keep any blended pixels, but remove any pixels that are explicitly from the selected line.

3. Click **Commit** to save the changes.

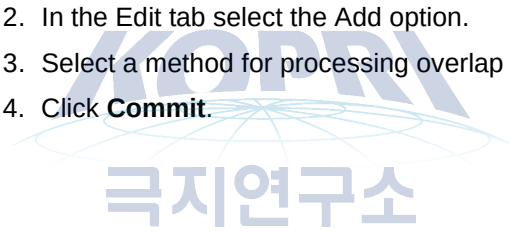
You can select a GeoBaR and perform a manual blending operation with it.

1. Click **Blend** to open a slider dialog that you can use to blend a GeoBaR into the existing mosaic.
2. Move the slider to see the effects of blending. When you have a desired blend, click **Commit**.
3. To back out of the Blend function without saving, click **Cancel**.

Add a new component

To add another GeoBaR to the mosaic:

1. Select a GeoBaR that is not part of the mosaic.
2. In the Edit tab select the Add option.
3. Select a method for processing overlap from the drop-down list.
4. Click **Commit**.



Conflict Resolution

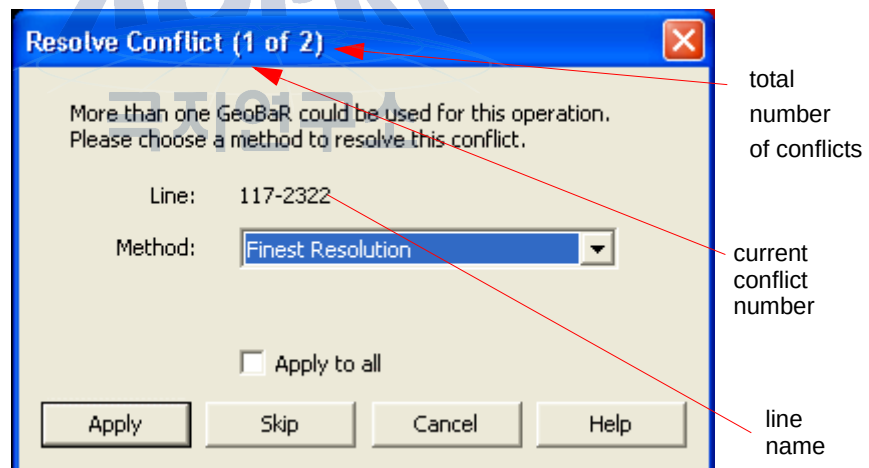
This dialog box can appear in any operation where there is more than one GeoBaR for a line, but only one GeoBaR can be used. The Resolve Conflict dialog box allows you to choose the single desired GeoBaR from a group of GeoBaRs.

The options for resolving this conflict are to select:

- the most recently created mosaic
- the finest resolution (looks for the GeoBaR that occupies the most disk space)
- the component GeoBaR for a mosaic being edited
- the source type: Side Scan, Beam Average, Time Series. If more than is of the specified type, then a new Resolve Conflict dialog box is displayed containing only the GeoBaRs that share the source type in conflict.

or to select the GeoBaR manually.

When conflict arises, the dialog box displays the name or identifying information for the track line, and a drop-down list of these resolutions.

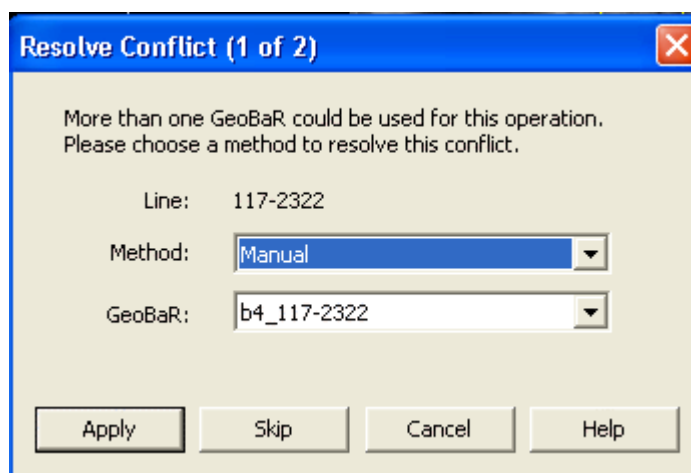


The title bar shows you the number of the current conflict and the number of conflict there are. If there is more than one conflict you can use the *Apply to all* option to apply the same method of resolution to all conflicts.

The dialog also has three buttons: **Apply**, **Skip**, and **Cancel**. All three of these buttons close the dialog. **Apply** uses the current settings to resolve this conflict. **Skip** will not resolve this conflict but will allow the user to continue with any other conflicts. **Cancel** will stop the process of resolving conflicts regardless of how many conflicts are remaining.

Manual resolution

If you choose to resolve the conflict by selecting a specific GeoBaR, the dialog box refreshes to display a drop down list of the conflicted GeoBaRs.



Sediment analysis

Use the Sediment Analysis Tool (SAT) in Mosaic Editor to analyze the angular responses of corrected data to determine sediment type. This tool is located on the Analysis tab of Mosaic Editor.

When a GeoBaR is created, a sediment analysis file is also created for the line. Sediment analysis is performed over a certain number of pings, controlled by the Patch Size in the Sediment Analysis Options.

Data is analysed with respect to the sediment angular response models in order to determine an average grain size. This average grain size is then cross-referenced to the customizable look-up table in order to provide a textual response.

The SAT tab has two main parts:

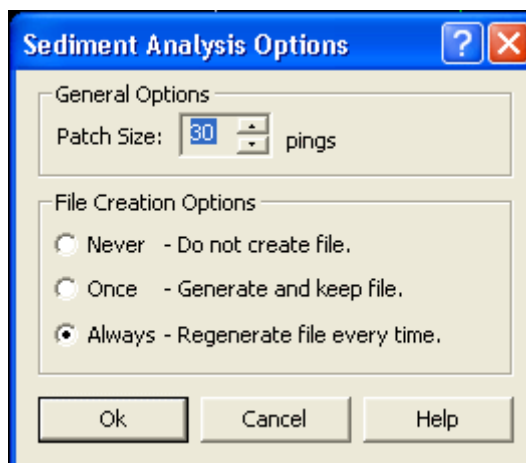
- a set of controls for initiating analysis or interacting with the backscatter models. The controls have both Standard and Advanced modes. (Analysis tab of Mosaic Editor), and
- a dockable, resizable graph window that displays the average angular response for a given range of data.

Set SAT options

1. Open the Display tab of the Tools > Options dialog box.
2. Select Mosaic Editor.
3. Select the Show All Sediment Analysis Patches check box.
4. Click **OK** and close the dialog box.

When the sediment analysis tool is activated, this will allow display of the patches within the selection area along the line.

5. Open the Sediment Analysis Options from the Mosaic Editor toolbar, or from Tools > Mosaic Editor > Sediment Analysis Options.



6. Set the number of pings in the Patch Size over which the sediment analysis will be performed.

By default, every time a new GeoBaR is created for a line, a Sediment Analysis file is also, overwriting any file that had been created previously. This can be changed to never have a sediment analysis file created, or to only generate the file once. n

7. Set the File Creation Option by selecting one of the three options.
8. Click **OK**.



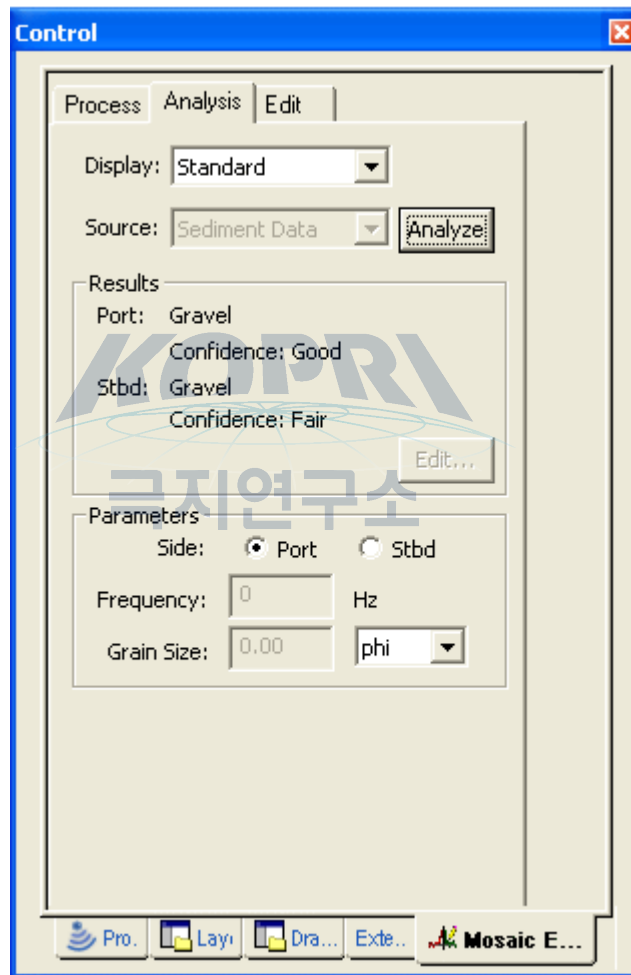
Analyze

There are two modes of sediment analysis: Standard and Advanced.

Standard Analysis

1. Select Standard from the Display drop-down list on the Analysis tab.
2. Click **Analyze**.

The results are displayed on the Analysis tab. The results show an estimate of mean grain size and a confidence in that analysis for each side based on the sediment angular response measurements collected by the sonar equipment.



Advanced

The Advanced analysis option enables you to adjust the values in the grain size table used in the analysis, set variations in parameter values for port and starboard data, and to set options for the graph displayed in the Sediment Analysis window.

1. Select Advanced in the Display field on the Analysis tab.

The tab is refreshed to display other options.

Process Analysis Edit

Display: Advanced

Source: Sediment Data Analyze

Results

Port:

Stbd:

Parameters

Side: ☒ Port ☐ Stbd

Parameter	Value
Frequency	0
Velocity	0.000
Density	0.000
Loss	0.00000
Roughness	0.0000
Gamma	0.00
Volume	0.0000
Grain Size	0.00
Porosity	0.0000
Tortuosity	0.0000
Permeability	0.0000

10000 300000

☒ Auto update

Model Options

☐ Use Biot model

Graph Options...

Process Analysis Edit

Display: Advanced

Source: Sediment Data Analyze

Results

Port: Gravel

Confidence: d=-1.#J

Stbd: Gravel

Confidence: d=-1.#J

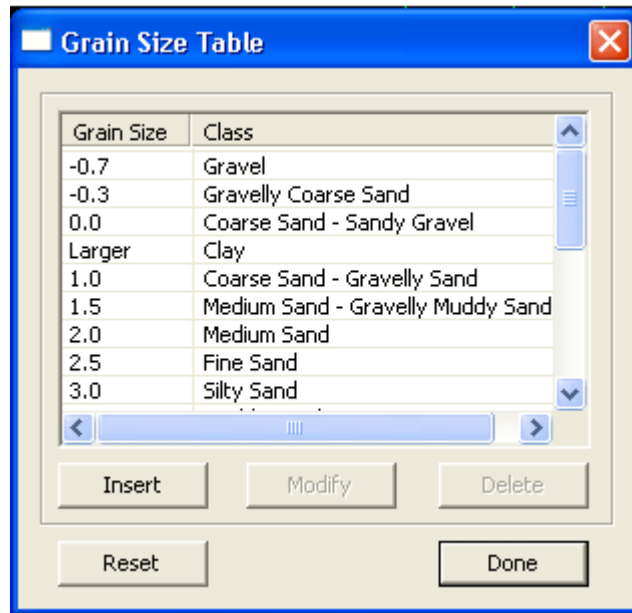
Edit...

Parameters

Side: ☐ Port ☒ Stbd

Parameter	Value
Frequency	10000
Velocity	1.482
Density	3.010
Loss	-0.00030
Roughness	527123902330...
Gamma	3.25
Volume	0.0060
Grain Size	-1.00
Porosity	0.4000
Tortuosity	1.2500
Permeability	1.0000

2. Select a Source.
 - Sediment Data: this options allows you to edit the Grain Size table.
 - Model Parameters activates the Parameters table so you can set different values for the parameters for port and starboard using the slider control.
3. Click **Edit** to open the Grain Size table.



Grain size values and their descriptions can be edited using the **Modify** button. New Classes can be added using the **Insert** button. Use **Reset** to restore the default values.

If you select Model Parameters as Source, the Parameters list box is activated so you can modify values in the list using the slider below it. When you modify this table you have the option of having it automatically update as you change values, or to use the Update button to apply all changes at the same time.

The Model Options field allows you to select to use Biot model. Click Graph Options to open the options dialog box for the Sediment Analysis Graph window.

Sediment Analysis Graph

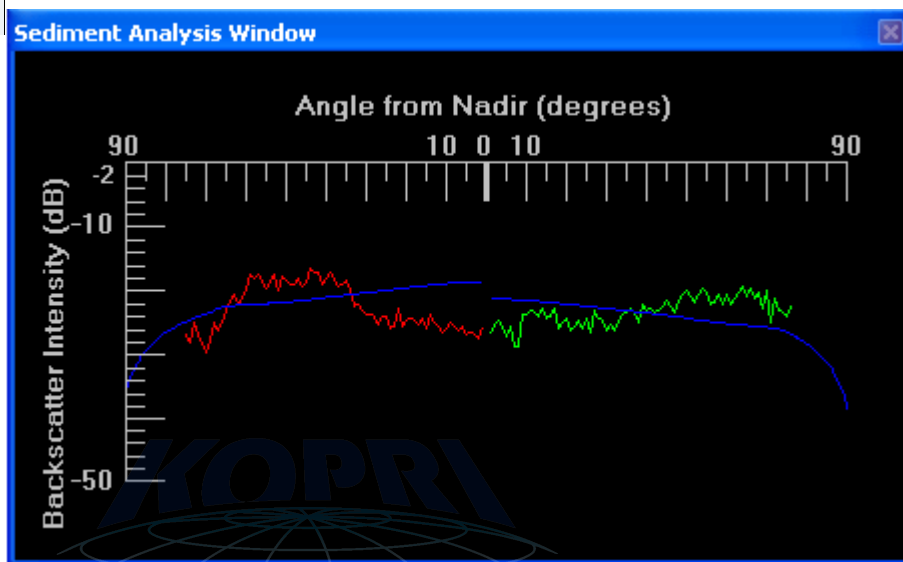
You can view the results graphically in the Sediment Analysis Window.

To open this window:

1. Select the Open Sediment Analysis graph command.

The graph is displayed.

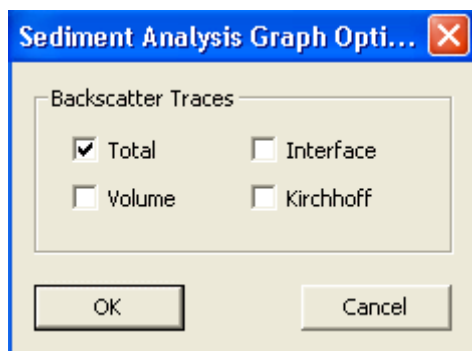
Menu	Tools > Mosaic Editor > Sediment Analysis Graph
Tool	



To close the graph window, select the Open Sediment Analysis graph command or toolbar button again.

To set which backscatter forms will be displayed in the graph window:

2. Click the Graph Options button on the Analysis tab.
3. In the Options dialog box, select the check boxes for the types you wish to display.



20

Processing in SIPS—Side Scan Editor

SIPS provides tools for viewing and processing side scan sonar and multibeam backscatter data. The SideScan Editor can be used to process data, to digitize and edit contacts, or as an alternative to correcting imagery in Mosaic Editor.

In this chapter...

“USING SIDE SCAN EDITOR” ON PAGE 404

“EDIT SIDE SCAN DATA” ON PAGE 405

“IMAGE PROCESSING” ON PAGE 412

“SIDE SCAN EDITOR INTERFACE” ON PAGE 422

“SIDE SCAN EDITOR CONTROLS” ON PAGE 425

“CONTACTS” ON PAGE 442

“SIPS TEMPLATE WIZARD” ON PAGE 448

Using Side Scan Editor

In Side Scan Editor you view, edit and process data in preparation for creating mosaics or digitizing and editing contacts.

Use Side Scan Editor to:

- use a waterfall display for editing, or
- apply advanced Time Varying Gain controls, or
- edit altitude data for side scan data, or
- digitize and edit contacts

Side Scan Editor workflow

Data in Side Scan Editor can be viewed in either raw or processed mode. Processing can be applied to a single ping, to a range of pings, or to one (or more) track lines.

1. If desired, the raw data may be edited by selecting, querying, rejecting or accepting pings. Rejecting pings removes them from consideration for any mosaics to be created from this data (see [“EDIT SIDE SCAN DATA” ON PAGE 405](#)).
2. Once pings are edited, you may need to digitize the “first return” or altitude if the sonar did not detect and record this data during acquisition. The altitude is required to perform slant range correction. If digitized altitude data does exist, it may need to be edited first. (see [“DIGITIZING SONAR ALTITUDE” ON PAGE 407](#)).
3. With fish altitude and an average sound velocity, the raw data can be slant range corrected. Slant range correct data is shown in processed mode, where the across track measurement is horizontal distance. (see [“APPLY SLANT RANGE CORRECTION” ON PAGE 414](#)).

In this processed mode, you can edit and query pings, make height and distance measurements, and mark and edit contacts.

4. Use the correction tools to remove unwanted artifacts:
 - [“BEAM PATTERN CORRECTION” ON PAGE 416](#))
 - [“ANGLE-VARYING GAIN” ON PAGE 419](#)
 - [“TIME-VARYING GAIN” ON PAGE 420](#)
 - [“DESPECKLE” ON PAGE 421](#))

The parameters for applying these correction tools can also be saved in a template file and loaded and applied again. (See [“SIPS TEMPLATE WIZARD” ON PAGE 448](#)).

5. Create and edit contacts

See [“CONTACTS” ON PAGE 442](#).

Corrected data from Side Scan Editor can be opened in Mosaic Editor where it can be used to create GeoBars and from them, composited mosaics, or to analyze bottom sediment (See [“INTRODUCTION” ON PAGE 387](#)).

Edit Side Scan Data

In Side Scan Editor you can reject or accept lines as you do in other HIPS and SIPS editors, except that you select a ping rather than an individual sounding or beam. (This line editing does not need to be done within the Side Scan Editor, it can be done in the HIPS Display window.)

[“ACCEPT/REJECT/QUERY” ON PAGE 405](#)

If navigation sensor data has been edited with in Navigation Editor it may be necessary to recompute towfish navigation. (See [“RECOMPUTE TOWFISH NAVIGATION” ON PAGE 406.](#))

If you intend to apply a slant-range correction, the altitude of the sonar must be known. If this is not already logged with your data, the altitude must be digitized. (See [“DIGITIZING SONAR ALTITUDE” ON PAGE 407.](#))

Accept/Reject/Query

You can change the status of an entire ping or of only the starboard or port side.

1. From the Side Scan toolbar, use the Side Scan Selection tool  to select the range of pings from the Side Scan Editor window (“waterfall view”) to be accepted or rejected (see [“SELECTION” ON PAGE 434.](#))
2. [Optional] From the HIPS Edit Toolbar, select
 -  Edit Port Side Only or  Edit Starboard Side Only.

3. Select the desired status from the menu or toolbar: Accept or Reject.

When a ping is rejected in the Side Scan Editor, it is given a status flag that excludes it from further processing in SIPS.

4. Select the Reject tool.

The status of the ping or range of pings is set to Rejected.

However, Rejected data is not deleted and can be changed to Accepted status again with the Accept command.

To make rejected data available for further processing in SIPS:

1. From the Side Scan toolbar, use the Side Scan Selection tool to select the rejected pings (see [“SELECTION” ON PAGE 434.](#))
2. Select the Accept tool.

Previously rejected data is now flagged as accepted and is visible in the Side Scan Editor.

Menu	Edit > Status Flag > Reject
Tool	
Pop-up	Reject

Menu	Edit > Status Flag > Accept
Tool	
Pop-up	Accept

Query

Menu	Edit > Query
Tool	
Pop-up	Query
Key	<Q>

Use the Query function to view information about selected pings.

1. From the Side Scan toolbar, choose the Side Scan Selection tool and select a range of pings to be queried (see “[SELECTION](#)” ON PAGE 434).
2. Select the Query tool.

Information about the selected data is shown in the Worksheet window. If the window is not open at the time you query the data, it will open automatically.

Recompute Towfish Navigation

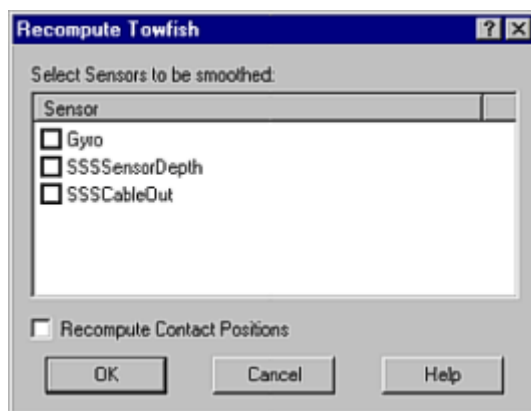
Navigation data for towed sensors can come from the following sources:

- If computed during data logging and stored in the raw side scan format, it can be converted directly into the SIPS towfish navigation data structure. The Recompute Towfish Navigation process is therefore not required.
- It can be computed by SIPS if specific sensor data is available. SIPS requires ship navigation data with cable out and towfish depth to compute towfish navigation, or ship navigation with horizontal layback.

If you want SIPS to compute the towfish navigation data:

1. Select one or more towfish track lines.
2. Select the Recompute Towfish Navigation command.

The Recompute Towfish Navigation dialog box is displayed.



Towfish sensor data can be smoothed in the Attitude Editor (see “[ATTITUDE EDITOR](#)” ON PAGE 572) and this data can be applied when the towfish navigation is computed. Select a check box to apply the smoothed data.

3. Select the *Recompute Contact Positions* check box to update the contact positions based on the new navigation data.

4. Click **OK**.

If contacts are contained in the track lines where towfish navigation has been updated, you must update the contact positions to match the new navigation (see [“RECOMPUTE CONTACT POSITIONS” ON PAGE 447](#)).

To compute towfish navigation from the ship’s navigation requires a horizontal distance and direction from the ship’s towpoint location to the towfish. The towpoint is defined in the vessel file.

- **Horizontal distance.** Recorded horizontal layback data or actual cable length both share the same data structure in SIPS called SSS Cable Out. SIPS can distinguish between the two by the towfish sensor depth data. If the sensor depth data is zero, the horizontal layback is used. If the sensor depth data is non-zero it will be combined with the cable out data using trigonometry to produce horizontal distances. All distances to the towfish are applied from the towpoint position on the ship as defined in the vessel configuration file.
- **Direction.** The direction from the ship’s towpoint location to the towfish is derived using a “follow-the-dog” method. The average of the first 30 seconds of the ship’s “course-made-good” is used for the initial direction. Thereafter, each successive position computed for the towfish occurs along the direction from the next ship’s position to the previous towfish position.

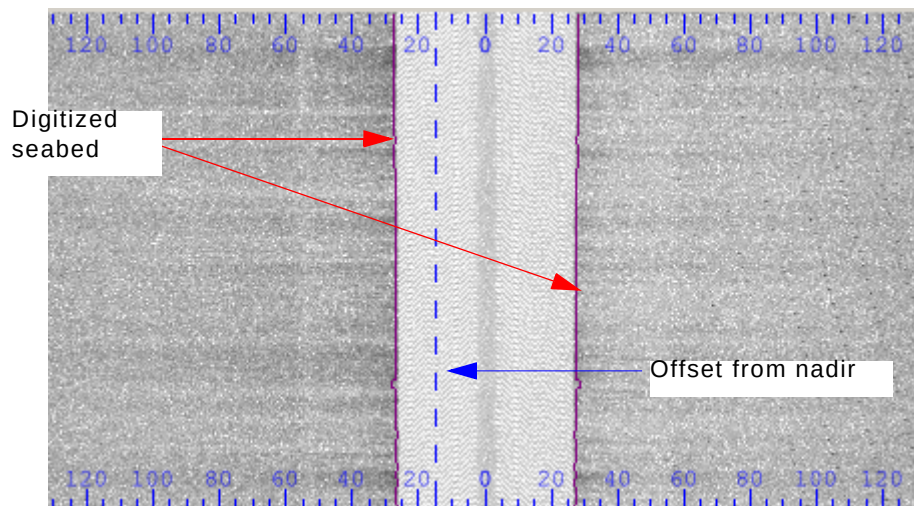
If horizontal layback or tow cable length data is not available, or if the Recompute Towfish Navigation step is not executed, then the recorded towfish navigation data converted into SIPS is used for generating the positions of contacts and for mosaics.

If towfish navigation is not available at all then the position of the side scan imagery data is assumed to be the same as the ship navigation data.

Digitizing Sonar Altitude

Before side scan data can be processed, the altitude of the sonar must be known. With some sonars, altitude is logged in the raw data files and is converted by SIPS. However, in other cases, altitude is not logged or is logged and needs to be edited. The Side Scan Editor provides automated and manual tools to digitize the bottom directly from the side scan trace.

A raw side scan sonar display with a digitized seabed is shown below.



Digitization and colour maps

Sometimes there is no clear distinction between the water column and the seabed. You can compensate for this by adjusting the display of intensity values in the editor so that the seabed and water column are clearly outlined. Also see “[COLOUR MAPPING](#)” ON PAGE 427.

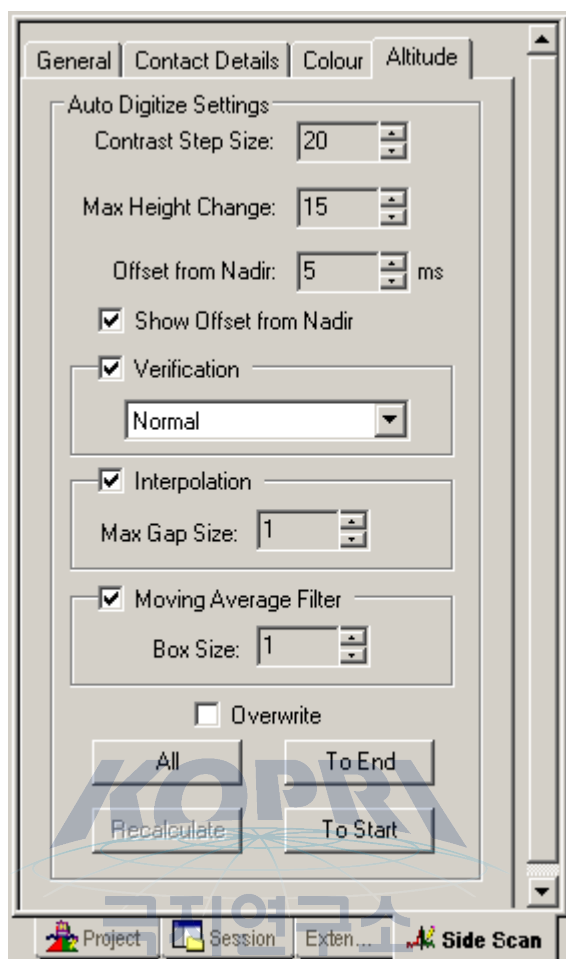
Menu	Tools > Side Scan Editor > Altitude > Clear
Tool	

1. Make sure that only two colours are displayed in the editor (for example, GreyScale.cma).
2. Use the sliders in the colour histogram to adjust the display in the editor.
3. Once there is clear distinction between the water column and seabed use the digitizing tools to trace the first bottom return.
4. To remove the digitized lines, select the Clear command.

Automatic digitizing

The automatic digitizing method traces the first bottom return using a sophisticated multi-pass algorithm. Automatic digitizing is most effective when there is a clear distinction between the water column and the bottom. This method can be applied to a range of pings or to the entire line.

Settings for automatically digitizing the side scan return are in the Altitude tab of the Control window.



The Altitude tab options are described below in the order that they appear in the tab. While the *Contrast Step Size* and *Max Height Changes* are compulsory for digitizing, the other options can be applied depending on the specific conditions of your data.

Contrast Step Size

The *Contrast Step Size* and *Max Height Change* options must be set to correctly auto digitize the side scan.

The *Contrast Step Size* is the minimum difference in contrast expected between the intensity values of the water column and the seafloor. The Signal Display Window may be helpful in determining a good step size.

Max Height Change

The *Max Height Change* is the maximum allowable ping-to-ping change in detected bottom position (in pixels). It is a restriction on the variation anticipated in detected bottom position. It could be visualized as error bars guiding the algorithm along the bottom.

1. Use the <Up> or <Down> arrow buttons to select the percentage for the *Contrast Step Size* and *Max Height Change* values.

Offset from Nadir

Strong solid returns in the water column, such surface reflections, can be compensated for by setting an offset from nadir in raw data mode.

2. Set the value in milliseconds for an *Offset from Nadir* by clicking the up or down arrow buttons.
3. Select *Show Offset from Nadir* to display the offset visually as a dashed line.
 - The line colour is set to the *Measure / Offset tools* colour in Tools > Options > Side Scan Editor.
 - The thickness of the line is set in the *Line thickness* field on the General tab in the Side Scan Editor Control tab.

Verification

The verification option tests the detected point to see if its intensity is consistent with nearby values further across-track that should also represent seafloor.

Its purpose is to detect and ignore anomalous points in the water column (for example, noise from equipment, reflections off the surface, marine life), by checking to see if there is water rather than sea floor on the other side of a detected point.

4. Select the Verification check box.
5. Select a desired strength-level for the verification from the drop-down list. Choices range from “Very Weak” to “Very Strong”. The default is “Normal”.

Interpolation

The *Interpolation* option fills along-track gaps in the detected bottoms.

6. Select the *Interpolation* option.
7. Select the size of the gap to be filled by clicking the up or down buttons beside the *Max Gap Size* field.

Moving Average Filter

The *Filter* option smooths the digitized line.

8. Click the Moving Average Filter check box.
9. Click the <Up> or <Down> arrow buttons to select the number of pings used for averaging in the Filter Width field.

Menu	Tools > Side Scan Editor > Altitude > Auto Digitize
Tool	

You can use the Auto Digitize tool, or use the buttons at the bottom of the Altitude tab to complete digitizing. If you are using the buttons, continue with Step 8, otherwise, go to Step 11.

10. Choose any of the following digitization options:

- Click **To Start** to extend the digitized region to the back of the entire line.
- Click **To End** to extend the digitized region to the end of the line.
- Click **All** to digitize the entire selection or the entire line.

11. If you change a value in the tab, click **Recalculate** to update the Digitization.

12. Select *Overwrite* to enable re-digitization of selected areas without clearing. With Overwrite disabled, only zero-altitude/cleared fish heights will be available for digitization.

Menu	Tools > Side Scan Editor > Altitude > Clear
Tool	

13. Click anywhere on the seabed to select the start and end pings for digitization and also to indicate the side (port or starboard) on which to perform the calculations.

14. [Optional] You can select the Clear tool to remove the digitization.

Manual digitizing

Add altitude lines by selecting areas along the first bottom.

Menu	Tools > Side Scan Editor > Altitude > Digitize
Tool	

1. Select the Manual Digitize tool.
2. Press and hold the mouse button and drag the cursor along the bottom contact.

You can also use the space bar to move along the track line while in digitizing mode.

As you drag the cursor, a digitizing line is drawn in the window. When you digitize one side, the other side is automatically mirrored.

3. Alternatively, create a point-to-point line by clicking carefully along the first return.
4. Cancel the Manual Digitize tool when finished.

At any time during the digitizing process, you can select the Clear tool to remove the digitization.

Interpolate Selection

Interpolation digitizes a straight line between the fish height values found at the start and end of the selection. Any altitude data within the selection is overwritten during this operation.

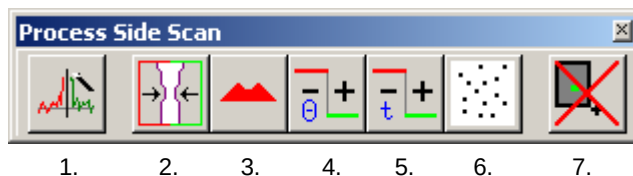
1. Use the Side Scan Selection tool to select an area of raw mode data that has been digitized. (See “[SELECTION](#)” ON PAGE 434)
2. Select the Interpolate Selection command.

The pixels between the digitizing points are interpolated and the digitizing lines are smoothed.

Menu	Tools > Side Scan Editor > Altitude > Interpolate Selection

Image Processing

Side scan imagery has been traditionally processed on a line-by-line basis, using a “waterfall” display, and a number of carefully designed process tools. These processes are available on the Process menu and on the Process Side Scan toolbar:



1. “SLANT RANGE CORRECTION” ON PAGE 413
2. “APPLY SLANT RANGE CORRECTION” ON PAGE 414
3. “BEAM PATTERN CORRECTION” ON PAGE 416
4. “ANGLE-VARYING GAIN” ON PAGE 419
5. “TIME-VARYING GAIN” ON PAGE 420
6. “DESPECKLE” ON PAGE 421
7. “PURGE REJECTED CONTACTS” ON PAGE 446

Imagery corrections can also be applied using the SIPS Template Editor (see “SIPS TEMPLATE WIZARD” ON PAGE 448).

Revert/Reapply

Menu	Tools > Side Scan Editor > Revert
Tool	

The most recent correction made in *processed* mode can be undone or redone using the Revert and Reapply tools.

1. Select the Revert tool to reverse the last correction.
2. Select the Reapply tool to reapply the last correction.

This facility to go back a step without losing your work, in effect enables you to “toggle” between the before and after of a process. For example, with the Signal Display Window open, use Revert/Reapply to see the effect of slant range correction.

Menu	Tools > Side Scan Editor > Reapply
Tool	

Slant Range Correction

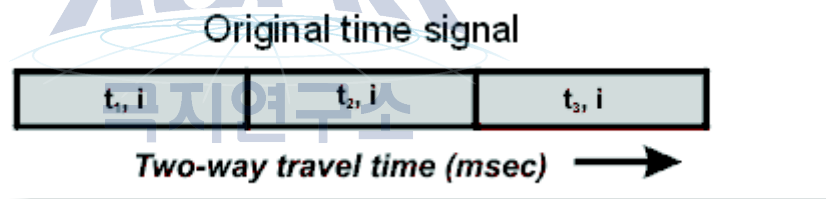
Side scan sonar is initially logged as a series of time-indexed intensity values for each ping. Slant range correction re-samples this raw side scan data to produce profiles of image pixels where the across-track scale is related to distance from nadir instead of time.

Across-track positioning
using height sources

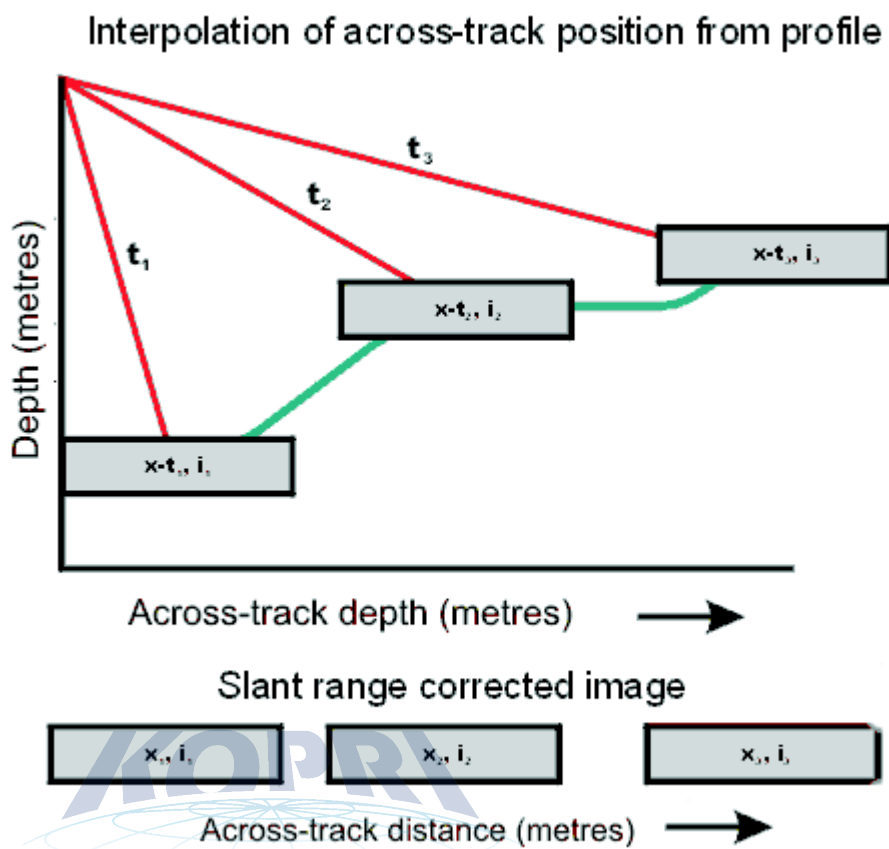
The standard slant range correction operation applies a sound velocity estimate to the two-way travel time for each intensity value. This produces an estimated ray length that when combined with the known sonar height (from the digitized or logged bottom) is used to produce the across-track distance to the pixel using simple trigonometry. This method presupposes that the bottom is flat across the ping and can result in the across-track misplacement of objects over varied or steeply sloping terrain.

SIPS can use a height source (such as a BASE Surface, grid, or tile) in the slant range correction operation to supply depth values to improve the across-track positioning of pixels.

In the following figure, raw side scan data is represented as a series of time (t) and pixel intensity values (i).



When a height source is used during slant range correction, a depth profile is first derived from the source along the path of the side scan ping. Then, the two-way travel time to each pixel is converted to a distance from nadir using the estimated velocity of sound in water. The distance is then used to calculate the position of the image pixel along the ping drawn from the height source.



The resulting output is an intensity value indexed to across-track distance (x) rather than time.

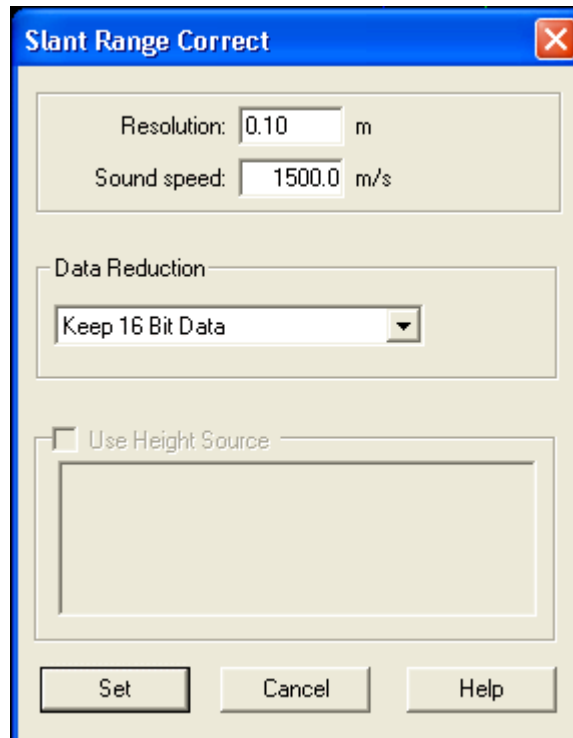
Apply Slant Range Correction

In the Side Scan Editor, Slant Range Correction is applied to data in raw mode. Other corrections in Side Scan Editor are made to data that has been slant range corrected. Once you slant-range correct data, you can return to raw mode to start again, however, any correction previously made to processed data will be lost.

1. Select the track line(s) in the Display window.
2. Select the Slant Range Correct tool.

The Slant Range Correction dialog box is displayed.

Menu	Process > Slant Range Correct
Tool	



1. Type the resolution (in metres or feet) for the slant range corrected file. The resolution value defaults to the minimum value appropriate to the sonar system. If this is not available then it defaults to 0.10 metres or 0.33 feet. A finer resolution generates a larger file.
2. Enter the average speed of sound.
3. Select the setting for Data Reduction from the drop-down list.
 - The default is to use the 16-bit factor that is stored with the line.
 - Select *Use 8-Bit Shift* if you want to create a slant range file using only eight bits of storage per pixel. This option is important if the data that you are slant range correcting was originally 16-bit and all 16 bits were maintained at conversion.
 - Select *Use Shift Factor Per Line*
4. Select the *Use Height Source* check box if you want to apply a height source, then select the height source from the list. (This is only available if you have a BASE surface or other height source open.)
5. Click **Set**. The slant range corrected data is displayed in the Side Scan Editor.

Menu	Tools > Side Scan Editor > Reapply
Tool	

Beam Pattern Correction

Beam pattern correction uniformly removes along-track banding inherent to the sonar beam. This effect is produced by each transducer uniquely.

Beam pattern correction relies on a user-generated beam pattern file to identify and remove this effect. Tools are provided to create, view and process beam pattern files. The process uses the beam pattern file to uniformly correct the selected line(s), producing a more consistent appearance in mosaics.

Once the beam pattern file is created it can be applied to one or more lines in the Display window, or to one or more pings in the Side Scan Editor.

If no Beam Pattern Correction file exists you will need to create one in order to apply Beam Pattern Correction parameters. All the tools to create a beam pattern file are accessible on the Beam Pattern Toolbar, while the Side Scan Editor is open.

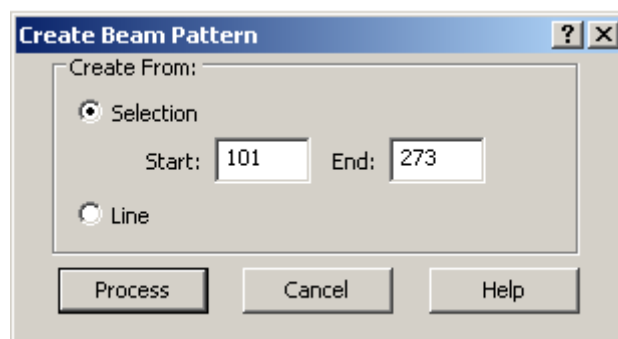
Create Beam Pattern Correction File

To create a beam pattern file you must select an area that is as flat, featureless and homogenous as possible. It is recommended that a “patch test” be done during a survey over an area known to have such properties. In order to create a more robust and accurate beam pattern correction file, it is also important to vary the fish height over the range expected to be used during the survey.

1. Using the Side Scan selection tool, select an area along the track line.
2. Select the Create Beam Pattern tool.

The Beam Pattern Correction dialog box is displayed.

Menu	Tools > Side Scan Editor > Beam Pattern Correction > Create
Tool	
Pop-up	Create Beam Pattern...



The option is available to alter the range of pings to be included in the creation of the beam pattern. While this should be done with care, it is possible to create a beam pattern file from a selection larger than the range visible in the Side Scan Editor

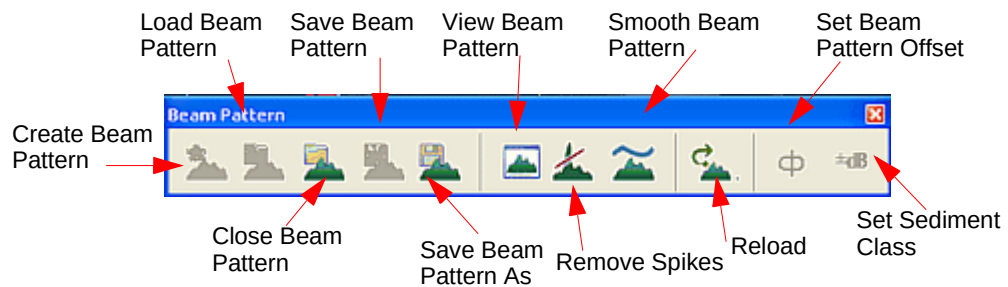
display. You may also select the whole line for the creation of the beam pattern if you wish. It is recommended that only an area meeting the criteria set forth above be considered for inclusion in a beam pattern file.

3. Select **Process** to create the Beam Pattern file.

The Windows Save As dialog box is displayed.

4. Type a name for the Beam Pattern file and select **Save**.

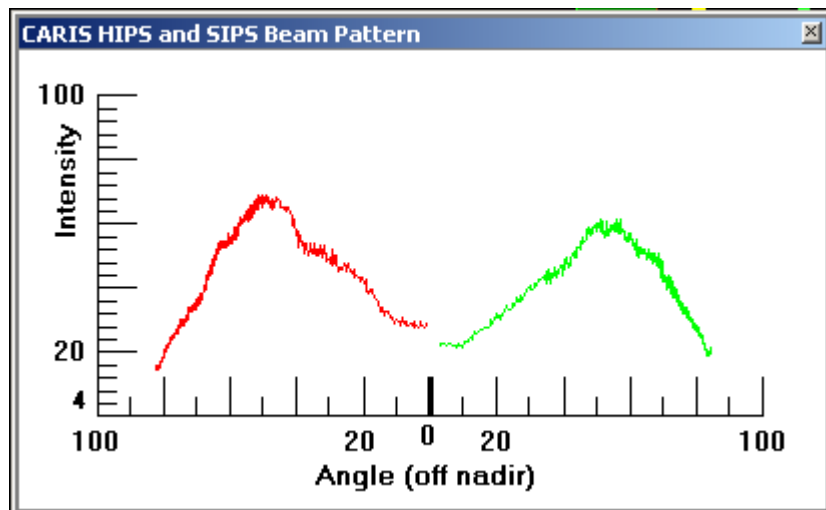
The **Save Beam Pattern**, **Save Beam Pattern As**, **View**, **Remove Spikes**, **Smooth**, and **Reload** tools are now active in the menu and on the Beam Pattern Correction toolbar (below).



View Beam Pattern

5. Select the View Beam Pattern tool.

The Beam Pattern Graph window is displayed. This window shows the intensity levels of the side scan sonar over the selected area.



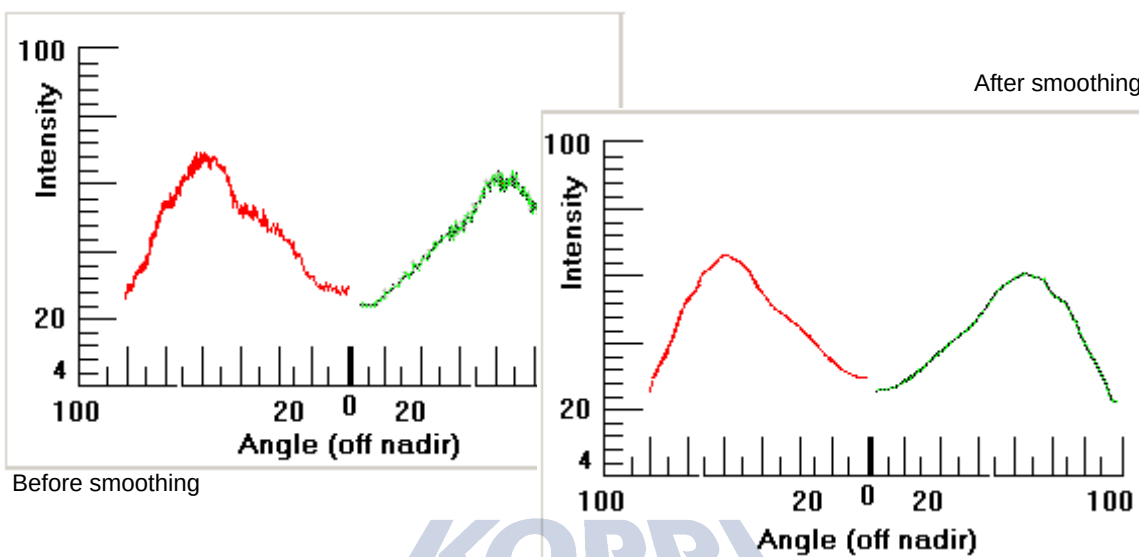
Remove Spikes/Smooth

The Remove Spikes tool removes anomalies from the Beam Pattern Graph.

6. Select the Remove Spikes tool.

The next step is to apply the Smooth Beam Pattern tool. The Smooth Beam Pattern tool uses a moving average filter to reduce noise in the beam pattern.

An example of the graph before and after using the Smooth tool is shown below. The left-hand window shows the unsmoothed graph and right-hand window shows the graph after smoothing.



7. Select the Smooth Beam Pattern tool.

The Smooth Beam Pattern tool can be used repeatedly until the preferred degree of smoothing is reached.

Reload

The **Reload** tool reloads saved changes from the active beam pattern file. Any changes to the beam pattern after the last save are lost.

For example, if you remove spikes and then Save, then apply Smooth Beam a few times, the Reload tool will restore the graph to the point just after you saved it.

8. Select the Reload tool.

Save/Save As

When you have completed smoothing the data, you can save these settings using the Save Beam Pattern or Save Beam Pattern As... tools.

9. Select Save Beam Pattern to save the filtering and smoothing changes to the Beam Pattern File.

10. Select the Save Beam Pattern As command to save the file as a new file.

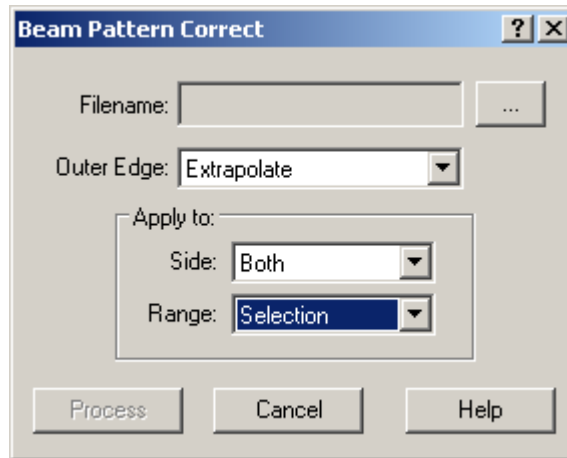
Apply Beam Pattern Correction

The Beam Pattern Correction file can be applied to a selection in the Side Scan Editor or to track line(s) in the Display window.

Menu	Process > Beam Pattern Correction
Tool	

1. Make a selection in the Editor, or, select a track line or group of track lines in the Display window.
2. Select the Beam Pattern Correction command.

The Beam Pattern Correction dialog box is displayed.



The Beam Pattern file will default to the last created, loaded, saved or executed one. You can use the Browse button to locate a different file for processing. The default location for Beam Pattern files is <Data Dir>/Sidescan.

The outer edges of some pings may have been recorded at angles beyond the extent of the beam pattern file being used. The Outer Edge option must be specified for handling these cases.

3. Select a method for handling sonar data collected outside the bound of the beam pattern file:
 - **Extrapolate:** Extrapolate the beam pattern to correct angles beyond the outer edge of the generated beam pattern file.
 - **Trim:** Remove sonar data that is beyond the extent of the beam pattern file. Trimmed data will appear as 0 intensity white space in the Side Scan Editor.
 - **Do Nothing:** Does not correct sonar data beyond the extent of the beam pattern file. Uncorrected data will appear the same before and after Beam Pattern Correction in the Side Scan Editor.
4. Apply the Beam Pattern Correction to the both sides of the side scan or to either the starboard or port sides.
5. You can apply the Beam Pattern Correction to your entire survey by selecting all the track lines, or you can open the Side Scan Editor and select a portion of the data:
 - **Ping:** the correction will apply to the single ping selected in the Side Scan Editor window.
 - **Selection:** the correction will apply to the range of pings you selected in the Side Scan Editor window.
 - **Line:** the correction will apply to the entire trackline you have selected.

- Click **Process** to apply the correction.

Angle-Varying Gain

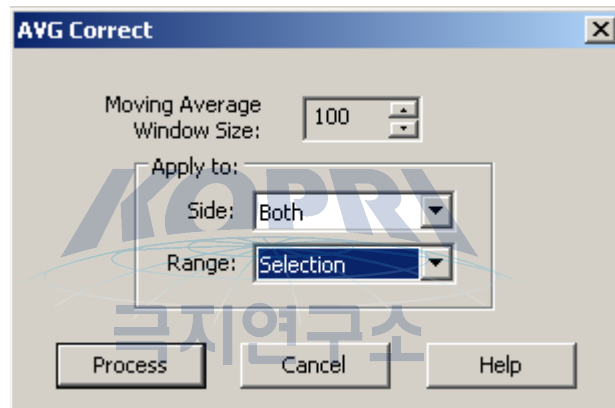
Angle-Varying Gain (AVG) correction removes the angular response of sediment from the imagery, normalizing the mean angular intensities, ping-by-ping, with a moving average filter.

AVG correction can be applied to a selection or a single ping in the Side Scan Editor or to one or more track lines in the Display window.

- Make a selection in Side Scan Editor. (See “[SELECTION](#)” ON PAGE 434 for selecting areas and pings).
- Select the AVG Correct tool.

The AVG Correct dialog box is displayed.

Menu	Process > AVG Correct
Tool	



- Select the number of adjacent pings to include in the moving average by clicking *Moving Average Window Size* up or down arrow buttons.

For example, an average based on a window size of 100 will include 50 pings before and after the ping being corrected.

- Apply angle-varying gain to the port, starboard, or both sides of the side scan.
- Apply the angle-varying gain correction to either a *Ping*, *Selection*, or *Line* by selecting the appropriate option.
- Click **Process**.

Time-Varying Gain

Time-Varying Gain (TVG) Correction allows you to adjust the signal intensity by applying a non-uniform, time-dependent gain.

During acquisition, this is necessary because of the attenuation that occurs due to absorption and spreading as the sonar beam travels back to the receiver. Since these returns are received over a predictable and constant time period, a time-varying curve can be used to increase gain to compensate for the decayed sonar return. In post-production, it may be necessary to augment the TVS correction applied during acquisition.

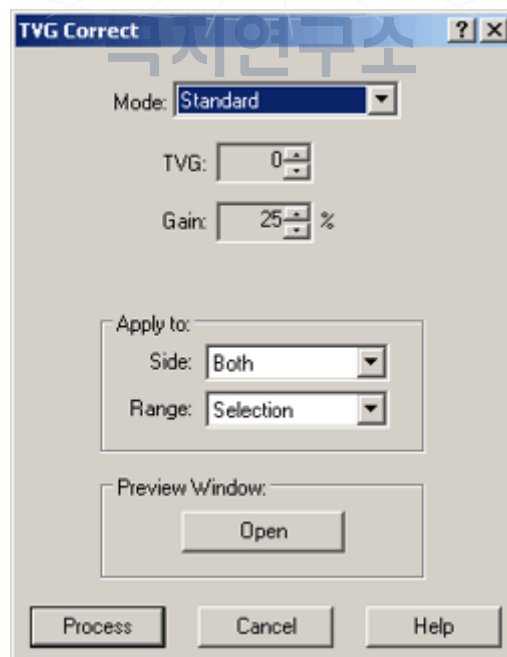
The TVG Correction command also allows you to apply a uniform gain correction without applying the any time-dependent gains by using only the Gain control.

TVG Correction can be applied to a single ping, selection, or the currently selected line in the Side Scan Editor, or to one or more track lines in the Display window.

Menu	Process > TVG Correct
Tool	

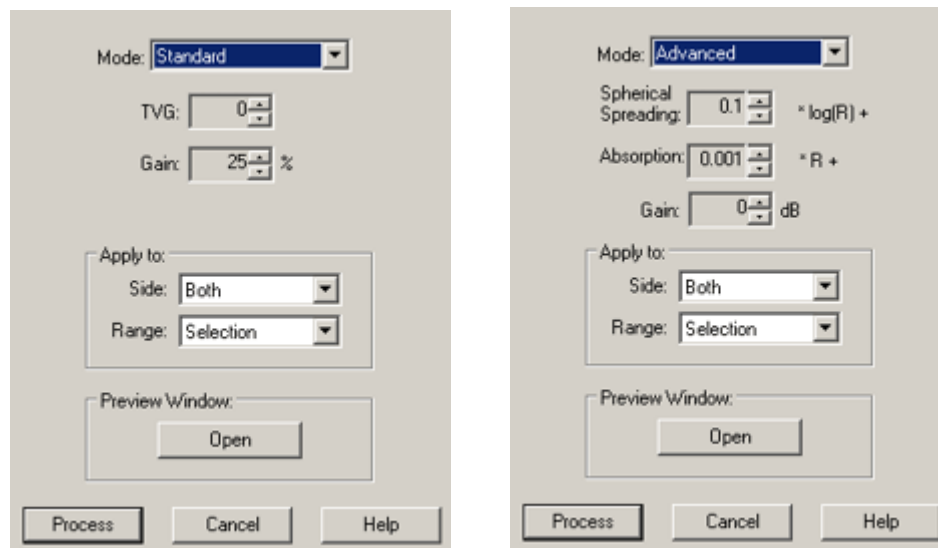
1. Make a selection in the Side Scan Editor. (See “[SELECTION](#)” ON PAGE 434 for selecting areas and pings).
2. Select the TVG Correct command.

The Time-Varying Gain Correct dialog box is displayed.



There are two modes for TVG correction: Standard and Advanced.

3. Select either the Standard or Advanced mode from the *Mode* drop-down list. (The options available depend on the mode selected.)



The Preview window is available when a selection or superselection is made in the Side Scan Editor. The Preview window is not available when a track line is selected.

The Preview window is divided into three panes:

- Gain (shown as a percentage)
- Intensity values before TVG is applied.
- Intensity value after TVG is applied.

Changes are instantaneously shown in the Preview window.

4. Click **Open** to view the Preview window. To close the window, click **Close**.
5. The TVG correction can be made to port, starboard, or both sides by selecting the appropriate from the *Side* drop-down list.
6. The correction can be made to a single ping, a selection, or the entire line by selecting any of these options from the Range drop-down list. (The options depend on the selection made in the Side Scan Editor or in the Display window).

Standard

The Standard mode contains two options for correcting TVG.

7. Increase or decrease the percentage *Gain* by clicking the up or down arrow buttons.
8. Increase or decrease the *TVG* value by clicking the up or down arrow buttons. This changes the TVG curve.

Advanced

The Advanced mode contains more precise options for correcting TVG.

9. *Spherical Spreading* compensates for the loss of energy caused by signal displacement along the sea floor. Increase or reduce the signal intensity by clicking the Spherical Spreading up or down buttons.

10. The *Absorption* value compensates for attenuation due to energy loss in water. The scale factor is in dB/unit distances. Click the up or down arrow buttons to increase or reduce this value.
11. Click **Process** to apply the TVG correction.

Despeckle

Despeckling uses a calculated value based on neighbouring intensity levels to replace the current pixel's intensity if it is outside the specified range. The value calculated from the neighbouring intensities can be derived by one of two methods mean or median.

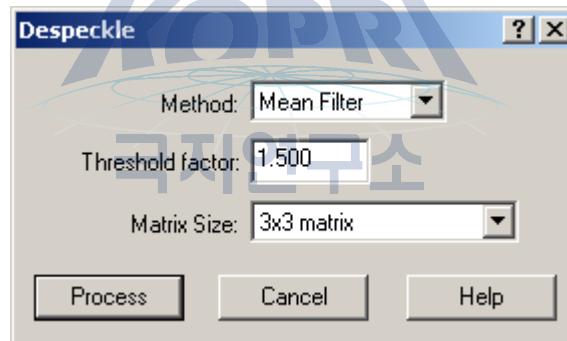
Despeckling imagery is a visual process, consisting of adjusting the despeckle values and viewing the display until the desired results are obtained.

Menu	Process > Despeckle
Tool	

The following steps are used for despeckling images:

1. Select a track line.
2. Select the Despeckle tool.

The Despeckle dialog box is displayed.



3. Select the Mean or Median Filter from the *Method* drop-down list.
4. Use the up and down arrows to select a *Threshold* for defining an acceptable range in which the pixel value will not be replaced.

For example, if the mean value is 50 and the threshold is +/- 20% then the acceptable range is 40 to 60. Thus a pixel value of 38 would be replaced by the mean value of 50 as it is outside the range, but a pixel value of 42 would not be replaced.

5. Select a pattern of neighbouring pixels from the *Matrix Size* drop down list be used in calculating the mean/median.
6. Click **Process**

The line is filtered to remove noise from the sonar image.

Side Scan Editor Interface

Menu	Tools > Side Scan Editor > Open
Tool	
Pop-up	Tools > Side Scan Editor

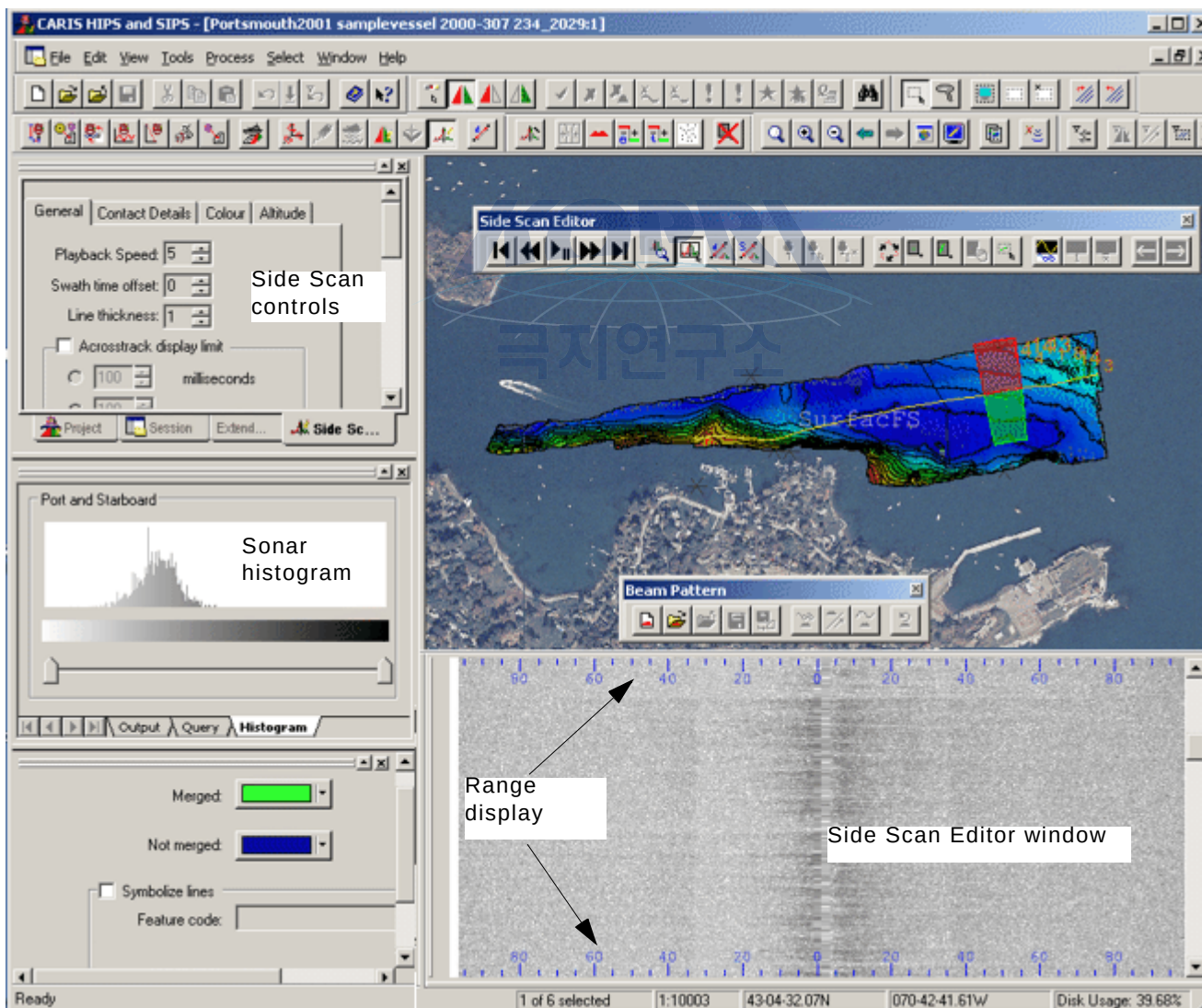
The Side Scan Editor consists of a data display window, toolbars and the Side Scan Editor tabs in the Control window.

To open the Side Scan Editor:

1. Select a towfish track line in the HIPS and SIPS Display window.
2. Select the Side Scan Editor tool.

When the Side Scan Editor is opened, the data for the selected track line is displayed in the Side Scan Editor window, which has a default location along the right side of the interface.

As well, a histogram of the sonar file is displayed in the Worksheet window, and the Side Scan Editor toolbar and the Beam Correction toolbar are activated.



Side Scan Editor window

The Side Scan Editor data display window (also called the “waterfall” view) can be undocked and moved to another position, for example, at the bottom of the interface, as in the figure above (see “[REPOSITION AND RESIZE WINDOWS](#)” ON PAGE 25).

There are two modes to display data in the Side Scan Editor window:

- **Raw:** (the unprocessed sonar data). In raw mode the across-track axis represents time, thus the data is shown in the sequence in which it was received. The central portion of the image still displays the water column. This mode will always show the raw data for the selected track line.
- **Processed:** (the processed sonar data). In processed mode the across-track scale represents distance. The water column is no longer visible as it is removed during the slant range correction process. The data displayed in this mode will reflect the last processing done to it.

1. Select a display mode.

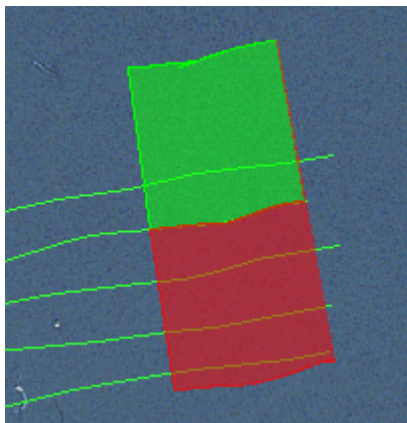
The display is refreshed to show the data in the selected mode. The selected mode is indicated with a check mark in the menu.

Menu	Tools > Side Scan Editor > Raw/Processed
Pop-up	Raw/Processed

Note: If the data does not fill the entire height of the Editor window, it will be displayed in the bottom of the window and can be processed normally. The empty area above the data will indicate “No data to display”.

Coverage outline

A coverage outline in the Display window automatically highlights the location of the side scan data that is visible in the Side Scan Editor window. The starboard and port areas of the coverage outline are appropriately colour coded. The size of the coverage outline varies with the amount of side scan visible in the Side Scan Editor window.



Colours for outlines and selection are controlled from the Tools >Options dialog box (see “SIDE SCAN EDITOR” ON PAGE 669).

Compression

The number of pixels used to display data in the Side Scan window is determined by the width of the display window and screen resolution. However, because the volume of data is often too great for the window to display all pixels, the imagery must be compressed.

There are three compression methods to choose from.

Menu	Tools > Side Scan Editor >
	Compression >Skip/Average/Maximum

1. Select a Compression command.

- **Skip** selects pixels for display at regular intervals across the track.
- **Average** compiles average pixel intensity within a group of pixels spaced at regular across-track intervals.
- **Maximum** selects the brightest pixels from groups of pixels at regular across-track intervals.

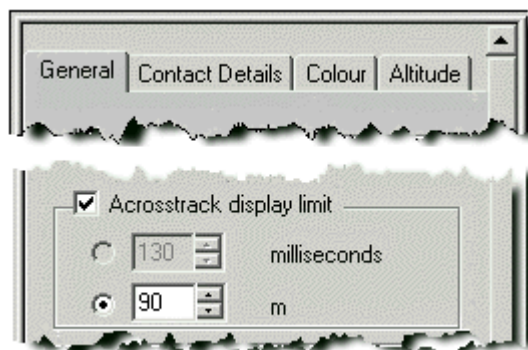
The display in the Side Scan Editor is refreshed to show the data according to the selected compression option. The default display uses the Skip option.

Side Scan Editor controls

The General tab of the Side Scan Editor contains controls for navigating and displaying data in the Editor window. This tab is visible in the Control Window when the Side Scan Editor is opened.

Across-track display

The width of the ping shown in the Side Scan Editor window can be increased or decreased by time or distance, using the controls in the *Acrosstrack Display Limit* fields.



To set across track display limits:

1. Make sure the Control window is open.
2. Select the General tab from the Side Scan Editor tab.
3. To have the entire width of the ping is shown in the Editor, leave the *Across Track Display Limit* box unchecked.
4. To limit the width of ping displayed, check the *Across Track Display Limit* box and select which value to use as limiter:
 - *Milliseconds*: Click the arrow button to change the time value. This option is automatically selected.
 - *Metres/Feet*: Click the arrow buttons to change the distance value.

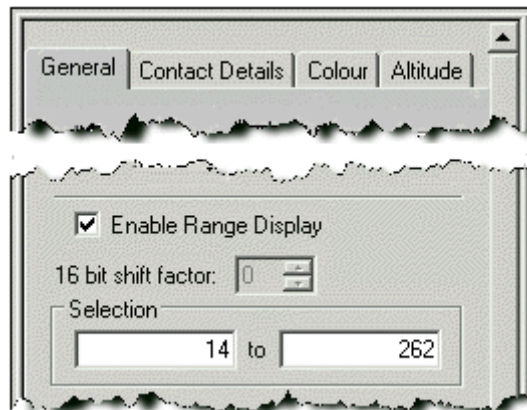
As time or distance is incremented or decreased, the amount of the data is displayed in the window is changed.

The units of distance units can be changed using the *Display* tab in *Options* on the *Tools* menu.

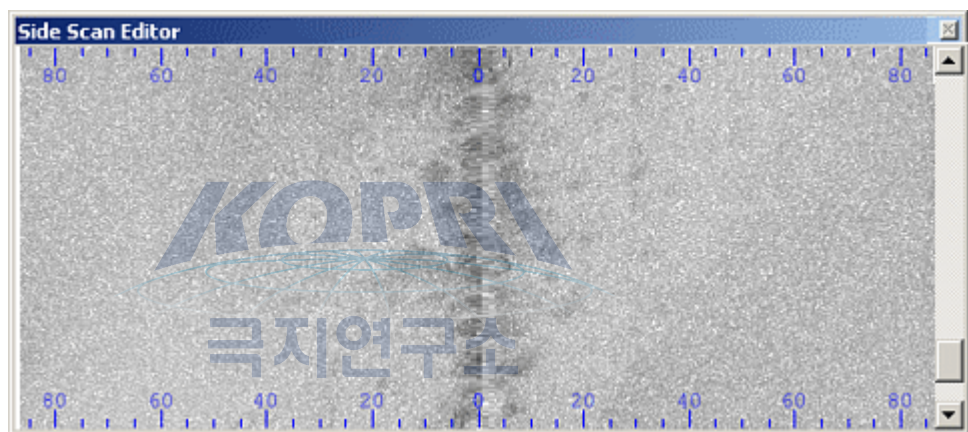
Enable Range display

The range display runs across the top and bottom of the Side Scan Editor window. In Raw mode the range displays time intervals in milliseconds. In Processed mode, distance is displayed in the units you have set in the Tools >Options >Display dialog box.

1. Select the Enable Range Display check box in the Side Scan Editor General tab.



The colour of the range display is set to the same colour used for measure/offset tools in the Side Scan Display Options of the Tools menu.



16-Bit Shift Factor

An 8-bit colour display in a 16-bit processed data set can be enhanced by bit-shifting to select which 8 bits are used to generate the display. This can create a more even distribution of pixels.

1. Make sure that 16-bit processed data is displayed in the Side Scan Editor.
2. Click the up or down arrow keys beside the 16 Bit Shift Factor field to select a value from 0 to 8.

The display is refreshed.

Ping selection

The two Selection fields display the start and end ping numbers when you select part of the trackline displayed in the Editor window. You can use these fields to select specific start and end pings.

Colour Mapping

Colour maps provide a clear visual representation of sonar intensity levels along the track line. Colour mapping is applied to the histograms displayed in the Worksheet window, as well as the port and starboard sections of ping in the Side Scan Editor window.

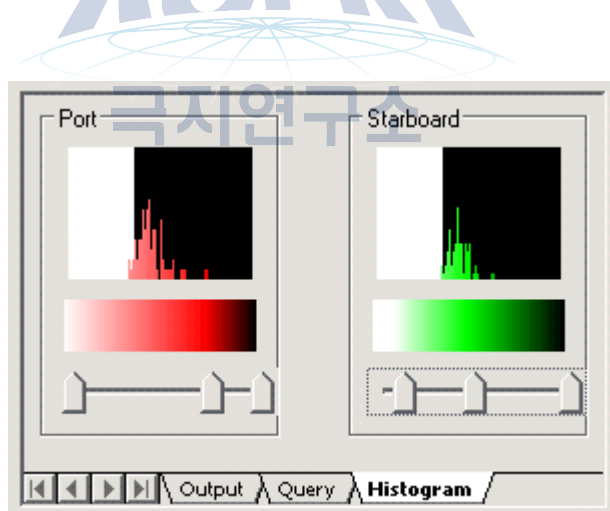
You can select different colour maps for port and starboard sections, or select a single colour map for both sections. All colour maps are stored with a .cma extension in the directory ...\\Hips\\System.

Change from GreyScale

To change the colour mapping from the default setting of GreyScale:

1. Open the Control window and select the Colour tab from the Side Scan Editor tab.
2. Select either *Port*, *Starboard* or *Both* to apply new colour to.
3. Select a colour map from the drop-down menu (the default colour map is GreyScale.cma).

When the colour map is chosen, both the histogram and the ping window are refreshed, so that the port and starboard sections (or both) display the selected colour mapping.



In the Histogram, the horizontal axis represents the intensity range of the pixels in the sonar file and the vertical axis represents the distribution of pixels in the editor.

Use the slider bar below the histogram in the Worksheet window to adjust colours. Each colour in the histogram has a slider control associated with it.

1. Move the slider to adjust the pixel value of that colour in the histogram and in the ping.

The value shown in the Control window adjusts as you move the sliders.

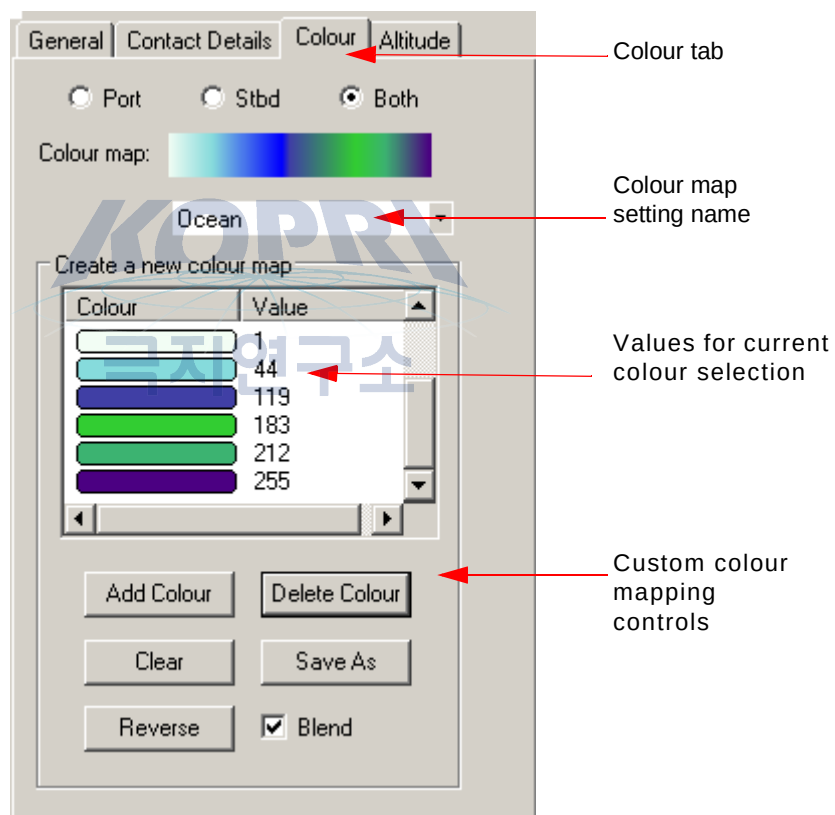
Colour display can be adjusted also using the other options:

- **Blend** will blend the colour borders
- **Delete Colour** will remove it from the list, and from the areas that it colours
- **Clear** will remove all colours. To view ping clearly, restore GreyScale colour map.

Custom colour maps

You can create custom colour maps using either the Colour tab or the sliders below the histogram in the Worksheet window.

1. Make sure both the Worksheet and Control windows are open.
2. Click **Add Colour**, or click on a slider to open the colour mapping controls.



The *Value* field shows the pixel value of the displayed colour.

The pixel values range from 1 to 255 with the first colour always assigned to pixel value 1. Pixel value 0 is always assumed to be transparent.

3. Enter a pixel value for the colour, as needed.
4. Click on the button to open a colour palette
5. Select a colour from the colour palette or click **Create Custom Colour** to create a custom colour from the standard Windows colour picker.

6. Click **OK**.

The new colour and its assigned pixel value is added to the listing in the Control window, and applied to the histogram in the Worksheet window. The colour of the ping in the Side Scan Editor also changes to display the new colour in the appropriate areas.

7. Repeat Steps 2 to 6 to insert more colours, as needed.

As you select more colours, the colour values and the depths are displayed in the Control window.

Reverse

Sonar recorders have traditionally used dark colours to represent high signal returns. You may want to use the Reverse option to change the order in the colour map to reflect this practice.

To reverse the colour map order, click **Reverse**.

8. Click **Save As** to retain the settings as a colour map.

The Save As dialog box is displayed.

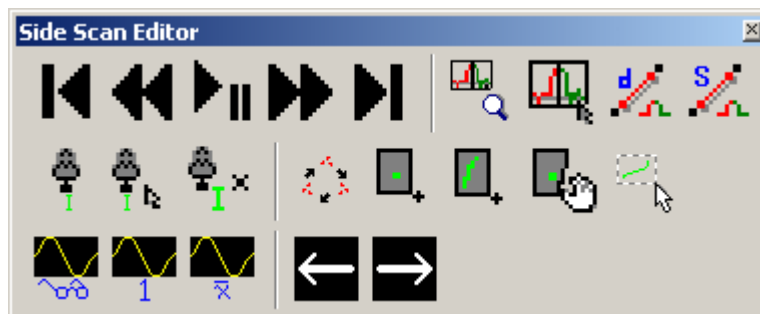
9. Type a file name for the colour map.



Toolbar

The Side Scan Editor toolbar is displayed in the interface when the editor is started.

The toolbar can be docked or undocked, or removed from the interface like other toolbars. Below is an example of the toolbar in the undocked position.



The toolbar contains controls to navigate through the track line and perform other functions.

Toolbar Buttons	Purpose
	Playback (see “NAVIGATE IN SIDE SCAN EDITOR” ON PAGE 431)
	Zoom (see “ZOOM” ON PAGE 433)
	Select (see “SELECTION” ON PAGE 434)
	Measure distance and shadow (see “MEASURE DISTANCE” ON PAGE 436 and “MEASURE SHADOW” ON PAGE 437)
	Digitize (see “DIGITIZING SONAR ALTITUDE” ON PAGE 407)
	Contacts (see “CREATE CONTACTS” ON PAGE 442)
	View waveform (see “SIGNAL DISPLAY WINDOW” ON PAGE 440)
	Revert and reapply (see “REVERT/ REAPPLY” ON PAGE 412)

Navigate in Side Scan Editor

You can navigate up or down the track line by clicking along the scroll bar to the right of the Side Scan Editor window.

- Clicking the scroll arrow buttons moves the view in the editor forward or backward by a single ping.
- Clicking the scroll bar, or dragging the scroll box forward or backward increments your view by a set of pings.

Alternately, you can move up or down the track line by turning the mouse wheel (if available).

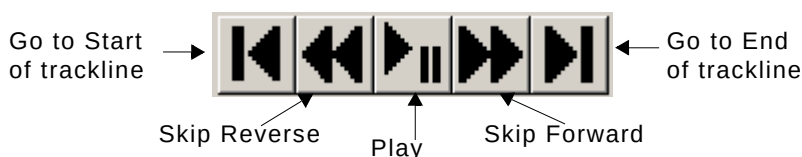
You can also navigate up or down the track line using the keyboard.

- Pressing <Page Up> or the space bar moves the editor forward by one “page” (the height (# of pings) visible in your Side Scan Editor window is the increment).
- Pressing <Page Down> or holding the <Ctrl> key while pressing the space bar moves the editor back by one “page”.
- Pressing <Home> takes you to the start of the track line, and pressing <End> takes you to the end of the track line.

Playback

The Side Scan Editor can automatically scroll data from the start of the track line to the end by using the *Playback* option.

The view in the Side Scan Editor will scroll at the speed set on the Side Scan tab of the Control window.



The ping coverage outline in the Display window moves with the display in the Editor.



1. Click Start to go to the start of the track line.



2. Click Play to start scrolling the data.

The Side Scan Editor moves the track line, ping by ping, until it reaches the end of the surveyed data.

3. Reset the Side Scan Editor view to the previous position by clicking Start.

Playback speed

You can adjust the scrolling speed for automatic scrolling in the *Playback Speed* field.

1. Make sure the Control window is open and Side Scan Editor tab is displayed.

Menu	Tools > Side Scan Editor > Playback Controls>Skip Forward/Skip Reverse
Tool	

View contacts while scrolling

2. Select speed value from the *Playback Speed* field in the General tab by clicking the up or down arrow buttons.

You can also view the data by moving up or down the track line in larger increments: “pages” the height visible in your Side Scan Editor window.

1. Click either the Start or End button to move to start or end of the track line.
2. Click Skip Forward or Reverse.

If you want your contacts to remain visible in the waterfall display while scrolling or using the Playback functions

1. Select Side Scan Editor from the Tools > Options > Display tab.
2. Select the *Display contacts during playback* check box, and click Apply.



Zoom

You can magnify an area in the Side Scan window with the Side Scan Editor Zoom tool.

Menu	Tools > Side Scan Editor > Zoom
Tool	

1. Select the Side Scan Zoom tool.
2. Press and hold the mouse button and drag the cursor over the area you want to enlarge.

A new window displaying the enlarged area will open.

You can display the image so that the entire zoomed area fits the zoom window or you can scale the image according to a selected percentage.

3. Right-click the mouse in the zoom display window and choose any of the following options from the pop-up menu:
 - Select the *Fit to Window* option so that the entire area of the zoomed image is displayed in the window.
 - Select the *Aspect Ratio* to keep the same height and width ratio for the zoomed area. When this option is cleared, the image is resized so that it fills the entire zoom window.
 - Select the *Scale* option to resize the zoomed area to a scale. The scale is selected from the drop-down list. When a scale is selected, the image is displayed according to the selected percentage.
 - Select *Close* to close the window.
4. You can use the Measure Distance and Measure Shadow tools in the Zoom window (see [“MEASURE DISTANCE” ON PAGE 436](#) and [“MEASURE SHADOW” ON PAGE 437](#)). When you release the mouse button, the results are shown in the Contacts tab in the Control Window.
5. Deactivate the Zoom tool when finished.

Selection

Data can be selected in the Side Scan Editor using the Side Scan selection tool. The selection tool can be used to select a range or a single ping within that range. Selected data can be viewed, edited, or corrected using a variety of tools.

To range-select data:

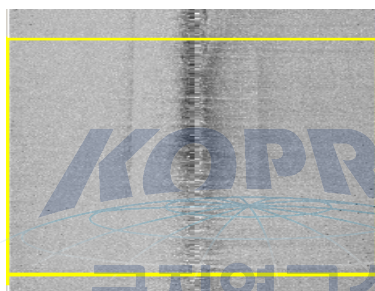
Menu	Tools > Side Scan Editor > Select
Tool	

1. Choose the Select Side Scan button on the Side Scan Editor toolbar.

The cursor will become a cross-hair when positioned in the Side Scan Editor window.

2. Press the mouse button and drag the cursor across the area of the Editor that you want to select.

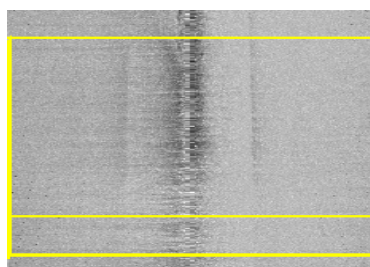
When you release the mouse button, the selected range is shown bounded with a rectangular yellow box.



The range remains selected until you click in the Editor window again.

To select a single ping:

3. Select a range of side scan (see above).
4. While the range is selected, press the <Up Arrow> key, which produces a third horizontal line representing the selected ping.

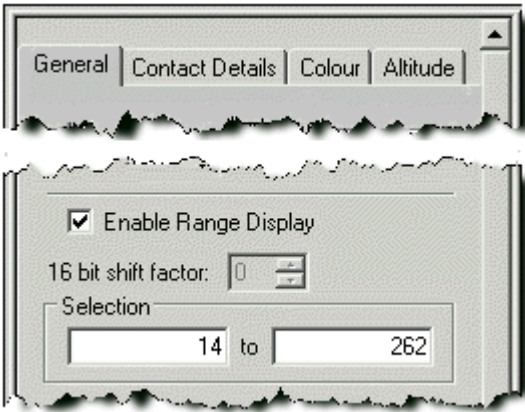


5. Continue pressing the <Up Arrow> key to move the selection up, or press the <Down Arrow> key to move the selection down.

Select by ping number

You can also use the Selection fields on the General tab of the Side Scan Editor Control window to select a range in the Editor window.

When you make a selection in the Editor window the start and end ping numbers of that selection are displayed in the General tab. To refine your selection, enter the specific ping numbers fields to specific start and end pings.



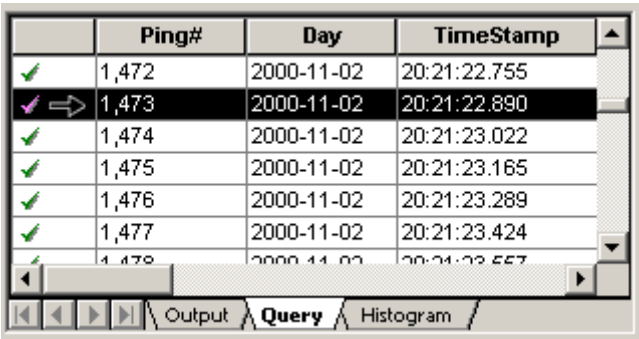
Superselection

Superselection is selecting data within an already selected range. You can superselect pings from the Worksheet window and display the superselected data in the Side Scan Editor.

1. Select a range of side scan data.
2. Select the Query command.

A table listing the pings in the selection is displayed in the Query tab of the Worksheet window.

Menu	Edit > Query
Tool	
Pop-up	Query
Key	<Q>



The image shows a screenshot of the 'Query' tab in the 'Worksheet' window. It displays a table with four columns: 'Ping#', 'Day', and 'TimeStamp'. The first column is partially visible and contains green checkmarks. The table lists several ping events from 2000-11-02. The row for ping 1,473 is highlighted with a black background and a mouse cursor icon.

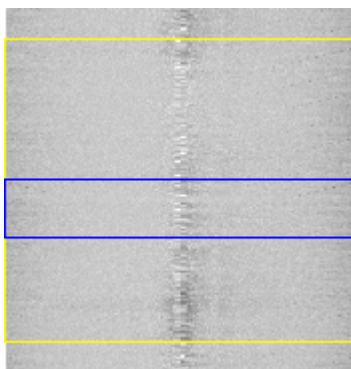
	Ping#	Day	TimeStamp
✓	1,472	2000-11-02	20:21:22.755
✓⇒	1,473	2000-11-02	20:21:22.890
✓	1,474	2000-11-02	20:21:23.022
✓	1,475	2000-11-02	20:21:23.165
✓	1,476	2000-11-02	20:21:23.289
✓	1,477	2000-11-02	20:21:23.424
✓	1,478	2000-11-02	20:21:23.557

3. To superselect a single ping, select the row in the Query tab.

The superselected ping will be highlighted within the selection in the Side Scan Editor.

3. To superselect a range of pings, click in the first column on the first row of the range and drag the mouse through to the last row of the range you want to select.

A rectangle is displayed containing the superselected range of pings within the selection.



Measure Distance

Measure distance

This tool enables you to measure distance between two points with the mouse. This feature is used in processed mode, in either the Side Scan Editor window or in the Side Scan Zoom window. Distance units are determined by the settings in the Display tab of the Options dialog box (see “[UNITS](#)” ON PAGE 673).

1. Make sure the side scan display is in processed mode.
1. From the Side Scan Editor toolbar, select the Measure Distance tool.
2. Press and hold the mouse button, and drag the cursor across the Side Scan Editor.

As you drag the cursor across the data, the distance is displayed at the cursor.

Menu	Tools > Side Scan Editor > Measure Distance
Tool	

Measure Shadow

Menu	Tools > Side Scan Editor > Measure Shadow
Tool	

This tool enables you to determine the height of an object by measuring its shadow. This feature is only available in processed mode, and can be measured in either the Side Scan Editor or in the Side Scan Zoom window.

1. Make sure the side scan display is in processed mode.
2. Select the Measure Shadow tool.
3. Press and hold the mouse button, and drag the cursor *horizontally* across the Side Scan Editor.

The height measurement is shown in the side scan window.

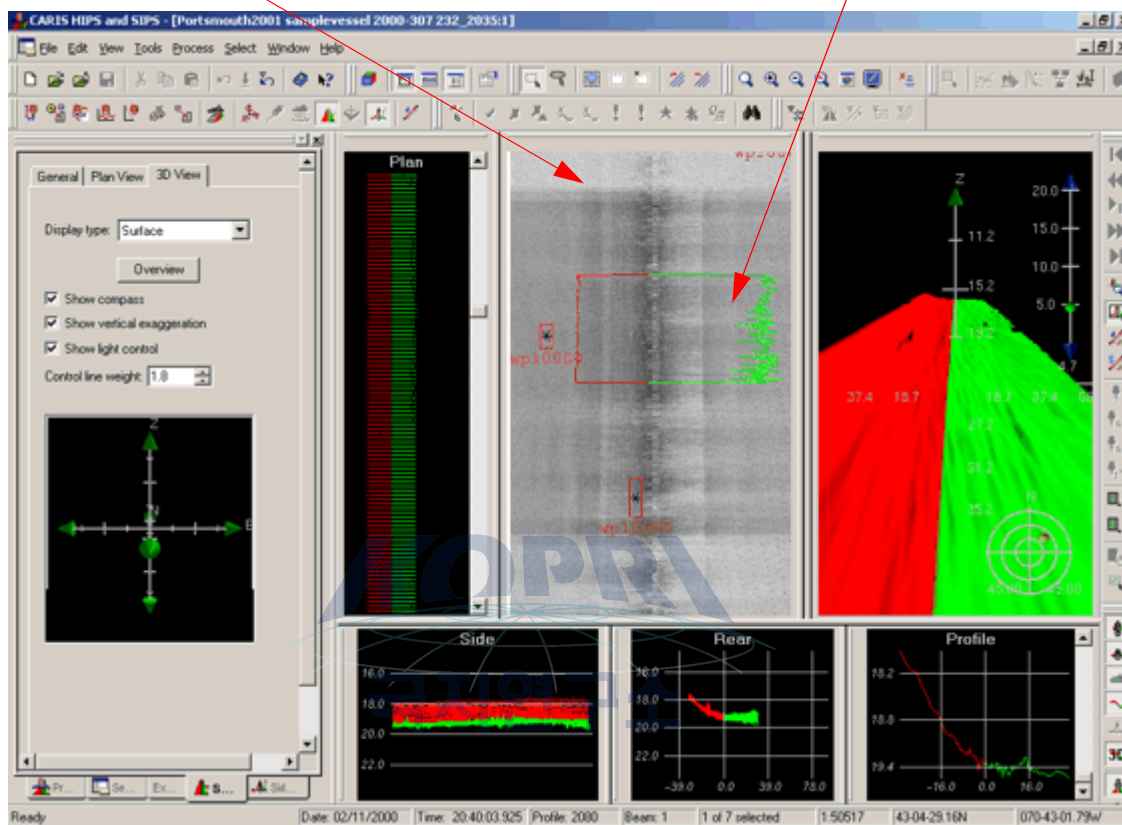


Side Scan Editor and Swath Editor

The Swath Editor can also be open at the same time as the Side Scan Editor.

Side Scan Editor

Coverage outline for multibeam data



When the Side Scan is open in this mode, the playback functions used to scroll the track line, are unavailable. You can, however, move up and down the track line by scrolling the Plan View in the Swath Editor (see “[EXAMINING SWATH DATA](#)” ON PAGE 643).

All other Side Scan functions and tools are available.

When both the Side Scan and Swath Editors are open, a coverage outline of the multibeam data is displayed in the Side Scan Editor. This feature is useful when the across-track coverage of the multibeam is less than that of the side scan.

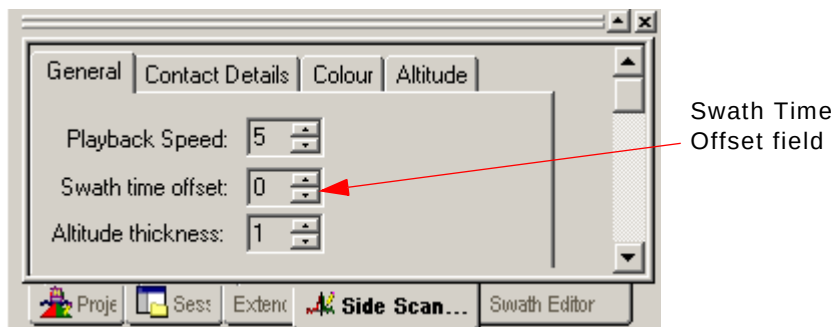
Swath Time Offset

If the multibeam data was recorded from a vessel and the side scan from a tow fish, then the coverage outline will not be in the correct along-track location.

The *Swath Time Offset* adjusts the along-track locations of the swath outline in the Side Scan Editor by applying a time correction value. The time correction value can be either positive or negative. Negative values are used for track lines where the side scan sonar is positioned before the multibeam echo sounder.

To adjust the swath time offset:

1. Make sure the Side Scan Editor is open. (The Side Scan Editor tab in the Control window will be visible.)
2. Click the <Up> or <Down> arrows for the Swath Time Offset field on the Side Scan editor tab until the correct delay (in seconds) between the vessel and towfish is displayed.



Signal Display Window

The Side Scan Editor includes a Signal Display Window for viewing sonar intensity levels. This window provides a plot of signal intensity against across-track distance (or time, in raw mode). The pre-and post-processing state of any correction can be compared using the Revert and Reapply functions

The Signal Display Window can display a mean of all sonar intensities in a selection or the sonar intensity values for a single ping. The display can be switched back and forth between mean and single profile modes by use of the buttons on the toolbar.

The Signal Display Window can be used in both the raw and processed modes.

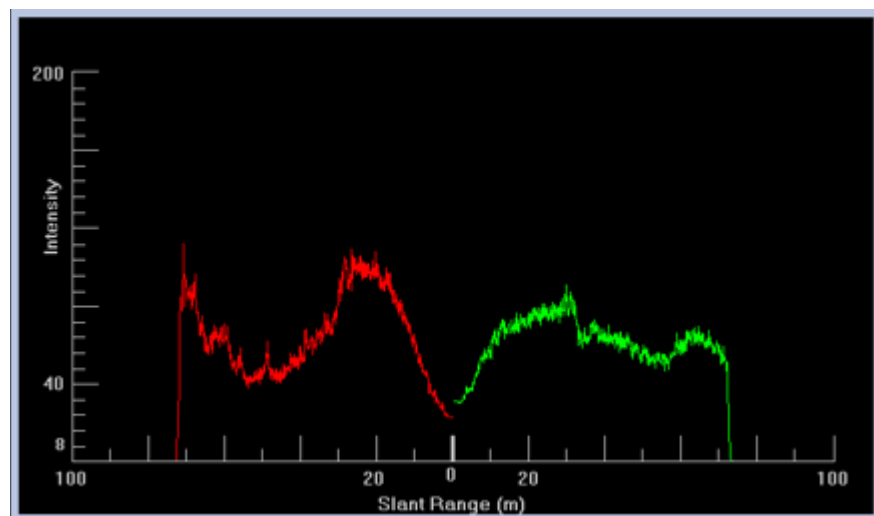
When the Signal Display Window is reopened, it will remember its previous setting and display either the mean intensity values for the entire selection or the intensity values of a single profile.

Open Signal Display Window

Menu	Tools > Side Scan Editor > Signal Display Window > Open/Close
Tool	

1. Select a range in the Side Scan window using the Side Scan Selection tool (see “SELECTION” ON PAGE 434).
2. Select the Signal Display Window tool.

The Side Scan Signal Display Window is displayed.



The vertical axis on the graph represents intensity level of the signal(s) being examined. The horizontal axis represents either time or slant-range distance depending on the display mode of the Side Scan Editor.

Menu	Tools > Side Scan Editor > Signal Display Window > View Selection Mean
Tool	

View Selection Mean

The mean of the intensity values in the selected range can be displayed.

3. Select the View Selection Mean tool.

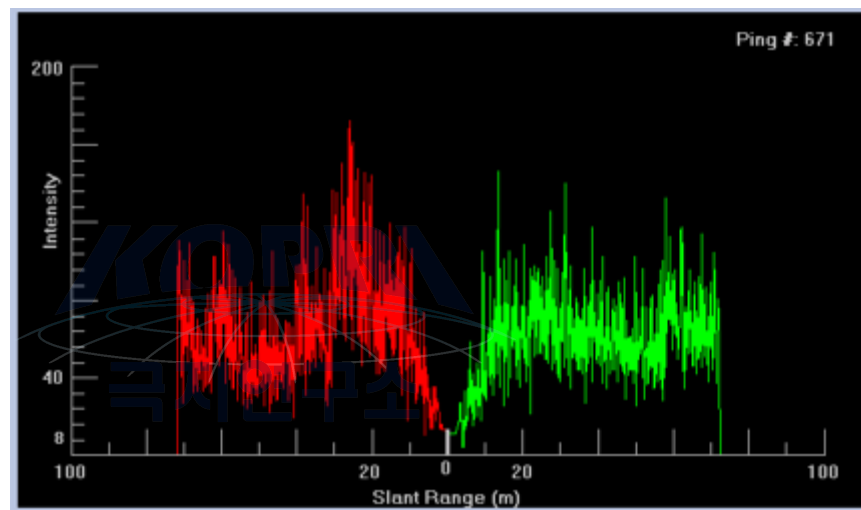
Menu	Tools > Side Scan Editor > Signal Display Window > View Single Ping
Tool	

View Single Ping

You can also view signal intensity for a single ping.

4. Select the View Single Ping tool.

The Signal Display Window is refreshed to show the sonar signal intensities for the single ping selected in the Side Scan window.

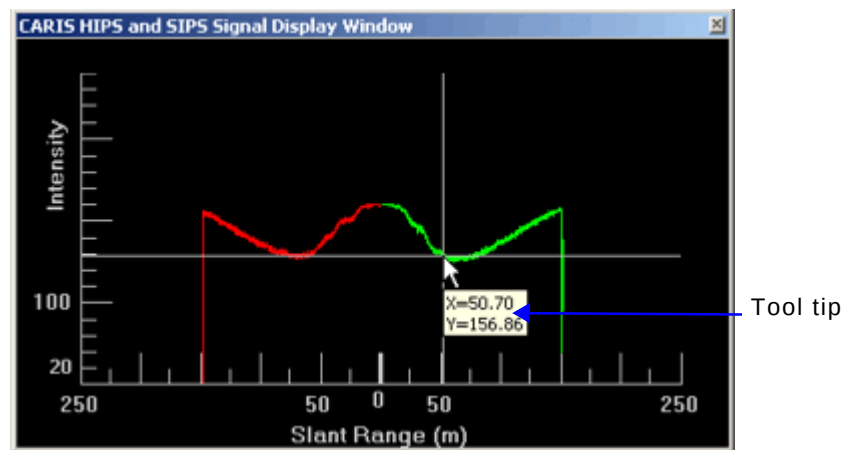


Pressing the Up Arrow key while an area of the side scan data is range selected will select a single ping

5. Use the Up and Down arrow key to view the sonar intensities for other single pings.

As you scroll through the selected range, the Signal Display Window will refresh to show the intensity values for each ping. The ping number is displayed in the top-right corner of the Signal Display Window in this mode. The location of the ping is also indicated by a new line within the selection. The single ping selection always defaults to the first ping in the selection.

You can view the position and specific intensity values of points by clicking on any point in the graph in the Signal Display Window. The intensity and time/distance values for that point are shown in a tool tip.



Contacts

A Contact is the representation of an object or feature on the sea bottom (for example, a wreck, or a pipeline) that is visible in the sonar data. Contacts can be georeferenced, have positions calculated, and have attributes attached to them in the Side Scan Editor using the Add Point or Add Line Contacts tools.

In SIPS, you can pick individual contacts directly from the Side Scan Editor interface. A contact record is created for each contact, and includes sufficient information to be subsequently imported to a CARIS map or to a database application.

A contact file is created for each survey line and is stored in the line folder within the project directory structure. Each contact file is a text file that can be viewed and edited using a text editor. Each file consists of zero or more contact records.

For more information on contact file structure, see “[CONTACT FILE FORMATS](#)” ON PAGE 745.

Create Contacts

Point type contacts can be created for objects such as rocks, underwater posts or pile as well as wrecks. Contacts can also be created for continuous objects such as pipelines or underwater cables.

Contact information is entered on the General tab of the Control window and updated on the Contact Details tab.

1. Make sure the Control window is open and the General tab in the Side Scan Section is displayed.
2. Enter information in the appropriate fields on the General tab.
 - *Contact Type*: Select a point or line contact type from the appropriate drop-down list. Each contact type is assigned a CARIS feature code, and there is an identifying symbol for each type. The contact types shown in the lists and the corresponding CARIS feature codes are stored in ...\\Hips\\system\\ContactFeature.txt.
 - *User Initials*: Type a maximum of three characters to identify the creator of the contact. The initials are used in the editor as part of a contact identifier.
 - *Prefix*: The prefix is usually the line number. It is combined with the contact number to generate a 12-character key for database applications.
 - *Image Width*: (optional) Enter a width for any image file created from the contact.
 - *Image Length*: (optional) Enter a length for any image file created from the contact.

- *Display with single colour*: Select this to have all contact markers and their identifiers appear in the same default colour. (The default colour can be set in Side Scan Editor Display Options on the Tools menu.) Leave blank to have a one colour apply to the contact markers and a different colour applied to the bounding box and contact labels.

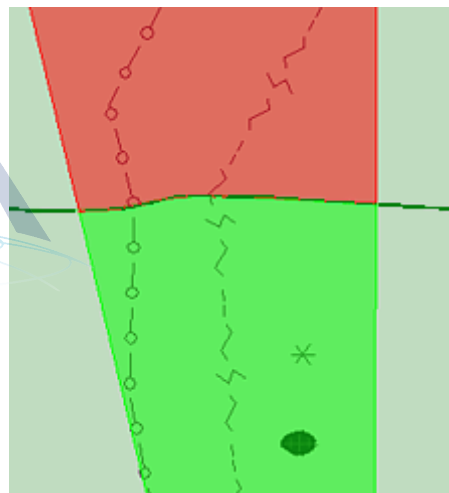
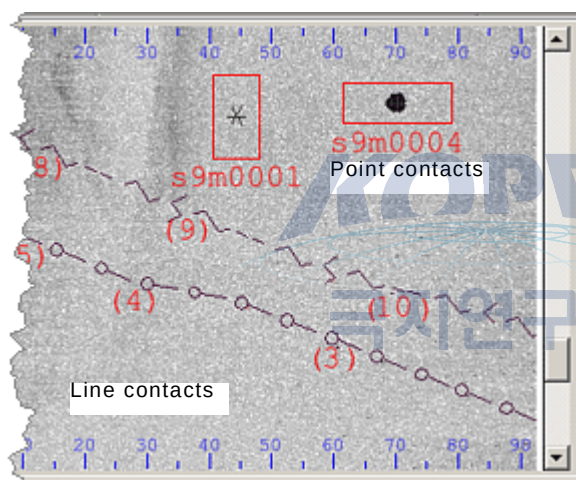
Point Contact

Menu	Tools > Side Scan Editor > Contacts > Add Point Contact
Tool	

3. To insert a point contact, select the Add Point Contact tool and click where you want to place the contact.

A contact marker is placed in the Side Scan Editor at the point where you clicked.

The type of contact is indicated by the symbol displayed. The contact is identified by the initials entered in the General tab, and a four-digit number (starting at 0001). The information entered in the General tab is assigned to the contact.



The image bounding box always snaps to the contact so that the contact point is in the middle of the box. The bounding box represents the image area of the contact. You can adjust the size of the image using the *Image Width* and *Image Length* fields on the Contract Details tab in the Control window.

Line Contact

Menu	Tools > Side Scan Editor > Contacts > Add Line Contact
Tool	

To insert a contact record for a line:

1. Select the Add Line Contact tool and click the point where you want to insert the contact.
2. Click another section of the Side Scan Editor.

The two points are joined by a line.

3. Continue adding line segments as needed to represent the contact.
4. Select **Edit Line> Remove last** to delete the line segment just created.
5. To escape the Line Contact tool, right-click the mouse and select **Edit Line> End** from the pop-up menu.

The contact lines are drawn in the Side Scan Editor. Each line is identified with a number, and each type of line is drawn in a different style. The information entered in the General tab is applied to the contact. The contact is identified with the initials entered in the General tab, along with a four-digit number (starting at 0001).

Repeat New Feature

Menu	Tools > Side Scan Editor > Contacts > Repeat New Feature
Tool	

When the Repeat New Feature tool is activated, you can add any number of contacts of the same type and attributes, without having to set each one separately.

To add multiple similar contacts:

1. Select the Repeat New Feature command.
2. Enter contact information in the appropriate fields on the General tab in the Control window.
3. Use the Add Point Contact tool to place the contacts, one after the other, into the Side Scan Editor.

The Repeat New Feature tool button will remain depressed while you add contacts. To change to a different type of contact or to change contact data, deactivate the Repeat New Feature.

Editing Contacts

You can reposition both line and point contacts and update the data associated with a contact.

The Select Contact tool is used to select point or line contact(s) for editing.

Select Contact

Menu	Tools > Side Scan Editor > Contacts > Select Contact
Tool	

1. Choose the Select Contact tool.
2. To select a *single* contact, click on or draw a box around the contact so that it becomes highlighted. Clicking on any part of a line will select the entire contact.
3. To select a number of contacts, press the mouse button and drag the cursor across an area so that the contacts within it are highlighted.

Move Contact

Menu	Tools > Side Scan Editor > Contacts > Move Contact
Tool	

1. To move a selected contact, select the Move Contact tool.
2. Position the cursor on top of the selected contact. Press and hold the mouse button. This will turn the highlighted contact into a red box with direction arrows.
3. Drag the contact to a new position.
4. Deactivate the Move Contact tool to finalize the new position of this contact. You are returned to the Select Contact tool.

You can use the Move Contact tool to move an entire line contact, or to adjust or realign part of the line.

5. To move a selected line contact, position the cursor on any part of the line, press and hold the mouse button, and drag the whole line to a new position.
6. To realign *part* of a selected line, click on the line. This will highlight nodes which will appear as squares on the line.
7. Click on the node to be adjusted, which will turn the node square red. Position the cursor on the node. Press and hold the mouse button, and drag it to a new position. This will pull the attached lines with it.

Changing Contact Information

You can change the information that is associated with the contact when it was first created, either by typing it in or with measurement tools.

1. Choose the Select Contact tool.
2. Select a single contact.

The contact is highlighted and the contact information is displayed in Contact Details tab in the Control window.

3. Type new information in the fields and/or select a new object type from the drop-down list.
4. Click **Update**.

Use the Measure Distance and Measure Shadow tools on the Side Scan Editor toolbar to amend the contact information.

Use Measure tools

Menu	Tools > Side Scan Editor > Measure Distance
Tool	

Menu	Tools > Side Scan Editor > Measure Shadow
Tool	

Set contact status

- To update the contact width information, choose the Measure Distance tool and press and hold <Ctrl> while dragging the cursor across the area of the contact to be measured.

If measuring in the Side Scan Editor window, the value in the Contact Width field will reflect the measurement as you are make it. If measuring in the Zoom tool, the value will be updated when the mouse button is released.

- To retain the updated information, release the mouse button and then the <Ctrl> key.
- To update the Contact Length information, choose the Measure Distance tool and press <Alt> while dragging the cursor across the contact area.
- To update the Contact Height field, select the Measure Shadow tool and press <Ctrl> while dragging the cursor across the contact area.
- Click **Update**. If you do not click Update, the values will be lost when the contact is de-selected.

The contact information is updated.

You can also use the Select Contact tool with the Query, Reject or Accept tools. A rejected contact can deleted from the track line using the Purge Rejected Contacts command.

- Select either an Accept, Reject or Query tool (see [“EDIT SIDE SCAN DATA” ON PAGE 405](#)).
 - If you select the Query tool, data relating to that contact is displayed in the Query tab of the Worksheet window.
 - If you select Accept or Reject, the contact is assigned the appropriate status flag.

Purge rejected contacts

Menu	Tools > Side Scan Editor > Contacts > Purge Rejected Contacts
Tool	

To delete a rejected contact

- Use the Select Contact tool to select the rejected contact.
- Select a Purge Rejected Contacts command.

The rejected contact is deleted.

Recompute Contact Positions

Update the geographic positions of contacts after towfish navigation has been recomputed for a track line or group of track lines (see “[SLANT RANGE CORRECTION](#)” ON PAGE 413).

1. Select the ship or towfish track lines layer in the Session tab of the Control window.
2. Select one or more track lines.
3. Select the Recompute Contact Position command.

Position information for contacts along the selected track lines are updated to match the new towfish navigation.

The start time, end time and elapsed time for the recompute process is reported in the Output window. Any error in the processing will be reported there also.

If you want your contacts to remain visible in the waterfall display while scrolling along a track line or using the Playback functions

1. Select Side Scan Editor from the Tools > Options > Display tab.
2. Select the *Display contacts during playback* check box, and click Apply.

Menu	Process > Recompute Contact Position

View contacts while scrolling



SIPS Template Wizard

The SIPS Template Wizard (STW) combines imagery correction tools into a single flow, which can be saved as a template file and consistently applied to data.

Use the Wizard dialog boxes to process one or more lines. The STW can also be run in Side Scan Editor to apply corrections to one track line at a time.

The STW can also create GeoBaRs after the corrections have been applied. GeoBaRs can be used to create mosaics or analyze sediment properties.

The STW uses either a SIPS engine or a Geocoder engine to correct data. Depending on which engine is chosen, (and the type of data being processed) different correction parameters are presented.

Menu	Process > SIPS Template Wizard
Tool	

The settings entered into the wizard can be saved to a SIPS Template File (STF) that can be loaded and used again.

To open the SIPS Template Wizard:

1. Select one or more track lines.
2. Select the SIPS Template Wizard tool.

SIPS Template Wizard (Step 1)

The SIPS Template Wizard (Step 1) dialog box is opened so you can create a template or load an existing one.

To create a new SIPS template file,

1. Select a Processing engine, either Geocoder or SIPS.

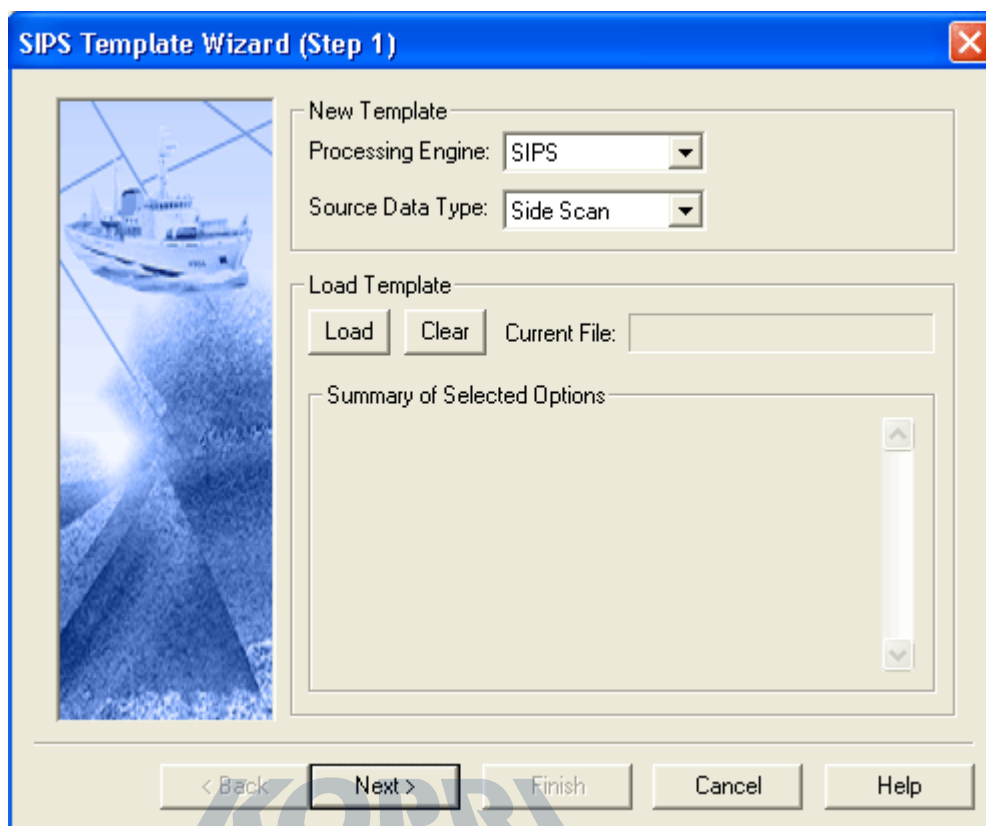
Depending on the engine chosen the dialog boxes which follow will display different options.

2. Select the type of data. (Note that the SIPS engine will not process Time Series data.)
3. Click **Next** to open the next dialog box to set process options.

Load Existing Template

To load an existing SIPS Template file:

1. Click **Load** and choose an existing file. The file name is displayed in the Current File field. The Summary provides an overview of the settings.
2. To remove the selected file, click **Clear**.
3. To execute the loaded SIPS Template file, click **Finish**.
4. If you want to modify the loaded options, click **Next**.

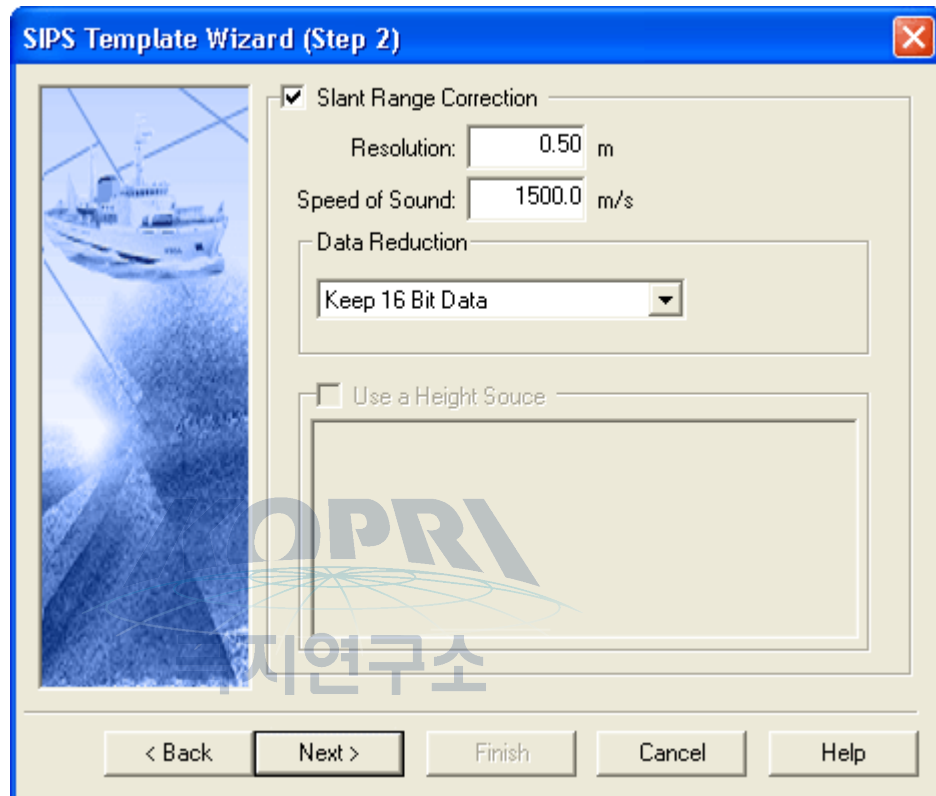


SIPS Template Wizard (Step 2)

The contents of the SIPS Template Wizard (Step 2) depends on the processing engine choice made at step 1.

SIPS engine

If you chose the SIPS engine, the options available for Slant Range Correction are displayed.

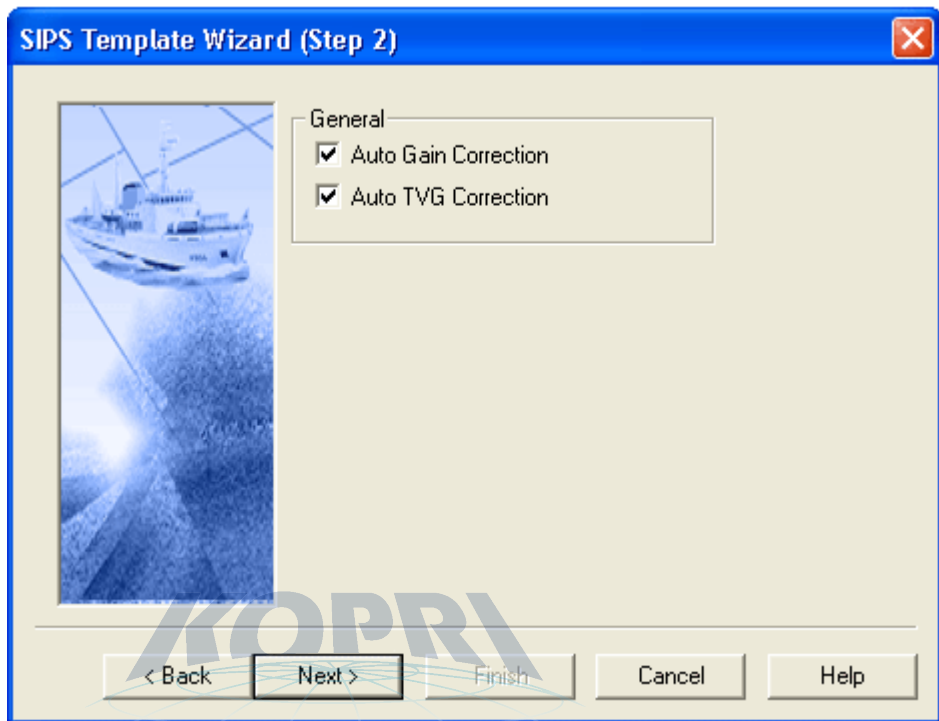


1. Select *Slant Range Correction* to enable this correction process.
2. Type the *Resolution* (in metres or feet) for the slant range corrected file. The resolution value defaults to the minimum value appropriate to the sonar system. If this is not available then it defaults to 0.10 metres or 0.33 feet. A finer resolution generates a larger file.
3. Type the average speed of sound.
4. Select the setting for Data Reduction from the drop-down list.
 - The default is to use the 16-bit factor that is stored with the line.
 - Select *Use 8-Bit Shift* if you want to create a slant range file using only eight bits of storage per pixel. This option is important if the data that you are slant range correcting was originally 16-bit and all 16 bits were maintained at conversion.
 - Select *Use Shift Factor Per Line* to use the shift factor that is stored with the line.
5. Select the *Use Height Source* check box if you want to apply a height source, such as a BASE surface and select the height source from the displayed list.

For information on slant range correction, see “[SLANT RANGE CORRECTION](#)” ON PAGE 413.

Geocoder engine

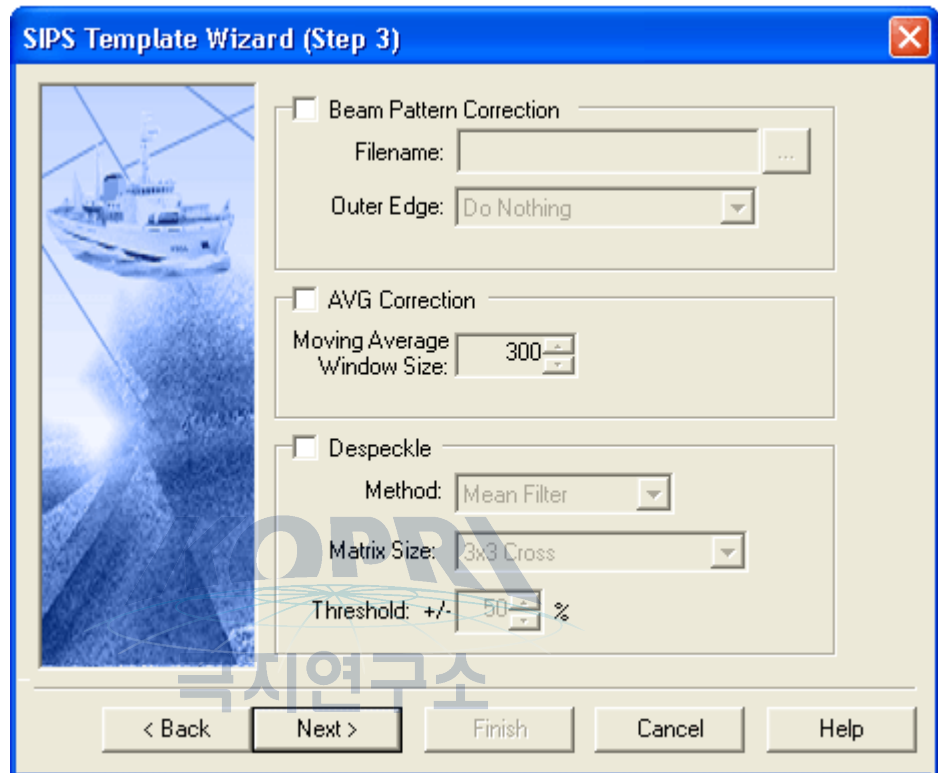
If you chose the Geocoder engine, the options to apply Auto Gain Correction and TVG Correction automatically are displayed.



1. Select Auto Gain Correction or Auto TVG Correction to apply these corrections with default settings.
2. Click **Next** .

SIPS Template Wizard (Step 3)

The dialog box at Step 3 of the Wizard contains the options for corrections to data. Depending on whether you are working with the SIPS engine or the GeoCoder engine, different variables for those corrections are displayed.



SIPS Engine

Beam Pattern Correction removes along-track banding. For further information, see “[BEAM PATTERN CORRECTION](#)” ON PAGE 416.

1. Select the *Beam Pattern Correction* check box to enable this option and browse to select an existing BPC file.

If no Beam Pattern Correction file exists you will need to create one in order to apply Beam Pattern Correction parameters. All the tools to create a beam pattern file are accessible on the Beam Pattern Toolbar, while the Side Scan Editor is open.

For information on creating a Beam Pattern Correction file, see “[CREATE BEAM PATTERN CORRECTION FILE](#)” ON PAGE 416.

The outer edges of some pings may have been recorded at angles beyond the extent of the beam pattern file being used. The *Outer Edge* option must be specified for handling these cases.

2. Select a method for handling sonar data collected outside the extents of the beam pattern file:
 - Extrapolate: Extrapolate the beam pattern to correct angles beyond the outer edge of the generated beam pattern file.

- **Trim:** Remove sonar data that is beyond the extent of the beam pattern file. Trimmed data will appear as 0 intensity white space in the Side Scan Editor.
- **Do Nothing:** Does not correct sonar data beyond the extent of the beam pattern file. Uncorrected data will appear the same before and after Beam Pattern Correction in the Side Scan Editor.

Angle-Varying Gain (AVG) removes the angular response of sediment from the imagery, normalizing the mean angular intensities, with a moving average filter applied ping by ping to selected areas of data. (See “[ANGLE-VARYING GAIN](#)” ON PAGE 419.)

3. Select the *AVG Correction* check box to enable the process.
4. Select the number of adjacent pings to include in the moving average by clicking *Moving Average Window Size* up or down arrow buttons.

The *Despeckle* function removes “noise” in the processed side scan image. (Noise consists of randomly scattered pixels that are brighter or darker than their neighbouring pixels). (See “[DESPECKLE](#)” ON PAGE 421.)

5. Select a *Method* from the drop-down list.
6. Select a *Matrix Size* from the list
7. Specify a *Threshold Factor* in the box.
8. Click **Next**.

Geocoder engine

If you selected Geocoder as the engine the dialog box at Step 3 displays these corrections with slightly different options:

The screenshot shows a dialog box with three sections. The first section, 'Beam Pattern Correction', has an unchecked checkbox and a 'Beam Pattern File:' label with a text box and a browse button. The second section, 'AVG Correction', has a checked checkbox, a 'Method:' label with a dropdown menu set to 'Trend', and an 'AVG Window' label with a text box set to '300' and up/down arrow buttons. The third section, 'Despeckle', has a checked checkbox and a 'Strength:' label with a dropdown menu set to '3 - Strong'.

Beam Pattern Correction removes along-track banding. For further information, see “[BEAM PATTERN CORRECTION](#)” ON PAGE 416.

1. Select the *Beam Pattern Correction* check box to enable this option and browse to select an existing BPC file.

If no Beam Pattern Correction file exists you will need to create one in order to apply Beam Pattern Correction parameters. All the tools to create a beam pattern file are accessible on the Beam Pattern Toolbar, while the Side Scan Editor is open.

For information on creating a Beam Pattern Correction file, see [“CREATE BEAM PATTERN CORRECTION FILE” ON PAGE 416](#).

Angle-Varying Gain (AVG) removes the angular response of sediment from the imagery, normalizing the mean angular intensities, with a moving average filter applied ping by ping to selected areas of data (See [“ANGLE-VARYING GAIN” ON PAGE 419](#).)

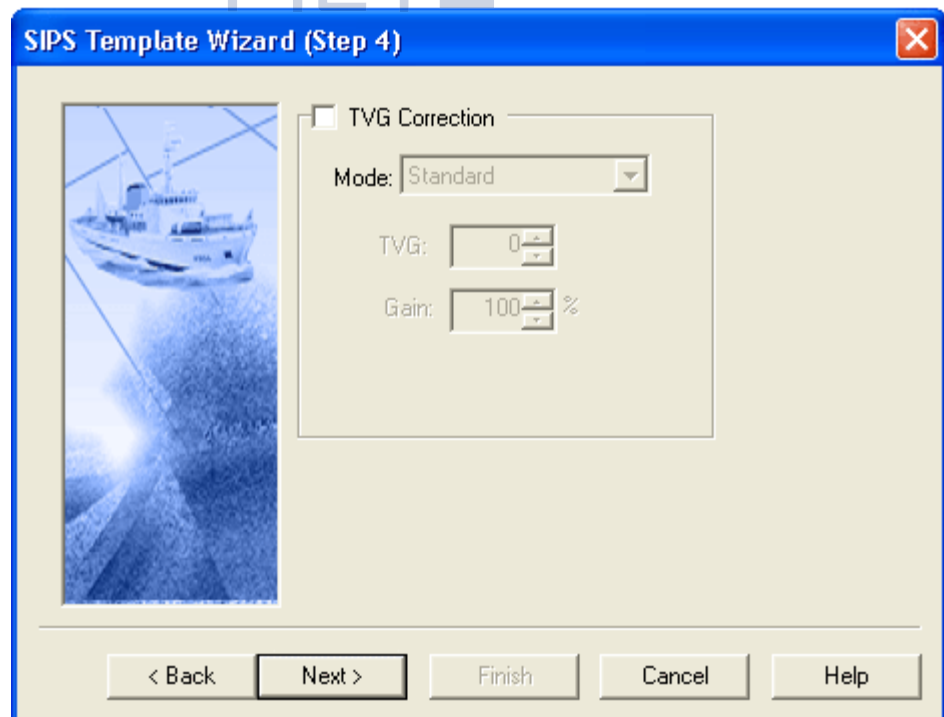
2. Select the *AVG Correction* check box to enable the process, and choose a method from the drop-down list: Trend, Flat, or Adaptive
3. Select the number of adjacent pings to include in the moving average by clicking *AVG Window Size* up or down arrow buttons.

The *Despeckle* function removes “noise” in the processed side scan image. (Noise consists of randomly scattered pixels that are brighter or darker than their neighbouring pixels). (See [“DESPECKLE” ON PAGE 421](#).)

4. Select Despeckle and select the strength from the drop-down list.

SIPS Template Wizard (Step 4)

The dialog box at step 4 when using the SIPS engine contains options for applying the time-varying gain correction.



SIPS engine

Time-Varying Gain Correction adjusts signal intensities by applying a non-uniform, time-dependent gain.

1. Select the *TVG Correction* check box to make this option active.
2. Select the Standard or Advanced modes from the *Mode* drop-down list.

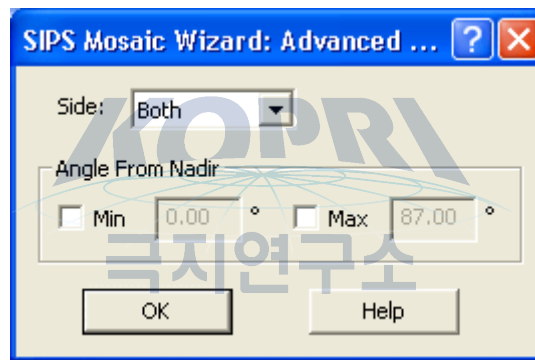
For further information, see “[TIME-VARYING GAIN](#)” ON PAGE 420.

3. Click **Next**.

Geocoder engine

If you are setting options for the Geocoder engine, the Step 4 dialog box displays options for the creation of GeoBaRs from the data. In this workflow GeoBaRs must be created, so the *Create GeoBaR* check box is automatically selected.

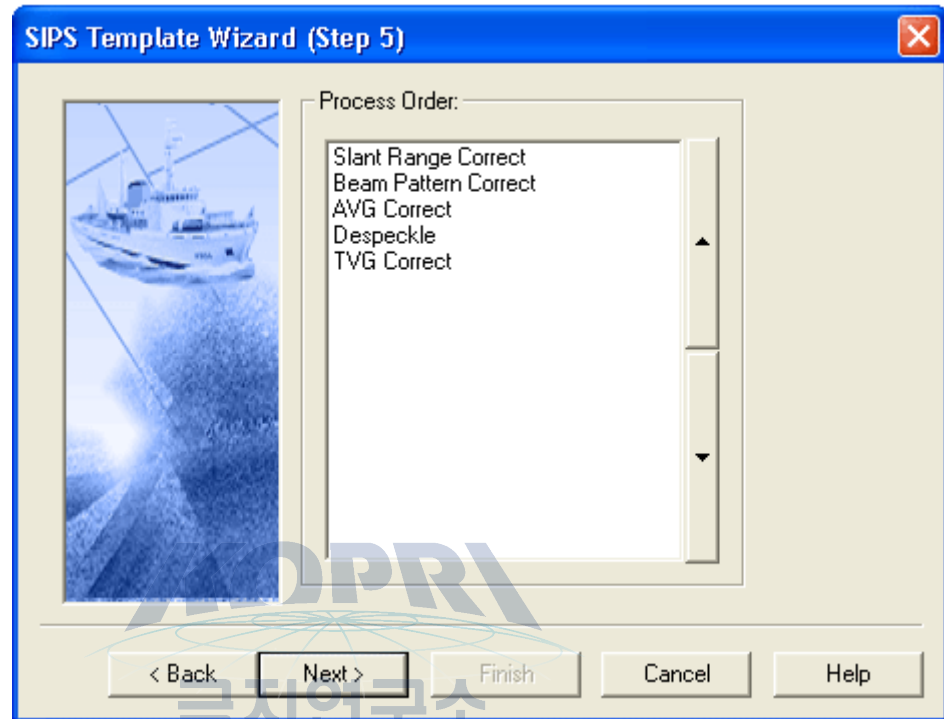
1. Type a name for the new GeoBaR.
2. Type a resolution or select *Auto* to have SIPS set the resolution for you.
3. [Optional] Select an alternate colour mapping scheme for your GeoBaR display from the drop -down list. The Preview field will show you the range of the colours in the colour map.
4. {Optional] Select Advanced



5. Click **Next** to see a summary of your options for the Geocoder engine and to save the template file.

SIPS Template Wizard (Step 5)

If you are using the SIPS engine, the next dialog box lists the order in which the options will be processed on the track line(s), and allows for this order to be adjusted.

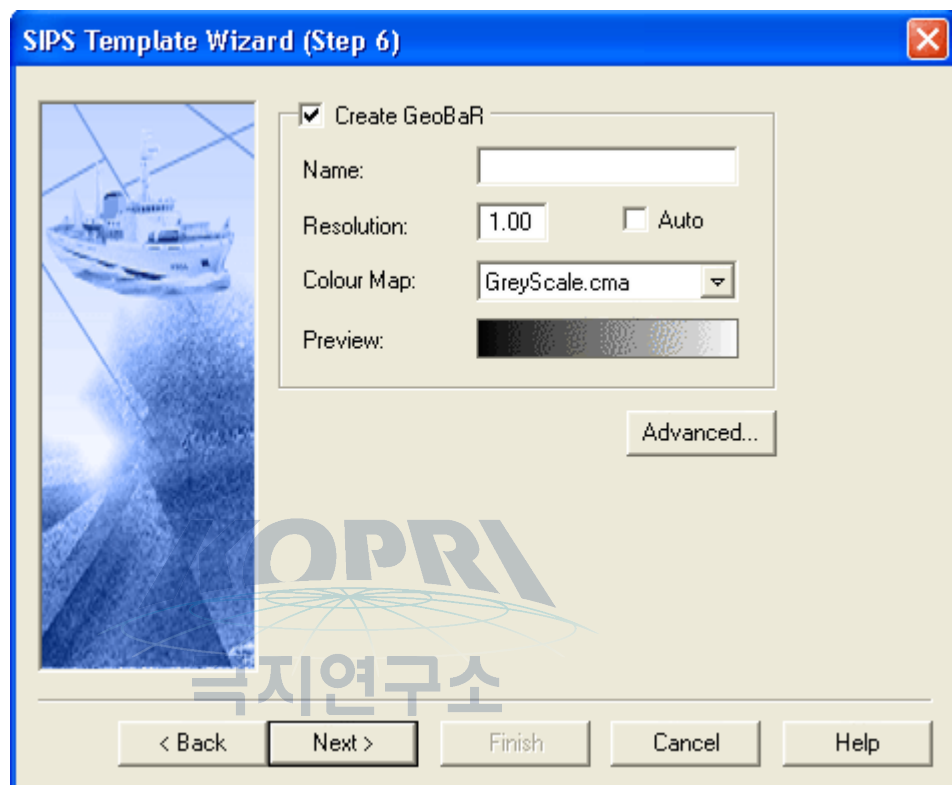


The *Process Order* list contains all options selected at the previous steps in the order that the operations will be processed on the track line.

1. If you want to change the processing order, select a correction and use the Up or Down arrow buttons to change its position in the list. The item at the top will be executed first.
2. Slant Range Correction will be executed first, if it has been included. The order of this correction cannot be changed.
3. Click **Next** .

SIPS Template Wizard (Step 6)

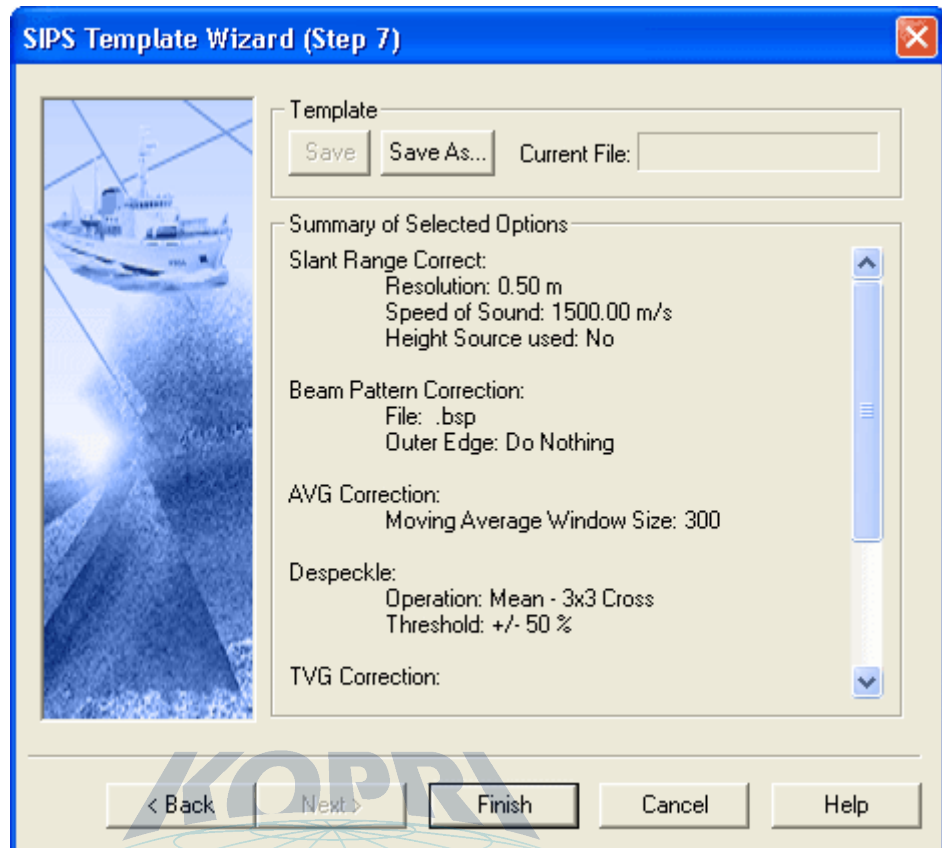
If you are creating a template for processes for the SIPS engine, this step gives you the option of georeferencing the data by having the STW create GeoBaRs after completing the listed processes.



1. Select the Create GeoBar check box to activate this option.
1. Type a name for the new GeoBaR.
2. Type a resolution or select *Auto* to have SIPS set the resolution for you.
3. [Optional] Select an alternate colour mapping scheme for your GeoBaR display from the drop -down list. The Preview field will show you the range of the colours in the colour map.
4. Click **Next** to display

SIPS Template Wizard (Step 7)

This step displays a summary of the options and associated values selected in the previous dialog boxes. These are the options which will be processed when the template file is applied.



1. Review the summary and if needed, click **Back** to get a previous dialog box to make changes.
2. If you wish to save this as a template, click **Save** to overwrite the currently loaded template file, or click **Save As** to create a new template file with these options.
3. If you do not wish to execute your template at this time, click **Cancel** to close the wizard. If you have saved your template, then your selection options will not be lost.
4. To execute the options selected in the Wizard, click **Finish**.

Once processing has commenced, clicking the **Cancel** button will not terminate immediately. The STW processing will stop once the current correction is finished processing.

21

Processing Single Beam Data

The Single Beam Editor contains data cleaning tools for data converted to HIPS from single beam echosounding surveys. The Data can be cleaned both interactively and with filters, and the display of data can be scaled horizontally and vertically, and sounding depths can be adjusted.

In this chapter...

“SINGLE BEAM EDITOR INTERFACE” ON PAGE 464

“CHANGE SOUNDING DEPTHS” ON PAGE 468

“SINGLE BEAM FILTERING” ON PAGE 472

“BARCHECK FUNCTION” ON PAGE 475

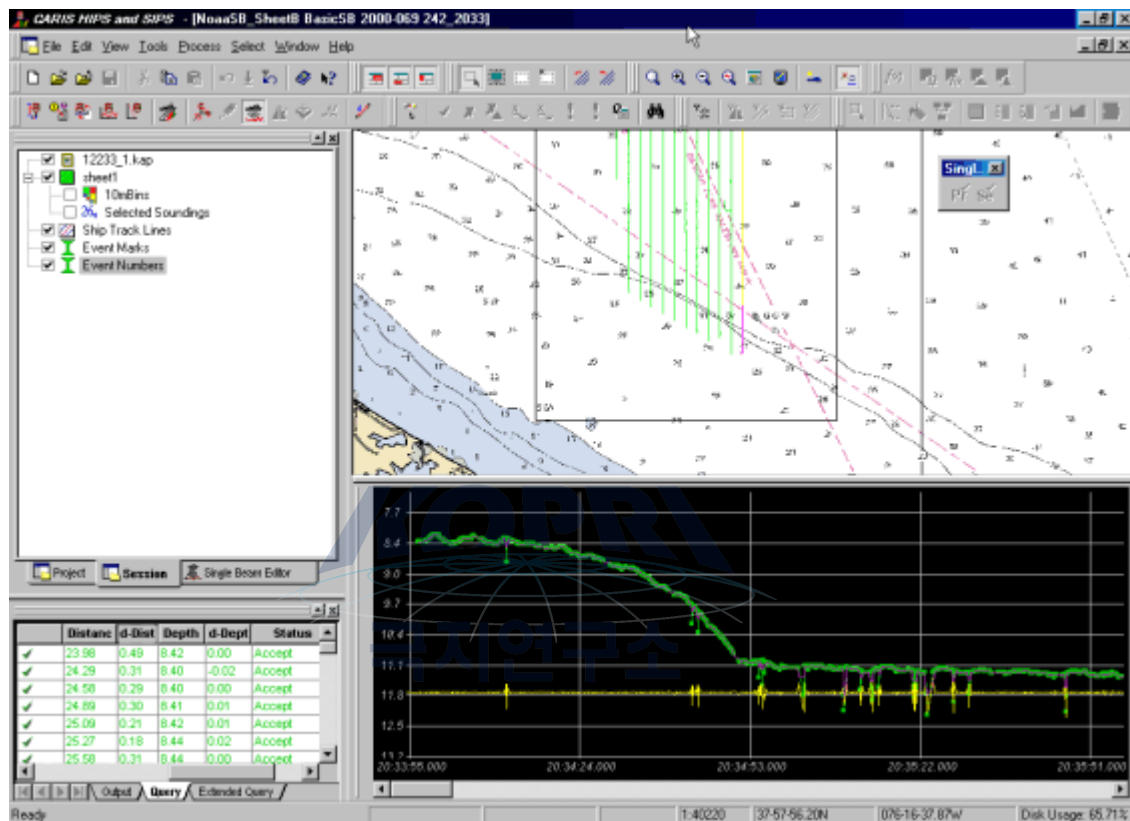
Single Beam Editor Interface

Menu	Tools > Single Beam Editor
Tool	

To open the Single Beam Editor:

1. Select a survey line in the Display window.
2. Select the Single Beam Editor command.

The Single Beam Editor is opened in the HIPS interface.



The Single Beam Editor is located (by default) below the Display window. The editor can be undocked and moved to another location like other windows in HIPS.

The display and events options are controlled from the Single Beam Editor tab in the Control window.

The soundings are shown in the editor as dots connected by lines. The horizontal scale represents distance or time. Distances are derived from the navigation data. The first sounding with an associated position is considered the start of the line. All subsequent distances are computed from this point using sounding positions interpolated from navigation data.

When the horizontal scale is by time, the sounding timestamps are used.

You can move up or down the track line by clicking the scroll bar or turning the mouse wheel (if available).

Toolbar

The Single Beam toolbar is automatically displayed when the editor is opened. This toolbar is used for selecting primary or secondary data as Selected data (see “PRIMARY AND SECONDARY DATA” ON PAGE 347). The toolbar can moved and docked in the interface like other toolbars (see “MODIFY EXISTING TOOLBARS” ON PAGE 29)



Display Options

Change horizontal scale

The range of data that is visible along the horizontal scale can be controlled by distance or time. As you increase these values more data is displayed in the editor.

The purpose is to provide a scaling method that simulates the echo sounder paper speed controls so that the digital profiles can resemble the analogue records.

1. Make sure the Control window is open.
2. In the Single Beam Editor tab, select either the *By Time* or *By Distance* option.
3. Select a range of data by clicking the *Horizontal Scale* arrow buttons.

Adjust vertical scale

The vertical scale displays the distance values. The *Auto* setting uses the maximum and minimum soundings in the current view to set the depth values for that view. As you move along the track line, the depth values change to accommodate the visible sounding data.

You can set a scale as a ratio of the vertical scale to the horizontal scale. As the ratio is increased, the vertical display of data becomes more exaggerated.

To set a vertical scale:

1. Clear the *Auto* check box.
2. Click the *Vertical Scale* arrow buttons to select an appropriate scale.

The display in the Single Beam Editor View is refreshed to accommodate the selected scale.

Adjust horizontal labels	The horizontal labels show the depth or time values at regular intervals along the survey line. The <i>Auto</i> selection spaces the labels far enough apart so you can see them clearly. You can determine the spacing you want for the labels. 1. Clear the <i>Auto</i> check box in the <i>Horizontal Labels</i> section. 2. Click the arrow buttons to select a new scale for the labels. If you select <i>By Distance</i> for the horizontal scale, then the labels are displayed as metres/feet. If you select <i>By Time</i>, the labels are displayed hours/minutes/seconds/fractions of a second. The display in the Single Beam Editor is refreshed to show the labels according to the selected settings.
Events	Event marks are commonly generated by the logging system at periodic intervals. Each event mark contains a unique identifier and time stamp. Display all event marks in a table. 1. Select the Event tab in the Control window. 2. Select the <i>Show Event Marks</i> check box. The event marks are displayed in a table format.
View moving average data	You can see the moving average data in the Single Beam Editor by selecting any of the following check boxes in the Single Beam Editor tab in the Control window. For more information on applying Moving Average filtering to single beam data, see “SINGLE BEAM CLEANING” ON PAGE 258. • <i>Data</i> graphs the raw sounding data. This box is checked by default. • <i>Moving Average</i> graphs the computed moving average from the adjacent data points as described above. • <i>Difference</i> graphs the difference between the original data values and the moving average for each data point. • <i>Thresholds</i> displays horizontal lines in the graph indicating the difference values that are rejected during filtering. Threshold is a multiple of the standard deviation (sigma).

Primary and Secondary Data

Dual frequency data can be imported through the Generic Data Parser, the Hypack converter and the Winfrog converter.

These frequencies (and the associated data) are designated as Primary or Secondary. By default, all Primary frequency data is designated as Selected. Selected data can be processed further in HIPS and other CARIS products.

Show/Hide data

1. Make sure the Single Beam Editor tab in the Control window is displayed.
2. Select or de-select the following check boxes to show or hide data. When the box is checked, the sounding data associated with that frequency is visible in the editor.
 - *Primary*
 - *Secondary*
 - *Selected*

The Single Beam Editor is refreshed to show the selected frequencies.

Select Primary/Secondary data

Although Primary data is automatically designated as Selected, you can, if needed, flag the Secondary data as Selected data. The two frequencies cannot be averaged.

1. Make sure that all frequency data is visible in the editor by selecting the *Primary*, *Secondary*, and *Selected* check boxes.
2. Press and hold the mouse button and drag the cursor to highlight both the Primary and Secondary data.
3. Select a Primary or Secondary command.

The highlighted Primary or Secondary data is now marked as Selected.

Menu	Edit > Single Beam > Primary/Secondary
Tool	 
Pop-up	Primary/Secondary
Key	<1>/<2>

Change Sounding Depths

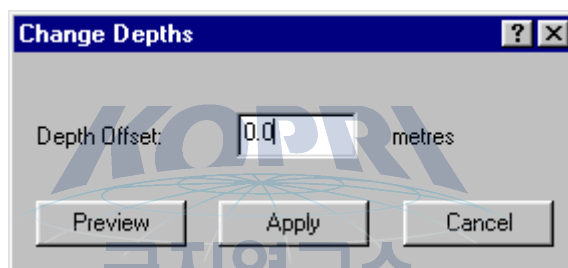
The Single Beam Editor lets you modify the digital depths created by the echo sounder's digitizer. Sometimes when fish or other obstructions in the water column trigger the digitizer, the sea bottom may still be visibly detectable on the analog sounding graph. This function lets you set the echo sounder's depth values to the analog sounding depth values.

Menu	Edit > Single Beam > Change Depths
Pop-up	Change Depths

Change Depths

1. Select the *Selected* check box, if needed.
2. Press and hold the mouse button, and drag the cursor to highlight the Selected soundings.
3. Select the Change Depths command.

The Change Depths dialog box is displayed.



The *Depth Offset* value is always set at 0.0. To move the sounding to a deeper depth level, enter a positive value (for example, 5.5). To move the sounding to a shallower depth level, enter a negative value (for example, -5.5).

4. Click **Preview** to view the sounding at the new level.
5. Click **Apply** to set the sounding at the new depth and close the dialog box.

You can also change depth values directly in the editor. This option omits the preview function of the dialog box.

1. Press and hold the mouse button and drag the cursor to highlight the Selected data sounding.

When the mouse is positioned over the selected data, the cursor becomes a two-headed arrow with a Z symbol beside it.

2. Press and hold the mouse button, and drag the cursor either up or down.

The highlighted soundings move with the cursor.

3. Release the mouse button when the soundings are at the new depth.

Add Depths

Add a new sounding by supplying time and depth. The position of the new sounding is interpolated from the existing navigation data (using the supplied time). A quality code can also be entered. If you enter a new depth, a new observed depths file and a new slant range (travel time) file is generated.

You can add depths by selecting an existing sounding and inserting a new depth or by creating a new time stamp without selecting an existing sounding.

Menu	Tools > Single Beam Editor > Add Depths
Pop-up	Add Depths

1. Select the Add Depths command.

The Worksheet window is displayed, if it is not already open.

2. Select the *Time* field and type a new timestamp value.
3. Select the *Depth* field and type a new depth value.
4. Select a new quality flag, if needed.
5. Press <Enter> to add the new depth value to the file, or press <Esc> to undo the change.

Single Beam Cleaning

Sounding data can be rejected interactively or by applying the single beam filters (see “[SINGLE BEAM FILTERING](#)” ON PAGE 472).

This section covers how to interactively reject, accept and query data in the Single Beam Editor. These processes are similar to the Swath Editor.

Reject Data

Each sounding carries several status flag switches that are turned on and off as needed. Each sounding begins with Accepted status. If rejected for any reason during processing it can be returned to Accepted status without loss of data.

A sounding rejected within the Single Beam Editor has the Rejected by Swath Editor flag turned on (the same status flag is used for both swath and single beam data).

To reject a sounding,

1. Select the data to be rejected so it is highlighted.
2. Select the Reject command.

The Rejected by Swath Editor status flag is now on and the sounding may or may not be displayed depending if the rejected data is visible.

You can show or hide rejected data. When the rejected data is turned off, these soundings are no longer visible in the Single Beam Editor.

1. Select the Show Rejected command.

Menu	Edit > Status Flag > Reject
Tool	
Pop-up	Reject
Key	<R>

Menu	View > Show Rejected
Tool	
Key	<F4>

Menu	Edit > Status Flags > Accept
Tool	
Pop-up	Accept
Key	<A>

Accept Data

Change Rejected soundings back to Accepted status.

1. Select the rejected data so it is highlighted.
2. Select the Accept command.

The soundings are now flagged as Accepted.

Query Data

View data on selected soundings.

1. Select the data to be queried.
2. Select the Query command.

Menu	Edit > Query
Tool	
Pop-up	

The following data is displayed in the Worksheet window. The data is colour coded depending on whether it is Primary, Secondary or Selected frequency data.

- Record
- Type (primary, secondary, or selected)
- Timestamp
- d-Time
- Approximate Position
- Distance
- d-Distance
- Depth
- d-Depth
- Status

Change sounding status

Once data information is displayed, you can change the status of the sounding.

1. Select the sounding data in the Worksheet window.
2. Select Accept or Reject commands.

Change sounding position

You can also change a sounding's position using the Worksheet window.

1. Select a sounding in the Worksheet window so it is highlighted.
2. Double-click the depth value.
3. Type a new depth value.
4. Click away from the highlighted area to de-select the sounding data.

Auto-Cursor Mode

The auto cursor combines the select and Accept/Reject/Query functions into a single procedure.

Menu	Edit > Auto Cursor
Tool	

1. Select the Auto Cursor command.
2. Select a Reject/Accept/Query command.
3. Press and hold the mouse button and drag the cursor over the data so it is highlighted.
4. Release the mouse button.

The data is marked as rejected/accepted or it is queried.

Single Beam Filtering

Using the Single Beam Editor you can filter single beam data converted from single and dual frequency echo sounders. This tool inherits some of the functions of the Swath Editor such as vertical exaggeration and filtering functions.

When dealing with bathymetric datasets, it is advantageous to reject outliers automatically. To do this, the Single Beam Editor has a set of filters.

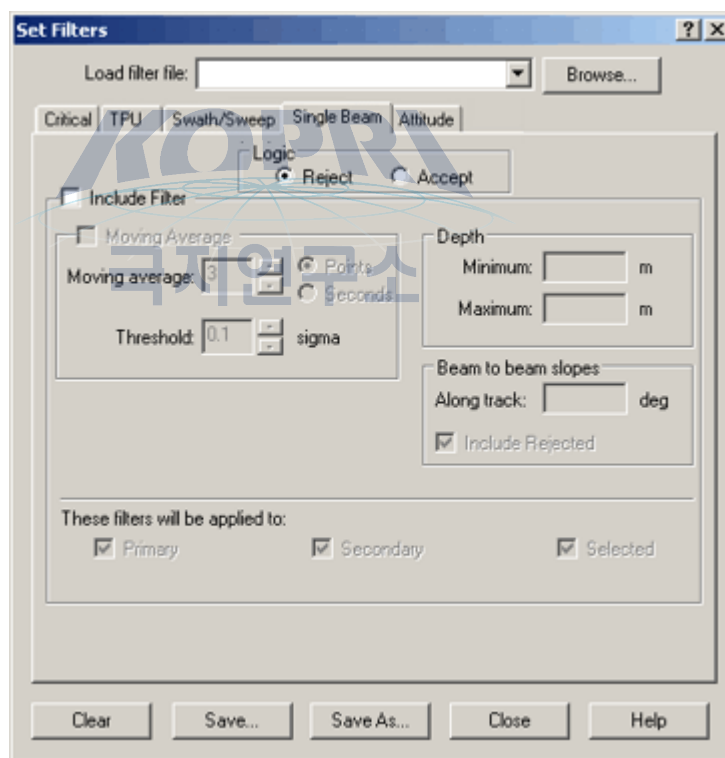
The parameters for these filters are set through the Set Filters dialog box, and saved in a HIPS Filter File (.hff) that can be reopened for use in another track line.

1. Select a track line.

Select the Set Filters command.

The Set Filters — Single Beam tab of the Set Filters dialog box is displayed.

Menu	Tools > Set Filters
Tool	



2. Make sure the Single Beam tab is displayed.
3. [Optional] Select an existing HIPS Filter File from the list or click **Browse** to select a file.

If you chose to load a filter file, all values in that file are shown in the fields. You can go to Step 7 or change any of the values.

4. Select either a *Reject* or *Accept* logic command to apply to the filtered data.

5. Select the *Include Filter* check box to activate the filtering options.
6. Select from three filtering options:
 - *Moving Average* (see “[MOVING AVERAGE FILTER](#)” ON PAGE 472)
 - *Depth* (see “[DEPTH](#)” ON PAGE 473)
 - *Beam-to-beam slopes* (see “[BEAM-TO-BEAM SLOPES](#)” ON PAGE 473)

You can define and apply more than one filter test. The filters are applied in sequence. Any data rejected by one filter is not considered in the next filter test.

7. Select the frequency to apply to the filters by making sure the appropriate box is checked.
 8. Click **Close**, or click **Clear** to remove data from the fields.
- Click **Save As** to save the settings to a filter file.

Moving Average Filter

The Moving Average Filter rejects (or accepts) data with difference values that fall outside of defined threshold limits. To view the Moving Average filtering options in the Single Beam Editor, see “[DISPLAY OPTIONS](#)” ON PAGE 465.

A moving average is calculated for each sounding (data point) by using the adjacent soundings. The amount of adjacent data is specified either as the number of points or as a time period.

1. Select the *Moving Average* check box to enable the associated fields.

Set the moving average
using seconds

This option uses a time range (in seconds) to calculate a mean average for each data point.

For example, if you select 10 seconds as the moving average, the filter calculates a mean average for any data point using itself and any data points in the five-second range either side of it.

Setting the moving
average using points

This option uses a range of adjacent data points to calculate a mean average for each data point.

For example, if the moving average is set to five data points. A mean for any data point is calculated using itself and the two data points on either side of it (if available).

2. Select how you want the moving average to be calculated by selecting either *Points* or *Seconds*.
3. Use the arrow buttons to select the number of seconds or data points.

A difference value for each sounding is calculated for each sounding from the adjacent soundings.

Thresholds

The thresholds indicate what difference values are rejected (or accepted) during filtering.

The upper threshold is determined by the following formula:

original mean value + (threshold value X the standard deviation)

The lower threshold is determined by the following formula:

original mean value - (threshold value X the standard deviation)

Select a threshold value by clicking the arrow buttons.

Depth

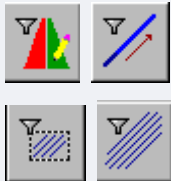
- Enter the depth values for filtering soundings. There are two options:
 - Minimum Depth*: Reject (or accept) any soundings that are shallower than the depth specified (e.g., 10 m).
 - Maximum Depth*: Reject (or accept) any soundings that are deeper than the depth specified (e.g., 50 m).

Beam-to-Beam Slopes

For each sounding, calculate the slopes, in degrees, to the previous and next soundings. If both slopes exceed the defined value and are of opposite sign, then reject the sounding.

- Enter the degree value for the slope.
- Select the *Include Rejected* option to include previously rejected soundings when recalculating the slopes during multiple runs of the filter.

Apply Filters

Menu	Tool > Apply Filters > 1 Screen/To End of Line/Selected Lines/ All Lines
Tool	

The last step is applying the automatic depth filter to the data.

- Select a Filter command to apply the criteria set by the Set Filters dialog box.

You have four options for applying the filters.

Filter 1 Screen. Apply the filters only to the soundings that are currently visible in the Single Beam Editor.

To End of Line. Apply the filters to the track line currently open in the Single Beam Editor, from the first sounding currently visible in the editor to the end of the line.

Selected Lines. Apply the filters to all of the currently selected track lines. This function does not require that the editor be open.

All Lines. Apply the filters to all track lines currently open in the Display window. This function does not require that the editor be open.

Barcheck Function

The barcheck function lets you generate a Sound Velocity Profile (SVP) file based on a list of measured depths against a list of actual depths. The file can then be used to perform sound velocity corrections.

1. Make sure the Selected data is visible.
2. In the Single Beam Editor, press and hold the mouse button and use the cursor to highlight the sounding(s).
3. Select an Add to Barcheck command.

The Add to Barcheck dialog box is displayed.

Menu	Edit > Single Beam > Add to Barcheck
Pop-up	Add to Barcheck

- The *Measured Depth* field displays the depth that was recorded by the sounder.
- The *Actual Depth* field displays the depth that was recorded by the barcheck.

If more than one sounding is selected, then a mean is calculated from the selected soundings.

4. Enter new depth values, if necessary.
5. Click **Add**.
6. Repeat Steps 2 to 5, as needed.
7. Click the Barcheck tab in the Control window.

The table shows the Measured Depth, the Actual Depth and the sound velocity.

8. If you want to delete a section, highlight it and click **Remove**.
9. Click **Save**.

The Save dialog box is displayed. The default location for the file is ..\Hips\Svp.

10. Type a name for the file and click **Save**.



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Processing Lidar Data



Overview

Light direction and ranging (Lidar) uses laser technology to measure bathymetry. In such surveys, laser wavelengths are transmitted to the water from a transceiver mounted on a plane or helicopter. Sounding data is returned to the transceiver in a continuous stream that forms a swath-like pattern.

HIPS currently supports the Laser Airborne Depth Sounder (LADS) system and the Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS) system.

Soundings are recorded in an bathymetry file. Each sounding has:

- a latitude and longitude position
- a depth value
- a timestamp
- an across-track and along-track position
- a quality flag
- a status flag.

Waveform data is also included for each sounding. This data is stored in a waveform file (see “[WAVEFORMS VIEW](#)” ON PAGE 480).

Sounding Quality and Status Flags

Quality flags

When a lidar sounding is converted into HIPS, it is given a quality flag that can be changed during processing. This table shows the quality statuses that can be attached to a sounding.

Quality Flag	Description
0	The sounding has a detected depth only. The alternative depth is invalid.
1	The sounding has both a detected and a valid alternative depth. A quality control/assurance decision has not yet been made.
2	The sounding has a detected depth and a valid alternative depth, and the user has decided to keep the detected depth.
3	The sounding has both a detected and alternative value, but the alternative value has been swapped with the detected value.

Status flags

Status flags are assigned to soundings during conversion, these status are determined from information provided by the specific acquisition format.

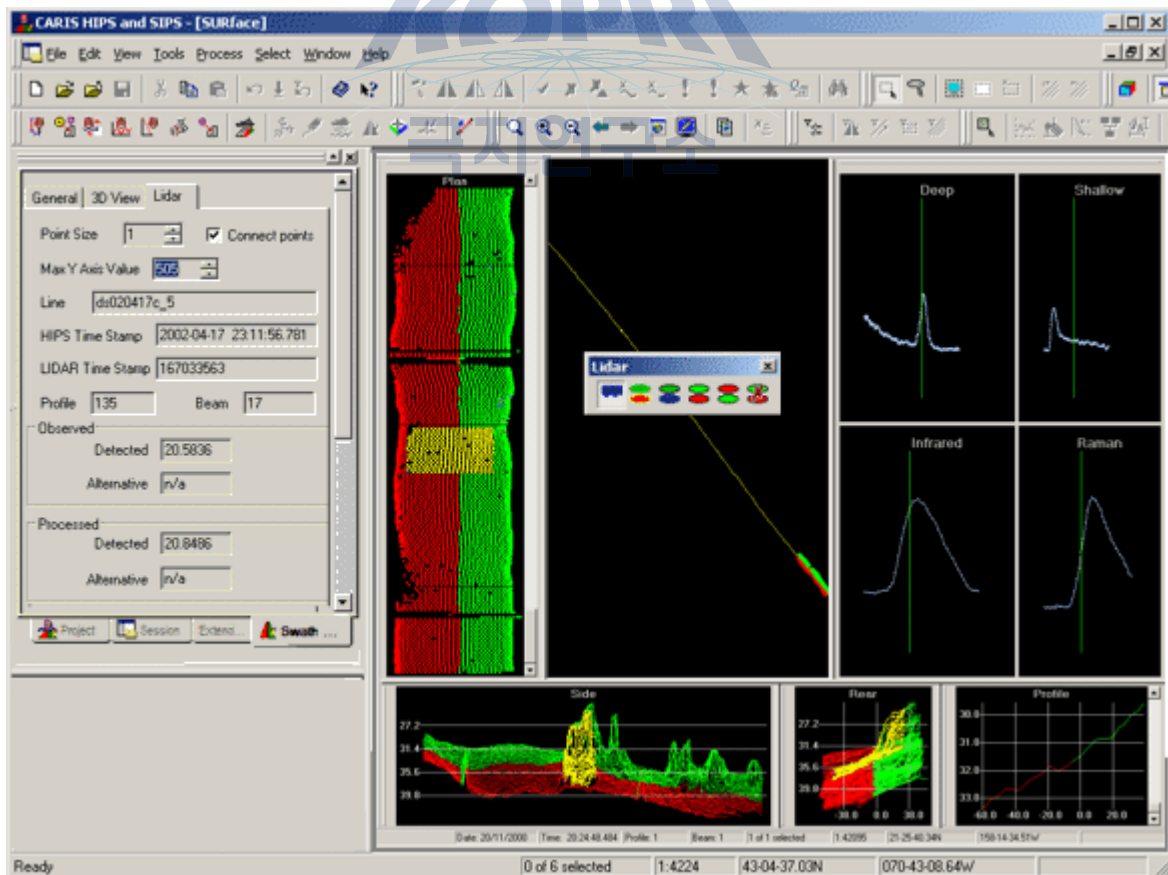
Lidar Data in HIPS

Lidar projects are organized in the same Project-Vessel-Day-Line hierarchy as sonar projects. Each project contains the following files:

- HIPS Vessel File
- an Observed Depths file (along-track and across-track sounding positions before merge)
- a Processed Depths file (lat/long sounding positions after merge)
- a bathymetry file
- a waveform file
- gyro data
- navigation data
- tide data

The default location of all the above files is ..\Hips\HDCS_Data.

To open Lidar data, see “SELECTING DATA” ON PAGE 482.



Swath Editor displaying SHOALS lidar data with the Waveform view and Lidar tab visible.

Toolbar

The Lidar toolbar controls the display and status options for soundings and associated waveform data in the Swath and Subset Editors.



This is a floating toolbar that can be moved or docked anywhere in the HIPS main window. The toolbar is not automatically displayed when the Swath Editor or Subset Editor is opened.

1. Select the Lidar Toolbar command.

Menu	View > Toolbars > Lidar
Pop-up	Lidar

Waveforms View

The Waveform view displays the waveform data for a super-selected sounding (see “[SELECTING DATA](#)” ON PAGE 482 for more information on superselection). The display in the Waveform view is determined by whether the data is in SHOALS or LADS format.

1. Select data in any of the Swath Editor or Subset Editor views.
2. Select the View Waveforms command.

The first sounding in the selection is superselected when the Waveforms window is opened.

There are four panels in the view. Each panel shows a graph of specific waveform data for the superselected sounding. The X axis represents time and Y axis represents amplitude.

The LADS waveform window contains one panel that shows a graph of specific waveform data for the superselected sounding. One line represents the detected depth sounding and the other line represents the alternative depth sounding (if applicable).

To view the complete waveform for SHOALS data, the Y-axis scale may have to be increased. The default value is 255.

1. Click the *Max Y-Axis Value* up or down arrow buttons until the entire wave form is within view.

Menu	Edit > Lidar > View Waveforms
Tool	

SHOALS

LADS

Point display

The points that describe the waveform graphs can be increased or decreased.

1. Select the Lidar tab in the Control window if it is not already displayed.
2. Click the *Point Size* up and down arrow buttons.

As the value changes, the displays in the four windows are redrawn to show the points at the selected size.

3. To draw a line through the points in the view, select the *Connect Points* check box.



Selecting Data

Open data

Menu	View > Toolbars > Lidar
Pop-up	Lidar

Menu	Edit > Lidar > View Waveforms
Tool	

Lidar data can be viewed and cleaned in the Swath and Subset Editors.

1. Open either the Swath Editor or the Subset Editor.
2. Select the Lidar Toolbar command.

The Lidar toolbar is visible.

3. Select the View Waveform command.

The Waveforms window (see [“WAVEFORMS VIEW” ON PAGE 480](#)) is displayed and the Lidar tab is displayed in the Control window. No data is visible in the Waveforms window yet.

There are two levels of selection in Lidar mode: regular selection and superselection.

- Selection refers to all highlighted soundings in any of the Views.
- A superselected sounding is a subset of the selected soundings and is highlighted in a different colour from the regular selection. When a group of soundings are selected, the first in the selection (i.e. the lowest beam and profile number) is automatically super-selected.

All selected soundings can be queried or rejected, but you can only view waveform data and sounding attributes for a superselected sounding. Make sure that the Waveforms window is displayed. When this window is closed, the superselection option is inactive.

4. Choose an Editor Selection mode (see [“QUERY LINE DATA” ON PAGE 6-148](#)). The Edit By Range option is selected by default.
5. Select data in any of the views.

The data is highlighted in the selection colour determined in the Options dialog box (see [“LIDAR” ON PAGE 665](#)). The superselected sounding is displayed in the Plan View (Swath Editor) and the 2-D and 3-D Views (Subset Editor).

The waveform data for the superselected sounding is displayed in the Waveforms window.

The following attributes for superselected sounding are displayed in the Lidar tab in the Control window:

- *HIPS Time Stamp*: Year-Month-Day-Hour-Minute-Seconds-Milliseconds.
- *LIDAR Time Stamp*: Half milliseconds since midnight (SHOALS only).
- *Profile number*: The along-track position of the sounding
- *Beam number*: The across-track position of the sounding.

- *Detected depth*: If this depth is selected for the Observed Depth file (depths prior to merge), then an asterisk is displayed beside the field.
- *Alternative depth*: If this depth is selected for the Observed depth file (depths prior to merge), then an asterisk is displayed beside the field.
- *Processed depth*: The depth value for the sounding after the Merge process
- *Confidence value*: The confidence value for the sounding (SHOALS only).
- *Tide*: Tide data for the sounding. Data must be merged before this value can be displayed.
- *Status*: Current status flag for the sounding.

You can use the Lidar tab to superselect a neighbouring sounding.

6. To view another sounding in the current selection, click the **Next** or **Previous** button in the Lidar tab of the Control window. This moves you to the next or previous selected sounding by ping and beam number.

The graphs in the Waveforms dialog box is refreshed to show the new data and the new superselected sounding's attributes are shown Lidar tab data fields.

Find sounding

You can also super select soundings by locating it by the time stamp (SHOALS data only).

1. Type the Lidar time stamp in the *Time Stamp* field.
2. Click **Find**.

The sounding with that time stamp is highlighted as super selected and the sounding data is displayed in the Lidar tab fields.

Superselect data in the Worksheet window

Queried data can also be superselected.

1. Select data in any of the views.
2. Select the Query command.

The selected data is displayed in the Query tab of the Worksheet window.

3. To superselect a sounding, click a row so it is highlighted.

The beam is highlighted as superselected in the Plan View.

Menu	Edit > Query
Tool	
Pop-up	Query
Key	<Q>

Selecting Detected and Alternative Data

In some instances, two depth values (detected and alternative) are returned. You can decide which depth value is most relevant and change the sounding's quality flag accordingly (see [“SOUNDING QUALITY AND STATUS FLAGS” ON PAGE 478](#)).

Depth values can be selected and changed in both the Swath Editor and the Subset Editor.

Highlight alternative soundings

Menu	Edit > Lidar > Highlight Alternative Depths
Tool	

This command highlights soundings that contain valid alternative depths. It does not select or superselect soundings.

1. Select the Highlight Alternative Depths command. This command highlights only data in the Plan View.

Soundings with a Quality flag of 1, 2, or 3 are highlighted in colour that is selected in the Options dialog box (see [“LIDAR” ON PAGE 665](#)).

You can select from three options.

This command refreshes the display so that the alternative depths for soundings with a Quality 1 flag are shown. This is a useful tool for viewing the position of alternative depths in relation to neighbouring soundings.

1. Select the View Alternative Depths command.

The data in the Views refresh to display the alternative soundings.

View all alternative depths

Menu	Edit > Lidar > View Alternative Depths
Tool	

Swap to alternative

Menu	Edit > Lidar > Swap to Alternative
Tool	

This command applies an alternative depth in a superselected sounding to the detected depth. With SHOALS data, the depth is swapped, and with LADS data, the depth and position are swapped.

1. Select soundings and super select a sounding with a Quality 1 flag.
2. Select the Swap to Alternative command.

An asterisk beside the depth value indicates whether the detected or alternative depth is currently in the HIPS depth file.

Keep detected

Menu	Edit > Lidar > Keep Detected
Tool	

This command is used to verify that the detected depth is preferred over the alternative depth. The Quality flag is changed to 3. (see “[SOUNDING QUALITY AND STATUS FLAGS](#)” ON PAGE 478).

1. Select soundings and super select a sounding with a Quality 3 flag.
2. Select the Keep Detected command.



Cleaning Sounding Data

Reject Data

Soundings can be assigned an Rejected by Disabling Sounding flag. These soundings are not included in the merge or any post-processing operations. Data can rejected in the Swath and Subset Editors.

1. Select a sounding or group of soundings.
2. Select the Reject by Disabling Sounding command.

The soundings are now flagged as rejected.

Menu	Edit > Lidar > Reject by Disabling Sounding
Tool	

Accept data

You can return soundings to the accepted status.

1. Select the Show Rejected command so the disabled soundings are visible.
2. Select the soundings.
3. Select the Accept command.

Menu	View > Show Rejected
Tool	
Key	<F4>

Menu	Edit > Status Flag > Accept
Tool	
Pop-up	Accept
Key	<A>

23

Batch Processing

Batch processing automates what could otherwise be labour-intensive or time-consuming processing by combining a number of tasks into a single batch file that can be reopened and used on multiple track lines.

The batch processing function is available in all licensing levels of HIPS and SIPS, but the processing options available are determined by the processing functions contained with the license.

In this chapter...

“RUNNING THE BATCH PROCESSOR” ON PAGE 488

“OPEN AN EXISTING HBP FILE” ON PAGE 489

“CREATE A NEW HBP FILE” ON PAGE 489

“SET UP A PROCESS” ON PAGE 490

“PROCESS DATA” ON PAGE 491

“BATCH PROCESSOR TASKS” ON PAGE 492

Running the Batch Processor

The workflow for using the HIPS Batch Processor is simple: select the tasks you want to apply as a batch process, save the file then process the data with the Run command.

Open Batch Processor

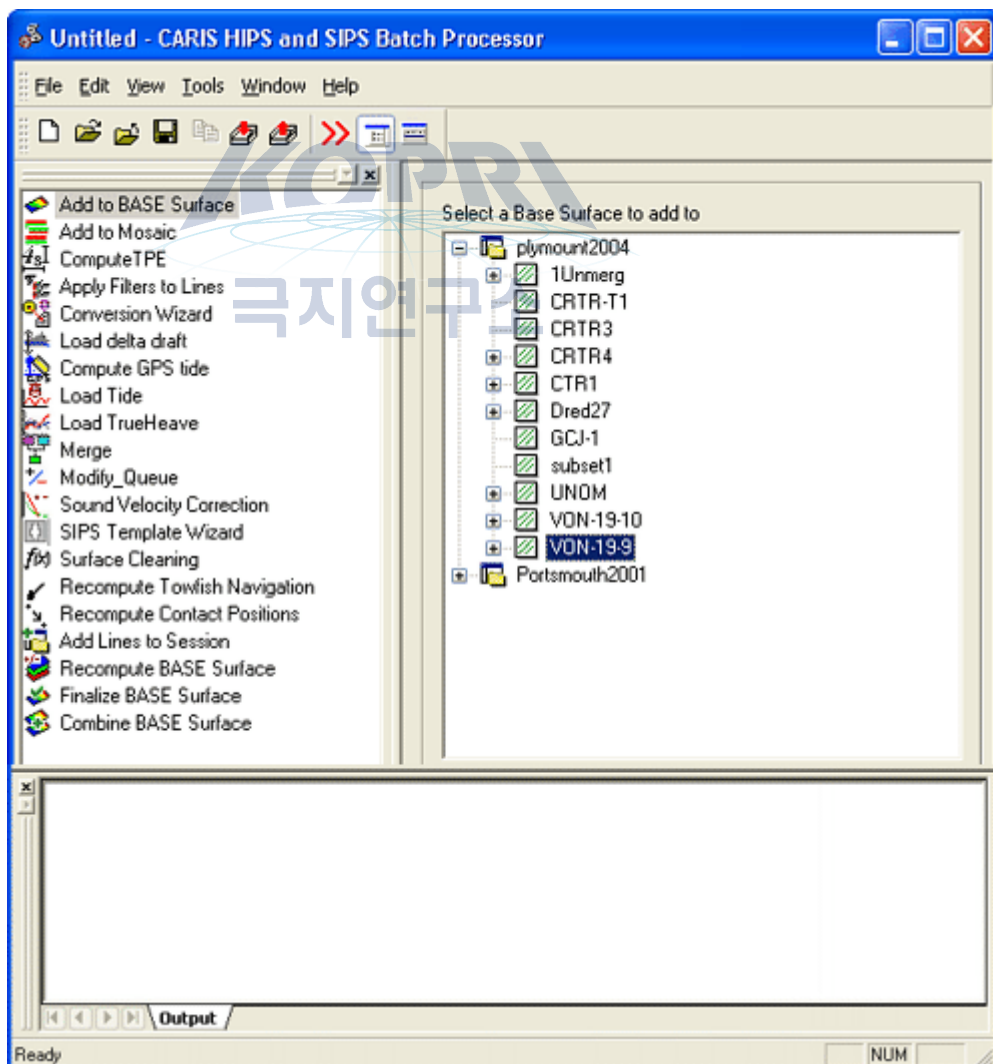
Batch Processor is a separate application that is opened from the HIPS and SIPS interface.

1. Select the Batch Processor command. You do not have to have a project or session file open in HIPS and SIPS.

The Batch Processor is opened.

The following image shows the Batch Processor with a complete list of tasks.

Menu	Tools > Batch Processor
Tool	



When the processor is first opened, it is ready to create a new HBP file.

The Batch Processor contains three windows.

- The window on the left is the process list, containing the tasks that have been activated to be run in the batch processor. See [“SET UP A PROCESS” ON PAGE 490](#)
- The window on the right displays the options associated with each selected task. See [“BATCH PROCESSOR TASKS” ON PAGE 492](#)

The window on the bottom displays the results of the processing operation.



Batch Processing files

All data entered into the batch processor is saved in a HIPS Batch Processing File (HBP) file. HBP files are in XML format and can be viewed in any text editor or XML-compliant browser. Batch processing files are saved in ..\Hips\Session and can only be used in the Batch Processor.

Create a New HBP File

Menu	File > New
Tool	
Key	<Ctrl+N>

When the Batch Processor is first opened, it is ready to create a new HBP file. If a HBP file is already open and you select the New File command, any previously open file is closed, and the Processor is reset for the new file.

1. Select the New File command.

A new file is ready to be modified in the Batch Processor.

Menu	File > Save/Save As
Tool	
Key	<Ctrl+S>

Save/Save As

1. In the Batch Processor interface, select a Save command to save a HBP file for the first time or save an existing file under a new name.

All files are saved to ... \Hips\Session.

Menu	File > Open
Tool	
Key	<Ctrl+O>

Open an existing HBP File

1. In the Batch Processor interface, select the Open File command.

The Open dialog box is displayed.

2. Select a file and click **Open**.

The file is displayed in the Batch Processor.

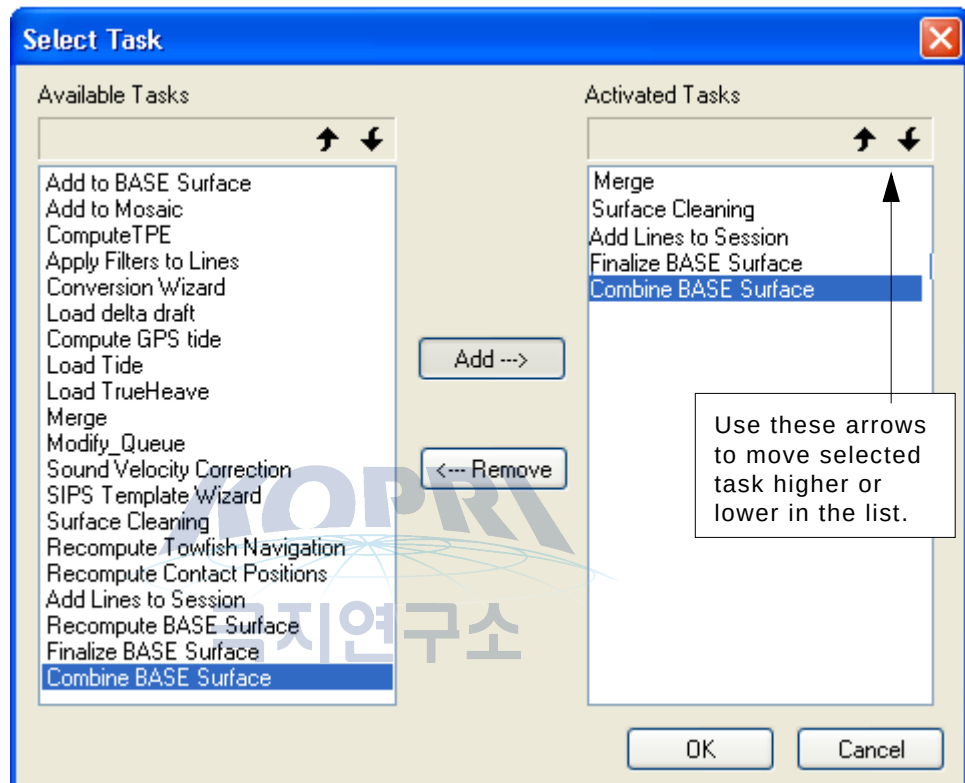
Set up a Process

Menu	Tools > Add Process
Tool	

A process is a specific order of activated tasks that are run through the Batch Processor. Each process is saved to the current HBP file. To add a task to your process list

1. Select the Add Process command.

The Select Task dialog box is displayed.



2. Select tasks for the process in three ways:

- Select an individual task so it is highlighted.
- Select a group of tasks by holding the <Ctrl> key and clicking each of the required tasks. The selected tasks are highlighted.
- Select a range of tasks by holding the <Shift> key and clicking the first and last tasks in the range. All tasks in between are highlighted.

The list of tasks in Activated Tasks must be in the same order as the workflow in HIPS&SIPS, e.g., Sound Velocity Correction must be listed before the Merge task, and Compute TPU after Merge, and so on.

3. Click **Add** to move the selected tasks from the *Available Tasks* list to the *Activated Tasks* list, or double-click to move the task(s) to the *Activated Tasks* list.

4. Change the order that tasks are listed in the process using two methods:
 - Highlight a task, and click the arrow buttons to move the task to a new position on the list.
 - Highlight the task and press and hold the mouse button to drag it to another location on the list.
5. To remove one or more tasks, select a task in *Activated Tasks* list using any of the three methods in Step 2 and click **Remove**, or double-click the list to move the task(s) to the *Available Tasks* list.
6. Click **OK**.

Menu	Tools > Rename Process
Pop-up	Rename Process

The selected tasks are shown in the *Process List* in the Batch Processor interface.

7. To give a process a different name, select the Rename Process the command.
8. The process name is now ready to be edited in the Process List window. Type a new name for the process.
9. To remove a task from the *Process List*, highlight the task and select the Remove Process command.
10. To move a task to a new position in the *Process List*, highlight the task and press and hold the mouse button to drag it to another location on the list.
11. Select a task to view the options associated with it.

Menu	Tools > Remove Process
Tool	

The options associated with the task are displayed in the right side of the interface. You will notice that many of the options resemble the dialog boxes used in the main HIPS interface.

12. Fill in as many task options as necessary (see “[BATCH PROCESSOR TASKS](#)” ON PAGE 492).

Menu	Tools > Run
Tool	

Process Data

1. Select the Run command.

When the Run command is selected, you are prompted to save the batch processor file if you have not done so already.

2. Save the Batch Process file.

The results of the Run process are displayed in the Output tab of the Worksheet window.

Batch Processor Tasks

When a task in the Process List is highlighted, the options associated with it are displayed in the right side of the Batch Processor window.

To find more information on any of the following tasks, click a link in the Reference column.

Batch Processor Task	HIPS and SIPS Command	Toolbar Button	Reference
Add to BASE Surface	Process > BASE Surface > Add to...		“ADD TO BASE SURFACE” ON PAGE 242
Apply Filters to Lines	Tools > Apply Filters		“TPU FILTERING” ON PAGE 203 “SWATH FILTERING” ON PAGE 322 “SINGLE BEAM FILTERING” ON PAGE 472 “ATTITUDE FILTER” ON PAGE 284 “FILTER CRITICAL SOUNDINGS” ON PAGE 298
Combine BASE Surfaces	Process > BASE Surface Combine	—	“COMBINE” ON PAGE 248
Compute GPS Tide	Process > Compute GPS Tide	—	“GPS TIDE” ON PAGE 741
Compute TPU	Process > Compute TPU		“COMPUTE TPU” ON PAGE 202
Conversion Wizard	File > Import > Conversion Wizard		“CONVERTING FILES TO HIPS/SIPS FORMAT” ON PAGE 132
Finalize Surface	Process > BASE Surface > Finalize	—	“FINALIZE BASE SURFACE” ON PAGE 247
Load Delta Draft	Process > Load Delta Draft	—	“DELTA DRAFT” ON PAGE 191
Load Tide	Process > Load Tide		“LOAD TIDE” ON PAGE 176
Load TrueHeave	Process > Load TrueHeave		“TRUEHEAVE DATA” ON PAGE 287

Batch Processor Task	HIPS and SIPS Command	Toolbar Button	Reference
Merge	Process > Merge		"MERGE" ON PAGE 185
Recompute BASE Surface	Process > BASE Surface > Recompute		"RECOMPUTE SURFACE" ON PAGE 244
Recompute Contact Position	Process > Recompute Contact Position	—	"RECOMPUTE CONTACT POSITIONS" ON PAGE 450
Recompute Towfish Navigation	Process > Recompute Towfish Navigation	—	"RECOMPUTE TOWFISH NAVIGATION" ON PAGE 406
SIPS Template Wizard	Process > SIPS Template Wizard		"SIPS TEMPLATE WIZARD" ON PAGE 451
Sound Velocity Correction	Process > Sound Velocity Correction		"SOUND VELOCITY PROCESSING" ON PAGE 170
Surface Cleaning	Tools > Surface Cleaning		"STATISTICAL SURFACE CLEANING" ON PAGE 307

24

Create Publications

Use Plot Composer 5.1 or other publishing utilities to print HIPS and SIPS products to PDF or paper.

In this chapter... 극지연구소

Publication Utilities

HIPS and SIPS data can be formatted for printing to paper or Portable Document Format (PDF) with:

- **CARIS Plot Composer** is an easy-to-use, comprehensive plotting tool kit that can efficiently produce paper products to illustrate raster and vector geospatial information. Plot Composer can use the data from other CARIS products such as Bathymetry DataBASE, in formats such as GeoTIFF, BSB, JPEG 2000, S-57, Shapefiles, AutoCAD, as well as HIPS and SIPS data to produce paper products.
- the **Publish** command, which is supported by the CARIS Publication Designer and Template Editor.
 - Publication Designer is used for building or modifying templates. Dictionary files can be opened in the Publication Designer and tags from those files inserted into the template. Other elements such as images or text can also be added.
 - Template Editor is used for creating or modifying borders, projected grids, and scale bars that can be opened with the template.

Each of these publishing utilities can be opened from Start > Programs > CARIS > Utilities. All of these utilities include reference guides and help files to assist you with these applications.

Plot Composer

Plot Composer is a comprehensive and intuitive plotting toolkit provided as a utility with various CARIS products. It provides the ability to efficiently produce paper products that illustrate raster and vector geospatial information.

Some of Plot Composer's key functions are:

- Capturing application data views in GeoTIFF format through close integration with parent CARIS applications such as HIPS and SIPS
- Configuring data and adding raster and vector data formats supported by CARIS applications in Viewports
- Adding geographic or grid/projection borders to data
- Configuring data views to be *north-up* or rotated
- Arranging plot object draw order, alignment or dimensions with the click of a button
- Adjusting the data display with dynamic pan, zoom, layer and property controls
- Adding plot markups, such as labels, lines and shapes
- Saving custom plot templates to reuse whenever necessary
- Printing the plot with any configured printer/plotter

This is an ideal utility for individuals and organizations that compile and manage geospatial information.

Plot Composer is shipped with HIPS and SIPS and a full description of its function can be found in the Plot Composer User Guide or help files.

To open Plot Composer:

1. Select Plot Composer from the Start > All Programs > CARIS > Utilities menu.

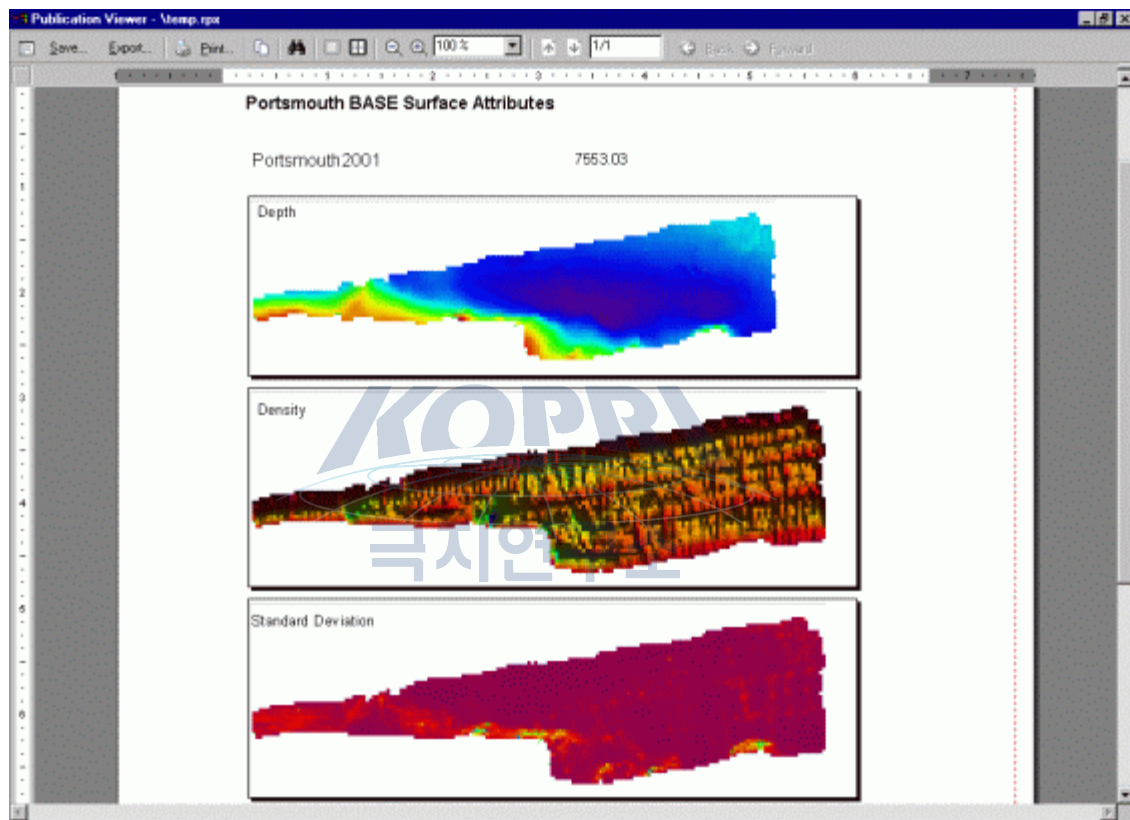
Publish command

Menu	View > Publish
Tool	

1. Open field sheet data in HIPS and SIPS.
2. Select Publish from the View menu.

The Publish command opens template files (RPX files) created in the CARIS Publication Designer. Adjust your output, then view your finished publication in the Publication Viewer, and copy, print or export it.

HIPS and SIPS data is displayed in the Publication Viewer.



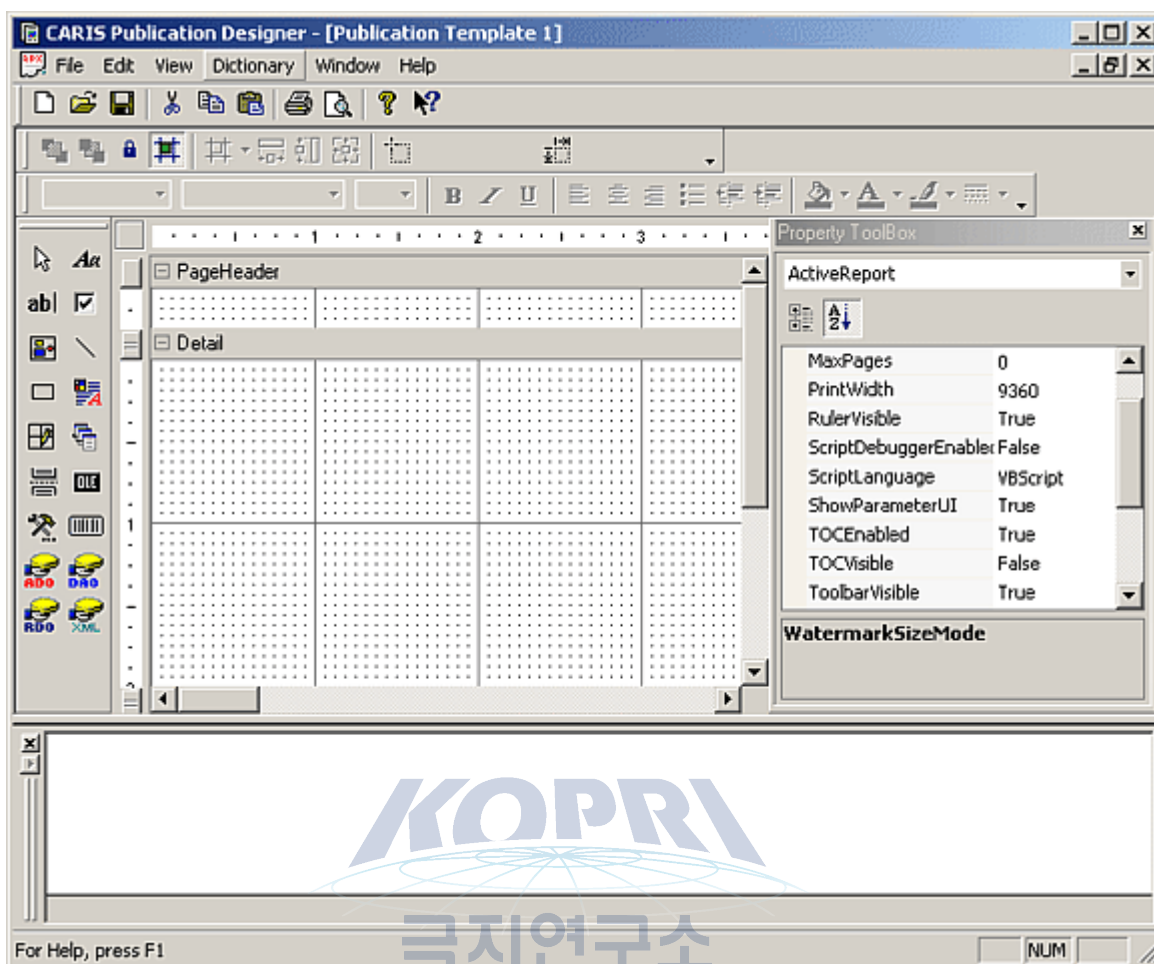
Publication Designer

Use the Publication Designer to build or modify templates. Open dictionary files in the Publication Designer and insert tags from those files into the template. Other elements such as images or text can also be added for visual effect.

To open the Publication Designer

1. Select Publication Designer from the Start > Programs > CARIS > Utilities menu.

The Publication Designer interface is displayed.



For more information, see the CARIS Publication Designer Users Guide that can be opened from Start > All Programs > CARIS > Utilities > Documentation, or the help that is available in the application.

Template Editor

The Template Editor defines borders, scale bars, and projected grids that can be saved and applied when creating templates for publication.

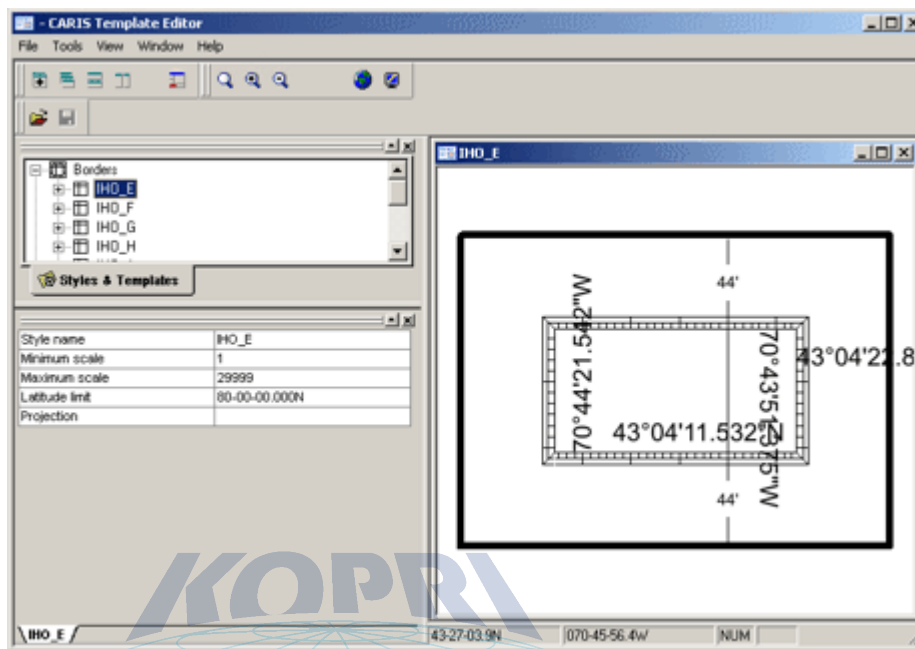
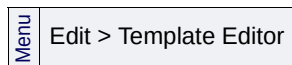
Template Editor files can be saved using any name with the following file extensions.

Template Component	File Extension
Borders	.bsd
Scale Bar	.ssd
Projected Grid	.grd

Default templates are stored in the ..\System directory where HIPS is installed. Your customized template files can be stored in any directory you choose

1. Select the Template Editor command.

The Template Editor is displayed.



For more information, see the CARIS Template Editor Reference Guide that can be opened from Start > All Programs > CARIS > Utilities > Documentation, or the help that is available in that application.

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Export Data

Sounding and contour layers can be exported to S-57 format. As well, data products can be exported in various formats with the Export Wizard.

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- "FORMATS EXPORTED" ON PAGE 503
- "EXPORT WIZARD" ON PAGE 505
- "BAG TO ASCII" ON PAGE 508
- "BASE SURFACE TO ASCII" ON PAGE 509
- "BASE SURFACE TO BAG" ON PAGE 511
- "BASE SURFACE TO IMAGE" ON PAGE 513
- "CONTACTS" ON PAGE 514
- "GSF TO CARIS MAP/HOB" ON PAGE 517
- "HIPS TIDE TO ASCII" ON PAGE 521
- "HIPS TO ASCII" ON PAGE 522
- "HIPS TO CARIS MAP" ON PAGE 525
- "HIPS TO FAU" ON PAGE 529
- "HIPS TO GSF" ON PAGE 530
- "HIPS TO HOB" ON PAGE 531
- "HIPS TO HTF" ON PAGE 533
- "SIPS TO UNISIPS" ON PAGE 536
- "MOosaic To IMAGE" ON PAGE 537
- "PROJECTION" ON PAGE 539
- "EXPORT" ON PAGE 540

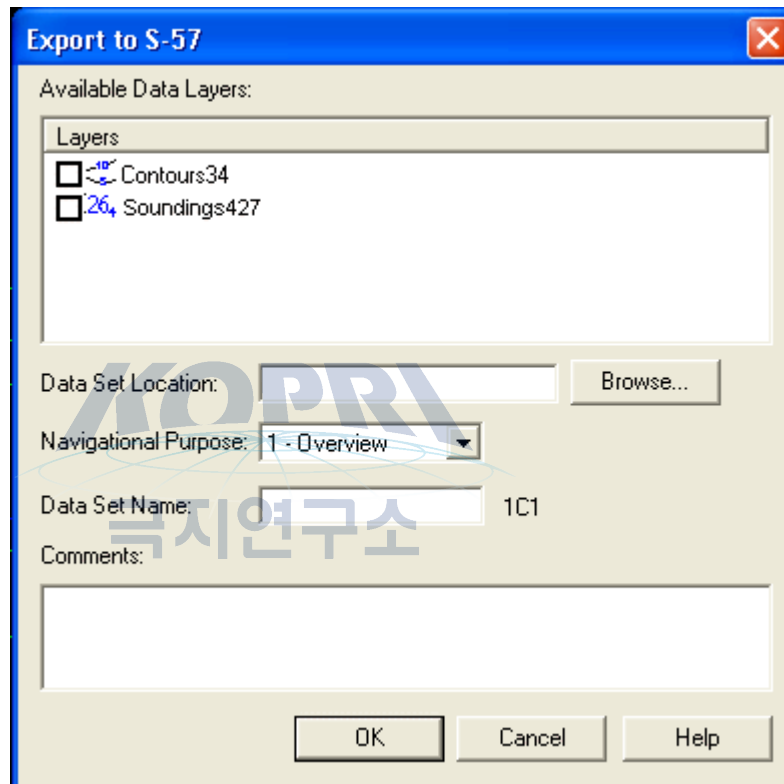
Export to S-57

You can export contour and sounding features to an S-57 file.

To export to S-57:

1. Open a project and field sheet containing a contour layer and or a contour layer.
2. Select the field sheet layer in the Layers tab.
3. Select Export to S-57 from the File menu.

The Export to S-57 dialog box opens.



4. Select a data layer to export.
5. Type the full path or click **Browse...** to enter the full path to the data.
6. Choose a Navigational Purpose layer from the drop-down list.
7. Type a data set name for the file.
8. Click **OK**.

Formats Exported

The HIPS Export Wizard is a separate application launched from the HIPS and SIPS interface. The Export Wizard converts HIPS data products (soundings, BASE Surfaces, mosaics, etc.) to the following formats:

- ASCII text file
- CARIS map
- Bathymetric Attributed Grid (BAG)
- (FAU)
- Generic Sensor Format (GSF) files
- Hydrographic Object Binary (HOB) file
- Hydrographic Transfer Format (HTF) files
- TIFF image
- Unified Sonar Imaging Processing System (UNISIPS) format

See the table below to view export options.

Export Formats

Format	Description	Refer to...
BAG to ASCII	Export data in Bathymetric Attributed Grid format to ASCII format	"BAG TO ASCII" ON PAGE 508
BASE Surface to ASCII	Export BASE Surface position and attribute data to a text file.	"BASE SURFACE TO ASCII" ON PAGE 509
BASE Surface to BAG	Export BASE Surface elevation and uncertainty values to Bathymetric Attributed Grid (BAG) file	"BASE SURFACE TO BAG" ON PAGE 511
BASE Surface to Image	Export BASE Surface attribute data as a georeferenced image for further processing in a CARIS product or other application.	"BASE SURFACE TO IMAGE" ON PAGE 513
Contacts	Export contacts to a CARIS map, an ASCII file, and/or a TIFF image.	"CONTACTS" ON PAGE 514
GSF to CARIS	Export soundings and tracklines from one or more Generic Sensor Format (GSF) files to a CARIS map. The GSF data does not have to be converted to HIPS format prior to using this utility.	"GSF TO CARIS MAP/HOB" ON PAGE 517
GSF to HOB	Export GSF data to a Hydrographic Object Binary (HOB) file that stores feature objects and associated attribute data. The HOB file can contain links to CARIS spatial objects.	"GSF TO CARIS MAP/HOB" ON PAGE 517
HIPS Tide to ASCII	Export tide data from track lines to text format.	"HIPS TIDE TO ASCII" ON PAGE 521
HIPS to ASCII	Export HIPS data to a customized text listing of soundings that you can load into other software systems.	"HIPS TO ASCII" ON PAGE 522

Format	Description	Refer to...
HIPS to CARIS	Export HIPS data to a CARIS map. This option contains three modes of exporting data: soundings, tracklines and swaths.	"HIPS To CARIS MAP" ON PAGE 525
HIPS to FAU		
HIPS to GSF	Export processed HIPS data to GSF format. A new GSF file is created for each trackline that is exported from HIPS. Conversely, when HIPS data is created from GSF data, a copy of the original GSF file is maintained inside the HIPS directory structure. The Export to GSF function updates these GSF files.	"HIPS To GSF" ON PAGE 530
HIPS to HOB	Export HIPS data to HOB files that store feature objects and associated attribute data. The HOB file can contain links to CARIS spatial objects. This option contains three modes of exporting data: soundings, tracklines and swaths.	"HIPS To HOB" ON PAGE 531
HIPS to HTF	Export data to a Hydrographic Transfer Format (HTF) file. The HTF is a text file that contains a header section and a sounding record. The Export wizard can save a header section so it can be loaded into multiple HTF files.	"HIPS To HTF" ON PAGE 533
SIPS to UNISIPS	Export SIPS data to a Unified Sonar Imaging Processing System (UNISIPS) format.	"SIPS To UNISIPS" ON PAGE 536
Mosaic to Image	Export a mosaic as a TIFF image for further processing in a CARIS product or other application.	"MOosaic To IMAGE" ON PAGE 537

Export Wizard

The first step to exporting data with the Export Wizard is to select the file format to be exported. The number of dialog boxes displayed in the subsequent steps depends on the export format selected in the Step 1 dialog box.

Menu	File > Export
Tool	

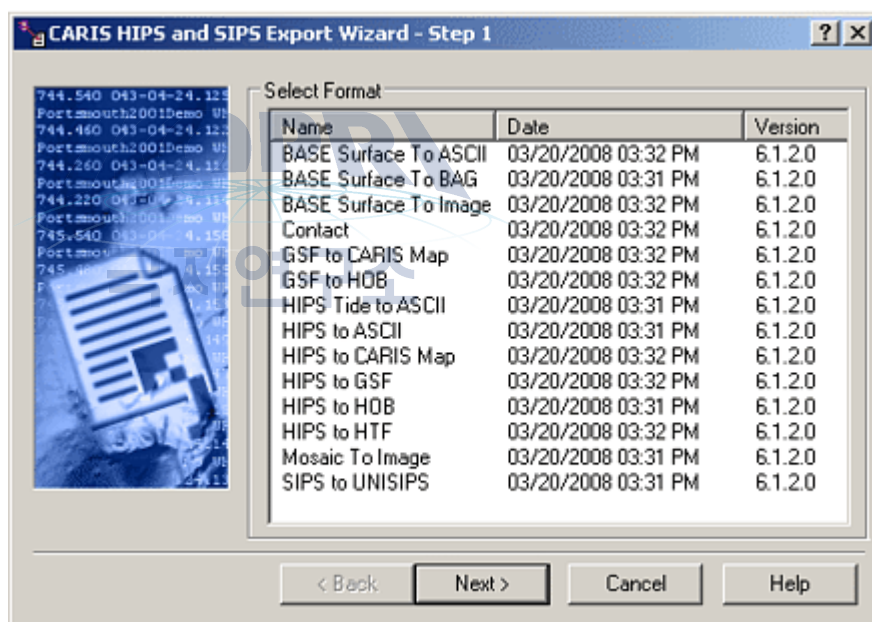
To use the HIPS Export Wizard:

1. Select the Export command.

The Export Wizard is displayed.

Step 1: Select Format

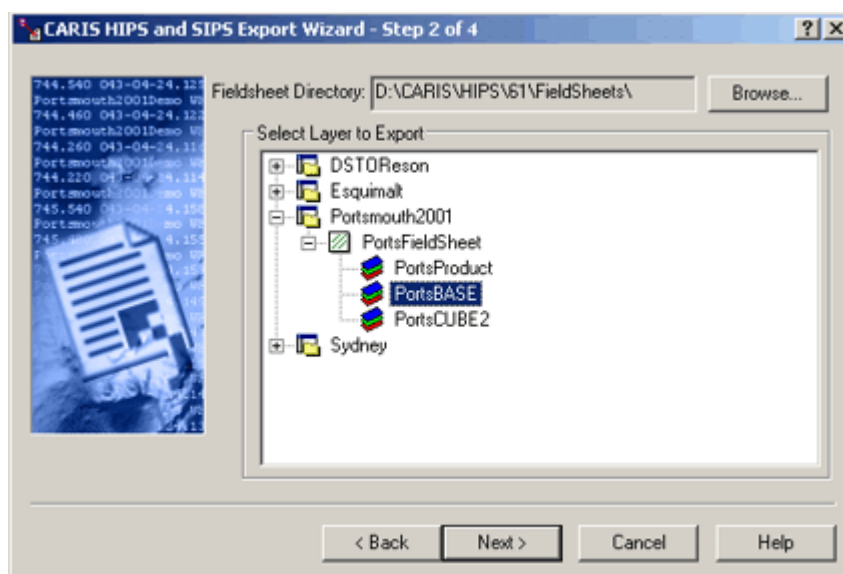
The Select Format dialog box displays the available formats for exporting data.



1. Select an export format.
2. Click **Next** to select data to export.

Step 2: Select Files

The second dialog box lets you select the data for export.



Depending on the product you are exporting and the format you are exporting to, the data displayed here will vary, for example, to export BASE surface to BAG, you will select a layer; to export HIPS data to FAU, select track lines.

For certain data you can Browse to the location of the specific product to be exported. Other product types will list the data available in the default directories.

BASE surface/Mosaic data

If BASE Surface or Mosaic data is selected to export, the dialog box displays all project files with associated field sheets and layers.

1. Use the Browse button to select a field sheet directory.
2. Expand the project file tree and select the layer you want to export.
3. If you are exporting a mosaic to an image, you can select more than one mosaic for export by holding the <Ctrl> button while selecting mosaics.

Contacts/HIPS soundings/SIPS

For these file formats the Step 2 dialog box displays the existing projects, organized in a Project/Vessel/Day/Line structure.

1. Select some or all of the files in the Project/Vessel/Day/Line directory. Click the expand icon (+) icon to view the file tree, if needed.

HIPS to HTF

When exporting HIPS to HTF this dialog box displays either a list of projects and associated field sheets, or the Project/Vessel/Day/Line data structure depending on which export option you select.

1. Select the *Field Sheet Product* option and select a field sheet product layer,
or

2. Select the *BASE surface* option and select one or more BASE surfaces,

or

3. Select the *Raw Data* option to export sounding data.

The file list will be refreshed to display the data available for export.

4. Open a project or session file tree and select a layer or trackline data.

If you select the *Raw Data* option, the *Include Rejected* option is active. This option includes rejected soundings in the export process.

5. [Optional] Select the *Include Rejected* option to export rejected data.

GSF

The dialog box displays a section for the file path and name of the GSF file.

1. Click Select to choose the GSF files to be imported to CARIS/HOB format.

The file path and name is displayed in the dialog box.

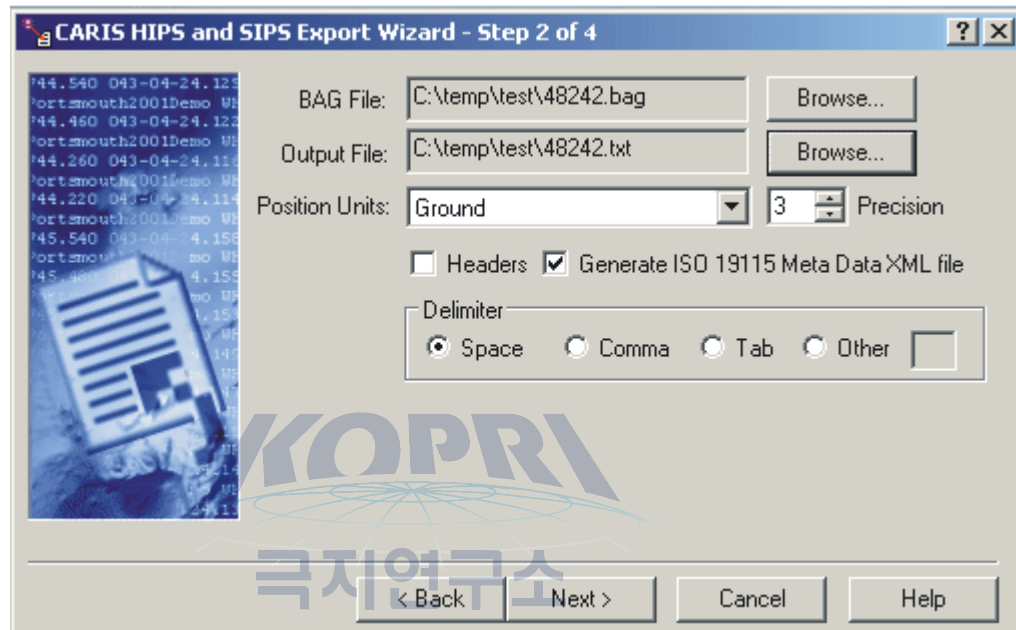
2. To remove a file, select it so it is highlighted and click Remove.



BAG to ASCII

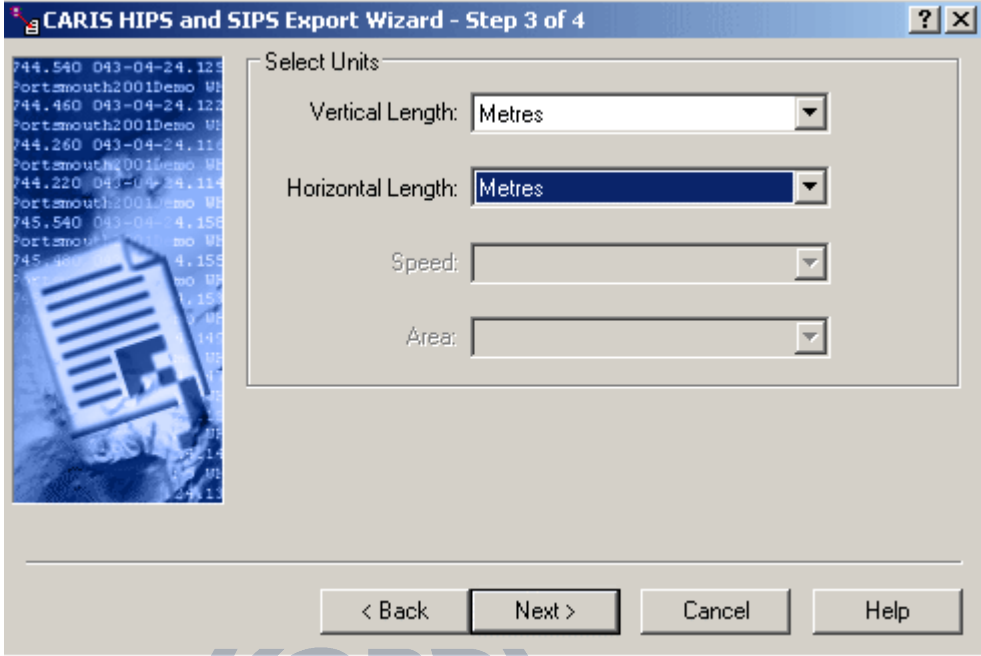
Export data from a Bathymetric Attributed Grid (BAG) file to an ASCII file and optionally to an ISO 19115 Metadata XML file.

BAG to ASCII - Step 2



1. Type a path and name for the BAG file, or click **Browse...** to select a folder and file name.
2. Type a path and name for the output file, or click **Browse** to select a folder and then type the file name.
3. Select *Positioning Units* (Ground, Geographic DMS, Geographic DMS (no formatting), Geographic DD/ Geographic DM) from the drop-down list.
4. Specify the number of decimal places to display the position values.
5. Select *Headers* to generate a header line at the top of the output ASCII file.
6. Select *Generate ISO 19115 Meta Data XML file* to generate an XML file with the same name as the output file.
7. Select what type of Delimiter you want to use to separate the fields in your output file. If you choose *Other*, type the character you want to use.
8. Click **Next**.

BAG to ASCII - Step 4



CARIS HIPS and SIPS Export Wizard - Step 3 of 4

Select Units:

Vertical Length: Metres

Horizontal Length: Metres

Speed:

Area:

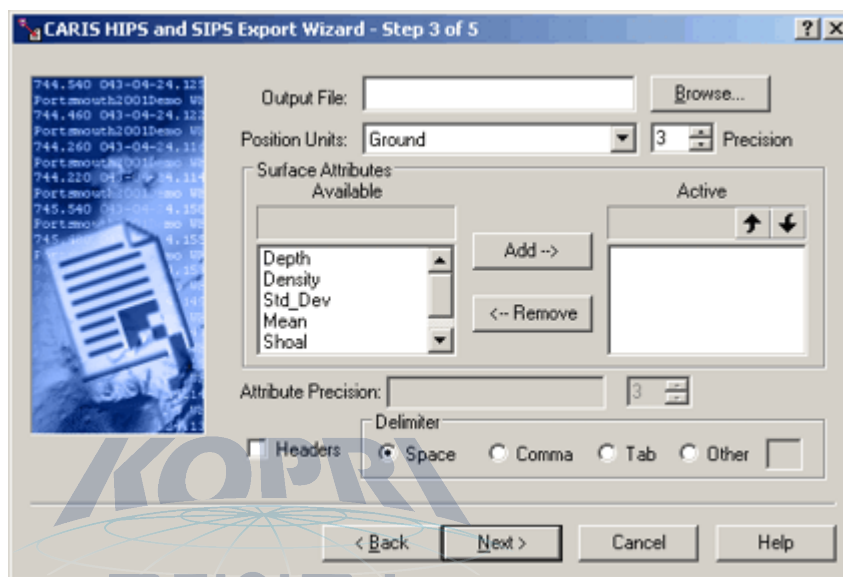
< Back Next > Cancel Help

1. In the *Vertical Length* field, select the units for depth and uncertainty values.
2. The *Horizontal Length* field is only active if you selected Ground in the *Position Units* field at Step 2. Select the units for position data.
3. Click **Next**.

BASE Surface To ASCII

Export BASE Surface attributes to an ASCII text file.

BASE Surface to ASCII (Step 3)



1. Type a path and name for the output file, or click **Browse** to select a folder and then type the file name.
2. Select the position units for data from the drop-down list:
 - ground units (east, north, depth)
 - geographic DMS (latitude, longitude, depth)
 - geographic DMS (no formatting)
 - Geographic DD (decimal degrees)
3. Select how many digits are displayed to the right of the decimal point by selecting a number using the *Precision* up or down arrow buttons.
4. Select the BASE Surface attribute values to be recorded in the ASCII file by selecting the attribute in the *Available* column and clicking **Add** to move it to the *Active* column.
5. To remove an attribute, select the attribute from the *Active* column and click **Remove** to move it back to the *Available* column.
6. Choose a *Attribute Precision* value (number of digits to the right of decimal point) for attributes in the *Active* column by selecting an attribute and clicking the up or down arrow buttons.
7. Select the *Headers* check box to create print attribute names at the top of the attribute rows.

8. Select either the *Space*, *Comma*, or *Tab* check boxes to use these characters as delimiters, or select the *Other* check box and type a character to use a delimiter.
9. Click **Next**.

BASE Surface To ASCII (Step 4)

This dialog box sets the unit type for recording data. The fields that are active in this dialog are determined by the attributes selected in the previous dialog box.



1. Select the units for recording BASE Surface data:
 - metres and kilometres
 - fathoms (US and international)
 - feet (US and international)
 - yards (US and international)
 - miles (US, international, and nautical)
2. Click **Next**.

If you export attribute data from a BASE Surface created prior to HIPS and SIPS 6.1, this Step 4 dialog box is not displayed because the default measurement unit is metres.

BASE Surface to BAG

Export a BASE Surface to a Bathymetric Attributed Grid file.

BASE Surface to BAG (Step 3)



1. Type the path and name for the BAG file, or click **Browse** and select a directory and name.
2. Select the BASE Surface attribute values to export from the drop-down list.

Metadata is general information about the file (the who, what, where, why, and how).

3. Type any information in the *Abstract* field.
4. Select a *Status* from the drop-down menu.
5. Click **Next**.

BASE Surface to BAG (Step 4)

This dialog box is a continuation of the metadata section.

1. Type personal information in the *Name*, *Position*, and *Organization* fields and select a *Role* from the drop-down menu.
2. Select a *Legal* constraint from the drop-down list. If the *otherRestrictions* option is selected, you can type it into the *Other* field.
3. Select a *Security* constraint from the drop-down list. Type other information in the *Notes* field.
4. Type a *Vertical Datum*. Remember that the values above the vertical datum are positive.
5. Click **Next**.

BASE Surface To Image

Select the following links to export a BASE Surface to an image file. [BASE Surface to Image \(Step 3\)](#)



1. Select a BASE Surface attribute to display as a georeferenced image. If the selected attribute has a legend associated with it, you can include this legend in the image. The legend will be drawn according to the property settings. If the cover of the field sheet matches the cover of the BASE Surface, the field sheet cover can be expanded to accommodate the legend so it does not cover the surface.
2. Select the *Display Raster Legend* check box to draw a raster legend for the selected attribute.
3. Select the *Expand cover to fit the raster legend* check box to expand the area cover so that the legend does not overlay the surface.
4. Click **Browse** to select the file path and name of the image file.
5. Select a colour format for the image.
 - *24 Bit* (16 million colours)
 - *8 Bit* (256 colours)

The Surface can be saved as a TIFF file with either an IGA or a TFW georeferenced file, or both. You can save the image as a GeoTIFF image that records the georeferenced information directly in the .TIFF file.

6. Select a geo-reference format for the image:
 - *GeoTIFF*

- *IGA/TIFF*
- *TFW/TIFF*

7. Click **Next**.



Contacts

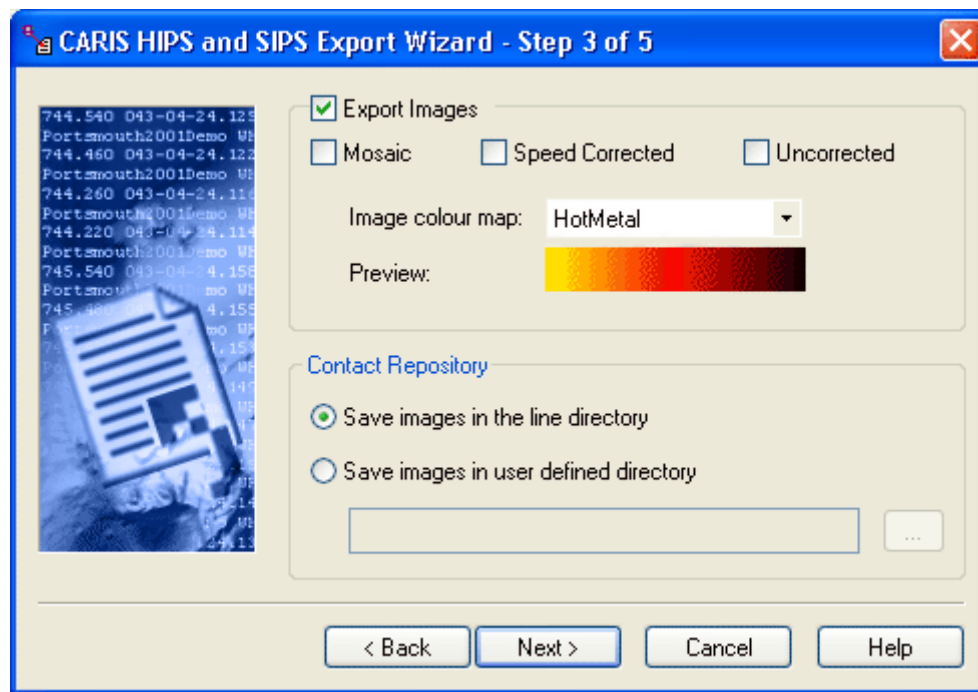
Export contacts to a CARIS map and/or an ASCII text file. You can also export contact snapshot images to TIFF files. The ASCII files are structured to be easily imported into a relational database.

If you select ASCII, you will have to browse to a folder location and type a file name. This name is used as the first component name of four files that will be created to store the contact information:

- **filename_ContactLine.txt** contains information identifying the survey line and indexes to the other files.
- **filename_ContactSingle.txt** contains all the information for single point contacts.
- **filename_ContactMulti.txt** contains all information for single point contacts.
- **filename_ContactMultiPoints.txt** contains all location information for multipoint contacts.

For more information on the structure of contact files, see "CONTACT FILE FORMATS" ON PAGE 745.

Contacts (Step 3)



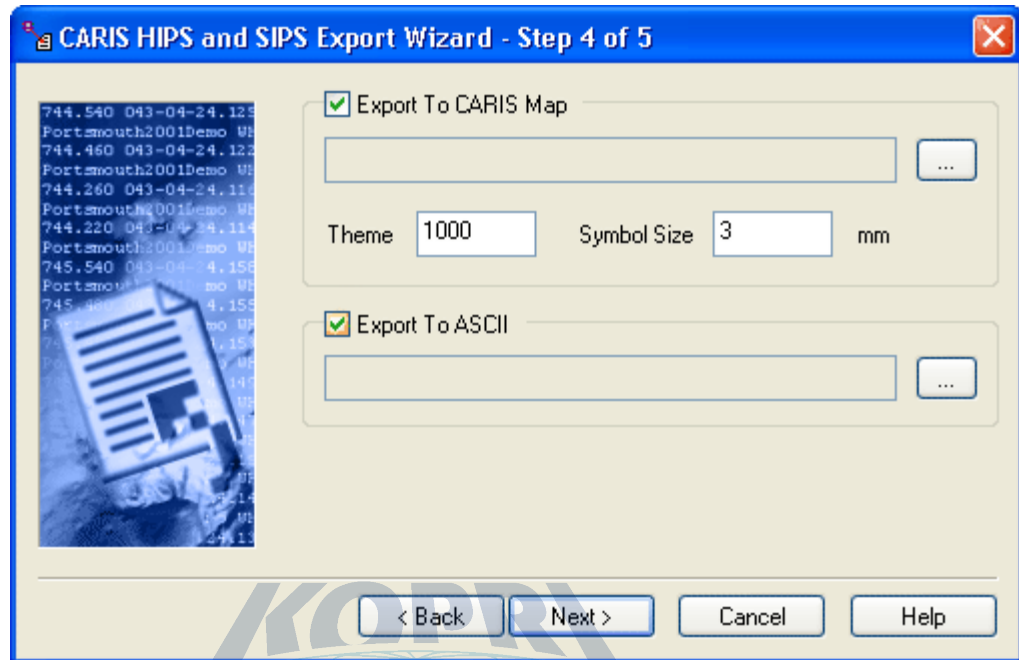
1. Select the *Export Image* check box to export the contact(s) in TIFF image format.
2. If you select *Export Image*, select from the following image formats:
 - *Mosaic*: This option creates a georeferenced TIFF image from contact data.
 - *Speed Corrected*: This option calculates the distance between profile lines in the contact and corrects for vessel speed.
 - *Uncorrected*: This option does not correct for vessel speed and renders a one-to-one correspondence between the side scan image and the contact.
3. To export the colour map that was selected in the Side Scan Editor, select the *Use Colour Map Specified in Contact File*.
4. To export the contact with a new colour map, select the *Use Other Colour Map* option and select the map from the drop-down list.

The selected colour map is displayed in the *Preview* field.

5. Select the directory location for the contact. You can select from two options:
 - *Save Images in the Line Directory*: This option saves the contact data to the line file in the HIPS/SIPS Project/Vessel/Day directory structure that you selected in the second dialog box.
 - *Save Images in User Defined Directory*: This option saves the contact data in another directory. Click **Browse** to select the folder where you want to save the data.
6. Click **Next**.

Contacts (Step 4)

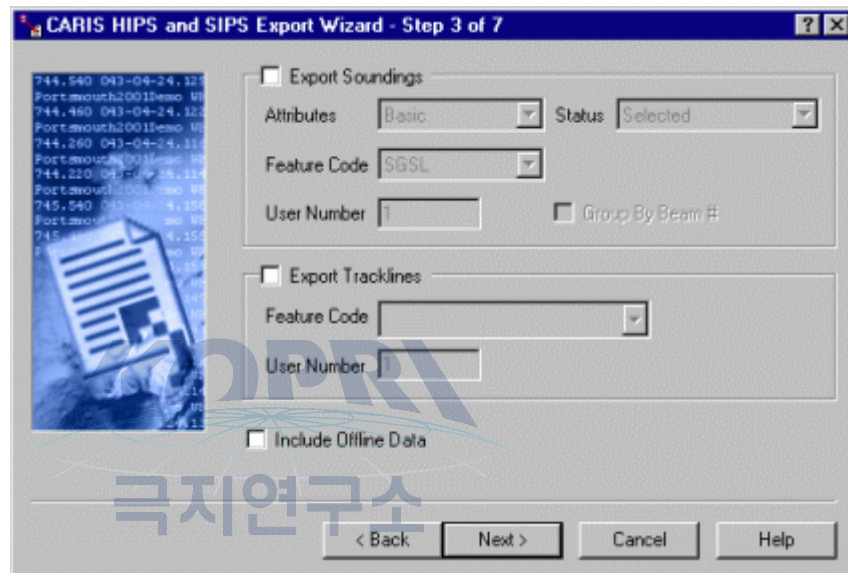
This dialog box contains options for exporting contact data to a HOB or CARIS file



1. Select either the *Export to CARIS Map* or *Export to ASCII* check boxes. Both can be selected at the same time.
2. Type a file name and path to store the contact data after export, or click **Browse** to select the file path (both CARIS data and ASCII text files are typically stored in `..\Hips\CARIS_Files`).
3. Type a layer number for the contact data in the *Theme Number* field.
4. Type a symbol size for the contact data in the *Symbol Size* field.
5. Click **Next**.

GSF to CARIS Map/HOB

The Generic Sensor Format (GSF) to CARIS/HOB function loads soundings and track lines from one or more GSF files into a CARIS map or HOB file. GSF data does not have to be converted to HIPS data prior to using this utility. **GSF to CARIS/HOB (Step 3)**



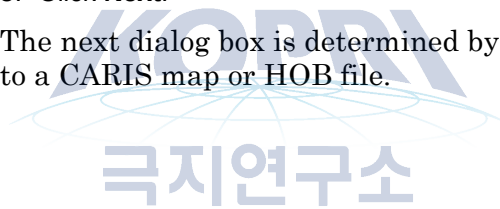
Data can be exported either in the form of soundings or track lines:

- **Soundings.** Export all soundings (subject to the HIPS Sounding Status and Data Thinning settings) that fit within the boundaries of the work file.
 - **Track Lines.** Export a line that connects the centre of each swath for each survey line, thus showing the track of the vessel along each survey line. It is not necessary to export soundings to use this option.
1. Select either the *Export Soundings* or the *Export track lines* check box.
 2. If you selected *Export Soundings*, complete any or all of the following fields:
 - **Attributes:** Select *Basic* or *Advanced* from the drop-down list. The *Basic Attributes* option creates mandatory CARIS feature attributes for the map file, such as feature code, user number and source ID.

The *Advanced Attributes* option creates additional CARIS feature attributes for soundings such as time stamps, launch identifier and tidal correction.

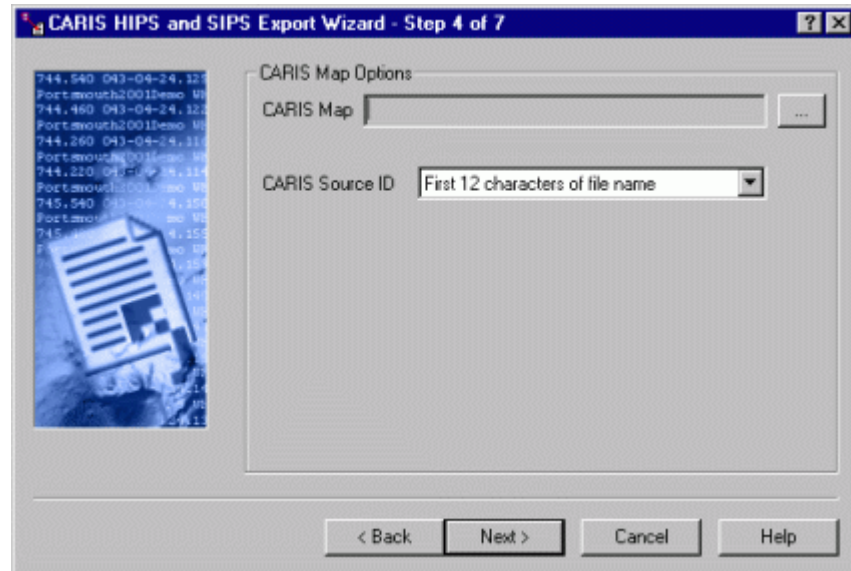
- *Status*: Select soundings flagged as Selected, Accepted or Accepted and Rejected.
 - *Feature Code*: Select a feature code for the soundings from the drop-down list.
 - *User Number*: Type a number value for layering data in the CARIS map or HOB file.
 - *Group By Beam*: Load soundings into user numbers according to sonar beam number. For example, all soundings from beam 37 are loaded to user number 37 in the CARIS map file or HOB file
3. If you selected *Export Tracklines*, complete any or all of the following fields.
- *Feature Code*: Select a feature code for the track lines object from the drop-down list.
 - *User Number*: Type a number value for layering data in the CARIS map.
4. Select the *Include Offline Data* check box to include data recorded during turns between track lines.
5. Click **Next**.

The next dialog box is determined by whether you are exporting to a CARIS map or HOB file.



GSF to CARIS (Step 4)

This dialog box is displayed if you are exporting to a CARIS map.



1. Click **Browse** to select a CARIS map for data export, or type the name of a new map.

The map file path and name are displayed in the *CARIS Map* field.

The *CARIS Source ID* is a 12-character alphanumeric attribute in CARIS maps. The ID can be the first or last 12 characters in a GSF project name.

2. Choose either the first 12 characters or the last 12 characters for the *CARIS Source ID*.
3. Click **Next**.

If you created a new CARIS map in Step 4, a projection list is displayed in the next dialog box. Otherwise you can begin export of the data in the next dialog box.

GSF to HOB (Step 4)

This dialog box is for saving the HOB file that contains the exported GSF data.

1. Click **Browse** and select a location and name for the HOB file.
2. Click **Next**.

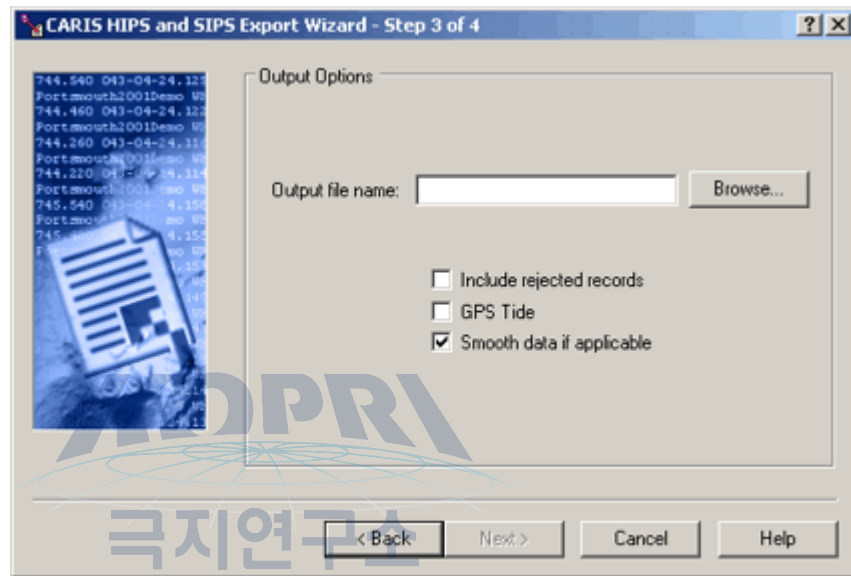


HIPS Tide to ASCII

Export HIPS tide data from selected track lines to a TID file. You can create TID files from single or multiple track lines in a project. TID files can be viewed in a text editor.

HIPS Tide to ASCII (Step 3)

This dialog box creates the output tide file.



1. Click **Browse** and use the standard Windows Open dialog box to select a path and name for the output TID file.

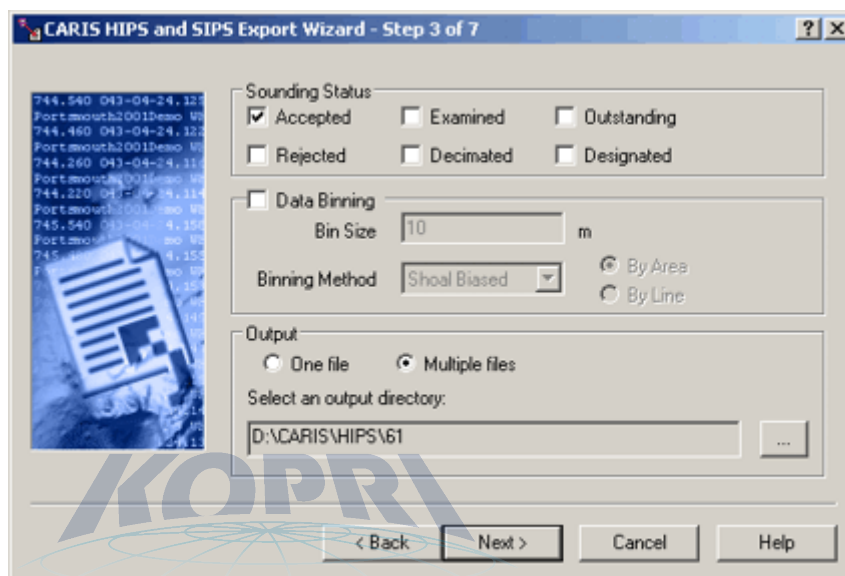
The path and name of the tide file is displayed in the *Output File Name* field.

2. Select the *Include Rejected Records* check box to include tide records that have been rejected.
3. Select *GPS Tide* to use tides calculated from a GPS ellipsoid height.
4. Select *Smooth data* to use tide data that has been smoothed for localized variability.

HIPS To ASCII

The HIPS to ASCII function creates a customized text listing of soundings that you can load into other software systems.

HIPS to ASCII (Step 3)



Each sounding in a cleaned HIPS dataset are stored with bits that determine the status of that sounding. You can choose to restrict the export process to soundings with specific status flags.

1. To export soundings with a specific status flag, select any of the *Sounding Status* check boxes.
2. Choose the sounding's unit of measurement by selecting either *Metres* or *Feet*.

The *Data Binning* option divides the survey area into a grid to select the shoal- or deep-biased soundings from each cell for export. The *Bin Size* option sets the size of the grid cells.

3. To apply a data thinning function, select the *Data Binning* check box.
4. Type the size for the grid cell in the *Bin Size* field and select either *Metres* or *Feet*.
5. Select either the *Shoal-Biased* or *Deep-Biased* options to export only the shoalest or deepest soundings, respectively, to the ASCII file.

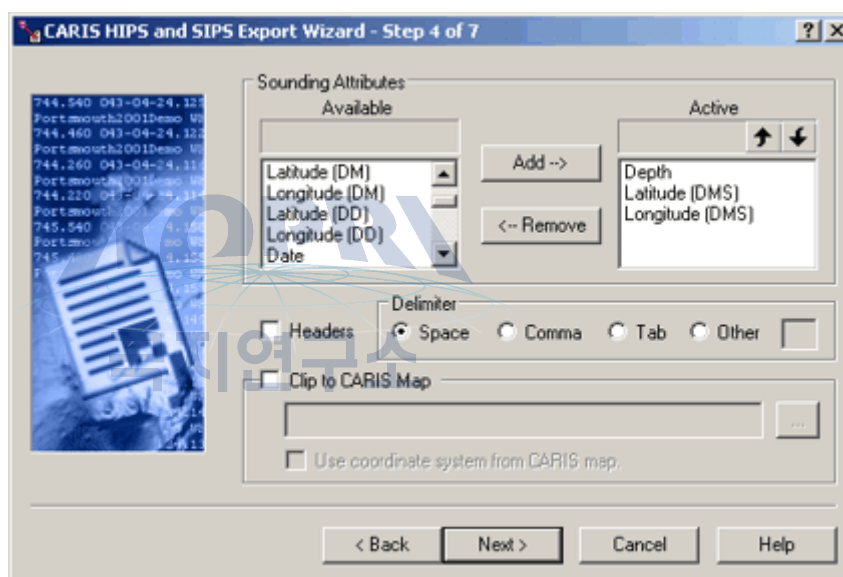
Soundings can be selected for export from each grid cell in the entire survey area or by processing each track line in sequence.

6. Select either the *By Area* or *By Line* options.

7. Select *One File* to export all data to a single file or select *Multiple Files* to export data to separate files for each survey line.
8. Select an output location for the data.
 - If you select *One File*, type a name and file path for the ASCII file, or click **Browse** to select a location and name for the file.
 - If you select *Multiple Files*, click **Browse** to select a folder to save the files. The files are automatically named according to Project_Vessel_Date_SurveyLine.
9. Click **Next**.

HIPS to ASCII (Step 4)

This dialog box lists the attributes that can be exported to the ASCII file and the delimiters used to separate data in the file.



1. Select the sounding attributes to be included in the ASCII file.
 - To add an attribute, select the attribute in the *Available* list and click **Add** to move it to the *Active* list.
 - To remove an attribute, select the attribute in the *Active* list and click **Remove** to move it to the *Available* list.
2. To change the order that attributes are exported, select the attribute in the *Active* list and click the up or down arrow buttons.
3. Select the *Headers* check box to create print attribute names at the top of the attribute rows.
4. Select either the *Space*, *Comma*, or *Tab* check boxes to use these characters as delimiters, or select the *Other* check box and type a character to use as a delimiter.

You can define the boundaries of the ASCII map data from the boundaries of an existing CARIS map. If you do not select this option, the extents are defined from the ASCII data.

5. Select the *Clip to CARIS Map* check box to use a CARIS map to define the boundaries of the ASCII map data.
6. Click **Browse** to select an existing CARIS map.
7. To use the coordinate system from the selected CARIS map for the ASCII data, click the check box.

If you selected the *Use Coordinate System From CARIS Map* option, the next dialog box prompts you to export the data. If you did not select this option, the next dialog box prompts you to select a coordinate system.

8. Click **Next**.

HIPS To ASCII (Step 5)

This dialog box sets the unit type for recording data. The fields that are active in this dialog are determined by the attributes selected in the previous dialog box.

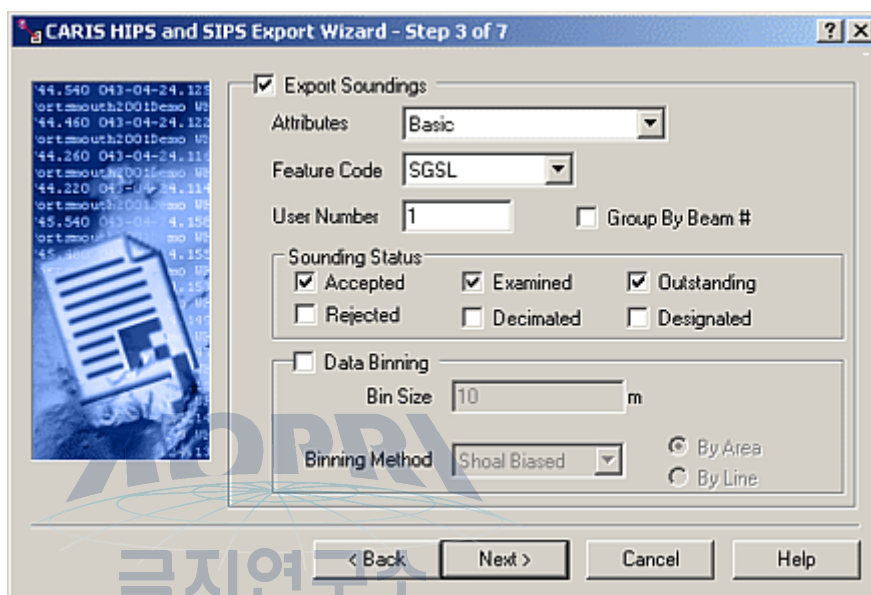
1. Select the units for recording sounding data:
 - metres and kilometres
 - fathoms (US and international)
 - feet (US and international)
 - yards (US and international)
 - miles (US, international, and nautical)
2. Click **Next**.

HIPS To CARIS Map

Export data to a CARIS map.

HIPS to CARIS (Step 3)

You can select which soundings are to be exported and how they will be stored in the CARIS map.



The *Export Soundings* option exports all soundings (subject to the sounding status and data binning settings).

1. Select the *Export Soundings* check box if you want to export soundings to a CARIS map. (See the next dialog box for the *Export Tracklines* and *Export Swaths* options).

There are four methods for exporting sounding attributes to a CARIS map.

- *Basic*: The basic sounding attributes in the CARIS map. These include user number, feature code, and source ID. This information is adequate to generate products such as sounding plots, contour plots, and DTMs.
- *Extended*. Basic attributes plus time stamps, launch identifier (first four letters of the vessel name), and tidal correction.
- *Extended with Key*: The extended attributes set, plus the profile number and beam number as the CARIS Key. The profile number and the beam number, in addition to the other attributes, allow each sounding to be identified uniquely with respect to the original data set.

- *Extended with Unique Key*: The extended attributes set, plus every object is given a unique key.

This additional information allows more flexibility for visualizing and manipulating CARIS files. For example, if time stamps are associated with each sounding, you can limit the display of soundings based on a time range.

However, each extra attribute adds to the storage requirements. More disk space is required to store the work file, and any HIPS program that processes the file must do more work and use more time and CPU resources.

2. Select from the four options in the *Attributes* drop-down list.
3. Select a new *Feature Code* for the soundings, if needed.

The *Group by Beam Number* option layers soundings according to a beam number in the CARIS file. Soundings belonging to a beam are assigned to the same user number in the map. User numbers in CARIS file are similar to layering. This option is used when exporting soundings from checklines into a separate checkline map so that a Quality Control Report can be generated. If you do not select this option, then a single user number will be used to hold all the exported soundings.

4. Select the *Group by Beam Number* check box to layer soundings according to beam numbers in the CARIS map.

The *User Number* option is available only if you do not select the *Group by Beam Number* option.

5. [Optional] Type a *User Number* to which all soundings are to be assigned.

The *Sounding Status* option enables you to export only soundings with a specific status flag.

6. To export soundings with a specific status flag, select any of the *Sounding Status* check boxes.

The *Data Binning* option divides the survey area into a grid for sounding selection. The *Bin Size* sets the size of the grid cells.

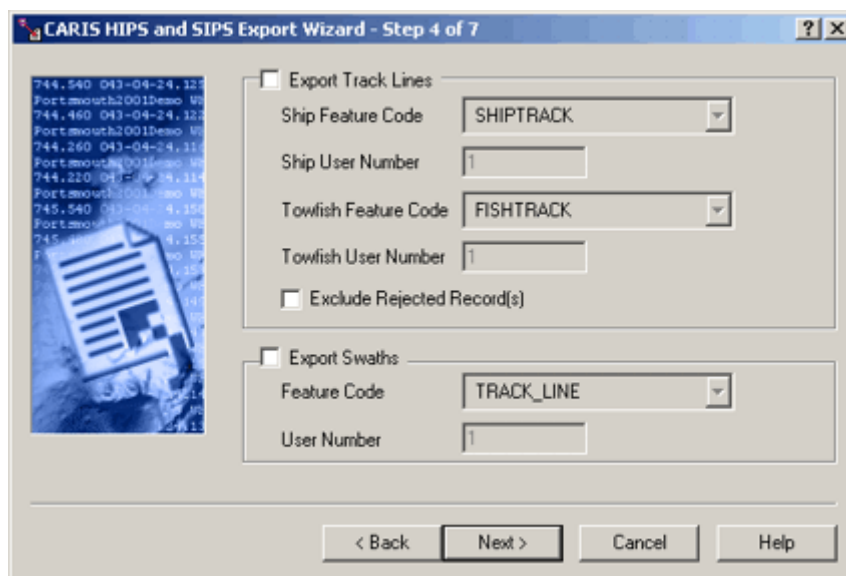
7. To apply a data binning function on export, select the *Data Binning* check box.
8. Type the size for the grid cell in the *Bin Size* field and select either *Metres* or *Feet*.
9. Select either *Shoal-Biased* or *Deep-Biased* to export only the shoalest or deepest soundings from each cell, respectively, to the CARIS file.

Soundings can be selected for export from the total survey area or by processing each track line in sequence.

10. Select either the *By Area* or *By Line* options.
11. Click **Next**.

HIPS to CARIS (Step 4)

This dialog box sets the track line and swath export options.



The *Export Track Lines* option connects a line along the centre of each swath, thus showing the track of the vessel along each survey line. It is not necessary to import soundings to use this option.

The *Export Swaths* command connects a set of lines (one per swath) along the outermost port and starboard beams, thus showing the coverage of each ping. It is not necessary to import soundings to use this option.

1. Select the *Export Track Lines* check box to export a line representing the track of the vessel along the survey area.
2. Type a new feature code for the vessel, if needed.
3. Type a *User Number* for the vessel so it is distinguished from other vessels in the same CARIS map.
4. Select a new *Towfish Feature Code*, if needed.
5. Type a *User Number* for the towfish so it is distinguished from other vessels in the same CARIS map.
6. Select the *Exclude Rejected Record(s)* check box to not include this data.
7. Select the *Export Swaths* check box to export a set of lines that represents the swaths along the survey.
8. Type a *User Number* for the swath so it is distinguished from other swaths in the same CARIS map.
9. Click **Next**.

HIPS to CARIS (Step 5)

1. Click **Browse** to select a CARIS map for data export, or type the name of a new map.

The map file path and name are displayed in the *CARIS Map* field.

The Source ID is a 12-character alphanumeric attribute in CARIS maps. The ID can be the first or last 12 characters in a project name or line name.

2. Select either *Project Name* or *Line Name* to use as a Source ID.
3. Choose either the first 12 characters or the last 12 characters for the Source ID.

The *Clip to CARIS Map* option cuts the HIPS data at the boundaries of an existing CARIS map. If this option is not selected, the geographic extents of the map are extended to accommodate the HIPS data.

4. Select the *Clip to CARIS Map* check box to implement this option.
5. Click **Next**.

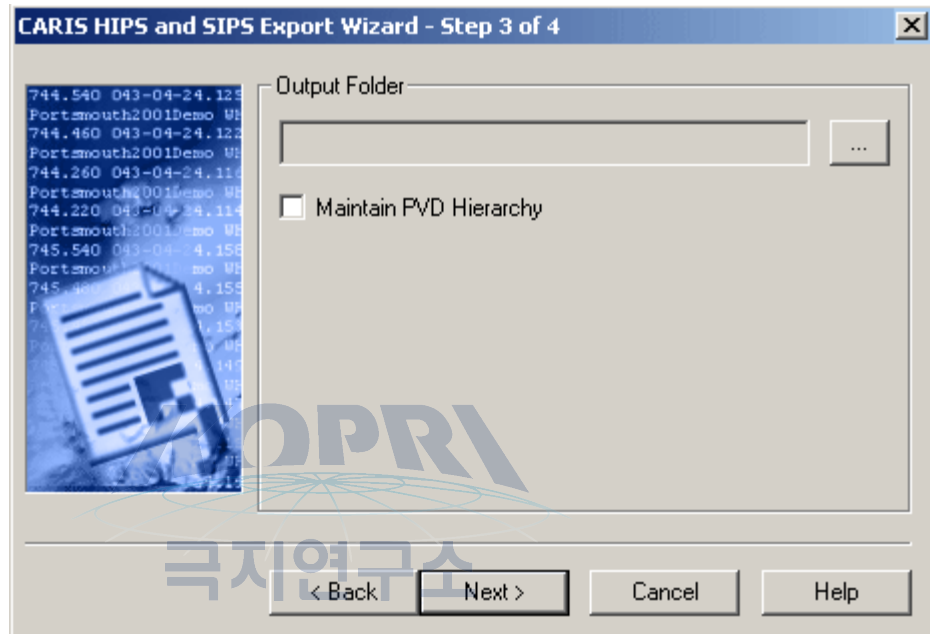
If you created a new CARIS map in Step 1, a dialog box for selecting a projection is displayed. Otherwise you can begin export of the data in the next dialog box.



HIPS to FAU

Export processed HIPS data, with optional heave/pitch/roll/quality/amplitude attributes, to the FAU format. The process will create multiple files with the extension *.fauTC designating the data as “tide corrected”. The names of the output files will match the HIPS line names.

After you have selected the tracklines to export, the next step is to designate an output folder.



1. Type a path and name for the output file, or click the Browse button (...) to select a folder and then type the file name.
2. Select *Maintain PVD Hierarchy* to create output directories that correspond to the HIPS data being exported.
3. Click Next.
- 4.

HIPS To GSF

The HIPS to GSF function exports processed HIPS data to a GSF format. A new GSF file is created for each track line that is exported from HIPS.

Conversely, when HIPS data is created from GSF data, a copy of the original GSF file is maintained inside the HIPS directory structure. The Export to GSF function updates these GSF files.

HIPS to GSF (Step 3)



1. Click the **Browse** button (...) to select a location for the GSF files.

The Browse for Folder dialog box is displayed. The stored GSF file will have the same name as the track line. The file path is displayed in the *Output File* field.

2. To export entire projects and maintain the HIPS Project/Vessel/Day/Line structure in the output, click the *Maintain PVD Hierarchy* check box.
3. Select the *Ignore Disabled Beams* option to exclude any soundings which have been rejected (because of disabled beams) from your export file.
4. Click **Next**.

HIPS To HOB

The Hydrographic Object Binary (HOB) file stores feature objects and associated attribute data. The HOB file can contain links to CARIS spatial objects.

HIPS to HOB (Step 3)



The *Export Soundings* option exports all soundings (subject to the sounding status and data binning settings).

1. Select the *Export Soundings* check box to export soundings to a CARIS map (see the next dialog box for the *Export Tracklines* and *Export Swaths* options).
2. To export soundings with a specific status flag, select any of the *Sounding Status* check boxes.

The *Data Binning* option divides the survey area into a grid for sounding selection. The *Bin Size* sets the size of the grid cells.

3. To apply data binning, select the *Data Binning* check box.
4. Type the size for the grid cell in the *Bin Size* field and select either *Metres* or *Feet*.
5. Select either *Shoal-* or *Deep-Biased* to export only the shoalest or deepest soundings, respectively, to the CARIS file.

Soundings can be selected for export from the total survey area or by processing each track line in sequence.

6. Select either the *By Area* or *By Line* options.

The *Export Track Lines* option connects a line along the centre of each swath, thus showing the track of the vessel along each survey line. It is not necessary to export soundings to use this option.

The *Export Swaths* command connects a set of lines (one per swath) along outermost port and starboard beams, thus showing the coverage of each ping. It is not necessary to export soundings to use this option.

7. Select the *Export Track Lines* and *Export Swaths* options.
8. Click **Next**.

HIPS to HOB (Step 4)

1. Click the **Browse** button to select a location for the HOB files.

The Browse for Folder dialog box is displayed.

2. Select a directory to store the HOB data and click **OK** to close the dialog box.

The file path is displayed in the *Output File* field.

3. Click **Next**.



HIPS To HTF

Hydrographic Transfer Format

The HIPS and SIPS Export Wizard converts field sheet layer data and soundings to a Hydrographic Transfer Format (HTF) file.

The HTF file is an ASCII file that can be opened in any text editor (such as Notepad). It consists of two sections: a header section and a sounding data record.

- The header contains general information about the survey.
- The sounding data record contains the depths and other relevant information.

The total number of fields generated in the sounding data record depends on the survey. At the start of the sounding data record is a Field Population Key that gives each field a 1 bit to show that a field is included, or a 0 bit to show if a field is not included.

For example: [00001111100000000000]

In the above Field Population Key, fields 5 to 9 contain data (hence the 1 bits), while fields 1 to 4 and 10 to 20 contain no data (hence the 0 bits). Fields without data are not written to the HTF file when it is generated. There are a total of 20 HTF fields in the sounding data record. Two additional fields are added by the Export Wizard for beam and profile number. Extra fields can be added, if needed. The HTF export automatically exports TPU depth and TPU position values if these are included in the track line.

The HTF file contains an ordered list of all possible fields and a description of each field.

Hydrographic Transfer Format Template

Sometimes the same header information can be used for multiple HTF files. The export wizard gives you the option of saving a header for use in another file. Headers are saved as HTFT files (Hydrographic Transfer Format Template). The file is in XML format that can be viewed in a text editor or an XML-compliant Internet browser.

HIPS to HTF - Output options

CARIS HIPS and SIPS Export Wizard - Step 4 of 6

Output options

Output File:

☒ Export to one file ☐ Export to multiple files

HTF Header Field	Value
HTF File Version	2.02
Copyright Information	
Data Usage Restriction	
Classification of Data	
Data Custodian	
HTF Creation Routine (Name & Version)	
Logging System (Name & Version)	
Processing System (Name & Version)	

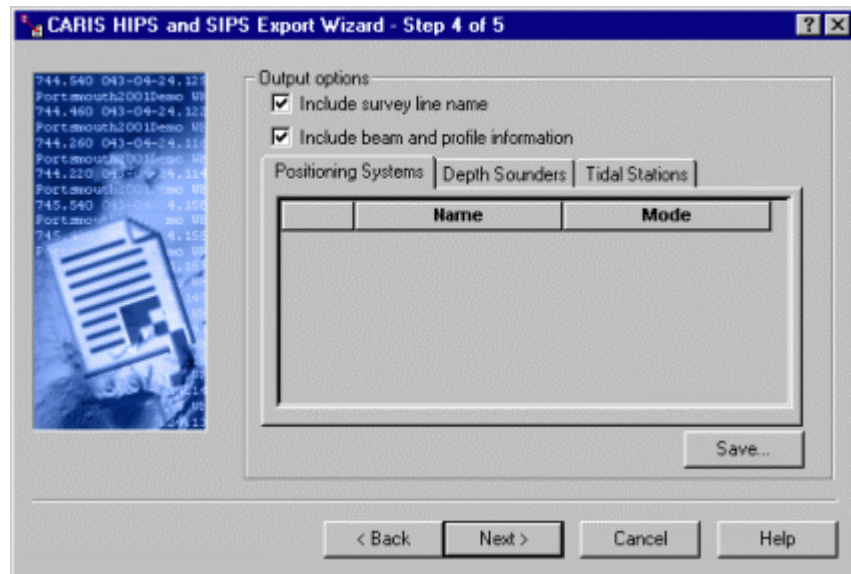
< Back Next > Cancel Help

Enter the necessary header information. You can directly enter the data or load it from an HTFT (Hydrographic Transfer Format Template) file.

If you are exporting soundings, you can export all data to a single file or export data from each survey line to its own file. This option is not available for field sheet products.

1. Select an output location for the HTF file(s).
 - If you choose *Export to One File*, type a name and file path for the HTF file, or click **Browse** to select a location and name for the file.
 - If you choose *Export to Multiple Files*, click **Browse** to select a folder to save the HTF files. The files are automatically named according to Project_Vessel_Date_SurveyLine.
2. To enter new header information, click the *Value* field next to the *HTF Header Field* and type the data.
3. Click **Load** to open data from an existing HTFT file into the *Value* fields.
4. Click **Clear** to remove data from all fields, if needed.
5. Click **Next**.

HIPS to HTF - Output options page 2



1. Select the *Include Survey Line Name* check box to include this information in the HTF file.
2. Select the *Include Beam and Profile Information* check box to include the beam and profile numbers in the HTF file.

If you entered values in the depth sounder, positioning system, and tidal station fields in the previous dialog box then the respective fields in these tabs are enabled. If you did not enter values, click **Back** and fill in the fields.

The Positioning Systems tab is for entering navigation systems information.

3. Type the name and model (and/or any additional information) of the system in the *Name* field.
4. Type the system used on the survey (GPS, DGPS, etc.).

The Depth Sounders tab is for entering sonar information.

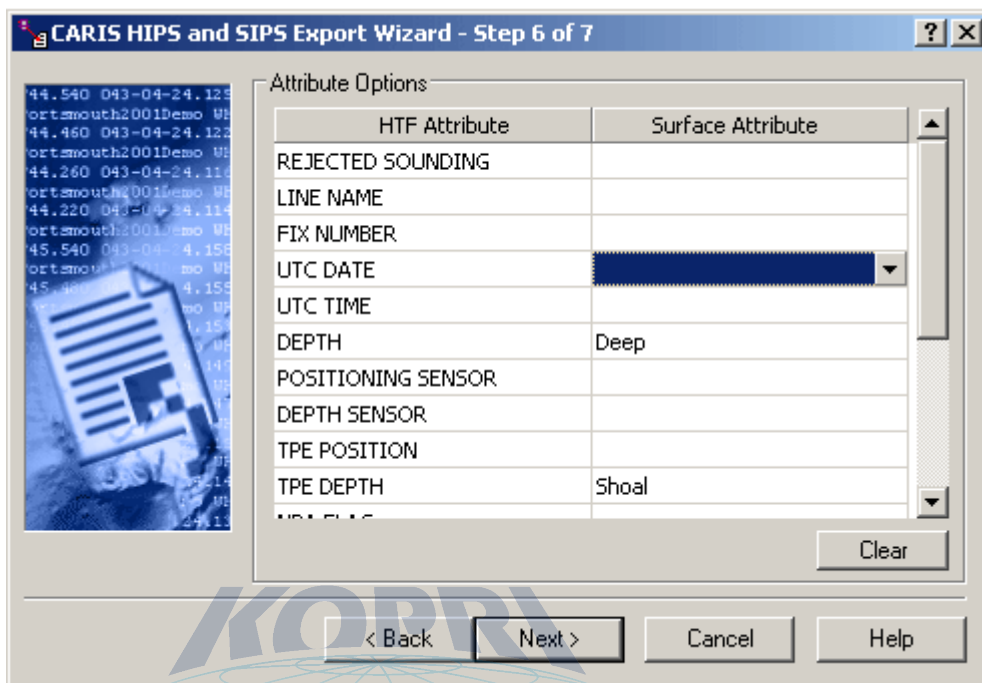
5. Type the name and model of the sonar system used on the survey.
6. Type the mode of sonar (multibeam, single beam, multi transducer).

The Tidal Stations tab is for entering tide information.

7. Type the name of a tidal station.
8. Type the location.
9. Type the method used to acquire data (predicted, observed, etc.)
10. Click **Save** to save information to a new or existing HTFT file.
11. Click **Next**.

HIPS to HTF - Attributes Options

If you are exporting a BASE surface you must map at least one BASE surface attributes to a HTF attribute.



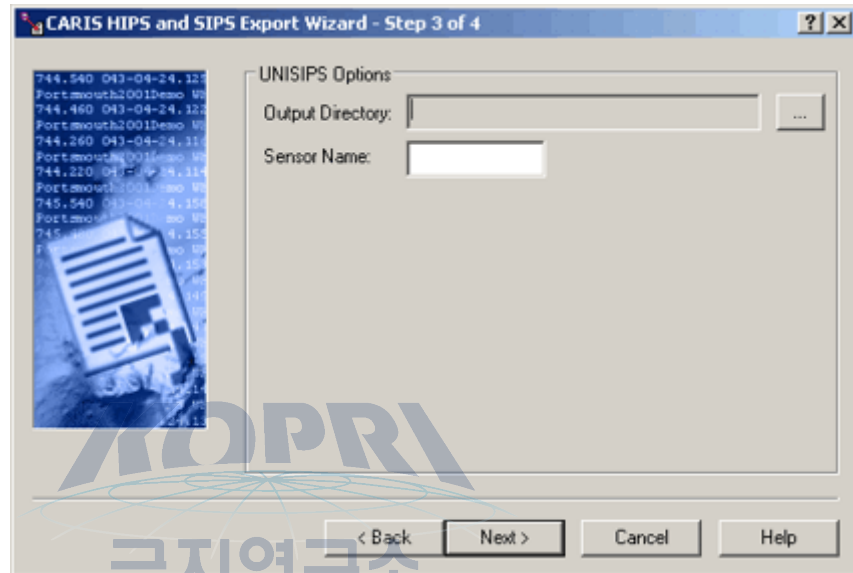
1. Click in a surface attribute field to access a drop-down box listing all the attributes available in the data file.
2. Select an attribute from the list.
3. Click **Clear** to remove all values from the Surface Attributes fields.
4. Click **Next** to go to Export.

SIPS To UNISIPS

Export SIPS data to a Unified Sonar Imaging Processing System (UNISIPS) format.

SIPS TO UNISIPS (Step 3)

Select a file to store the data.



1. Click **Browse** to select a location for the UNISIPS files.

The Browse for Folder dialog box is displayed.

2. Select a directory to store the UNISIPS data and click **OK** to close the dialog box. The UNISIPS file will have the same name as the track line with a .u file extension.
3. Type a *Sensor Name* in the field (up to 10 characters).

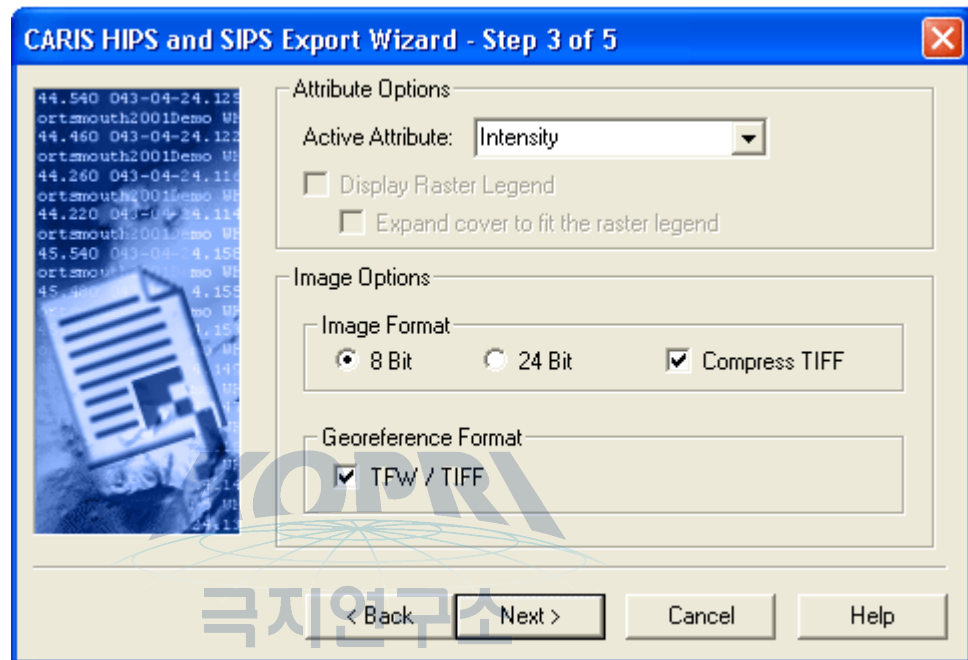
The file path is displayed in the *Output File* field.

4. Click **Next**.

Mosaic To Image

You can export a mosaic or group of mosaics to an image format for inclusion in a CARIS product or other application.

Mosaic to Image (Step 3)

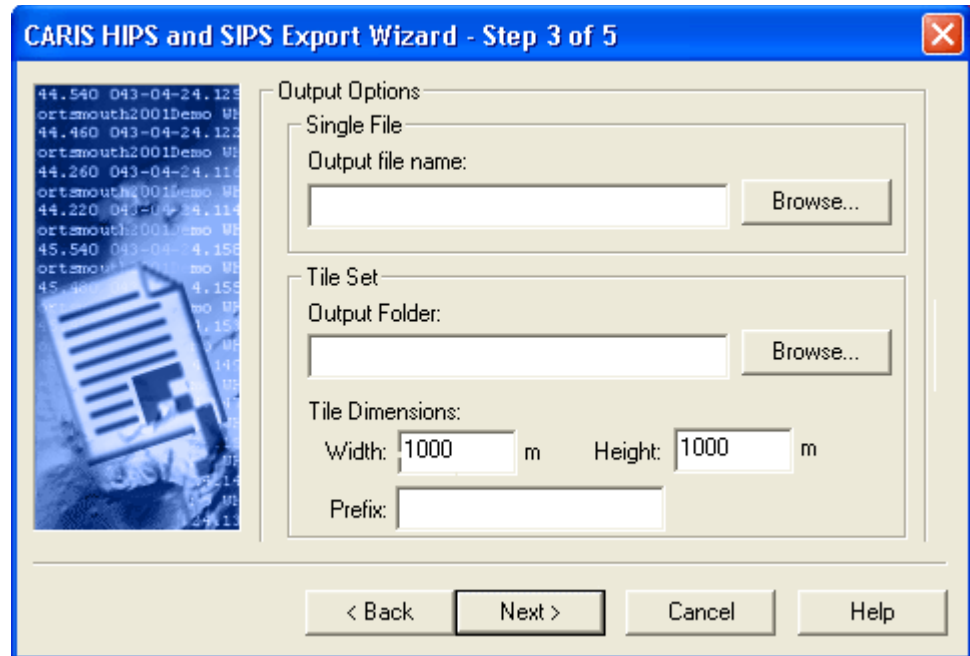


1. From the *Active Attribute* list, select an attribute layer of the mosaic to export.

If you have activated a legend and its attributes in the Properties for the mosaic being exported, you can choose to export that legend with the mosaic.

2. Select the *Display Raster Legend* check box.
3. Select *Expand cover to fit the raster legend* to enlarge the area containing the mosaic and legend.
4. Select an image format:
 - *8 Bit* (256 colours)
 - *24 Bit* (16 million colours)
5. By default the output file is compressed. If you do not want file compression, de-select the *Compress TIFF* check box.
6. To save georeference information with the image, select the *Georeference Format* check box.
7. Click **Next**.

Mosaic to Image (Step 4)



You can export a single file or a tile set, or both formats at the same time.

1. Click **Browse**, and select the file path and *Output File Name* for the image file.
2. Click **Browse**, and select the path to the *Output Folder* for the tile images.
3. Set the Tile Dimensions to specify the size of the tile. The units here are those set in Tools > Options > Display > Units (see “UNITS” ON PAGE 673).
4. Type a prefix for the exported tile files.

The files will have a tile number appended to the prefix. The tile number is in the format RxC where R and C are the row and column index for the current tile. For example, with prefix RTFM, tiles would be numbered RTFM_1x1, the second RTFM_2x2etc.

5. Click **Next**.

Projection

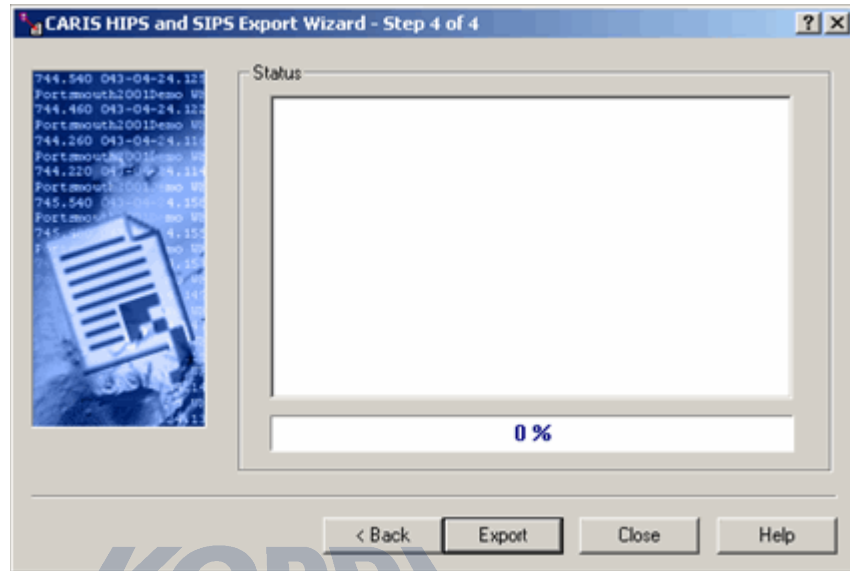
All sounding data is stored in HIPS and SIPS as un-projected longitude and latitude. This dialog selects the appropriate coordinate system to reference the soundings. All soundings will be transformed to this coordinate system as they are exported.



1. Choose a coordinate system by selecting a Projection Group from the list.
2. Select a Zone associated with the Projection Group (the Key field is filled when the Zone is selected).
3. Click **Next**.

Export

At this step you execute the export with the settings you have chosen. The dialog box shows the percentage of data exported and the status of the export process.



1. Click **Back** to review your settings.
2. Click **Export** to export the data with the settings you've selected.

A progress indicator shows the percentage of files converted to the selected format. When the export is completed, the **Restart** button is displayed to enable you to go back and export another file with the same or with different parameters.

Part 2: HIPS&SIPS Editors

- 2.** Vessel Editor
- 3.** SVP Editor
- 4.** Tide Editor
- 4.** Navigation Editor
- 6.** Attitude Editor
- 6.** Subset Editor
- 8.** Swath Editor





2

Vessel Editor

Use the Vessel Editor to create HIPS vessel files, and to edit sensor offsets and error estimates in those files.

In this chapter... 극지연구소

“VESSEL EDITOR INTERFACE” ON PAGE 546

“CREATE A NEW HVF” ON PAGE 548

“CREATE VESSEL OUTLINE” ON PAGE 555

“3-D CONTROLS” ON PAGE 557

“EDIT SENSOR CONFIGURATION” ON PAGE 560

Vessel Editor Interface

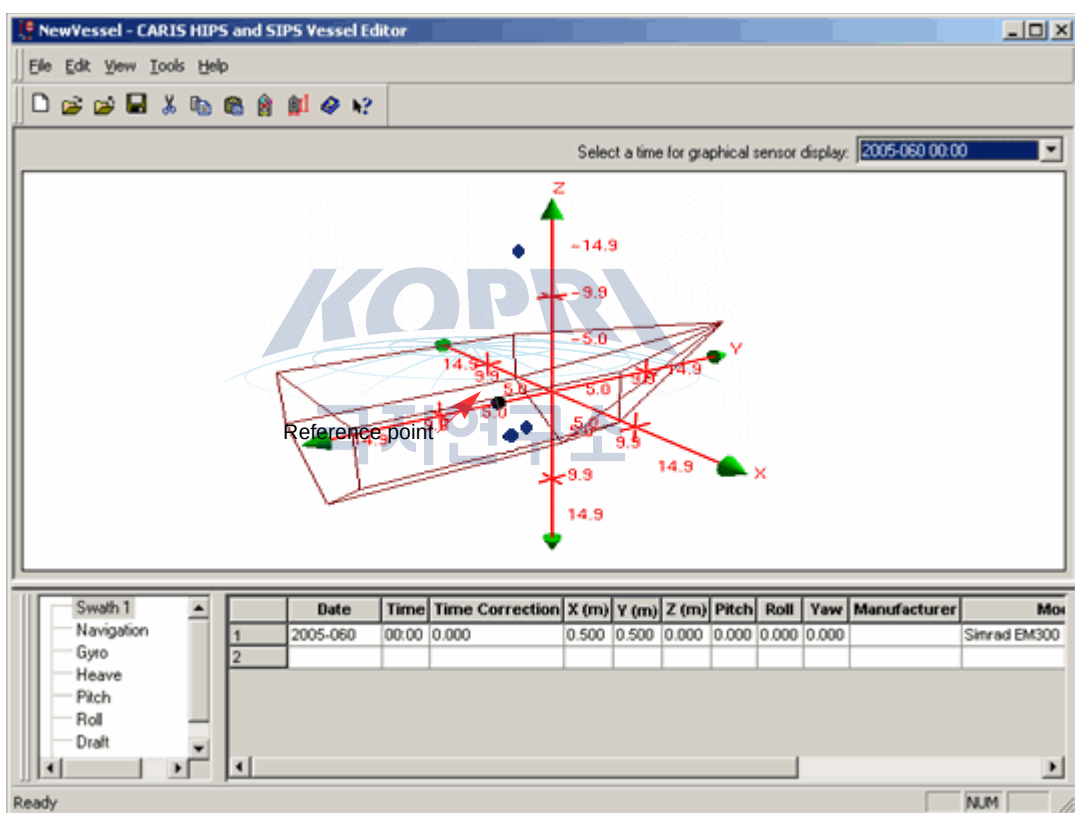
Open the Vessel Editor

The Vessel Editor is launched from the HIPS and SIPS interface.

1. Select the Vessel Editor command from the Edit menu or from the Tools toolbar.

The Vessel Editor is displayed.

The image below shows an example of the Vessel Editor displaying a vessel file and a vessel outline.



The Vessel Editor displays a wire-frame diagram of the vessel. The display can be manipulated in three dimensions using the 3 D display compass. Location of a sensor is represented by a coloured dot or line.

Above the vessel outline display is a drop-down list containing all the unique time stamps in the vessel file. You can select a time stamp and view the outline configuration at that single point in time.

Below the outline are the tables into which you enter information on the sensors used in the survey.

Open and Close Files

To open a saved file in the Vessel Editor:

1. Select the Open command from the file menu.

The Open File dialog box is displayed.

2. Select the file from the list and click **OK**.

The file opens in the Vessel Editor with the vessel's outline displayed in the editor, and a list of active sensors displayed in the Sensors list box.

Vessel Configuration Files that were created in previous versions of HIPS and SIPS can be opened and edited in the Vessel Editor. The files are automatically re-saved as HIPS Vessel Files.

To close an existing file:

1. Select the Close command from the File menu.

You are prompted to save changes made in the Vessel Editor.

2. Select a Save command.
3. Click **OK**.

To create a text file listing the parameters entered in Vessel Editor:

1. Open the HVF in the Vessel Editor.
2. Select the Vessel Report command. from the Tools menu.

The Save As dialog box is displayed. The default directory is Hips*version number*\HDCS_Data\VesselConfig.

Exit the Vessel Editor

Close the Vessel Editor and all files.

1. Select Exit from the File menu.

Create a New HVF

Use the HIPS and SIPS Vessel wizard to set the parameters needed to create a new vessel file. The wizard will take you through the steps to enter vessel information and sensor configuration information based on the type of survey data.

Once the vessel file is created you can enter the sensor position data using a 3D outline for the vessel. (See [“CREATE VESSEL OUTLINE”](#) ON PAGE 555.)

Additional information such as the ellipsoid used in the survey and sensor configuration data is then entered after the file has been created.

To create a new HIPS vessel file:

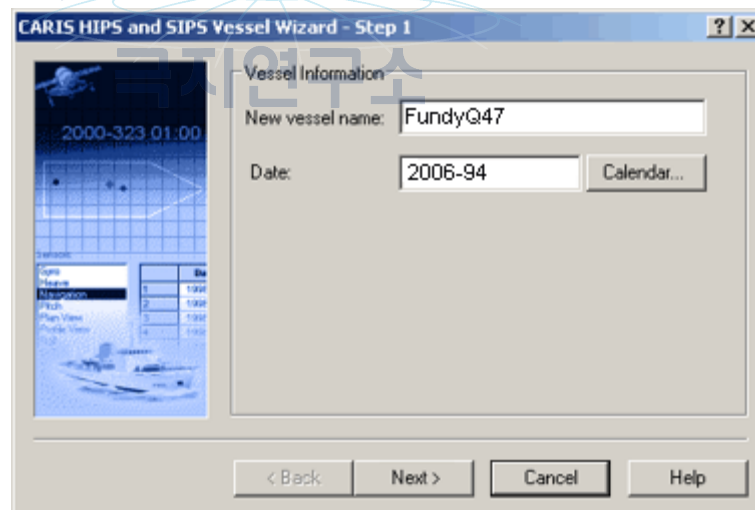
1. Select the New Vessel File command.

The Vessel Wizard - Step 1 dialog box is displayed.

(The dialog boxes displayed by the wizard are contingent on the type of sonar used in the survey.)

Menu	File > New
Tool	

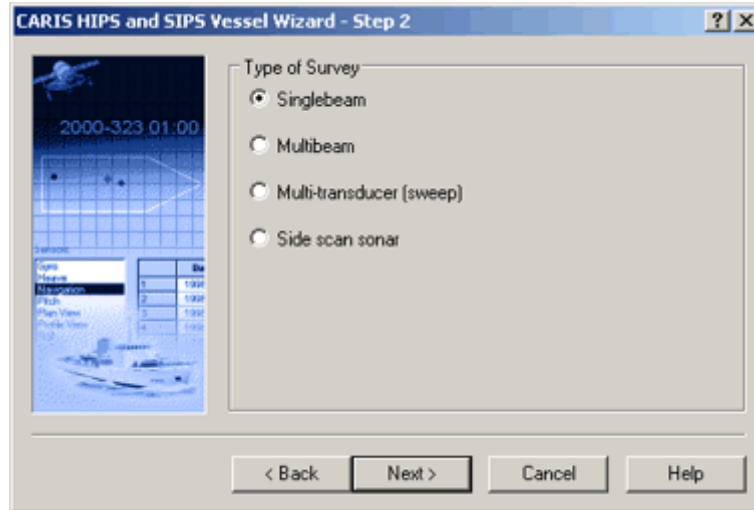
Vessel Information



1. Type a name similar to the vessel used in the survey. Make sure the name does not include any spaces.
2. Click the **Calendar** button to insert the year and date from which the vessel file is valid.
3. Click **Next** to open the next dialog box: [“TYPE OF SURVEY”](#) ON PAGE 549.

Type of Survey

The second dialog box prompts you to enter the sonar type used in the survey.



There are four sonar types:

- *Singlebeam*
- *Multibeam*
- *Multi-transducer*
- *Side Scan Sonar*

1. Select a sonar type by clicking the appropriate check box.
2. Click **Next** to go to the next step in the Vessel Wizard,

or,

if you selected *Side Scan Sonar*, click **Finish**.

Single Beam

If you select Single Beam as the type of survey data in Step 2, then the remaining steps in the creation of a new HVF are “**MOTION SENSORS**” ON PAGE 552 and “**CONFIGURATION OPTIONS**” ON PAGE 553.

Multibeam

If you selected Multibeam in the Step 2 dialog box, Step 3 will ask you for information on the sonar model and number of transducers.

1. Select the appropriate check box to indicate that one or two transducers were used in the survey.
2. Enter the number of beams in each transducer.
3. Select the sonar model.
4. Click **Next** to continue.

Multi-Transducer

If you selected Multi-transducer in the Step 2 dialog box, you will now be asked for information on the number and types of transducers and for TPE specific parameters.

1. Enter the *Number of Transducers* on a boom.
2. Select *Yes* if the transducers are mounted to a fixed boom or to the hull of the vessel, or select *No* if the transducers are on a movable (decoupled) boom.
3. Type the default *Alongtrack* value of all the transducers relative to the ship's Reference Point.
4. Type the default *Depth* of all the transducers relative to the ship's Reference Point.
5. Select the sonar model from the *Model* drop-down list.

The following parameters are necessary to calculate Total Propagated Error.

6. Type the distances from the positioning system to the centre of the boom in the *Navigation to Boom X-Y-Z* fields.
7. Type the distance from the motion recording unit to the centre of the boom in the *MRU to Boom X-Y-Z* fields.

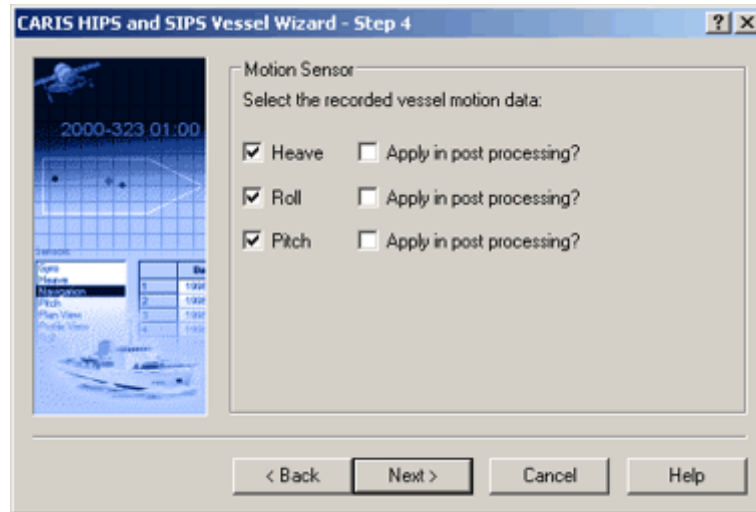
The *Roll* and *Gyro* misalignment values are needed for fixed-boom system. However, for a decoupled boom, only a *Gyro* misalignment value is needed.

The *Squat* and *Heave* percentage values are transducer responses to overall heave and squat. For fixed-boom transducers this should be 100% and less than 100% for decoupled-boom transducers.

8. Type a degree offset in the *Roll* and *Gyro* fields.
9. Type a percentage value in the *Squat* and *Heave* fields.
10. Click **Next** to open the next step: **"CONFIGURATION OPTIONS" ON PAGE 553.**

Motion Sensors

This dialog box determines which attitude sensors are displayed in the HVF.



1. Create entries for any (or all) of the following sensors by clicking the appropriate box:

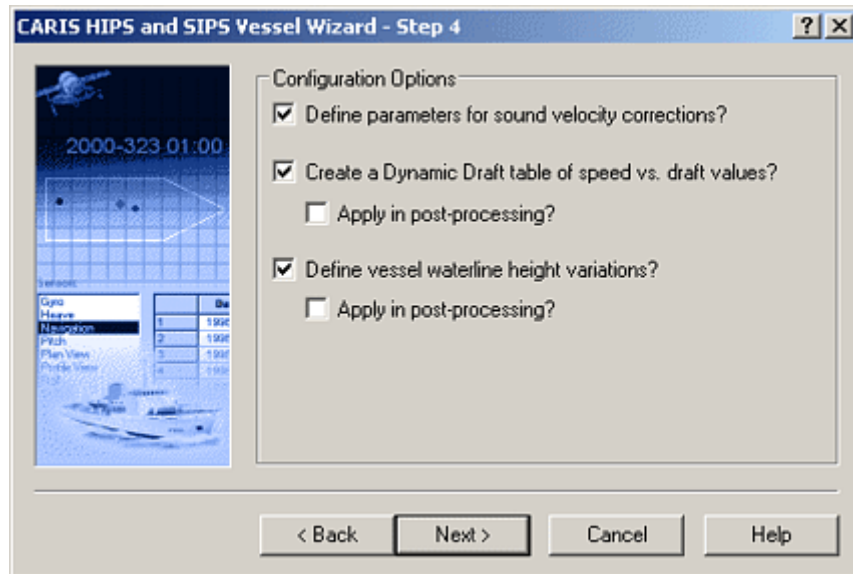
- *heave*
- *pitch*
- *roll*

The *Apply in Post Processing* option means that the data is applied during the Merge process or during Sound Velocity Correction.

2. Click any of the check boxes if you want to apply the attitude sensor data in post processing.
3. Click **Next**.

Configuration Options

The Configuration Options dialog box is displayed



This dialog box lets you enable three options:

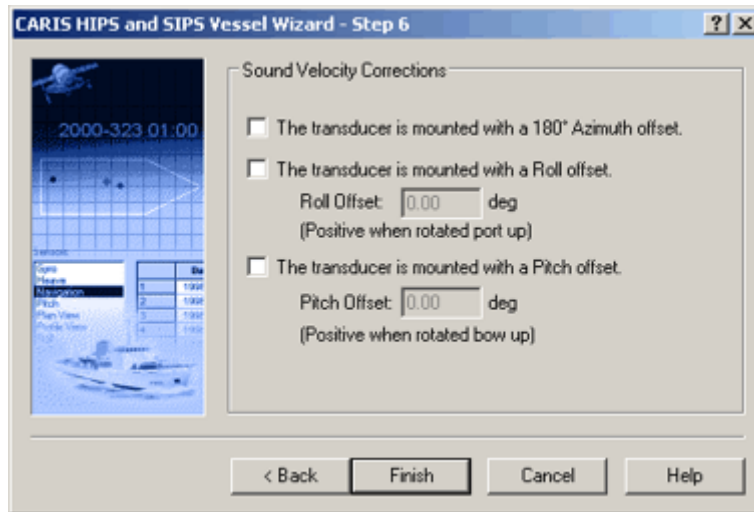
- the SVP (Sound Velocity Profile) pole parameters
 - dynamic draft values
 - waterline height variation
1. To include sound velocity corrections, click the *Define Parameters for Sound Velocity Corrections* check box.
 2. To apply dynamic draft values to vessel speeds, click the *Apply Dynamic Draft* check box.

A draft-versus-speed table is created in the Vessel Editor. You can enter values in this table once the vessel file is created.

3. If you want to apply long period variations in the waterline height in processing data, click the *Define Vessel Waterline Height Variation* check box.
4. Click the appropriate *Apply in Post Processing* check boxes, as needed.
5. If you selected the *Define Parameters for Sound Velocity Corrections* check box, click **Next**, or click **Finish** if did not select this option.

Sound Velocity Corrections

The Sound Velocity Corrections dialog box is displayed only if you selected the *Define parameters for sound velocity corrections* check box in the Configuration Options dialog box.



This dialog box records any transducer pole offsets.

Transducer head offsets must be taken into account when the SVP is applied to the data.

1. Select the 180-degree Azimuth box if the transducer is reverse mounted.
2. If the transducer is mounted with a large roll offset for use under wharves or along banks, then select the *Roll Offset* check box
3. Type the amount of offset (in degrees) in the *Roll Offset* box.
4. If the transducer is mounted with a large pitch offset such that it is pointed forward or backwards, then select the *Pitch Offset* check box.
5. Type the amount of offset (in degrees) in the *Pitch Offset* box.
6. Repeat the above steps for the second transducer if there are two poles.
7. Click **Finish**.

A new HIPS Vessel File is created. You can now create an outline for the vessel (see “[CREATE VESSEL OUTLINE](#)” ON PAGE 555).

Create Vessel Outline

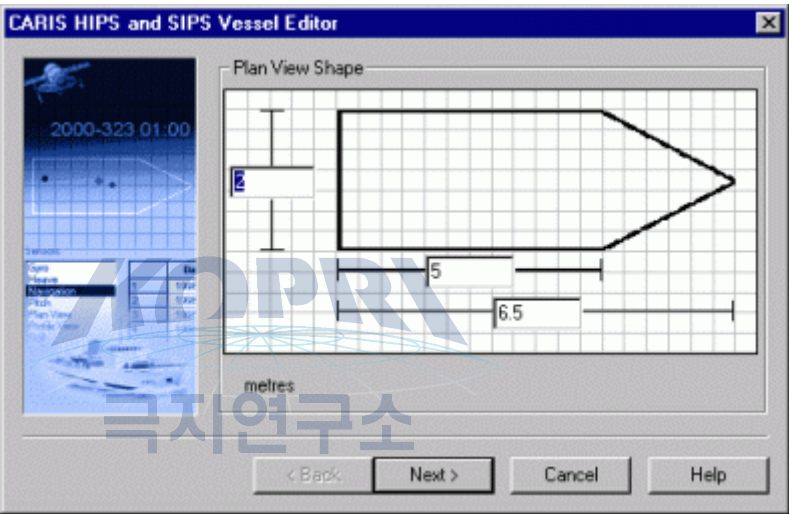
Menu	Edit > Vessel Shape
Tool	

The Vessel Shape command creates a 3-D outline of the vessel and displays it in the Editor. You can also use the Vessel Shape command to revise an existing vessel outline.

The Vessel Shape command opens three dialog boxes so you can enter measurements to define the length, width and height of the vessel, and the position of the Reference Point in the vessel.

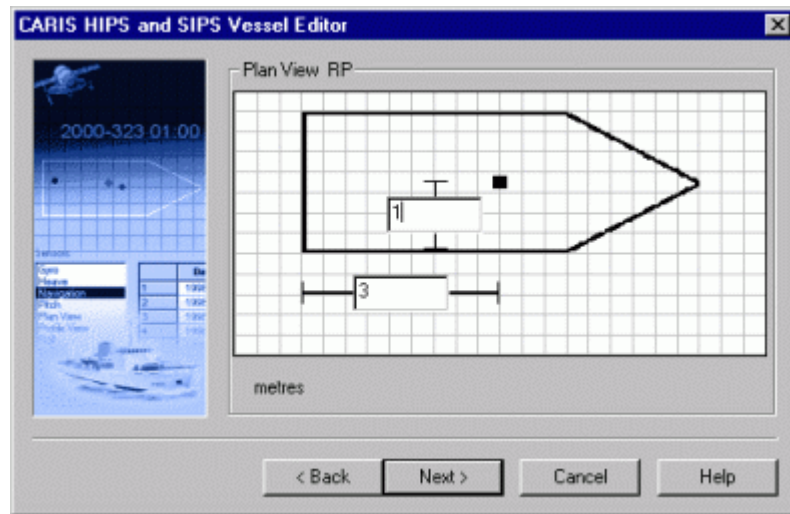
- 1. Open the HVF if it is not already open.
- 2. Select the Vessel Shape command.

The Vessel Shape - Step 1 dialog box is used for entering width and length of the vessel.



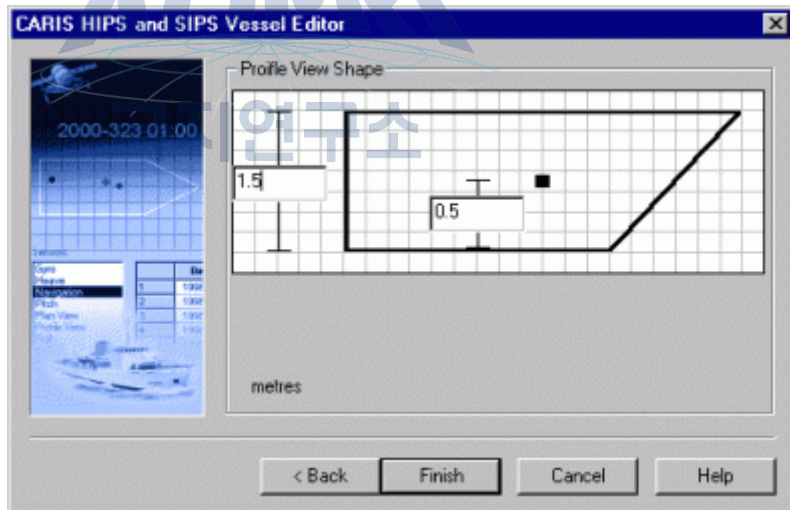
- 1. Enter a width for the vessel (port to starboard).
- 2. Enter a length for the vessel (stern to the base of the bow).
- 3. Enter a length for the vessel (stern to the tip of the bow).
- 4. Click **Next**.

The Vessel Shape - Step 2 dialog box is displayed. It is used to set the position of the Reference Point (RP).



1. Type the distance from the stern to RP.
2. Type the distance from the starboard side to the RP.
3. Click **Next**.

The Vessel Shape - Step 3 dialog box sets the height measurements for the vessel.



1. Type the height of the vessel.
2. Type the height of the vessel RP from the keel.
3. Click **Finish**.

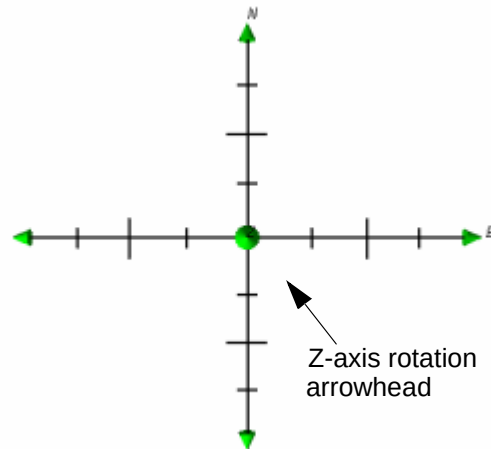
The Vessel Editor displays the vessel outline.

3-D Controls

The outline displayed in the editor can be rotated, zoomed and panned using the compass (control axes), keyboard, and mouse.

Compass

Rotation along the X-Y-Z axis is handled by moving the arrow heads at the ends of the compass.



1. To rotate the image along the Z-axis, click the middle arrow head and drag the cursor upward so that the image is rotated. The compass can be rotated 90°.
2. To rotate the image along the X-Y axis, click any of the other arrow heads and drag the arrow head in a left-right or up-down direction. The compass can be rotated 360°.
3. Alternatively, the image can be rotated in the horizontal plane by grabbing the Z-arrow, then pressing the <Ctrl> key and the left-mouse button and moving the cursor up and down in the view. Rotation around the Z-axis can be performed by pressing the <Shift> key and moving the cursor left and right in these windows.

Pan

There are three pan options:

- To pan along the X-Y axis: place the cursor in the 3-D area, press the middle mouse button and drag the display to a new location.
- To pan along the Z-axis: place the cursor in the 3-D area, press and hold both the <Shift> key and middle mouse button and move the cursor in the window.
- To centre the 3-D Display window on a selected point: position the cursor over the point and click the middle mouse button.

Zoom

The zoom option is similar to pan

1. Press and hold both the <Ctrl> key and right-mouse button while dragging the mouse up or down to zoom in or zoom out.

Options Dialog Box

Default ellipsoid

The HVF must contain the ellipsoid and datum used by the navigation system in the survey vessel, regardless of whether projection coordinates or geographic coordinates are stored in the data.

The list of available ellipsoids is maintained in the datum.dat file referenced by the uslXdatum environment variable. By default, this file is located in the System directory.

Set the ellipsoid for a new vessel file to be the same as the one used in the survey.



Menu	Tools > Options

1. Select the Options command.
- The Options dialog is displayed.
2. Select the Options - General tab.
3. Select an ellipsoid from the pull-down menu.
4. Click **OK** to close the dialog box.

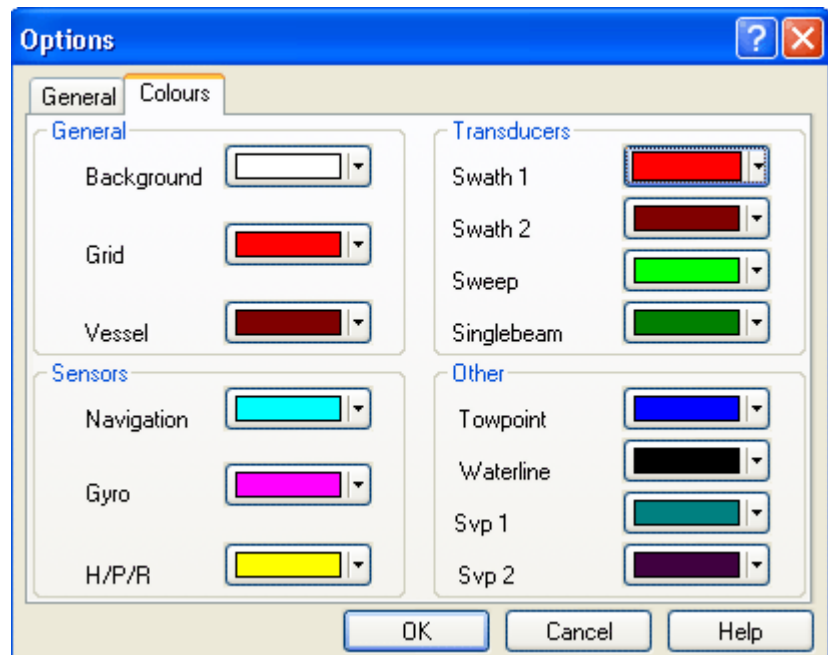
The name of the ellipsoid is displayed in the Navigation section of the editor.

Colours

The locations of sensors and other equipment are shown by a colour markers. You can select another colour for a sensor marker.

Menu	Tools > Options

1. Select the Options command.
- The Options dialog box is displayed.
2. Select the Options - Colours tab.



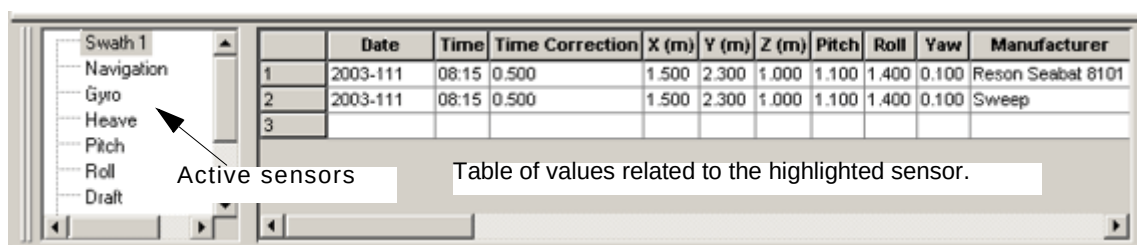
3. Select a colour from the pull-down palette, or create a custom colour from the standard Windows colour picker.
4. Click **OK** to activate the changes and close the Options dialog.



Edit Sensor Configuration

The active sensors listed in the Vessel Editor (shown below) are determined by the sensor and other parameters you selected when creating the vessel file.

If you want to add data for a sensor not already included in the vessel file, you can add a sensor to the list and enter its data. You can also remove a sensor and its values from the vessel file.



In general, if sensor offsets or calibration values have already been applied to logged data during data acquisition, then the same offsets and calibration parameters must not be entered in the Vessel Editor.

Also, if compensation for heave, pitch, and roll has already been made to the recorded sounding data during data acquisition, for example as in Simrad data, then it must not be applied again.

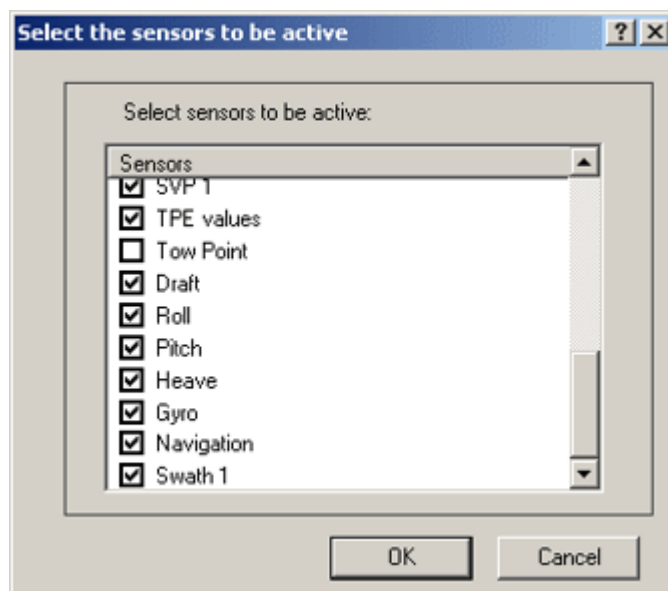
Toggle data fields

Menu	Edit > Active Sensors
Tool	

To add or remove sensors from the list of active sensors,

1. Select the Active Sensors command.

The Active Sensors dialog box is displayed.



If a box is checked, the sensor is included in the vessel file and displayed in the Editor table.

2. Make sure a sensor box is checked to enable the sensor, or cleared to remove the sensor.
3. Click **OK**.

The list is refreshed to show the selected active sensors.

Sensors

Different sensors can require specific edits applied to the parameter data. The following sections explain the individual sensor data fields.



Swath

The swath sonar, also known as multibeam, typically has beams that are formed in a fan shape, radiating from the centre of the transducer.

1. Click *Swath 1* in the Sensors list box so the selection is highlighted and the swath data fields are displayed.
2. Type data (as needed) in the following fields:
 - Date: The year and Julian day of current swath time stamp.
 - Time: The hour and minute of the current swath time stamp.
 - Time Correction: The time correction value.

The X-Y-Z fields set the location of the transducer from the Reference Point (0).

- X: The athwart-ship distance of the transducer, positive to starboard.
- Y: The along-ship distance of the transducer, positive to the bow.
- Z: The vertical distance of the transducer, positive into the water.

The Pitch, Roll and Yaw fields refer to misalignment of the transducer, during mounting, from the vessel coordinate system.

- *Pitch*: The offset is positive when rotating the transducer towards the bow (bow up).
- *Roll*: The offset is positive when rotating the transducer away from starboard (starboard down).
- *Yaw*: Indicates the horizontal rotational offset and is positive for a clockwise rotation.
- *Manufacturer*: The maker of the transducer.
- *Model*: The make of the transducer. The model information is necessary for the calculation of Total Propagated Error.
- *Serial Number*: The serial number of the transducer.

Since the Simrad data read into HIPS is already corrected, the Swath values in the HVF must be set as follows:

- The X/Y/Z offsets are zero because the Simrad data acquisition has already applied static draft and shifted the swath profile to the vessel reference point.
- The Roll / Pitch / Yaw transducer mounting rotations are typically zero because the Simrad data acquisition has already applied patch test calibration results.

Navigation

The navigation section of the HVF describes the location of the navigation source (for example, antenna or motion sensor). This section is used as a link between the fixed positioning coordinate system and the instantaneous vessel coordinate system.

1. Click *Navigation* in the Sensors list box so the selection is highlighted and the navigation data fields are visible.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current navigation time stamp.
 - *Time*: The hour and minute of the current navigation time stamp.
 - *Time Correction*: The time correction value.

The X-Y-Z fields set the location of the navigation source from the Reference Point (0).

- *X*: The athwart-ship distance of the source, positive to starboard.
 - *Y*: The along-ship distance of the source, positive towards the bow.
 - *Z*: The vertical distance of the source, positive into the water.
 - *Ellipsoid*: From the drop-down list, select the ellipsoid on which the navigation is based. The ellipsoid should be the same as the one used in the survey.
 - *Manufacturer*: The maker of the navigation equipment.
 - *Model*: The make of the navigation equipment.
 - *Serial Number*: The serial number of the navigation equipment.
-

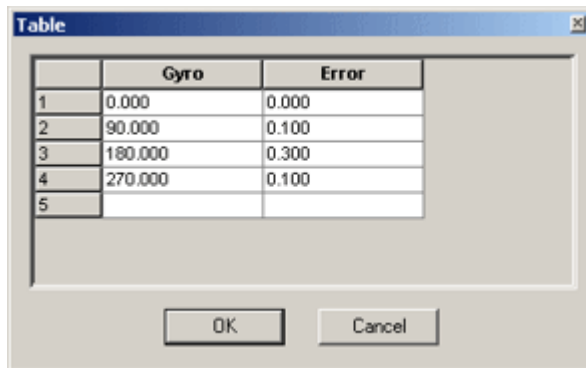
Gyro

The gyro sensor refers to any device providing a heading orientation of the vessel.

1. Click *Gyro* in the Sensors list box so the selection is highlighted and the gyro data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current gyro sensor time stamp.
 - *Time*: The hour and minute of the gyro sensor time stamp.
 - *Time Correction*: The time correction value.

The Gyro Error is measured in degrees and is the difference between the recorded sensor value and the applied heading of the vessel: $\text{Applied Heading} = \text{Recorded value} - \text{Gyro Error}$.

3. Click an **Edit** button in the *Error* column to open the Gyro Error Table.



The screenshot shows a dialog box titled 'Table' with a table containing two columns: 'Gyro' and 'Error'. The table has five rows, with the first four rows containing numerical data and the fifth row being empty. Below the table are 'OK' and 'Cancel' buttons.

	Gyro	Error
1	0.000	0.000
2	90.000	0.100
3	180.000	0.300
4	270.000	0.100
5		

4. Type new values in the *Gyro* or **Error** fields and click **OK** to close the dialog box.
5. Type data (as needed) in the following fields.
 - *Manufacturer*: The maker of the sensor equipment.
 - *Model*: The make of the sensor equipment.
 - *Serial Number*: The serial number of the sensor equipment.



Heave

The heave sensor records the vertical motion of the vessel. Although the heave sensor has its own section in the Vessel Editor, it is usually part of the same sensor package as Pitch and Roll in most survey configurations.

1. Click *Heave* in the Sensors list box so the selection is highlighted and the data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current heave sensor time stamp.
 - *Time*: The hour and minute of the current heave sensor time stamp.
 - *Time Correction*: The time correction value.

The X-Y-Z fields set the location of the heave sensor from the Reference Position (0).

The X-Y-Z location of the heave sensor must be defined **ONLY** when you intend to apply heave data during Merge **AND** when remote heave compensation is necessary.

- *X*: The athwart-ship distance of the sensor, positive to starboard.
- *Y*: The along-ship distance of the sensor, positive to the bow.
- *Z*: The vertical distance of the sensor, positive into the water.
- *Error*: The applied instantaneous values for the heave sensor are computed by subtracting the appropriate errors from the recorded values:

$$\text{Applied Heave} = \text{Recorded Heave} - \text{Heave Error}.$$
- *Apply*: Select Yes to apply heave data in the merge process.
- *Manufacturer*: The maker of the sensor equipment.
- *Model*: The make of the sensor equipment.
- *Serial Number*: The serial number of the sensor equipment.

The location of the heave sensor is shown in the Vessel Editor by a coloured dot.

Note: Simrad systems apply dynamic Heave, Pitch, and Roll values to the swath data during survey. Therefore, the HVF must be set up with the *Apply* switches for Heave, Pitch, and Roll set to "No" so these values are not applied twice.

Pitch

Pitch refers to the rotational motion of the vessel around the X (port/starboard) axis. Although the pitch sensor has its own section in the Vessel Editor, it is usually part of the same sensor package as roll and heave in most survey configurations.

1. Click *Pitch* in the Sensors list box so the selection is highlighted and the data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current pitch time stamp.
 - *Time*: The hour and minute of the current pitch time stamp.
 - *Time Correction*: The time correction value.
 - *Error*: The applied instantaneous values for the pitch sensor are computed by subtracting the appropriate errors from the recorded values:

$$\text{Applied Pitch} = \text{Recorded Pitch} - \text{Pitch Error}.$$
 - *Apply*: Select Yes to apply the pitch data in the merge process.
 - *Manufacturer*: The maker of the sensor equipment.
 - *Model*: The make of the sensor equipment.
 - *Serial Number*: The serial number of the sensor equipment.

The location of the pitch sensor is indicated in the Vessel Editor by a coloured dot.

Note: Simrad systems apply dynamic Heave, Pitch, and Roll values to the swath data during survey. Therefore, the HVF must be set up with the *Apply* switches for Heave, Pitch, and Roll set to "No" so these values are not applied twice.

Roll

Roll refers to the rotational motion of the vessel around the Y (fore/aft) axis. Although the roll sensor has its own section in the Vessel Editor, it is usually part of the same sensor package as pitch and heave in most survey configurations.

1. Click *Roll* in the Sensors list box so the selection is highlighted and the roll data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current roll time stamp.
 - *Time*: The hour and minute of the current roll time stamp.
 - *Time Correction*: The time correction value.
 - *Error*: The applied instantaneous values for the roll sensor are computed by subtracting the appropriate errors from the recorded values:

$$\text{Applied Roll} = \text{Recorded Roll} - \text{Roll Error}.$$
 - *Apply*: Select Yes to apply the roll data in the merge process.
 - *Manufacturer*: The maker of the sensor equipment.
 - *Model*: The make of the sensor equipment.
 - *Serial Number*: The serial number of the sensor equipment.

The location of the roll sensor is indicated in the Vessel Editor by a coloured dot.

Note: Simrad systems apply dynamic Heave, Pitch, and Roll values to the swath data during survey. Therefore, the HVF must be set up with the *Apply* switches for Heave, Pitch, and Roll set to "No" so these values are not applied twice.

Dynamic Draft

The squat and lift of a vessel changes as the speed changes. For some vessels, if the squat/lift is not accounted for, significant errors are introduced into the soundings. In this section, you can specify up to 10 speed-draft value pairs. During merge, the difference between the instantaneous draft and the static draft is computed and the final depth compensated.

Draft is measured in metres/feet, and speed is measured in knots. All draft values entered should be relative to the same reference, but what that reference is, is not important. The first Speed-Draft pair must correspond to a state where no draft correction is necessary. The delta draft values, relative to the initial draft, are computed and used to correct observed soundings.

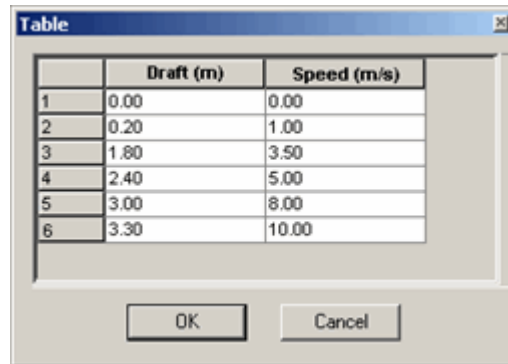
The following formula is used to correct soundings for dynamic draft:

$\text{Depth} = \text{observed depth} - \text{waterline} + \text{delta draft}.$

Delta draft is computed from the present vessel speed, as derived from the navigation system.

You can also create your own dynamic draft model and load Delta Draft information directly which will override the Dynamic Draft table in the HVF.

1. Click *Dynamic Draft* in the sensors list box so the selection is highlighted and the dynamic draft data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current time stamp for the draft table.
 - *Time*: The hour and minute of the current time stamp for the draft table.
 - *Apply*: Select Yes to apply the table during merge (or No to not apply the table).
3. Click **Edit** in the *Error* field. A dialog box containing a table with up to 10 speed-draft pairs is displayed.



	Draft (m)	Speed (m/s)
1	0.00	0.00
2	0.20	1.00
3	1.80	3.50
4	2.40	5.00
5	3.00	8.00
6	3.30	10.00

4. Click inside the *Speed* cell and type a speed value (in knots).
5. Click inside the *Draft* cell and type a corresponding draft value.
6. Continue entering as many speed /draft pairs as needed.
7. Click **OK**.

The speed-draft table is saved in the HVF.

- *Comments*: Any additional comments.

Single Beam

The Single beam section refers to a vertical beam echo sounder with one transducer mount. It can be a single or dual frequency sounder defined as one beam with one transducer.

1. Click *Single Beam* in the Sensors list box so the selection is highlighted and the data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current single beam time stamp.
 - *Time*: The hour and minute of the current time stamp.
 - *Time Correction*: The time correction value.

The X-Y-Z fields set the location of the transducer from the Reference Point (0).

- *X*: The athwart-ship distance of the transducer, positive to starboard.
- *Y*: The along-ship distance of the transducer, positive to the bow.
- *Z*: The vertical distance of the transducer, positive into the water.
- *Manufacturer*: The maker of the transducer.
- *Model*: The make of the transducer.
- *Serial Number*: The serial number of the transducer.

SVP

A sound velocity profile (SVP) records the speed of sound at various depths in the water column. One of the processes available in HIPS is the application of SVP data in sound velocity corrections. However, this procedure is not available for all types of sonars because some sonars and their data logging systems compensate for sound velocity during data acquisition.

To ensure the SVP is accurately applied in HIPS, the transducer X-Y-Z offset values must be entered.

1. Click *SVP 1* in the Sensors list box so the selection is highlighted and the SVP transducer data fields are visible. If there is a second transducer then click *SVP 2* and complete the same procedures as listed below.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current SVP pole time stamp.
 - *Time*: The hour and minute of the current SVP pole time stamp.
3. Select Yes if there are dual transducers (or No if there is only a single transducer).

The following three fields are for entering the pole's X-Y-Z coordinates. All coordinates are measured from the Reference Point

4. Type the transducer's X-Y-Z offsets in the following fields:
 - *X*: The athwart-ship distance of the transducer, positive to starboard.
 - *Y*: The along-ship distance of the transducer, positive to the bow.
 - *Z*: The vertical distance of the transducer, positive into the water.

Note: The Reference Point for Simrad data is the centre of rotation. It should be possible to retrieve offset values from the Simrad Installation Datagram.

The next three fields refer to the alignment of the transducer. The values you entered in the wizard when creating the HVF are displayed in these fields. The fields are only to be used for large transducer mounting offsets.

- *Pitch*: Pitch offsets of the transducer.
- *Roll*: Roll offsets of the transducer.
- *Yaw*: Rotation of the transducer (either 0 or 180 degrees).

For information on applying SVP in processing see Sound Velocity Processing in the HIPS and SIPS User Guide.

Sweep

Sweep systems typically contain multiple vertical beam transducers mounted on a boom and pointed straight down. The reference point for a sweep system can be anywhere on the X-Y plane, but must be on the water surface.

1. Click *Sweep* in the Sensors list box so the selection is highlighted and the data fields are visible.

	Date	Time	Time Correction (s)	Transducers	Transducer Status	TPE Status
1	2009-103	00:00	0.000	6	edit	edit
2					edit	edit

2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current sweep time stamp.
 - *Time*: The hour and minute of the current sweep time stamp.
 - *Time Correction*: The time correction value.
 - *Transducers*: Number of beams mounted on the boom.
3. Click the **Edit** button in the *Transducer Status* field to view a table for entering data for individual beams on the boom.

	Time Correction (s)	X (m)	Y (m)	Z (m)	Pitch (deg)	Roll (deg)	Gyro (deg)
1	0.000	0.000	5.000	8.000	0.000	0.000	0.000
2	0.000	0.000	5.000	8.000	0.000	0.000	0.000
3	0.000	0.000	5.000	8.000	0.000	0.000	0.000
4	0.000	0.000	5.000	8.000	0.000	0.000	0.000
5	0.000	0.000	5.000	8.000	0.000	0.000	0.000
6	0.000	0.000	5.000	8.000	0.000	0.000	0.000
7							

OK Cancel

4. Type values in the fields and click **OK**.
5. Click **Edit** in the *TPE Status* field to enter TPE values for each beam on the boom and to edit values entered in the new vessel wizard.

TPE Settings for Sweep

Navigation to Boom:

x m

y m

z m

MRU to Boom:

x m

y m

z m

	Fixed	Heave (%)	Squat (%)	Roll (deg)	Gyro (deg)
1	Yes	11.00	5.00	4.00	3.00
2	Yes	11.00	5.00	4.00	3.00
3	Yes	11.00	5.00	4.00	3.00
4	Yes	11.00	5.00	4.00	3.00
5	Yes	11.00	5.00	4.00	3.00

OK Cancel

6. Type values as needed and click **OK**.



Towed Sensors

If a towed sensor—such as a side scan sonar—is used on a survey, then SIPS can compute the sensor's position as from the ship's position by calculating the horizontal layback and a direction to the sensor.

1. Click *Towed* in the Sensors list box so the selection is highlighted and the Towed data fields are displayed.
2. Type data (as needed) in the following fields:
 - *Date*: The year and Julian day of the current towed sensor time stamp.
 - *Time*: The hour and minute of the current towed sensor time stamp.
 - *Time Correction*: The time correction value.
 - *Layback Error*: The error in the computed or recorded horizontal layback. This can be used, for example, to compensate the recorded layback data or tow cable length for the distance between the origin of the measurements and the defined tow point location in the tow cable length. This value is subtracted from the computed horizontal layback.
 - *X*: Offset of the tow point from the vessel's reference position.
 - *Y*: Offset of the tow point from the vessel's reference position.
 - *Z*: Height of the tow point (negative upwards) in relation to the datum that is referenced to the sensor depth (in most cases, this is the waterline).
 - *Manufacturer*: The maker of the towed sensor.
 - *Model*: The make of the towed sensor.
 - *Serial Number*: The serial number of the towed sensor.

Waterline

The purpose of this section is to define long-period changes in the vessel's draft due to fuel burn or other loading changes.

Specifically, you can enter the height of the waterline below the Reference Point.

If the Waterline section of the vessel configuration is not defined then the default of zero is used by the software as the height of the waterline below the RP.

The Waterline section must be present in the HVF for use in sound velocity corrections.

1. Click *Waterline* in the Sensors list box so the selection is highlighted and the waterline data fields are displayed.
2. Type data (as needed) in the following fields:
 - Date*: The year and Julian day of the current waterline time stamp.
 - Time*: The hour and minute of the current waterline time stamp.
 - Waterline*: The distance from the RP, positive when below the RP.
 - Apply*: Select Yes to apply the waterline data in the merge process.

For Simrad data, the Waterline value must be set to the same value recorded as **WLZ** in the Simrad Installation Datagram.

The Waterline value will only be used during Sound Velocity Correction.

The Apply switch must be set to **“No”**. It must not be set to **“Yes”**, because it must not be used by Merge.

Total Propagated Error

This section defines the values for calculating Total Propagated Error (TPE). TPE is derived from a combination of all individual error sources. The TPE Configuration section of the vessel file contains the following errors (among others):

- nav/gyro/heave/pitch/roll/tide errors
- latency error estimate
- sensor offset error estimates.

These errors are combined with individual sonar model characteristics in the DeviceModels.xml file to calculate horizontal and vertical uncertainty values for every sounding along a track line when TPE is applied.

1. Expand the TPE section by clicking + icon.
2. Type data (as needed) in the Offsets section:
 - *MRU to Transducer*: The physical offset in three dimensions from the motion recording unit to transducer 1 on the vessel.
 - *MRU to Transducer2*: The physical offset in three dimensions from the motion recording unit to transducer 2 on the vessel.
 - *Navigation To Transducer*: The physical offset in three dimensions from the navigation antenna to transducer 1 on the vessel.
 - *Navigation To Transducer2*: The physical offset in three dimensions from the navigation antenna to transducer 2 on the vessel.
 - *Transducer Roll*: The mounting roll offset for transducer 1. The offset is positive when rotating the transducer away from starboard (starboard down).
 - *Transducer Roll 2*: The mounting roll offset for transducer 2. The offset is positive when rotating the transducer away from starboard (starboard down).
3. Type data (as needed) in the Standard Deviation section:
 - *Motion Gyro*: The measurement standard deviation of the heading data in degrees.
 - *Heave % Amplitude*: An additional heave standard deviation component that is the percentage of the instantaneous heave.
 - *Heave (m)*: The measurement for standard deviation of the heave data. Most heave manufacturers quote heave error as being determined from StaticHeave or PercentageOfHeave depending on which value is larger.
 - *Roll*: The measurement standard deviation of the roll data in degrees.
 - *Pitch*: The measurement standard deviation of the pitch data in degrees.
 - *Position Nav*: The standard deviation associated with the measurement of positions for the vessel. This is usually the error of the GPS sensor being used.

- *Timing Trans*: Standard deviation in transducer time stamp measurement.
- *Nav Timing*: Standard deviation in navigation time stamp measurement.
- *Gyro Timing*: Standard deviation in gyro time stamp measurement.
- *Heave Timing*: Standard deviation in heave time stamp measurement.
- *Pitch Timing*: Standard deviation in pitch time stamp measurement.
- *Roll Timing*: Standard deviation in roll time stamp measurement.
- *Offset X*: Standard deviation for the X measured offset on the vessel.
- *Offset Y*: Standard deviation for the Y measured offset on the vessel.
- *Offset Z*: Standard deviation for Z measured offset on the vessel.
- *Vessel Speed*: The standard deviation for the vessel speed measurements.
- *Loading*: Vertical changes during the survey because of fuel consumption, etc.
- *Draft*: The standard deviation in the vessel draft measurements.
- *Delta Draft*: The standard deviation in the dynamic vessel draft measurements.
- *MRU Align StdDev Gyro*: This value is the uncertainty of the motion recording unit placement within the vessel fixed coordinate frame.
- *MRU Align StdDev Roll/Pitch*: This value is the uncertainty of the motion recording unit placement within the vessel fixed coordinate frame.
- *Comments*: Any additional information.

3

SVP Editor

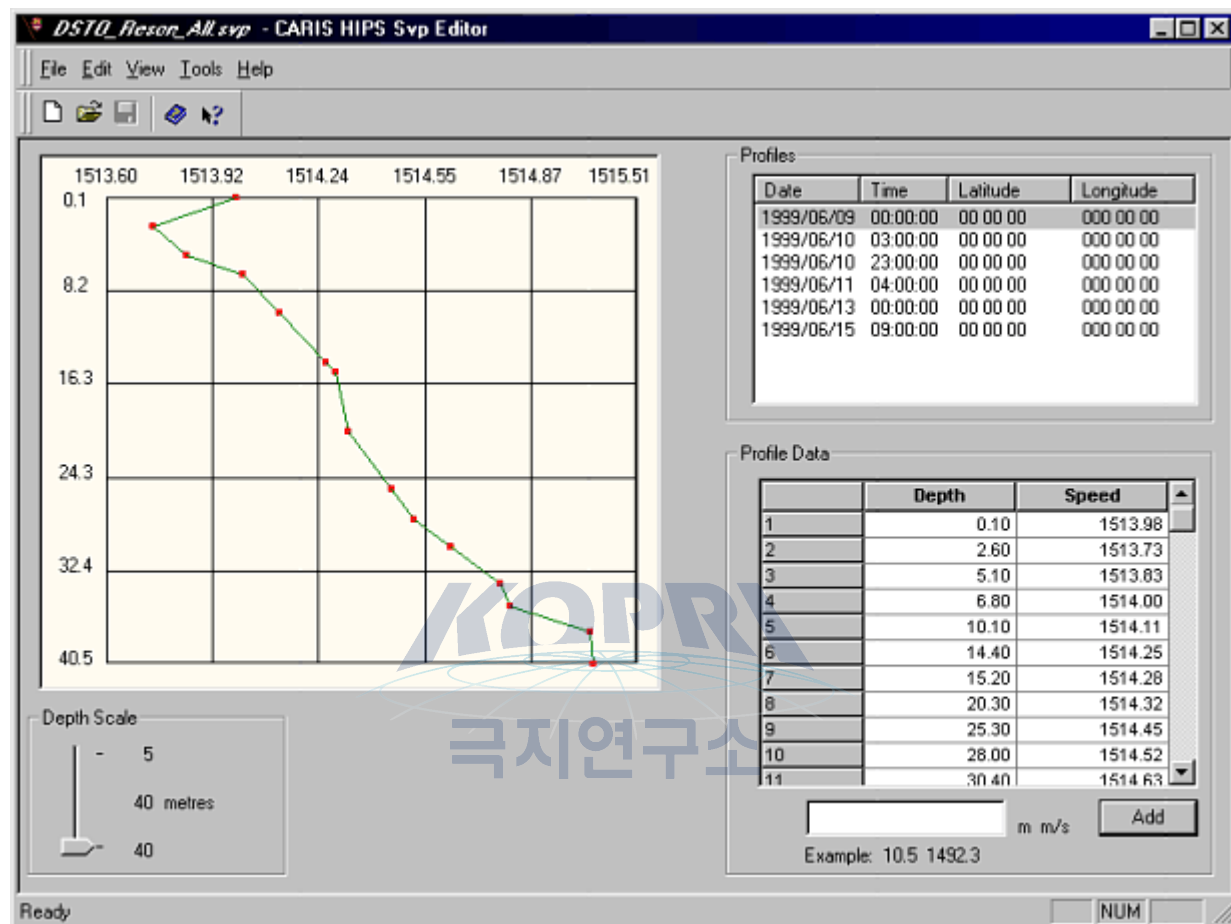
The SVP Editor helps you to edit existing SVP data, or to create new data.

In this chapter...

- "SVP EDITOR INTERFACE" ON PAGE 578
- "OPTIONS" ON PAGE 580
- "SVP FILES" ON PAGE 582
- "CREATE A NEW SVP FILE" ON PAGE 583
- "EDIT SVP DATA" ON PAGE 585

SVP Editor Interface

The SVP Editor is a separate program that is launched from HIPS and SIPS.



The *Profiles* area lists profiles contained in the SVP file. The profiles include a latitude and longitude position for applying the *Nearest in Distance* option. Below the *Profiles* section is a table of the depth/speed values for a selected profile. The left-hand side of the editor contains a graphical representation of the depth/speed data.

The *Depth Scale* slider determines the view for the depth/speed graphed area by setting a maximum depth value. You can change the vertical display of data by dragging the slider.

Open an Existing File

Menu	File > Open
Tool	
Key	<Ctrl+O>

1. Select the Open File command.

The Open dialog box is displayed. All SVP files are located, by default, in ..\Hips\Svp.

2. Select an SVP file so it is highlighted, or type the file path in the *File Name* text box.
3. Click **OK**.

A list of profiles is displayed. Data in the first profile is displayed in the Profile Data table and the speed/depth graphed area.

4. To navigate between profiles, click the time stamps in the *Profiles* list box.



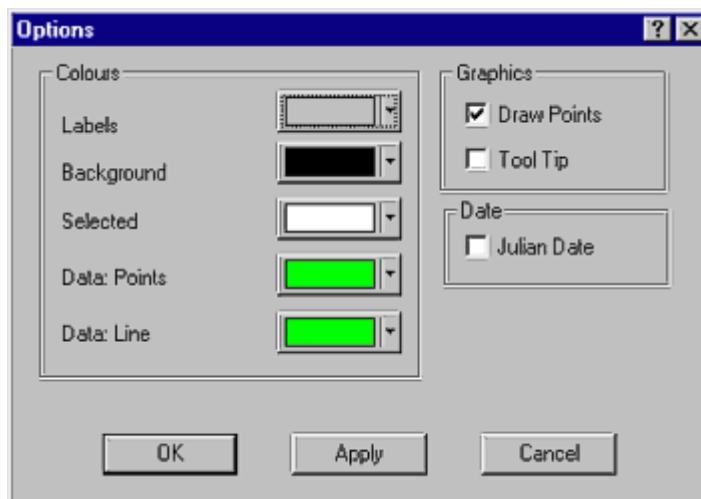
Options

Menu	Tools > Options

You can select the colours used for the graphical display.

1. Select the Options command.

The Options dialog box is displayed.



Colour Options

2. Select a colour from the drop-down palette or create a custom colour from the standard Windows colour picker.
3. Click **OK**.

The display is refreshed to show the selected colours.

Draw points

Show or hide the depth/speed data points in the graphical display.

4. Select the *Draw Points* check box.

If the box is checked, the data points are visible in the graphical display.

5. Click **Apply** to apply and save changes to the current file.
6. Click **OK**.

Show/hide tool tips

A tool tip is a label containing the depth/time position for a data point in the graphical display. The label becomes visible when the mouse cursor is moved in the graphical display.

7. Select the *Tool Tips* check box to show or hide the tool tips.

If the box is checked, the depth/time labels are visible.

8. Click **Apply** to apply and save changes to the current file.
9. Click **OK**.

Show Julian date

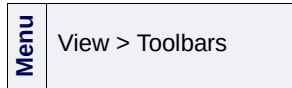
Switch the date fields in the SVP editor between the regular calendar format and Julian calendar format.

10. Make sure the *Julian Date* box is checked if you want to select this feature.

11. Click **Apply** to apply and save changes to the current file.
12. Click **OK** to close the dialog box.

Show/hide toolbars

Display or hide a HIPS and SIPS toolbar.



1. Select the Toolbars command.

If there is a check next to a toolbar name, then that toolbar is visible. If it is not checked, the toolbar is not visible.

Show/hide Status Bar

Display or hide the Status Bar.



1. Select the Status Bar command.

If there is a check mark next to the Status Bar on the View menu, then the status bar is visible. If it is not checked, the status bar is hidden.



SVP Files

Sound Velocity Profile files are in text format and can contain more than one profile. SVP files are similar to one shown below.

```
[SVP_VERSION_2]
E:\HIPS\Svp\sampleSvp_v2.svp
Section 2000-198 22:37:00 47:15:04 -54:19:51
    1.00 1405.00
    5.00 1440.00
   10.00 1456.00
   15.00 1480.00
   20.00 1490.00
   25.00 1494.00
   40.00 1500.00
   70.00 1505.00
  130.00 1510.00
Section 2000-198 23:00:00 47:15:03 -054:19:52
    1.00 1408.00
    5.00 1430.30
   10.00 1440.56
   15.00 1456.00
   20.00 1475.00
   25.00 1485.00
   40.00 1500.00
   70.00 1550.00
```

The SVP file has the following characteristics (starting from the top):

- The section labelled [SVP_VERSION_2] specifies the version of the SVP file.
- The path and name of the file.
- A section heading for each profile. The section heading contains:
 - the year and day (Julian date) that the profile was recorded
 - time that the profile was recorded
 - the latitude and longitude of the profile location.
- A list of depth/speed values.

Create a New SVP File

Menu	File > New
Tool	
Key	<Ctrl+N>
Menu	File > Save As

To create a new SVP file:

1. Select the New File command.
2. Add new SVP profiles (see “[CREATE NEW PROFILE](#)” ON PAGE 583.)
3. Create new depth/speed values, as needed.
4. Select the Save As command.
5. Type a name for the SVP file in the file name box.
6. Click **Save**.

The file is saved the directory you selected.

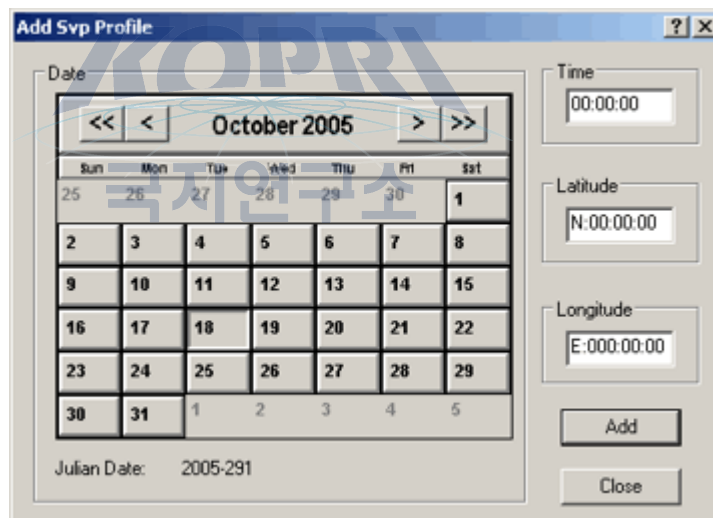
Create New Profile

Menu	Edit > Add Profile
Key	<Ctrl+Insert>

New SVP profiles can be created through the SVP Editor.

1. Select the Add Profile command.

The Add SVP Profile dialog box is displayed.



2. Click the arrow buttons at the top of the calendar to select a month and year (all profiles must be time stamped).
3. Click a day button on the calendar to select a day for the file.
4. Enter the new hour/minute values (use the 24-hour clock) by clicking each section in the *Time* box and typing new values.
5. Enter latitude and longitude coordinates in the appropriate boxes, if needed.
6. Click **Add** to apply settings.

The new file information is displayed in the *Profiles* box.

If you are enter new speed/depth data, you must enter this data in pairs. There are two options for entering data:

- separate the depth/speed data with a space: 15 1200
- separate the data with a comma: 15, 1200

Enter new depth/speed data

7. Click a profile to display the data in the SVP editor.
8. Type new depth *and* speed values in the text box beside the **Add** button.
9. Click **Add**.
10. Repeat Steps 1 through 3 until all necessary values are entered.



Edit SVP Data

You can use the SVP Editor to modify existing speed/depth values, append new data to an existing file, delete data or delete a complete profile.

Change depth/speed values

Individual values in the depth/speed table can be changed.

1. Position the cursor over any *Depth* or *Speed* cell in the table.
2. Click inside the cell.
3. Type a new value.
4. Click outside the cell.

The table is changed to reflect the new data.

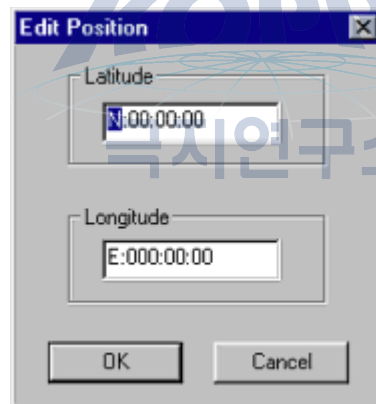
Edit geographic coordinates

Enter new latitude and longitude positions for SVP data. This information is important if you want to use the *Nearest in Distance* option for sound velocity correction (see "[SOUND VELOCITY PROCESSING](#)" ON PAGE 241).

Menu	Edit > Edit Position

1. Click a time stamp beside a profile.
2. Select the Edit Position command.

The Edit Position dialog box is displayed.



3. Click the latitude coordinates and type new ones.
4. Click the longitude coordinates and type new ones.
5. Click **OK**.

The new geographic coordinates are displayed in the *Latitude* and *Longitude* sections of the Profiles area.

Delete speed/depth data

1. Press and hold the mouse button, while dragging the cursor over the data points in the graphical display, or click a row number in the table.

The selected data is highlighted.

2. Select the Delete command.

The Speed/Depth data points are removed from the graphical display and the values are no longer displayed in the table.

Menu	Edit > Delete
Key	<Delete>

Remove Profiles

Remove a currently open profile from the SVP editor.

Menu	Edit > Remove Profile
Key	<Ctrl+Delete>

1. Select a profile by clicking the time stamp in the *Profiles* list box.

The depth/speed values are displayed in the editor.

2. Select the Remove Profile command.

The profile is removed from the editor.

- 3.

Exit SVP editor

Close the SVP Editor.

1. Select the Exit command.

2. If you have not saved any changes you are prompted to do so.

The SVP Editor is closed.

Menu	File > Exit



4

Tide Editor

Use the Tide Editor to create or edit tide files. Tide data is used to generate final depths relative to the tide datum by subtracting the tide from the sounding depth.

In this chapter...

극지연구소

Open Tide Editor

The Tide Editor presents tide file information in both graphical and tabular formats. You can use the editor to edit an existing file or to create a new tide file to apply to survey lines before the Merge process.

Tide files are located by default in ...\\Hips\\Tide and have a .tid file extension.

To open the Tide Editor:

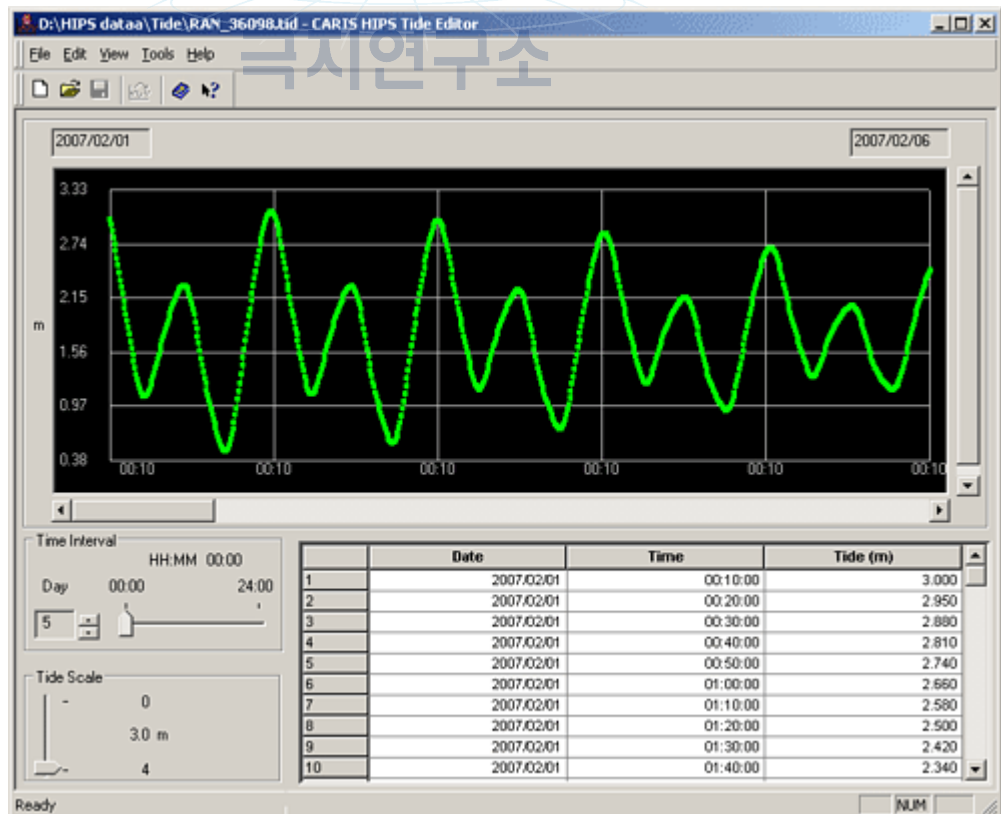


1. Click on the Tide Editor button in the Tools toolbar , or select the Tide Editor command from the menu in the HIPS and SIPS interface.

Menu	File > Open
Tool	
Key	<Ctrl+O>

1. Select an Open command to display the Open dialog box.
2. Select a tide file and click **Open**, or type the file name and path in the field.

The selected tide file is displayed in the editor. The graphical display shows a tide versus time graph of the data. Tide-level values are represented on the vertical axis. Time is represented on the horizontal axis. The tide data is also displayed in a table below the graphical display.



Adjust tide scale	To control the vertical scale of the graphical display: • Move the <i>Tide Scale</i> slide bar to select a range for the height of the vertical tide axis.
Adjust time interval	Change the horizontal scale by adjusting the <i>Time Interval</i> setting. • The day option lets you view data by 24-hour increments. • The hour/minute option lets you view data in increments of less than 24 hours. 1. Click the <i>Day</i> arrow buttons to select the range of days for displaying data. 2. If the <i>Day</i> value is set to zero then move the slide bar to select the minute/hour range for the display of data. The display of tide data is adjusted for the new time interval along the horizontal axis.
Save a tide file	Save changes to an existing tide file. 1. Select the Save command. The file is saved with the changes.



Editing Tide Data

Edit table data

Edit data in an existing tide file.

1. Select a Date/Time/Tide cell in the tide table.

The cursor is displayed in the cell.

2. Remove the existing data and type a new entry.

The graphical display refreshes to show the new data.

Delete a tide entry

1. Press and hold the mouse button while dragging the cursor over data in the graph, or click the appropriate number cell in the tide table.

The data is highlighted.

2. Select the Delete command.

The tide data is removed from the graphed line and the table.

Menu	Edit > Delete
Key	<Delete>

Search time gaps

Tide gauges, recording tidal height observations, may be subject to occasional outages resulting in gaps in the tidal time series. The time gaps option lets you search for these gaps. You can enter new data, if needed.

1. Select the Options command.

The Options dialog box is displayed.

2. Select the General tab if it is not already displayed.
3. Enter a value (in minutes) in the *Time Gaps* box.
4. Click **OK**.

5. Select the Next Time Gap command.

When the interval (in minutes) between adjacent data points is the same as, or greater than, the *Time Gaps* value, the adjacent data points are highlighted.

6. Repeat the process, if necessary, by selecting the Next Time Gap command for each tide data point on the graphed line.

You can enter new data between two values.

Menu	Tools > Next Time Gap
Tool	
Key	<Ctrl+G>

Enter new data

Enter data for a new or existing tide file.

1. Select the Add Tide command.

The Add Tide dialog box is displayed.

Menu	Edit > Add Tide
Key	<Insert>

Add Tide

Date

<< < April 2005 > >>

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
1	2	3	4	5	6	7

Julian Date : 2005-114

Time

00:00:00

☒ Input Interval

min

Tide

m

Add

Close

2. Change the date (if necessary) by clicking the arrow buttons at the top of the calendar until you have selected the desired month and year.

3. Click the appropriate day button on the calendar.

The selected date (year and day) is displayed below the calendar.

The default time is the time of the currently selected tide record.

4. Click any of the three sections (00:00:00) in the *Time* box so they are highlighted and type the desired time (use the 24-hour clock).

The *Input Interval* option lets you quickly enter a series of tide values at a regular time interval, using the <Enter> key. You do not need the mouse to move the cursor between fields.

5. If you want to regularly increment the times for tide data, click the *Input Interval* check box.

6. Enter the minutes that the time value is to be incremented.

7. Enter a tide value.

8. Click **OK**.

The new tide data is displayed in the editor. If you selected the *Input Interval* option, the time is incremented by the value set in the *Input Interval* box.

Create a New Tide File

Menu	File > New
Tool	
Key	<Ctrl+N>

You can create new tide file.

1. Select the New command.

Any tide file that is currently open in the editor is closed.

2. Select the Add Tide command and type a new tide entry (see [“ENTER NEW DATA” ON PAGE 552](#)).

The data is displayed in graph format in the editor.

3. Repeat until all values are entered.

4. When ready, select the Save or Save As command.

The Save As dialog box is displayed.

5. Type a name for the file and click **OK**.

Menu	File > Save/Save As
Tool	
Key	<Ctrl+S>



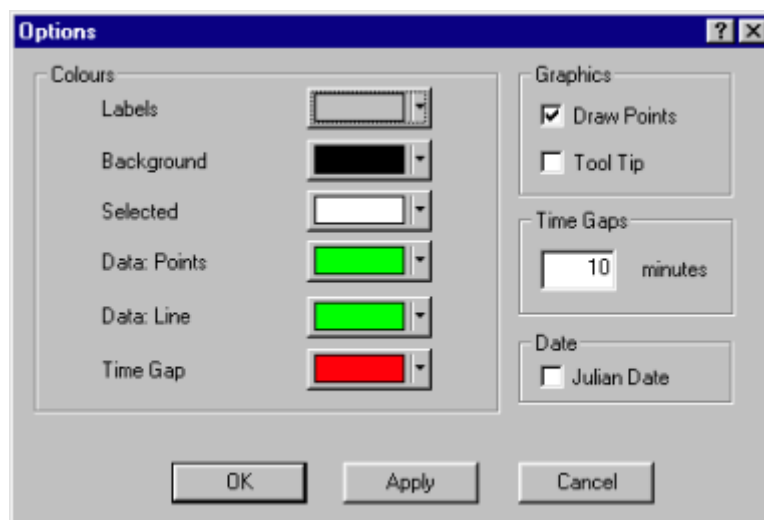
Options

Menu	Tools > Options

You can adjust the colour display of graphical data.

1. Select the Options command.

The Options dialog box is displayed.



Colour

2. Select a colour from the drop-down colour palettes, or create a custom colour from the standard Windows colour picker.
3. Click **Apply** to apply and save the settings for the project.
4. Click **OK** to close the dialog box.

The display is now refreshed to show the selected colours.

Show/Hide tide points

1. Select the Options command.

The Options dialog box is displayed.

2. Select the *Draw Points* check box.

When the Draw Points check box is selected, the data points are visible.

3. Click **Apply** to apply and save the settings for the project.
4. Click **OK** to close the dialog box.

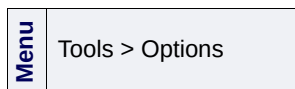
Show/Hide tool tips

A tool tip is a label that displays a specific tide level on the graph, when the cursor is positioned over it. You can show or hide tool tips.

1. Select the Options command.
2. Select the *Tool Tips* check box. If this option is checked then it is enabled.
3. Click **Apply** to apply and save settings for this project.
4. Click **OK** to close dialog box.

Set date display

The date in tide file table can be displayed in either Julian Day format or regular calendar format.



1. Select the Options command.

The Options dialog box is displayed.

2. Click the *Julian Date* box, if the box is checked, this option is selected.
3. Click **Apply** to apply and save settings for this project.
4. Click **OK** to close dialog box

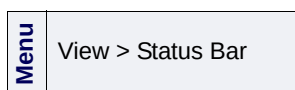
Show/Hide toolbar



1. Select the Toolbar command.

2. Click the Toolbar menu item. When the check mark is displayed, the toolbar is visible.

Toggle status bar



Display or hide the status bar.

1. Select the Status Bar command.
2. Click the Status Bar check box. When the check mark is displayed, the status bar is visible.



Exit the Tide Editor

Close the Tide Editor.



1. Select the Exit command.

You are prompted to save any unsaved changes.

2. Click **Yes** to save the changed file.

The Tide Editor is closed.





4

Navigation Editor



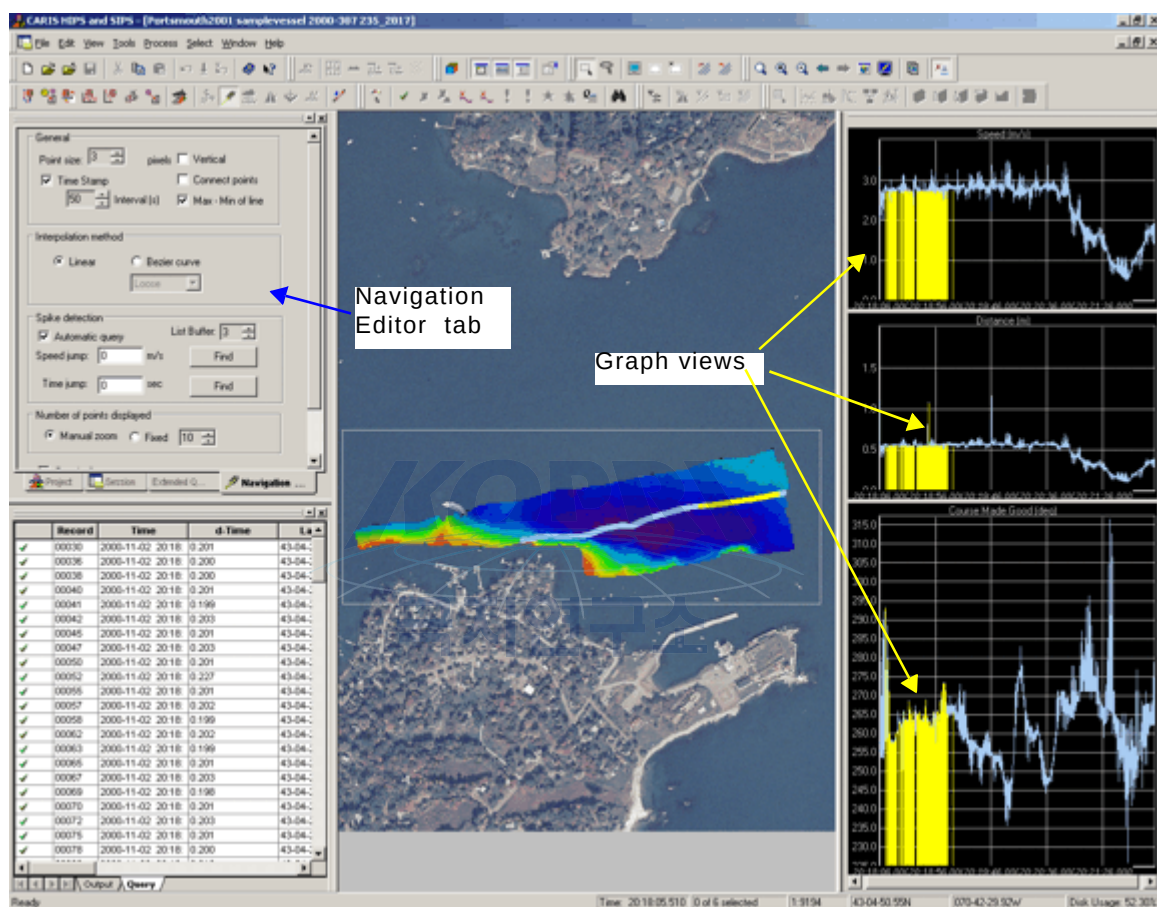
Navigation Editor Interface

Menu	Tools > Navigation Editor
Tool	

The Navigation Editor lets you examine and clean the position data for both the ship and towfish.

1. Select a track line.
2. Select the Navigation Editor command.

The Navigation Editor is displayed in the HIPS&SIPS interface.



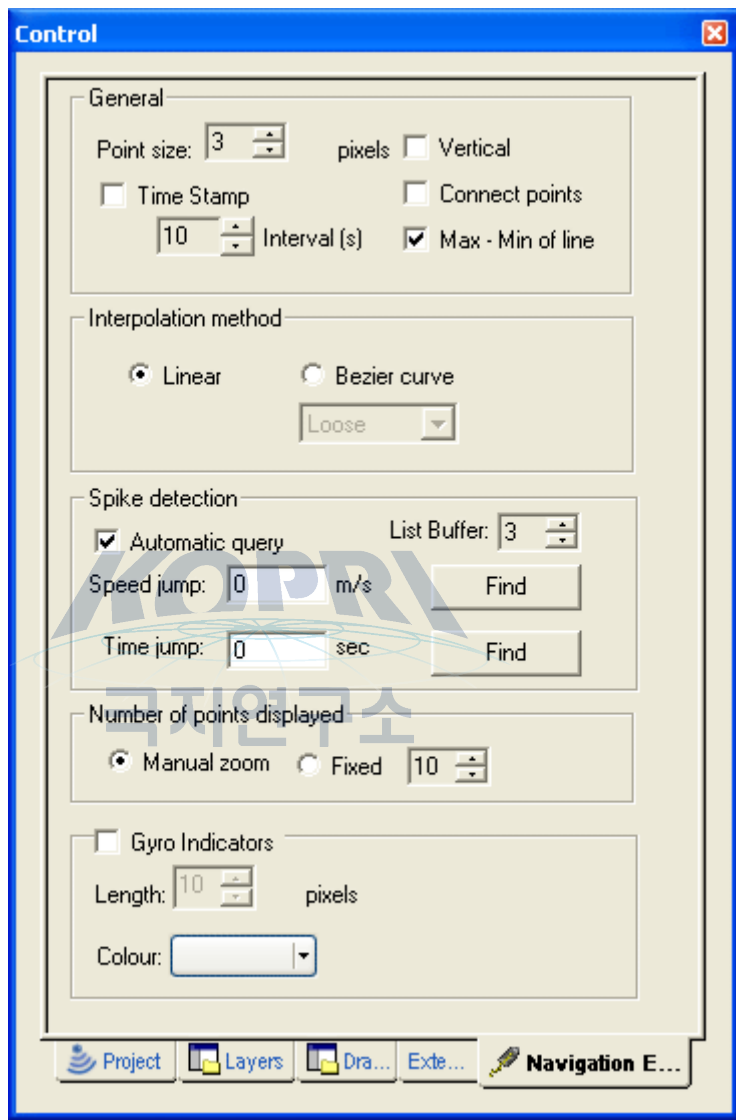
The Navigation Editor shows the track lines as a series of continuous symbols, with each point representing a navigation fix. The CARIS feature code used to represent the navigation symbols is selected in the Options dialog box (see “GENERAL” ON PAGE 657).

The editor contains three time-series graph views of information that is calculated between points in the recorded navigation data:

- **Speed:** Calculated speed.
- **Distance:** Calculated distance.
- **Course Made Good:** Calculated direction (in degrees) from one navigation fix to the next.

Display Properties

Display of various aspects of the data in Navigation Editor is controlled by the properties options on the Navigation Editor tab in the Control window.



The amount of data displayed in the three graph views is determined by the number of navigation points visible in the Display window.

The point symbols can be resized to a maximum of 10 pixels.

1. In the Control window, select the *Navigation* tab.
2. Click the up or down arrow buttons beside the *Point Size* box to change the size of the symbols.

The view in the Display window is refreshed so the navigation data is shown in the new point size.

Resize data points

Menu	Window > Control
Tool	

Time Stamps	Display lines to represent time stamps in the Navigation Editor windows. The time stamp interval is displayed in seconds and can be changed. 1. Select the <i>Time Stamp</i> check box to display time stamp lines. 2. Click the up or down arrow buttons beside the <i>Interval</i> to select the gap (in seconds) between time stamps.
Set minimum/maximum of line	When this option is selected the vertical scaling of the graphs fits the maximum and minimum range of values for the entire line. Otherwise the vertical scaling of the graphs fits the max-min range of the data currently in view. 1. Open the Control window. 2. Select the <i>Navigation</i> tab. 3. Select the <i>Max-Min of Line</i> check box.
Number of points displayed	This option determines the number of points visible in the Display window. • When <i>Manual</i> is selected, use the zoom tools to determine how many navigation points are visible in the Display window. • When <i>Fixed</i> is selected, a set number of points are displayed in the window. 1. Open the Control window. 2. Select the <i>Navigation</i> tab. 3. Select either the <i>Manual</i> or <i>Fixed</i> check boxes (Manual is selected by default). 4. If you selected the <i>Fixed</i> check box, enter the number of navigation points to be displayed by clicking the up or down arrow buttons.
Connect points	Join the displayed navigation point symbols with a line representing the current interpolation method. 1. Open the Control window. 2. Select the <i>Navigation</i> tab. 3. Select the <i>Connect Points</i> check box. The navigation points are connected by line drawn according to the current interpolation method of the line.
Gyro indicator line	A gyro indicator line that shows vessel heading can also be displayed in the Navigation Editor. This feature is useful for detecting dramatic changes in heading that could effect data acquisition. 1. Select the <i>Gyro Indicators</i> check box to display the gyro line in the Display window. 2. Click the up or down arrow buttons to select the size (in pixels) of the gyro indicator line. 3. Select a colour for the line from the <i>Colour</i> picker, or create a custom colour using the standard Windows Colour Palette.

6

Attitude Editor



Attitude Editor

The Attitude Editor displays sensor data related to the movement of a vessel or towed sensor. It also displays data from other auxiliary sensors that use a simple time/value data model. The data is plotted in chronological order and is time stamped. You can edit data directly in the editor or set filter parameters to reject unwanted data.

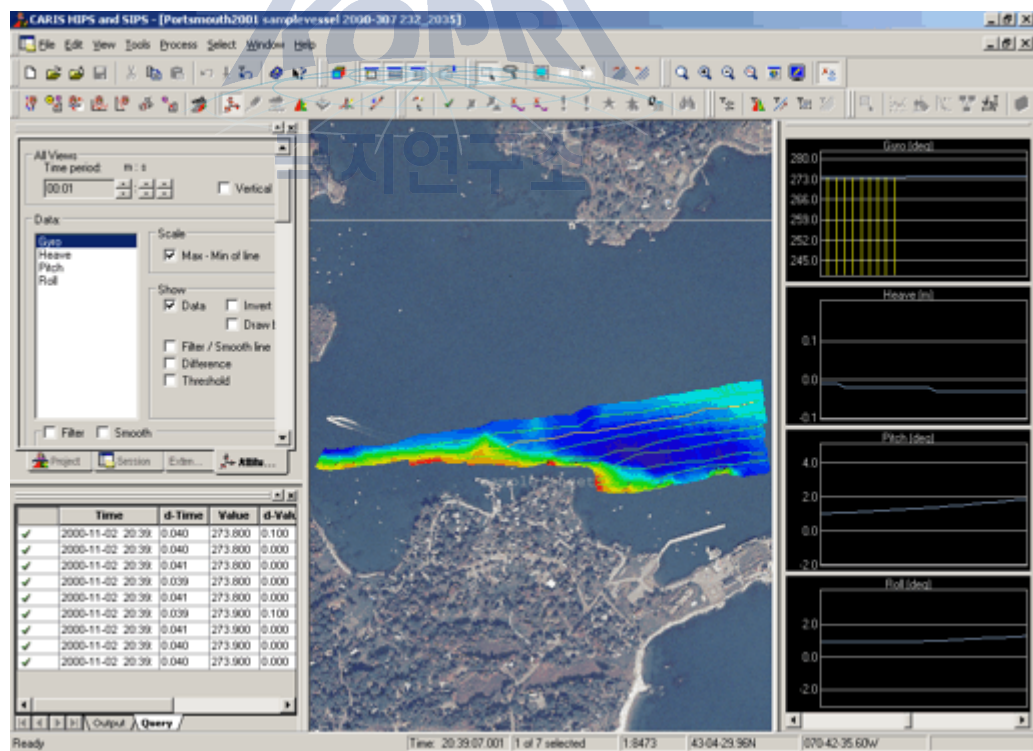
Attitude Editor Interface

The Attitude Editor is displayed in the HIPS and SIPS interface. To open the Editor:

1. Select a track line so it is highlighted.
2. Select the Attitude Editor command.

The Attitude Editor is displayed (as shown below). You can open the Attitude Editor while the Swath Editor is active and examine attitude and sounding data at the same time (see "SWATH EDITOR" ON PAGE 201).

Menu	Tools > Attitude Editor
Tool	
Pop-up	Attitude Editor



The Project-Vessel-Day directory and file name of the selected track line is displayed on the title bar.

Data is graphed in the windows according to an X-Y axis. In the default layout, the X-axis represents time and the Y-axis represents data.

By default, the following data is displayed in the editor:

- **Gyro:** Gyro observations are displayed in degrees from positive 1 to 360.
- **Heave:** Heave observations are displayed according to the Units setting in the Options dialog box and are positive as the vessel moves upward.
- **Pitch:** Pitch observations are displayed in degrees and are positive when the bow is down.
- **Roll:** Roll observations are displayed in degrees and are positive when the starboard side is up.

However, this is not the only data that can be displayed in the editor. All sensor data in HIPS/SIPS format can be displayed except for depths, navigation, and side scan data.

Besides the above sensors, the following sensors can be displayed (if available):

- loaded tide
- side scan gyro
- side scan cable out
- side scan depth
- side scan height
- delta draft
- GPS height
- GPS tide
- speed on water

Applanix's MS POV systems calculate TrueHeave values from real-time heave values. The computed TrueHeave data and real-time heave values are stored in a binary file that is not converted to HIPS/SIPS format when other data is imported. These files have to be separately loaded to the track line. For more information, see ["TRUEHEAVE DATA" ON PAGE 287](#).

Display Options

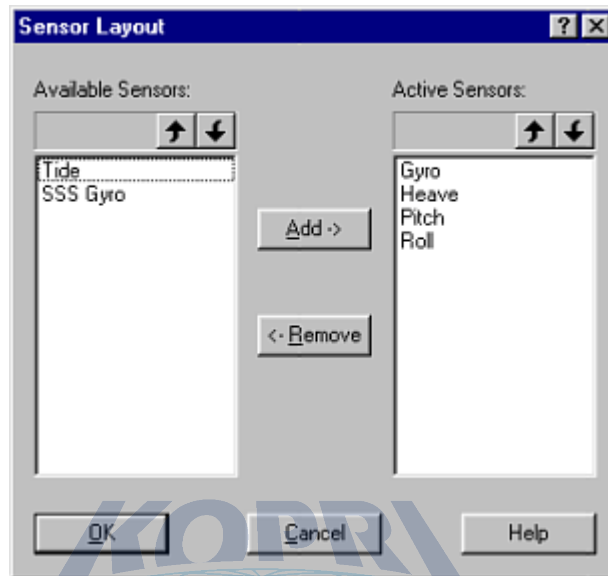
Show/hide sensor data

Menu	Tools > Sensor Layout

You can control which attitude sensors are displayed.

1. Select the Sensor Layout command.

The Sensor Layout dialog box is displayed.



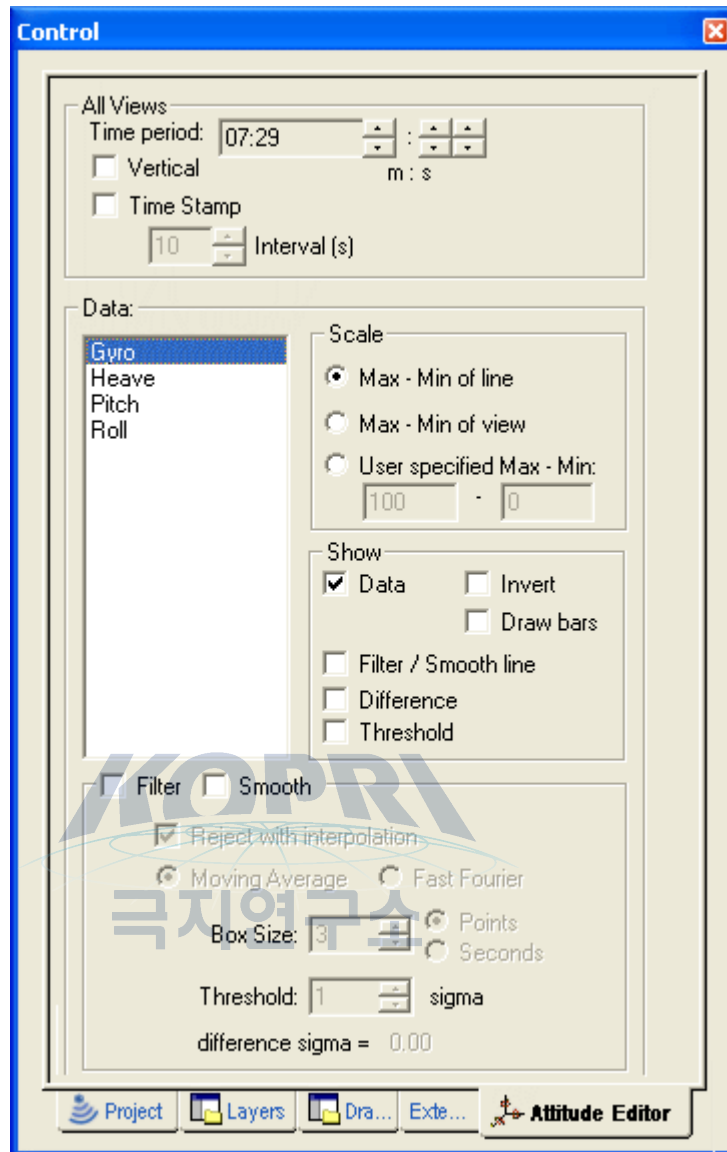
2. To remove a sensor from the *Active Sensors* list, select the sensor and click **Remove**.
3. To add a sensor to the *Active Sensors* list, select a sensor from the *Available Sensors* list and click **Add**.
4. Set the order that sensor windows are displayed by selecting a sensor and clicking the up or down arrow buttons, or by selecting the sensor and dragging it to a new position.
5. Click **OK** to apply settings.

The Attitude Editor is displayed according to the selected settings.

The display of data in the Attitude Editor windows is controlled through the Attitude Editor tab in the Control window. This tab is visible when the Attitude Editor is opened.

1. Open the Control window.
2. Select the *Attitude Data* tab if the tab is not already displayed.

Menu	Window > Control
Tool	



Time

By default, time is displayed on the X-axis. As the time scale is increased, more data is displayed in the graphs. As the time is decreased, less data is displayed.

3. Click the up or down arrows beside the *Time Period* box to set time in minutes and/or seconds.
4. Select the *Time Stamp* check box to display the time stamp in the windows.
5. Click the *Time Interval* up or down arrow buttons to select an interval for time stamp display.

The display in all graphs is adjusted to the new time setting.

Scale Data

By default, the data scale is shown on the Y-axis. The scale of the data axis can be based on the minimum and maximum values of data in the entire line, the minimum and maximum values of the data currently in view, or by a user-defined axis.

1. Select a sensor from the *Data* list.
2. Select from one of three scaling options:
 - Select *Max-Min of Line* to scale data according to the minimum and maximum data values of the entire line.
 - Select *Max-Min of View* to scale data according the minimum and maximum values currently in view.
 - Select *User-defined Max-Min* to define maximum and minimum scale and type the values in the maximum and minimum fields.

Vertical view

The *Vertical* option switches the data graph windows from a horizontal layout to a vertical layout. In this mode, the X-axis represents the data values and the Y-axis represents time.

1. To view the Attitude Editor in vertical mode, click the *Vertical* check box.

The Attitude Editor windows are displayed in vertical mode.

Other Display Options

Invert view

The *Invert* command displays the data in a “mirror-image” view. This function is useful for viewing towfish depth in the water column.

1. Select an attitude data type in the *Data* list.
2. Select the *Invert* command.

The data is shown as inverted in the appropriate section.

Draw bars

The *Draw Bars* function displays vertical bars for each sensor value in the graphs. This option makes it easier to see time gaps between sensor values.

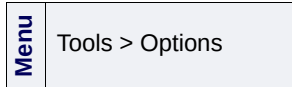
1. Select the *Draw Bars* check box in the Attitude Data tab of the Control window.

The *Smooth/Filter Line*, *Difference* and *Threshold* options are described in the Shows Graphs section of “SMOOTH DATA” ON PAGE 192

Colour Display

The colour for displaying the various graph lines can be changed.

1. Select the Options command.



The Options dialog box is displayed.

2. Click the Display tab and click the *Sensor Editors* category so it is highlighted.
3. Select a colour for the sensor filter line from the drop-down colour palette, or create a custom colour from the standard Windows colour picker.
4. Click **OK**.

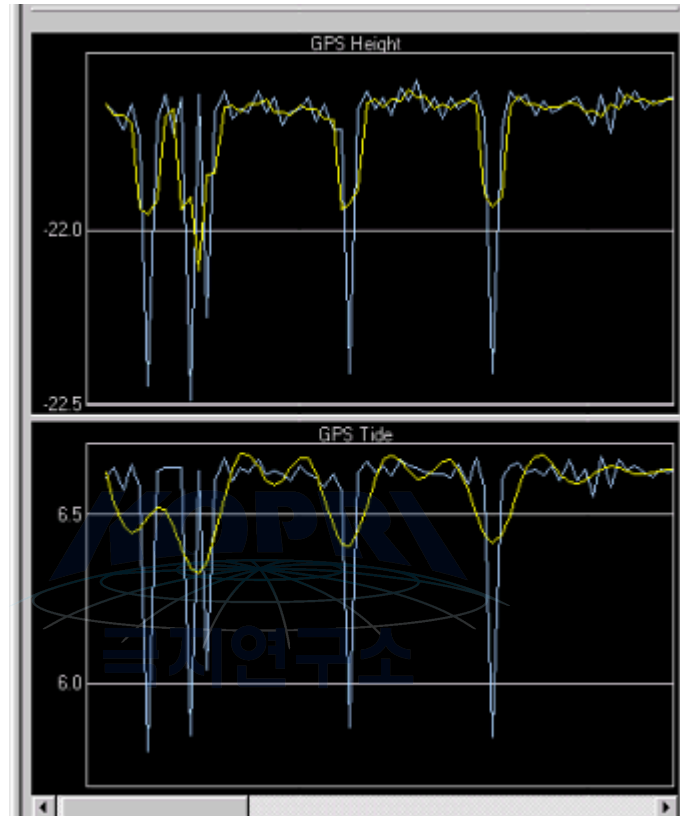
See “[DISPLAY](#)” [ON PAGE 80](#) for more information on colour options for the Attitude Editor.



Smooth Data

The Smooth Sensor function is used to smooth out localized variability. Any sensor data that can be viewed in the Attitude Editor can be smoothed.

Below is an example of GPS height and tide.



The blue line represents the original data and the yellow line represents the smoothed data. The parameters for creating the smoothed data are saved to the SmoothedCoefficients file in the HCDS_Data\Project\Vessel\Day\Line folder. The file is in XML format. This file is applied to the track line during the merge process and SVP Correction.

Moving Average and Fast Fourier Transform

There are two methods available for smoothing: Moving Average and Fast Fourier Transform (or FFT).

- The *Moving Average* function calculates an average sensor value over a window of data using the Box Size parameter. The window is defined as a number of data points or seconds centred on a point. The average value for all of the values in the window is calculated and will be given to the central point.
- The *Fast Fourier Transformation* performs a low-pass filter on the selected sensor. You select a Box Size in either points or

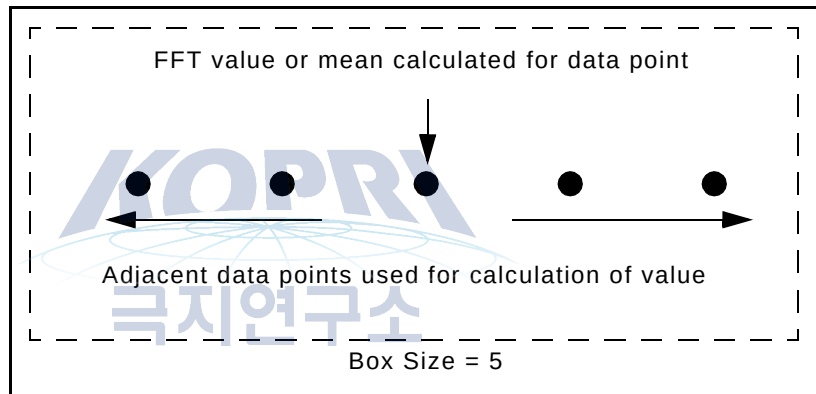
seconds. This value is converted into seconds and then inverted to become the cut-off frequency. Increasing the Box Size results in greater smoothing.

Box size

The *Box Size* (Step 6) determines how many neighbouring data points are used in the smoothing calculation. The number of neighbouring data points can be determined using time or a set number of points.

Note the different ways the Moving Average and the FFT use the Box Size parameter. The Moving Average function uses the Box Size to determine the window that is used to calculate the average for the new “smoothed” centre point. The FFT algorithm uses the Box Size to define the cut-off frequency that is then applied to all data.

In the following example, the box size is set to five data points. A FFT value or mean for any data point is calculated from itself and the two data points on either side of it (if available).



1. Make sure that the Control window is open and the Attitude Data tab is visible.
2. Select a sensor in the *Data* list box, or click inside a sensor window in the Attitude Editor.
3. Select the *Smooth* option.
4. Select either the *Moving Average* or *Fast Fourier* smoothing options.
5. Select either the *Points* or *Seconds* check boxes.
6. Click the *Box Size* up or down arrow buttons to select the number of adjacent data points or a time range.

Show graphs

7. Show any of the four graphs by selecting the appropriate check boxes:

- *Data* graphs the raw sensor data. This box is checked by default.
- *Filter/Smooth Line* graphs the computed values derived from the adjacent data points as described above.
- *Difference* graphs the difference between the original data values and the moving average or FFT value for each data point.
- *Thresholds* display horizontal lines in the graph indicating the difference values that are clipped during smoothing. Threshold is a multiple of the standard deviation (sigma).

The upper threshold signal is determined by the following formula:

original mean value + (threshold value X the standard deviation)

The lower threshold signal is determined by the following formula:

original mean value - (threshold value X the standard deviation)

The smoothing function applies the results only to the Data graph and Filter/Smooth Line graph.

The line is smoothed according to the parameters set above. When you close the Attitude Editor, you are prompted to save any changes. This saves any smoothing changes to the SmoothedCoefficients file.

8. Click **Yes** to save smoothed data.

6

Subset Editor

The Subset Editor is a tool for viewing and editing georeferenced sounding and lidar data.

In this chapter...

“SUBSET EDITOR INTERFACE” ON PAGE 619

“SIZE AND RESIZE SUBSET” ON PAGE 621

“THE 3D VIEW” ON PAGE 626

“SUBSET EDITOR TAB” ON PAGE 623

Overview

The Subset Editor differs from the Swath Editor in that soundings no longer have only an across-track and along-track relationship—but once corrected for navigation, vessel heading and other auxiliary sensors, each sounding has a latitude and longitude value attached to it.

With the Subset Editor you can:

- view data in a three-dimensional mode so features such as depressions and rises are visible.
- rotate data to view it from different angles.
- view BASE Surface areas in the 3-D window.
- view and edit CUBE surfaces, using subset tiles to track the areas that have been completed.
- flag soundings as needed to status of:
 - rejected
 - accepted
 - outstanding
 - examined
 - designated.

[“DESIGNATED SOUNDINGS” ON PAGE 207.](#)

[“SUBSET CLEANING” ON PAGE 410](#)

Subset Editor Interface

Menu	Tools > Subset Editor
Tool	
Pop-up	Tools > Subset Editor

Subset bounding box

Menu	Tools > Subset Editor > Load Subset
Tool	

Open Subset Editor

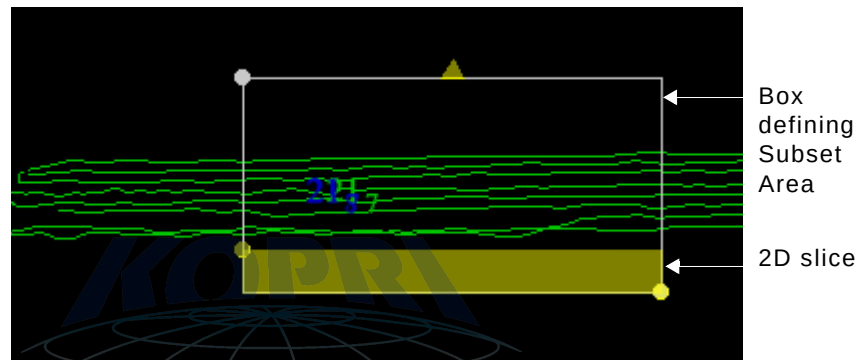
Track lines should be merged before the Subset Editor is opened.

1. Select the Subset Editor command.

The cursor changes shape.

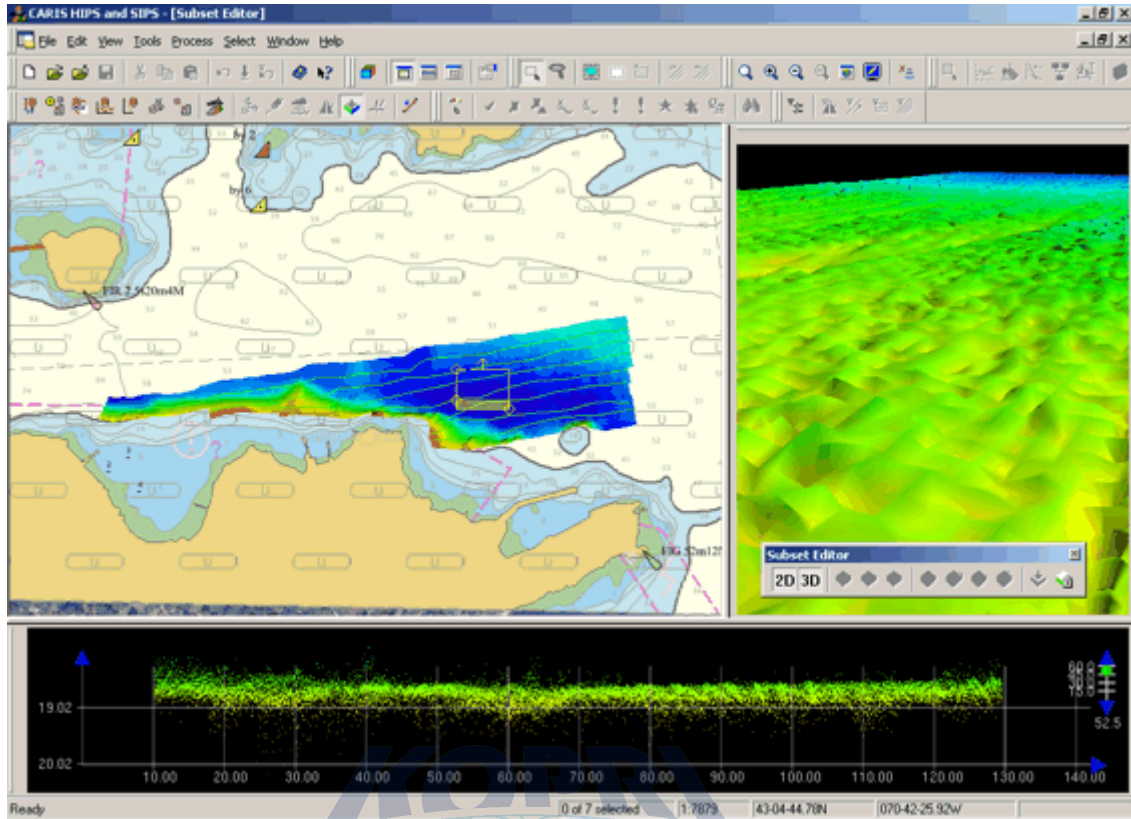
2. Press and hold the mouse button, and drag the cursor across the area of the Display window where you want to create the subset.

As the cursor is dragged across the Display window, a bounding box is drawn to show the subset area.



3. Select the Load Subset command.

The subset is generated and displayed in the Subset Editor windows. Below is an example of HIPS and SIPS with the Subset Editor open.



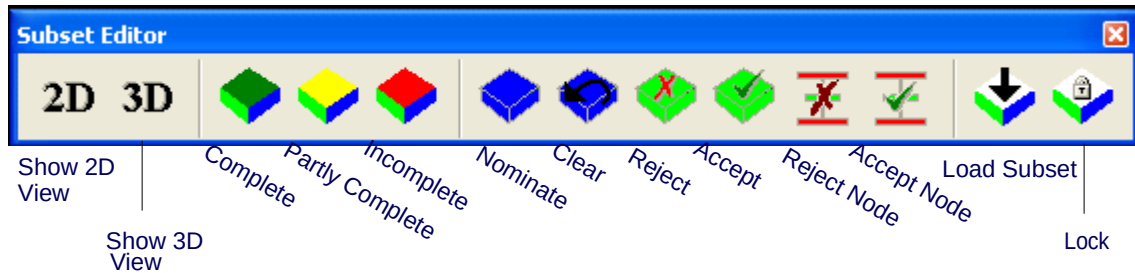
The Subset Editor has the following components:

- **Subset bounding box:** The bounding box selects an area where the subset is generated. Each time the box is moved or resized, a new subset is generated. The yellow 2D slice box defines the area to appear in the 2D window.
- **The 3D View:** The 3D (three-dimensional) View shows all soundings in the subset area. The view in the window can be rotated or changed.
- **The 2D View:** The 2D (two-dimensional) View displays soundings from the subset area that are within the 2D slicing box.

Toolbar

Subset Editor commands can be accessed from the toolbar. This floating toolbar is automatically opened when the editor is started. (If it is not visible when the Subset Editor is opened, the View > Toolbars > Subset Editor command can restore it.)

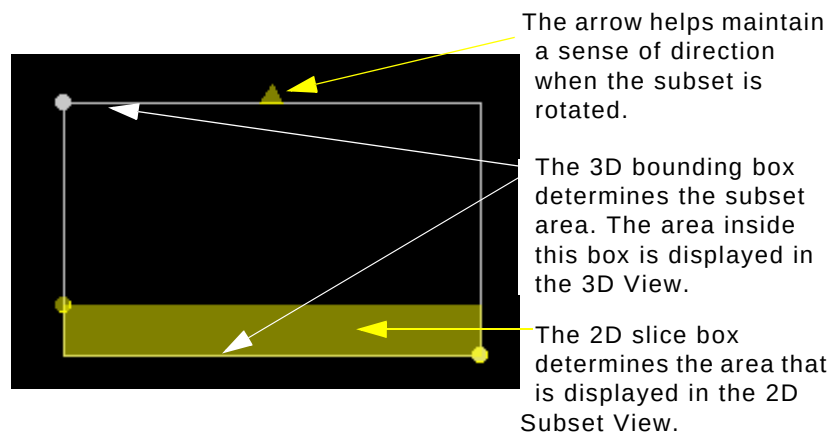
It can moved and docked like other toolbars (see “[MODIFY EXISTING TOOLBARS](#)” ON PAGE 28).



Size and Resize Subset

The size of the subset is determined by the bounding box. As the bounding box area is changed, a new subset is generated and the displays in the 2-D and 3-D Views are refreshed to show the new area.

Below is an example of the subset bounding box. Note that the shape has been altered for display purposes and does not match the box shape as it is first shown in the interface.



To resize the subset areas:

1. Position the cursor over any of the balls at the corners of the boxes.
2. Press and hold the mouse button and drag the ball.
3. As the ball moves with the cursor, the box is resized to a new area.

You can also move the 2-D Subset slice up or down in the bounding box by pressing the arrow keys. The arrow at the top of the box shows the direction of the 2-D slice when the up arrow key is pressed.

When the box is resized, a new subset is generated.

To rotate the subset:

1. Press and hold the <Ctrl> key.
2. Position the cursor over any of the corner balls of the box.

Press and hold the mouse button to rotate the bounding box to the desired angle.

Auto load subset

Menu	Tools > Subset Editor > Load Subset
Tool	

The *Auto Load Subset* option automatically loads subset data in the 3-D and 2-D Views when a subset area is created or changed. To create or adjust a subset area without immediately loading data, turn this option off.

1. In the middle section of the Subset Editor tab, select or clear the *Auto Load Subset* check box to turn this option to on or off (the default status is selected).
2. If you de-selected the *Auto Load Subset* option and want to load data manually, draw the subset and select the Load Subset command.

Menu	Tools > Subset Editor > Lock
Tool	
Key	<L>

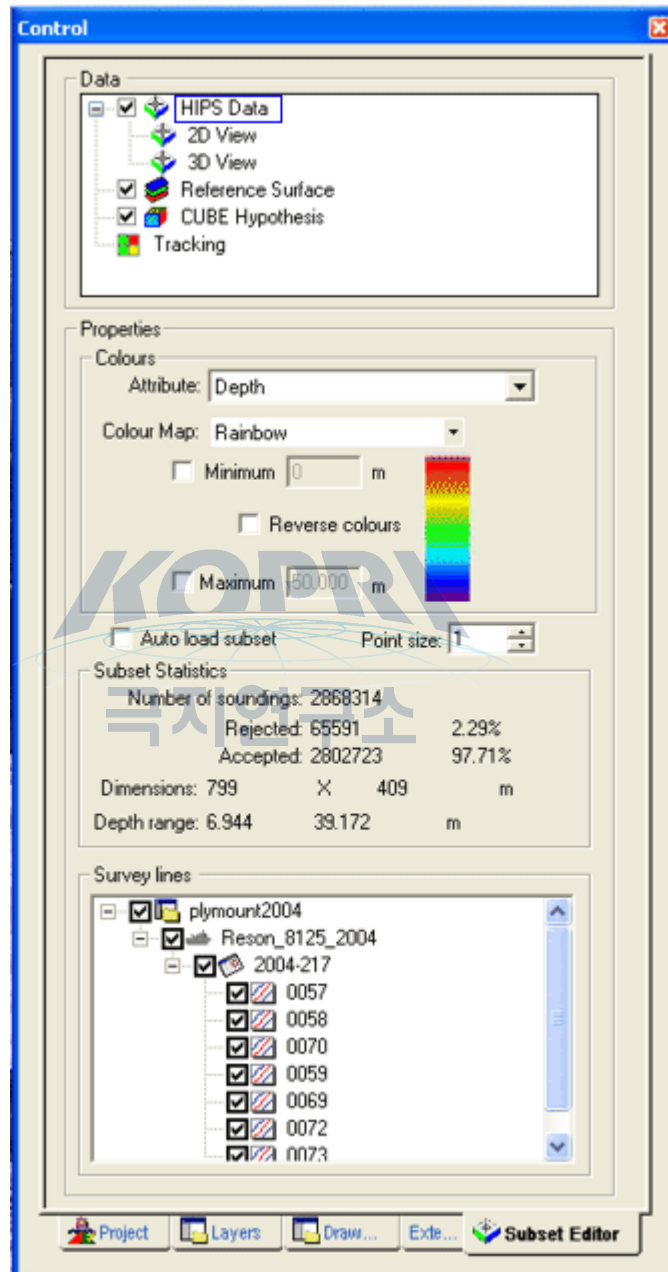
The Lock option locks the subset area so you do not accidentally resize or move the subset while moving it in the Display window. A new subset cannot be created while the lock is active.

1. Select the Lock command after creating a new subset or resizing a existing one.

The subset area is now locked into place and cannot be adjusted until the lock is removed.

Subset Editor Tab

The Subset Editor tab is opened in the Control window when the Editor is started. The tab controls the data properties for the data layers in the Editor.



The top part of the tab are the layers representing the data types. When you select a layer, the bottom part of the tab is refreshed to display the controls for the data properties for that layer.

The check boxes beside the layers control the display of data in the 3D and 2D Views. When the check boxes are selected and the layers are highlighted, data associated with that layer are shown in the 3D Display. When the check boxes are cleared, the data is no longer displayed.

The following layers are listed in the Subset Editor tab:

- **HIPS Data:** This layer controls the properties for sounding selection and display. The **3D and 2D** sublayers control the display in their respective views.

For more information on the controls related to these layers, see the following sections:

- [“VIEW SUBSET INFORMATION” ON PAGE 624.](#)
- [“COLOUR OPTIONS” ON PAGE 625](#)
- [“THE 3D VIEW” ON PAGE 626](#)
- [“THE 2D VIEW” ON PAGE 630](#)
- **Reference Surface:** This layer controls the properties related to the display of BASE Surfaces in the 3D View of Subset Editor. For more information related to this layer, see the following section:
 - [“SUBSETS AND BASE SURFACES” ON PAGE 339.](#)
- **CUBE Hypothesis:** This layer controls the display and editing properties related to CUBE data. For more information related to this layer, see the following section:
 - [“HYPOTHESIS EDITING” ON PAGE 266.](#)
- **Tracking:** This layer controls the properties for subset tiles. For more information on the controls related to this layer, see the following section:
 - [“TRACKING LAYER PROPERTIES” ON PAGE 336.](#)

View Subset Information

Each time a subset is generated, the following information is shown in the middle section of the Subset Editor tab:

- total soundings in the current subset
- total memory used by subset
- total accepted soundings
- total rejected soundings
- width
- height
- minimum depth level
- maximum depth level

Colour Options

You can control how soundings are displayed in the subset.

1. Make sure the Control window is open.
2. In the Properties > Colours section of the Subset Editor tab, open the drop-down list in the *Attribute* field.
3. Select one of the following attributes from the drop-down list to colour code soundings:
 - **Depth:** The recorded depth level of the soundings.
 - **Amplitude:** Backscatter intensity values.
 - **Depth Uncertainty:** The vertical uncertainty values accorded to soundings.
 - **Position Uncertainty:** The horizontal uncertainty values accorded to soundings.
 - **IHO S-44:** The S-44 Survey Order ranking applied to soundings.
 - **IHO S-57:** The S-57 Zones of Confidence (CATZOC) attributes ranking applied to soundings.
 - **Project:** The project where the data was saved.
 - **Vessel:** The vessel(s) used on the survey.
 - **Day:** The day the sounding data was recorded.
 - **Line:** The track line in the project.
 - **Amplitude:** The sonar's wave pattern.
 - **Detection Method:** The phase detection method.

Colour Map

You can represent a range of values using a colour map. The colour ranges can be applied to other subsets so you have a standard colour code for displaying data.

- The colour at the top end of the selected map represents the minimum value (and all values less than the minimum value).
 - The colour at the bottom of the map represents maximum value (and all values greater than the maximum value).
 - The colours in between the minimum and maximum colours represent the depths and uncertainties between the defined range.
4. To set a minimum and maximum values, select these two check boxes and type the values in the respective fields. If these values are not set, then they are automatically read from the subset.
 5. [Optional] Select the *Reverse Colours* check box to reverse the order in the colour map.

The display in the Views is refreshed to show the subset in the selected colours.

Menu	Tools > Subset Editor > 3D View
Tool	3D

The 3D View

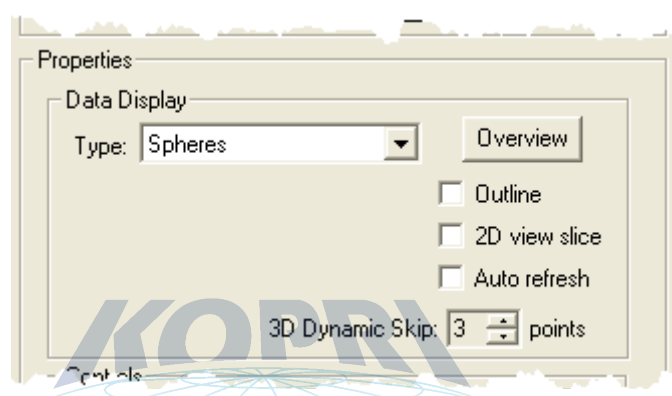
The 3D View displays the entire subset. You can use this view to examine and clean data.

1. Select the 3D View command to open the 3D view window.

All controls for the 3D View are contained in the 3D View sub-layer of the Subset Editor tab.

1. Click the Expand (+) icon beside the HIPS Data layer and select the 3D View sub-layer in the Subset Editor tab.

The properties for the 3D View are displayed in the Data Display area below.



3-D Subset Display

The *Type of Data Display* selected will determine the soundings that will be shown in the 3-D View:

1. Select the display type from the list.
 - Points
 - Spheres
 - Cylinders
 - Surface
 - Surface Wireframe

The 3-D View is refreshed to show the soundings according to the selected display type. The options for each display type is explained in the following table.

Display Type	Definition	Options
Surface	The soundings are shown as a smooth surface.	Soundings are drawn to the 3-D View either by selecting the shoalest sounding in a user-defined area (or bin), or by selecting all soundings.
Surface Wireframe	The soundings are shown as a Triangulated Irregular Network (TIN) that connects soundings.	1. Select the <i>Shoal Bin Size</i> to select the shoalest sounding in an area (bin), or select <i>Use All Points</i> to display every sounding. 2. If you selected the <i>Shoal Bin Size</i> option, type the size of the area for selecting the shoalest sounding. 3. Click Regenerate.

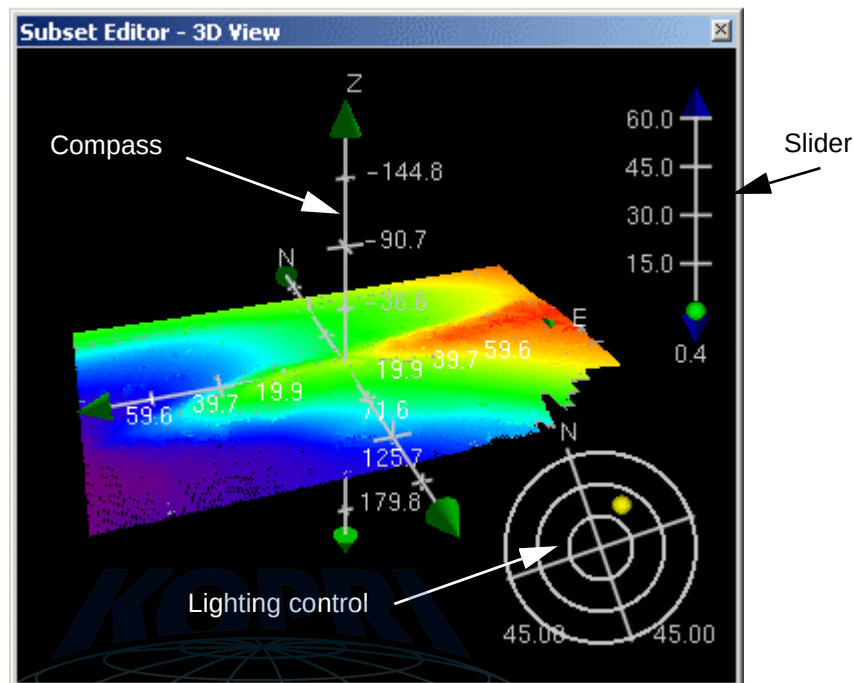
Display Type	Definition	Options
Points	Soundings are shown as unconnected points.	3D Dynamic Skip option determines how many sounding profiles and beams are displayed. For example, the value 6 means that only every 6th profile and 6th beam are shown in the view. 1. Select a skip value by clicking the up or down arrow buttons, or directly typing a value in the <i>3-D Dynamic Skip</i> field. 2. Click Regenerate.
Spheres	Soundings are shown as unconnected spheres.	
Cylinders	Soundings are shown as cylinders. If the soundings contain horizontal and vertical uncertainty values, then the cylinders are sized according to those values. For example, soundings on the outer edge of a swath have a larger radius than soundings on the inner edge because of the greater horizontal uncertainty. Soundings without TPU values are drawn to a set size.	



Controls

Rotation, illumination and exaggeration options

The compass (or control axes) rotates the view, the sun dial controls adjust illumination, and the slider controls vertical exaggeration.



2. Select or clear the *Compass*, *Lighting* and *Exaggeration* check boxes to show or hide these controls in the 3D View.

Shading

Darkens the image in the 3-D View.

3. Select the *Shading* check box.

Symbolize Critical Soundings

Display soundings with Outstanding, Critical and Designated flags.

4. Select the *Symbolize Critical Soundings* check box.

Overview

Reset the View so the entire subset area is visible (default).

5. Click **Overview**.

Show subset outline

Display an outline of the subset bounding box.

6. Select the *Show Subset Outline* option. When this option is checked, the outline is displayed in the 3D View.

Show 2D slice

Display an outline of the 2D slice area.

7. Select the *Show 2D* slice option. When this option is checked, the 2D slice outline is displayed in the 3D View.

Allow rotation under data

This option rotates the 3D display by 180° to view soundings underneath the subset. When this option is not selected, the subset can only be rotated by 90°.

8. Select the *Allow Rotation Under Data* option to rotate the subset display by 180°.

Wireframe colours	Select a colour to display 3-D and 2-D outline in the 3-D View. 9. Select a colour from the picker, or click Other and create a custom colour from the palette.
Pan and zoom	The pan, zoom and rotation functions are the same as in the 3-D View in the Swath Editor. See “PAN AND ZOOM” ON PAGE 652 for more information.



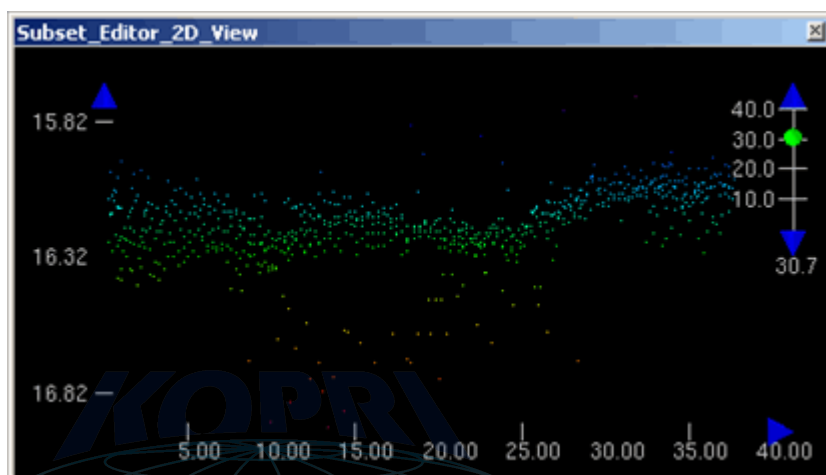
The 2D View

The 2D View displays a profile of soundings within the 2D slicing box. You can use this view to examine and clean data.

The location and size of the cutaway view is determined by the size of the 2D slice box (see “[SIZE AND RESIZE SUBSET](#)” ON PAGE 621). As the slice box is re-sized or moved to another position in the subset, the display in the 2DView changes accordingly.

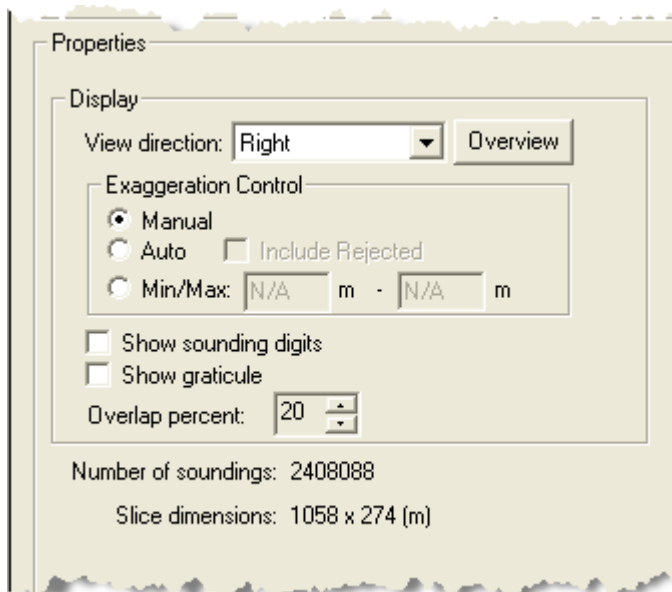
Menu	Tools > Subset Editor > 2D View
Tool	2D

1. Select the 2D View command to display data in the 2D View window.



All controls for the 2D View are in the 2D View sub-layer in the Subset Editor tab.

2. Click the Expand (+) icon beside the General layer and select the 2D sublayer in the Subset Editor tab.



The 2D View tab contains the following information:

- number of soundings in the 2D slice
- dimensions of the slice (height x width)

When the 2D slice bounding box is resized, the information in the tab is refreshed with new data.

Change view perspective

When the 2D View is first displayed, the view perspective is determined by the dimensions of the 2D Slice Box.

- If the height of the slice box is greater than the width, the view is automatically shown from the left side.
 - If the width of the slice box is greater than the height, the view is automatically shown from the bottom.
3. Select any of the following options from the *View Perspective* drop-down list to change the view angle:
 - top (view data from the front of the slice box)
 - right (view data from the right side of the slice box)
 - centre (view data from above the slice box)
 - bottom (view data from the back of the slice box)
 - left (view data from the left side of the slice box)

The 2D View is refreshed to show the data from selected angle.

4. To return to the default view, select *Automatic* from the drop-down list.

2D vertical exaggeration

The vertical exaggeration is the ratio of the vertical scale versus the horizontal scale. You can set the vertical exaggeration scale with the vertical exaggeration scale in the 2D View.

1. Position the cursor over the ball on the vertical exaggeration scale.
2. Press and hold the mouse button, and move the ball up or down the scale.
3. To change scale values, click the arrows at either end of the vertical exaggeration scale to increase or decrease the scale by a value of 10.

As you move the ball, the data in the 2D View is rescaled.

The *Auto Exaggeration* option determines the scale automatically by using all visible depths.

When *Auto Exaggeration* mode is on, the *Include Rejected* option controls whether or not the rejected data is used to determine the minimum and maximum sounding depth to be displayed in the 2D View.

4. Select the *Auto Exaggeration* check box.
5. Select the *Include Rejected* option to resize the display in the view to include rejected data.

The 2D View is adjusted to display data according to the maximum and minimum settings.

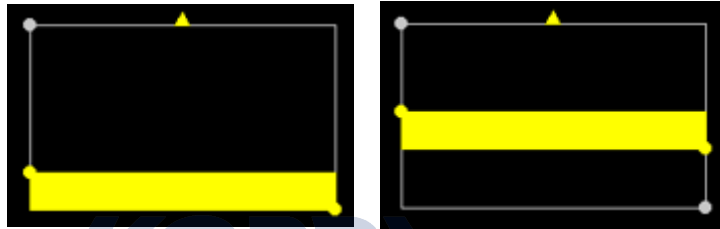
Display options

The display can also be modified to draw sounding values in the View and display a grid with depth and distance values.

1. Select the *Show Sounding Digits* check box to draw sounding values in the View.
2. Select the *Show Graticule* check box to display a grid representing depth and distance. If the Show Graticule check box is cleared, the grid is removed from the 2-D View, but the values representing distance and depth are still displayed. The vertical scale represents depth and the horizontal scale represents distance. The values shown in the 2D View are determined by the display option:
 - If the top/bottom/left/right display options are selected, both the depth and distance are shown.
 - If the centre display option is selected, distance in both directions are displayed.

Move 2-D Display

You can move the 2-D Slice box within the subset with the arrow keys.



The 2-D Slice Box is moved up as the up arrow key is pressed.

1. Press the arrow keys to move the 2-D Slice Box within the subset.
2. Select an *Overlap Percent* to determine how much of the 2-D Slice Box overlaps the previous area in the 2-D View when the box is moved.

Pan and zoom options

The pan and zoom functions are the same as in the 3D View in the Swath Editor. See “[PAN AND ZOOM](#)” ON PAGE 652 for more information.

You can also pan in the Subset Editor Views by clicking on a sounding with the middle-mouse button. This will shift the subset so that the sounding is centred in the View.

To return the display in the View to original setting before zoom and pan operations, click **Overview**.

Measure Distance

You can use the Measure Distance tool in the 2-D and 3-D Views to evaluate data problems, such as timing offsets, heave problems, etc.

1. Select the Measure Distance command.

A ruler icon is displayed next to the cursor.

Menu	Tools > Measure Distance
Tool	

2. Press and hold the mouse button and drag the cursor along the 2-D View or 3-D View. To maintain a straight horizontal line, press and hold the <Shift> key while drawing the line. To maintain a straight vertical line, press and hold the <Ctrl> key while drawing the line.

As the cursor is dragged across the View, a line is drawn from the start point to the point where the mouse button is released. The distance between the two points is shown along the line.

Close Subset Editor

Menu	Tools > Subset Editor
Tool	
Pop-up	Tools > Subset Editor

1. Select the Subset Editor command.
2. If changes were made to the data, you are prompted to save them.

When data in the Subset Editor is changed and saved, the ProcessedDepths and ObservedDepths files are updated to reflect the changes.

3. Click **OK** to save changes.

The Subset Editor is closed and no longer visible in the HIPS interface.





8

Swath Editor

The Swath Editor provides data-cleaning tools for multibeam data, multi-transducer data and Lidar data.

You can also use the Swath Editor to flag Designated Soundings

IN THIS CHAPTER...

“SWATH EDITOR INTERFACE” ON PAGE 636

“SWATH EDITOR DISPLAY OPTIONS” ON PAGE 640

“EXAMINING SWATH DATA” ON PAGE 643

“EXAMINE DATA IN THE 3-D VIEW” ON PAGE 648

Swath Editor Interface

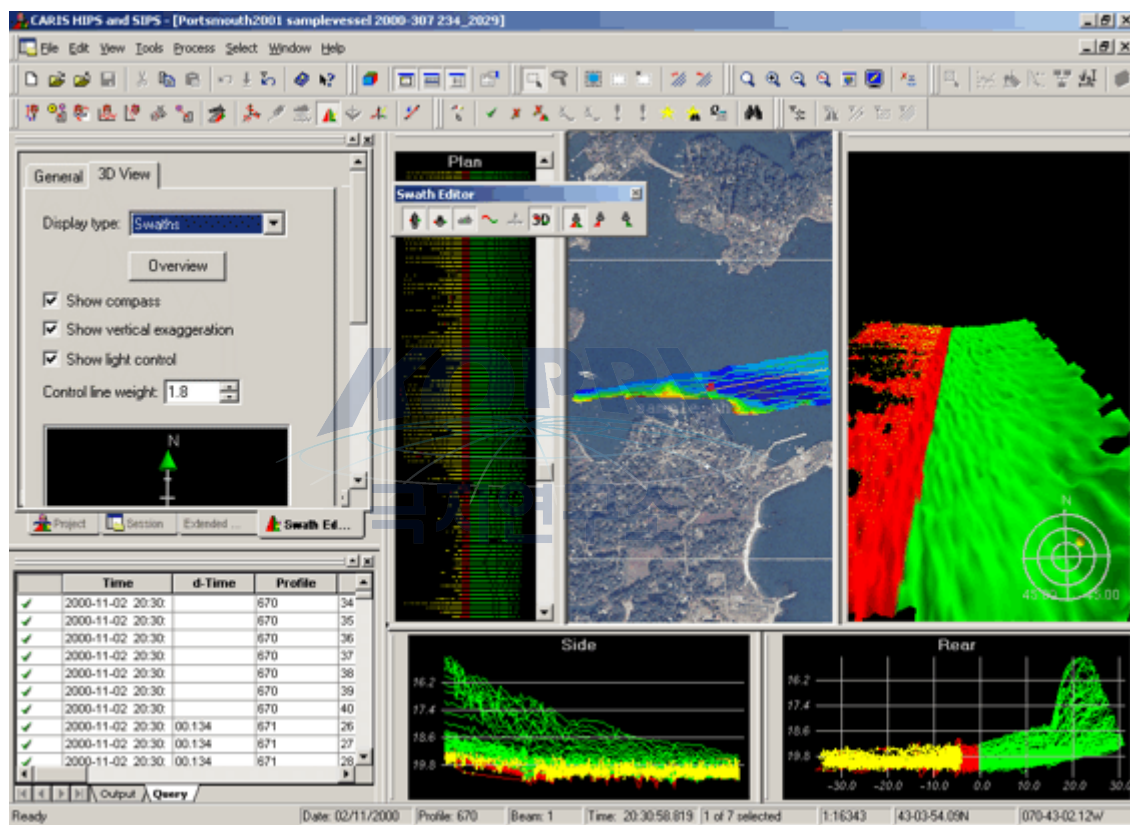
Menu	Tools > Swath Editor > Open
Tool	
Pop-up	Tools > Swath Editor

A track line must be selected before the Swath Editor editor can be opened (see “[SELECT SURVEY LINES](#)” ON PAGE 123).

1. Select the Open Swath Editor command.

The Swath Editor opens with all views displayed. The Project-Vessel-Day directory and file name of the selected track line is displayed on the title bar.

The main Swath Editor display is the 3-D View. The image below shows the default layout for the Swath Editor windows.



The Swath Editor consists of six views:

- Plan View
- Side View
- Rear View
- Profile View
- 3-D View (Swath Editor Display)
- Amplitude View

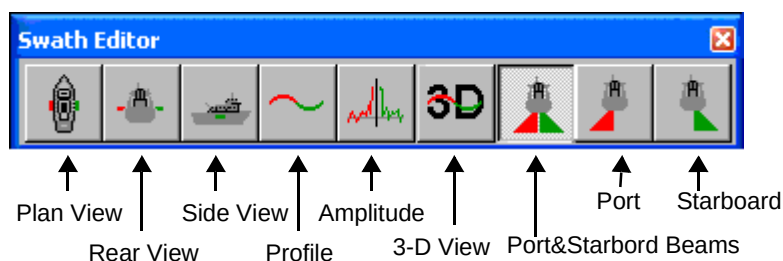
Views can be displayed, hidden or positioned anywhere on the interface. They can also be adjusted to any size you want. (See “[REPOSITION AND RESIZE WINDOWS](#)” ON PAGE 26). The layout of the views is remembered by the application when you exit HIPS.

If the dataset contains side scan data, you can also open the Side Scan Editor while the Swath Editor is open (for more information on the Side Scan Editor, see “[INTRODUCTION](#)” ON PAGE 384).

The tabbed pages in the Control window set the various Swath Editor features.

Toolbars

The display of the views is controlled from the Swath Editor toolbar.



This is a floating toolbar that is automatically displayed when the editor is opened. The toolbar can be docked or floated over any area of the interface. Its appearance is controlled from the Toolbar dialog box (see “[MODIFY EXISTING TOOLBARS](#)” ON PAGE 28).

To close the Swath Editor

1. Click the Swath Editor tool button again.



All Swath Editor views close and you are prompted to save any changes.

2. Click **OK** to save changes.

Plan View

The Plan View presents an overhead view of the swath profiles and beams. All profiles are spaced equally in the along-track direction. Across-track beam spacing is to correct scale. Each beam is represented by a square.

Menu	Tools > Swath Editor > Plan
Tool	

1. Select the Plan View command.

The number of swath profiles displayed in the Plan View is determined by three factors:

- height of the view
- point size of the beams
- distance (in points) between swath profiles (see [“DATA DISPLAY IN VIEWS” ON PAGE 639](#))

You can apply a number of colour options:

- colour by port and starboard beams (see [“SWATH EDITOR” ON PAGE 672](#))
- colour by sonar detection method (not supported by all sonars) (see [“SWATH EDITOR” ON PAGE 672](#))
- colour by depth interval (see [“COLOUR BY DEPTH” ON PAGE 642](#))
- sun illumination (see [“LIGHTING CONTROL” ON PAGE 651](#)).

Rear View

The Rear View presents the survey as seen from behind the vessel. Each line represents one swath.

Select the Rear View command.

Menu	Tools > Swath Editor > Rear
Tool	

Side View

The Side View presents the survey as seen from the side of the vessel with the vessel travelling from left to right. Each line represents soundings from the same beam.

1. Select the Side View command.

You can change the display (see [“DATA DISPLAY IN VIEWS” ON PAGE 207](#)) and depth label settings for this view (see [“SOUNDINGS” ON PAGE 210](#)).

Menu	Tools > Swath Editor > Side
Tool	

Menu	Tools > Swath Editor > Profile
Tool	

Profile View

The Profile View displays a single swath.

1. Select the Profile View command.

The time stamp and profile number of the swath are shown in the status bar.

Menu	Tools > Swath Editor > Amplitude
Tool	

Amplitude View

The Amplitude View displays the beam-averaged amplitude data that is recorded with the swath bathymetry data.

1. Select the Amplitude View command.

Beam-averaged amplitude data are intensity values for each sounding depth created by a multibeam sonar system.

Menu	Tools > Swath Editor > 3D View
Tool	

3-D View

The three-dimensional (3-D) View shows all soundings currently visible in the Plan View in three-dimensional format. The data in this window can be rotated and moved around (see "COMPASS" ON PAGE 649).

Select the 3-D View command.

Data Display in Views

You can show or hide the display of data in the Rear, Side and Profile Views:

- show or hide port beams
- show or hide starboard beams
- show both port and starboard beams (default setting)

1. Choose the Port or Starboard Beams command.

The display is refreshed to show only the Port or Starboard data.

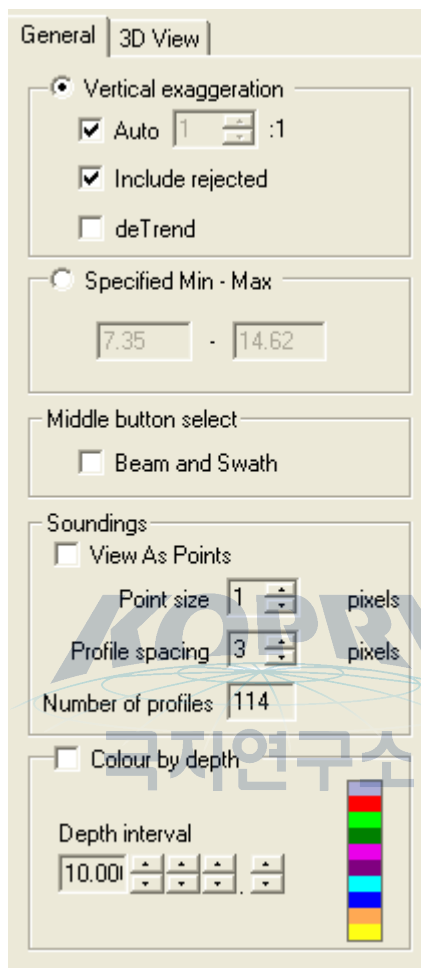
2. To view both starboard and port beam data, select the Port and Starboard Beams command.

Both Port and Starboard beams are displayed in the Rear, Side and Profile Views.

Menu	Tools > Swath Editor > Port Beams/ Starboard Beams
Tool	

Swath Editor Display Options

The display options for the views are controlled through the General tab in the Control window.



The following sections describe the options in this tab.

Vertical Exaggeration

The vertical exaggeration is the ratio of the vertical scale versus the horizontal scale used in the Rear and Side Views.

The vertical exaggeration can be determined automatically by including all visible depths or it can be manually set.

When *Auto* mode is on, the *Include Rejected* option controls whether or not the rejected data is used to determine the minimum and maximum sounding depth in the Rear and Side Views.

1. Deselect the *Auto* mode by clearing the check box.

2. Click the up or down arrow buttons beside the *Vertical Exaggeration* box to set the vertical exaggeration.

You can set the vertical and horizontal scale of the view to control the amount of rejected data in the view

3. Select the *Include Rejected* option to resize the display in the view to include rejected data.

This deTrend option is used when the general slopes of the sea floor topography makes it difficult to see individual depth spikes. DeTrend removes the general slope of the sea floor from the Rear and Side views and redraws the swath and beam profiles making it easier to locate depth spikes.

4. Select the *deTrend* check box to view data. Select the command by selecting from Tools > Swath Editor > deTrend.

Specified Min-Max

Use a constant scale as an alternative to vertical exaggeration by setting a minimum and maximum range for displaying data.

1. Select the *Specified Min-Max* check box to implement this option.
2. Type the minimum and maximum ranges for the scale.

The views are automatically refreshed to show data according to the scale.

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Soundings

By default, beams in the Side, Rear, and Profile Views are connected by lines. Sometimes, beams can be more clearly distinguished if displayed as points.

1. Select the General tab in the Control window.
2. Select the *View as Points* option to change the lines to points.
3. Click the up or down buttons beside the *Point Size* box to set a size value between one and five points.

Increase or decrease the beam display size in the Plan View.

4. Click the up or down buttons beside the *Point Size* box to set a size value between one and five points.

Beams are resized as determined by the point size setting. The *Number of Profiles* box displays a value for the maximum amount of profiles that can be shown in the Plan View. This value is incremented up or down as the beam display size values are changed.

Colour By Depth

Display soundings as colour coded by depth interval.

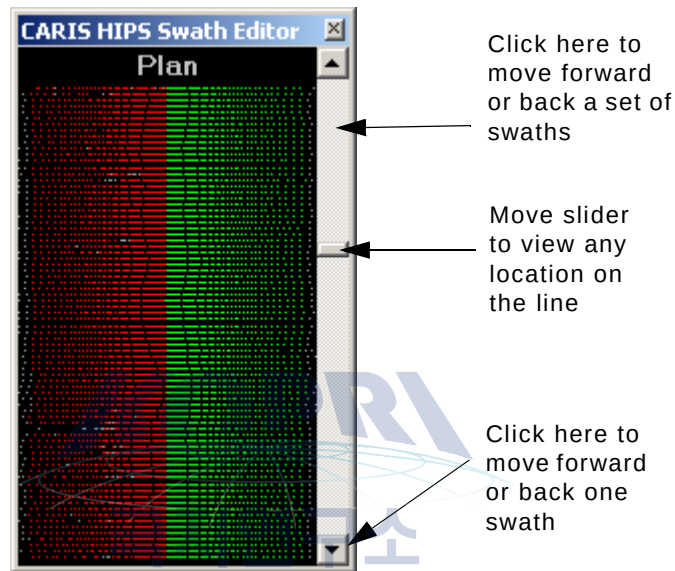
1. Select the Plan View tab in the Control window.
2. Select the *Colour by Depth* box so it is checked.
3. Click the up or down buttons beside the *Depth Interval* box to select a depth interval for the colour band.

The soundings are now displayed by depth level.

Examining Swath Data

The scroll bar in the Plan View represents the time period of the entire line. You can use the slider to move along the trackline or use the scroll arrows for more precision.

Each click on an arrow button moves the screen forward or backward one swath. Clicking the grey area of the scroll bar moves the screen forward or backward for a set of swaths. As you move along the track line, all the views refresh to display the same data as in the Plan View window..



As you move up or down the track line, all the views refresh to display the data from the swaths that are visible in the Plan view.

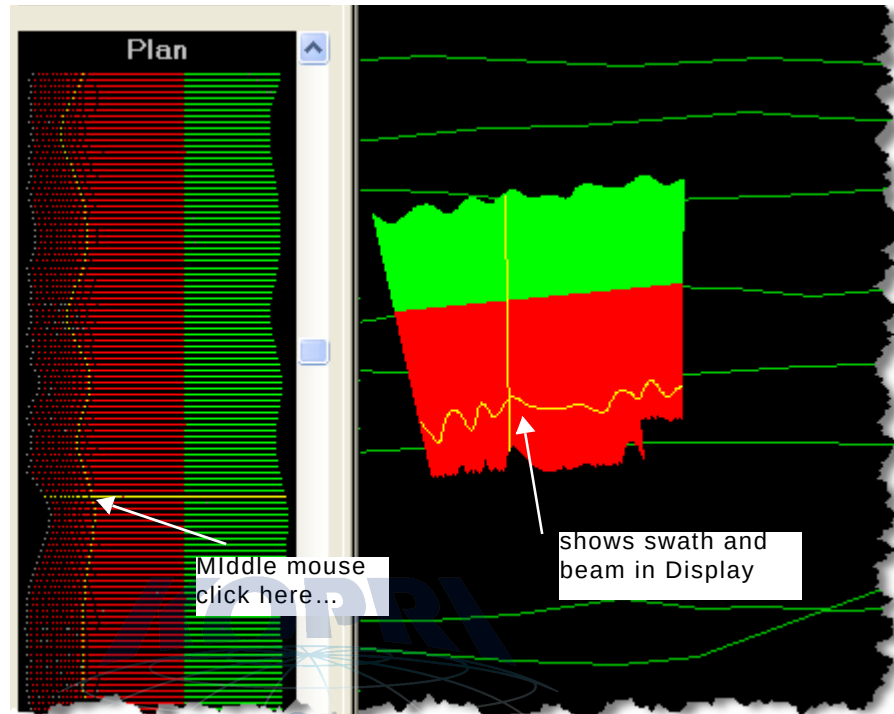
The geographic location of the swaths currently in view is shown by the sounding coverage outline in the Display window (see ["SWATH COVERAGE OUTLINE" ON PAGE 645](#)).

As an alternative, use the following methods to scroll through a track line:

- Press the space bar to move up the track line.
- Use the mouse wheel (if available) to move up or down the track line.
- Press <Ctrl + spacebar> to move down the track line.
- Use the mouse wheel (if available) to move up or down a track line.
- Press the <Home> or <End> buttons to move to the start or end of the track line.

Select Swaths and Beam

The Middle button select option lets you select an individual swath or beam profile and see its location in the Display window. By moving the cursor in the Plan, Rear, 3-D or Side View while holding down the middle mouse button, individual swaths and beams will be highlighted in the Display (see example below).



To view both beam and swath profiles

1. Select the *Beam and Swath* check box in the *Middle Mouse Select* section of the General tab in the Control window.
2. Place the cursor in either the Plan View, Rear View or Side View and click the middle mouse button.

The selected swath is highlighted. The other views are updated to reflect the same beam and swath location. The positions of the swaths and beams are also displayed in the sounding coverage outline.

If the Attitude Editor is open, you can view the sounding's position in relation to attitude data by the yellow line in any of the sensor windows (see "[ATTITUDE EDITOR](#)" ON PAGE 185).

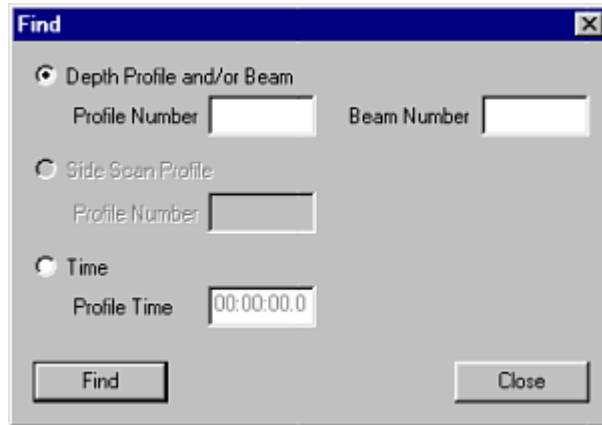
Find soundings

Search a survey line for a specific swath or beam.

1. Select the Find Soundings command, or right-click and select **Find** from the pop-up menu in the Plan View.

The Find Soundings dialog box is displayed.

Menu	Edit > Find
Tool	
Pop-up	Find
Key	<Ctrl+F>

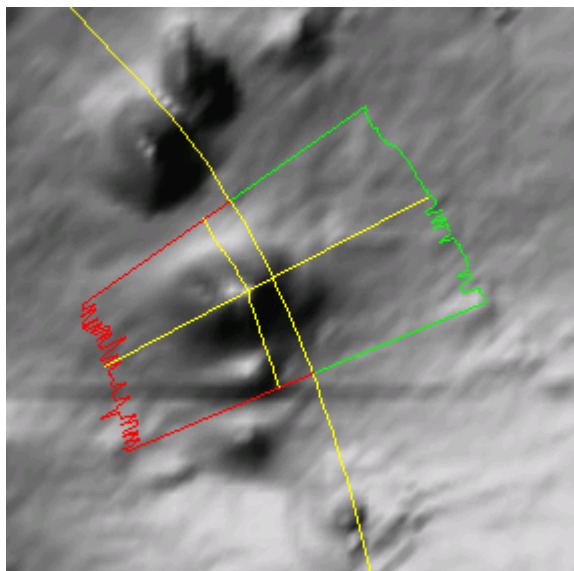


2. To search by the swath or beam number, select the *Profile and/or Beam* option.
3. Type the swath or beam number in the *Profile Number* or *Beam Number* field.
4. To search for a swath that was recorded at a specific time, select the *Time* option.
5. Click inside the *Profile Time* box and type the time in the relevant fields (hour:minutes:seconds:decimal fractions of a second). Make sure you use the 24-hour clock.
6. Click **Find**.

The selected beam or swath is highlighted in the Plan, Rear and Side Views.

Swath Coverage Outline

The swath coverage outline is a marker in the Display window that shows the location of data currently visible in the Swath Editor (see example below) The display of the outline is controlled from the Options dialog box (see “**SENSOR EDITORS**” ON PAGE 90).



Automatic Recentre

The automatic recentre option ensures that when the coverage outline reaches the edge of the Display window (when scanning along the track line), the display redraws with the coverage outline in the centre. This option is available in the General Options dialog box. (see [“GENERAL” ON PAGE 77](#)).



Changing Track Lines

After examining a track line, you may want examine another line.

There are four options for navigating between track lines in the Swath Editor:

- Select the Next Line command
- Select the Previous Line command
- Click a line in the Display window so that the line is opened in the Swath Editor at that location
- Select a track line file name Project data tree in the Control window.

Menu	Select > Next Line
Tool	

Menu	Select > Previous Line
Tool	



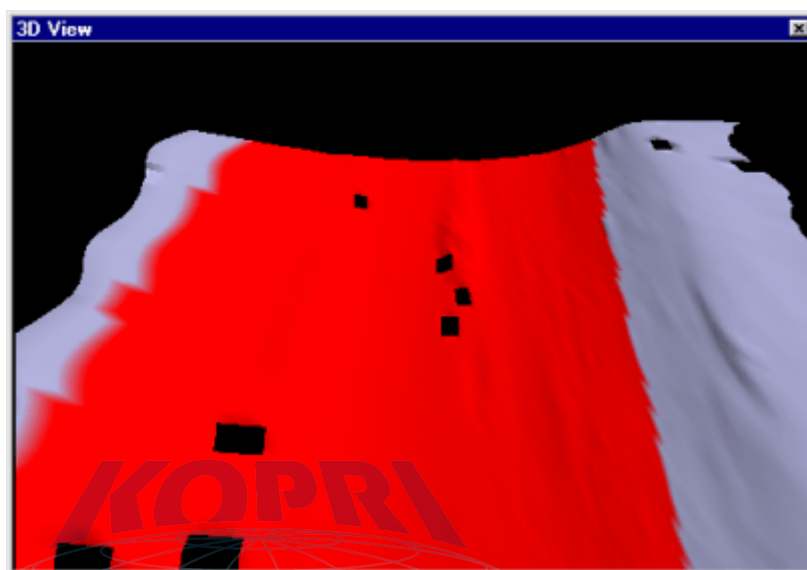
Examine Data in the 3-D View

Menu	Tools > Swath Editor > 3D View
Tool	

Swath data be displayed in 3D format. The 3-D feature provides greater flexibility for examining and cleaning data.

1. Select the 3-D View command.

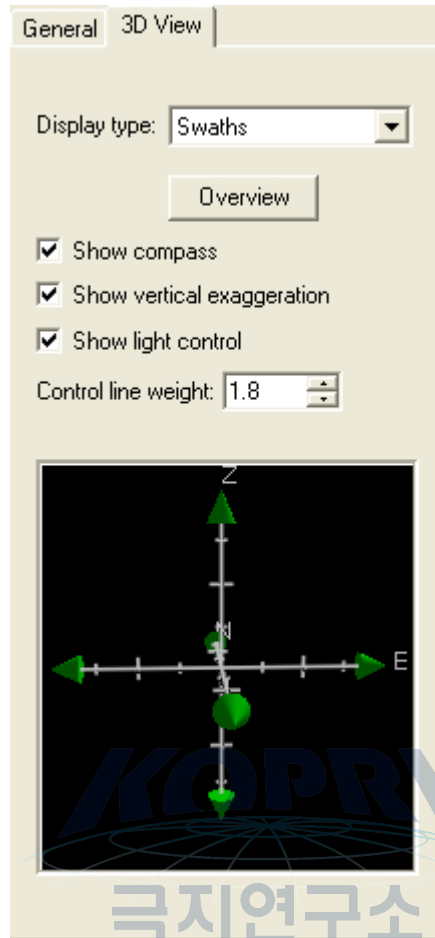
The 3-D view is displayed in the Swath Editor.



The 3-D display is manipulated by three controls:

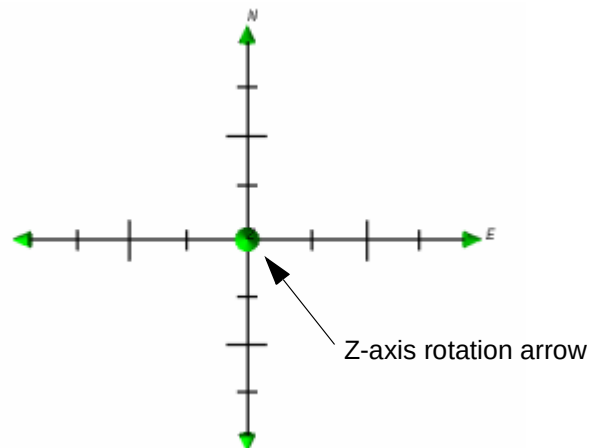
- the compass
- the vertical exaggeration slider
- the light control.

The display of data and 3-D controls is handled through the 3-D View tab, shown below. The line thickness of these controls can be altered by changing the *Line Weight* value in the 3-D View tab.



Compass

Rotation along the X-Y-Z axis is handled by moving the arrow heads at the ends of the compass. The compass is visible in both the 3-D View and the 3-D View tab.



1. To rotate the image along the Z-axis, position the cursor on the middle arrow head, press and hold the mouse button, and drag the cursor so that the image is rotated. The compass can be rotated 90°.
2. To rotate the image along the X-Y axis, position the cursor on any of the other arrow heads, press the mouse button and drag the arrow head in a left-right or up-down direction. The compass can be rotated 360°.
3. Alternatively, the image can be rotated in the horizontal plane by grabbing the Z-arrow, then pressing the left-mouse button and moving the cursor up and down. Rotation around the Z-axis can be performed by pressing the <Shift> key and moving the cursor left and right in these windows.

The image is rotated in the same direction as the arrow heads.

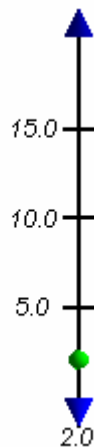
4. To return the image to its original position, click **Overview** in the 3-D View tab.

The image is restored to its original position.

Vertical Exaggeration Slider

By changing the vertical exaggeration, you can display seabed features more clearly.

Vertical exaggeration is controlled by the scale slider in the 3-D View. The slider can be displayed or hidden by selecting (or clearing) the *Show Vertical Exaggeration* check box in the 3-D Controls tab.



1. To change vertical exaggeration, position the cursor over the ball on the vertical exaggeration scale.
2. Press and hold the mouse button, and move the ball up or down the scale.

You can also change the vertical exaggeration using a dialog box.

3. Double-click the ball in the vertical exaggeration slider.

The Vertical Exaggeration dialog box is displayed.

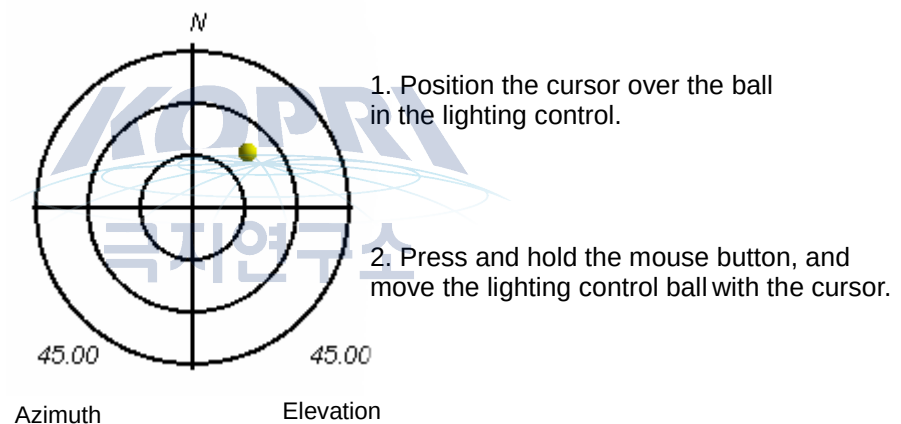
4. Type a value in the Vertical Exaggeration field and click **OK**.

The display is refreshed to show the image according to the selected exaggeration scale. The scale value is displayed below the slider.

Lighting Control

The lighting control handles shading effects by controlling the position and angle of the light.

The elevation value (on the bottom right of the compass) varies from 90° to 0° starting from the middle of sundial. The azimuth value (on the bottom left of the compass) varies from 0° to 360° in a clockwise direction. The lighting control can be displayed or hidden by selecting (or clearing) the *Show Light Control* check box in the 3-D View tab.



As the ball is moved, the elevation and azimuth values change.

You can also change the shading effect using a dialog box.

1. Double-click the ball in the lighting control.

The Set Sun Position dialog box is displayed.

2. Type new values in the *Sun Elevation* and *Sun Azimuth* fields and click **OK**.

The image is refreshed to the new lighting angle.

Pan and Zoom

There are three pan options for the 3-D View:

- To pan along the X-Y axis: place the cursor in the 3-D View, press the middle mouse button and drag the display to a new location.
- To pan along the Z-axis: place the cursor in the 3-D View, press and hold the <Shift> key and middle mouse button and move the cursor in the window.
- To centre the 3-D View window on a selected point: position the cursor over the point and click the middle mouse button.

There are three zoom options:

- Press and hold the <Ctrl> key and right-mouse button and drag the cursor up in the display to zoom into display.
- Press and hold the <Ctrl> key and right-mouse button and drag the cursor down in the display to out of display
- Rotate the mouse wheel in a counter-clockwise direction to zoom into the display, or rotate the mouse wheel in clockwise direction to zoom out of the display.



Appendices

A. Options

B. Data Directories

C. HIPS Status Flags





A

Options

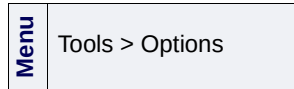
“ENVIRONMENT” ON PAGE 676

“3D TAB” ON PAGE 681



Introduction

The Options dialog box has a number of parameters to help you control the appearance of the interface, the behaviour of some commands, and the system environment.



1. Select the Options command.

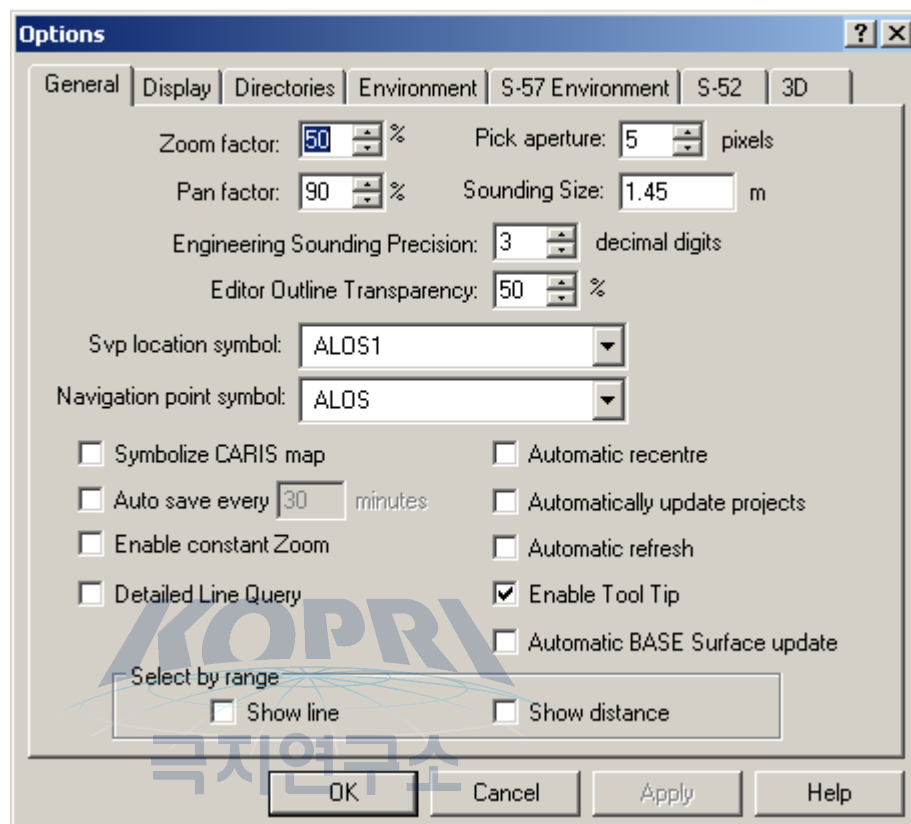
The Options dialog box is displayed. The dialog box contains the following five tabs:

2. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.



General

On the Options - General tab you can set parameters that determine how you want to work with data.



1. Set the parameters described in the table below.

Field	Description	To assign a value...
Zoom Factor	Set the percentage to increase or decrease the display scale when using the Zoom functions.	Select a percentage rate for the zoom tool using the up or down arrows in the <i>Zoom Factor</i> box.
Pan Factor	Set the percentage used to move up, down, left, or right while using the Pan tools.	Select a percentage by clicking the up or down arrow keys beside the <i>Pan Factor</i> box.
Pick Aperture	The Pick Aperture determines the maximum distance (in pixels) that a cursor can be from an object to select it. For example, if the Pick Aperture is set to five, the cursor must be a distance of five pixels (or less) to select an object.	Select the pixel area for the Pick Aperture by clicking the up and down arrow buttons.
Sounding Size	Display sounding digits in a field sheet or tiled area at a selected size (millimetres at map scale).	Enter a sounding size value in the <i>Sounding Size</i> field.

Field	Description	To assign a value...
Engineer Sounding Precision	Set the number of places to the right of the decimal point that digits are shown for engineering sounding display.	Select the precision value by clicking the up or down arrow buttons.
Editor Outline Transparency	Control the transparency levels of fills for Swath, Side Scan and Subset Editor outlines in the Display window.	Select a percentage value for transparency (0 equals no transparency, 100 equals total transparency) by clicking the up or down arrow buttons.
SVP Location Symbol	Select a feature code for the symbol that shows the location where SVP data was recorded.	Select a feature code from the drop-down list.
Navigation Point Symbol	Select a feature code for the symbol display of points in the Navigation Editor.	Select a feature code from the drop-down list.
Symbolize CARIS Map	This option draws the background CARIS map with its associated line patterns and symbolization.	Check the <i>Symbolize CARIS Map</i> box to implement this option.
Auto Save	Automatically save all status flag changes at set intervals.	Select the <i>Auto Save</i> check box to implement this function. Enter the interval (in minutes) that work is to be saved.
Enable Constant Zoom	Control whether the Zoom function allows repeated Zoom commands until the Zoom function is turned off.	Make sure the <i>Enable Constant Zoom</i> box is checked to implement this option.
Detailed Line Query	Display all data fields for a track line when it is queried.	Select the <i>Detailed Line Query</i> command.
Automatic Recentre	Redraw the Display window so that the sounding coverage outline is always displayed in the centre when scrolling along the line.	Select the <i>Automatic Recentre</i> check box.
Automatically Update Projects	Save the UTM zone setting in a project so HIPS/SIPS does not have to search for the zone when a project is reopened. This option is only available when project created using Select UTM zone automatically option.	Make sure the <i>Automatically Update Projects</i> box is checked to implement this option.
Automatic Refresh	Refresh the Display window automatically when layers are turned on or off, or when the drawing order is changed in the Control window.	Make sure the <i>Automatic Refresh</i> box is checked to implement this option.
Enable Tool Tip	Show/hide the display of ToolTips when the cursor is over a BASE surface or toolbar button.	Make sure the <i>Show Tool Tip</i> box is checked to implement this option.
Automatic BASE Surface Update	Automatically update BASE Surfaces after cleaning sounding data in the Swath and Subset Editors, or after cleaning CUBE data in the Subset Editor.	Select or clear the <i>Automatic BASE Surface Update</i> check box.

Field	Description	To assign a value...
Show Line	Display a diagonal line inside the bounding box that is drawn when the mouse button is pressed down and the cursor is dragged across the screen.	Click the <i>Show Line</i> check box.
Show Distance	Display the distance that the bounding box covers when it is drawn on the screen.	Click the <i>Show Distance</i> check box.

- Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.



Display

Menu	Tools > Options

1. Select the Options command.

The Options - Display dialog box is displayed.

2. Select the Display tab.

The Display tab has a list of various display controls such as colour, fonts, position of labels on grids and so forth.

The controls for the selected editor or window are displayed on the right side of the window. Refer to the appropriate section below for instructions to set the parameters for each window or editor.

3D Display

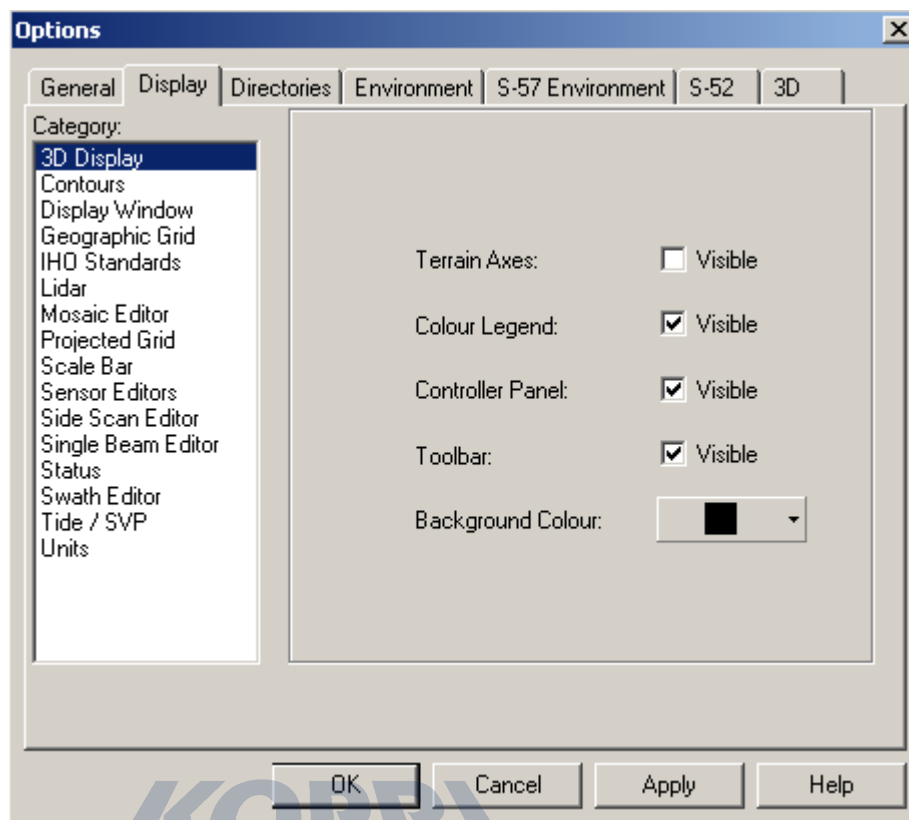
Use settings in the Tools > Options > Display > 3D to:

- display a *Terrain Axes* (x,y,z) grid for the selected surface.
- turn on or off the display of the *Colour Legend*. When turned off, the legend's on/off button within the 3D View is also removed.
- turn on or off the display of the *Controller Panel*. When turned off, the controller panel's on/off button within the 3D View is also removed.
- display the 3D View *Toolbar*. If this option is not enabled, the commands can be accessed from the View > 3D Flight Path submenu.
- select the colour to use as the *Background Colour* of the 3D View.

Contours

Use the settings in the Tools > Options > Contours to set the display of labels in contour lines created in a product surface. Set:

- Size in mm of the contour label.
- Number of decimal places to the right of the decimal point to display in the label.
- Space in mm around the label when the masking option is used.

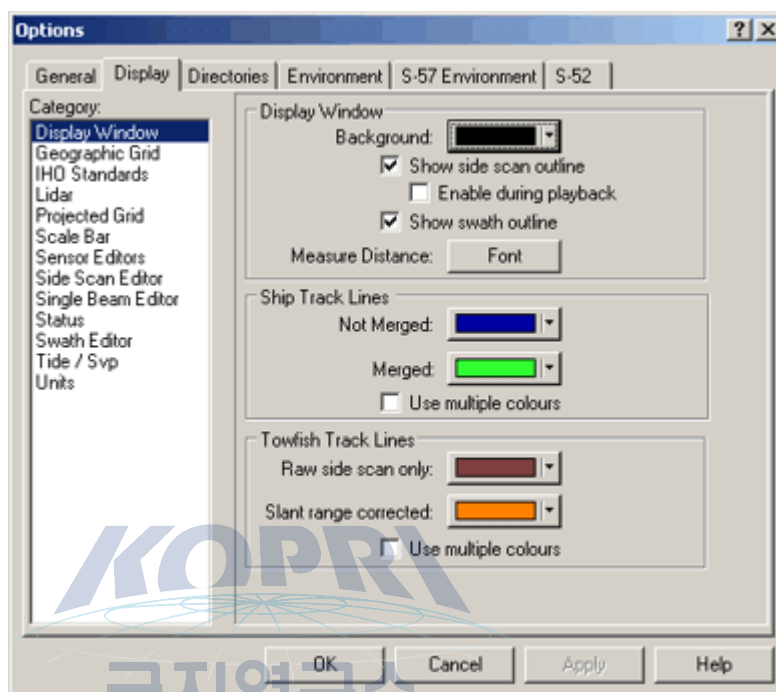


- Orientation of the label with respect to the contour line it is labelling.

Display window

The Tools >Options - Display Window tab controls the display and colour features for the ship and towfish track lines.

1. Select Display Window from the *Category* list.



2. Set the parameters described in the table below.

Field	Description	To assign a value...
Display Window fields:		
Background	Control the background colour.	Select a colour for the background from the colour palette, or create a custom colour from the standard Windows colour picker.
Show Side Scan Outline	The side scan outline marks the extent of the data currently visible in the Side Scan Editor.	Select the <i>Show Side Scan Outline</i> check box to display the marker in the Display window while the Side Scan Editor is open.
Enable during playback	Move the side scan outline along the track line during the Playback option in the Side Scan Editor.	Select the <i>Enable During Playback</i> check box to make this option active.
Show Swath Outline	The swath outline marks the extent of the data currently visible in the Swath Editor.	Select the <i>Show Swath Outline</i> check box to display the marker in the Display window while the Swath Editor is open.

Field	Description	To assign a value...
Measure Distance	Select a font to display measurements when the Measure Distance command is used.	Click Font and select a type face, font size and colour from the dialog box.
Ship Track Lines fields		
Not Merged	The colour for track lines that have not been merged into a position/depth file	Select a colour from the colour palette, or create a custom colour from the standard Windows colour picker.
Merged	The colour of track lines that have been merged into a position/depth file.	
Towfish Track Lines fields		
Raw Side Scan Only	The colour used to display track lines when side scan data is still in raw mode.	Click the <i>Use Multiple Colours</i> check box to enable this option for ship track lines or towfish lines.
Slant Range Corrected	The colour used to display track lines when side scan data has been slant range corrected.	
Use Multiple Colours	This option uses a set of ten distinct colours to colour the track lines in the Display window. This is helpful if the survey data was logged as multiple files along the same runline.	

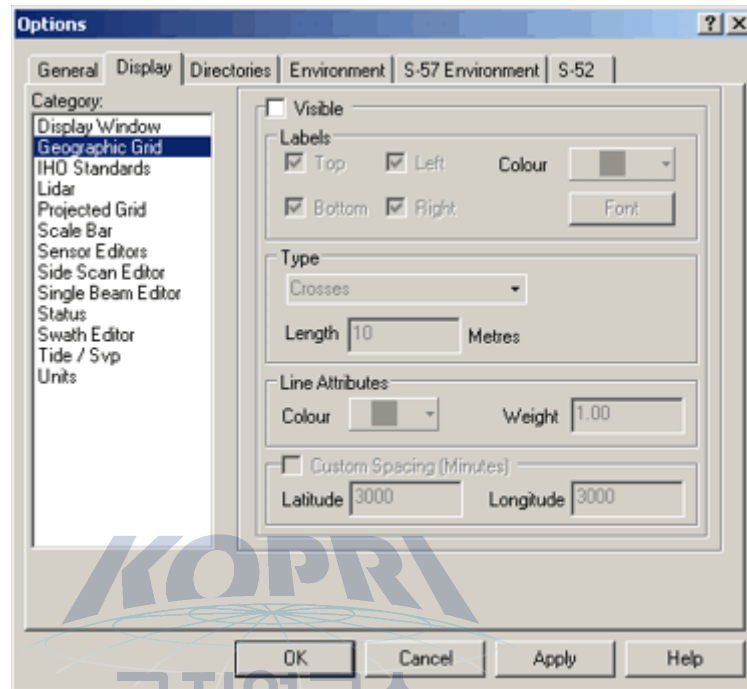
3. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.



Geographic Grid

The Options - Geographic Grids tab controls the options for displaying grids based on geographic units.

1. Select Geographic Grid from the *Category List*.



2. Set the parameters described in the table below.

Field	Description	To assign a value...
Visible	Show a grid based on geographic coordinates in the Display window.	Select the check box.
Labels: Top/Left/ Bottom/Right	Display geographic coordinates at selected locations in the Display window	Select the check boxes.
Colour	Set a colour for the grid labels.	Select a colour from the colour picker, or create a custom colour from the standard Windows colour palette.
Font	Typeface and point size for grid labels	Click the Font button to open the standard Windows Font dialog box to select a font type and size.
Type	The type of markings for the geographic grid.	Select a type from the drop-down list.
Length	The length of the markings (mm at map scale).	Type the length.

Field	Description	To assign a value...
Line Attribute Colour	Colour for the geographic grid markings.	Select a colour from the colour picker, or create a custom colour from the standard Windows colour palette.
Weight	Thickness of the markings	Type a value into the field.
Custom Spacing	Position the grid markings at selected locations in the workspace.	Select the check box.
Grid Spacing	Spacing of grid markers in mm at map scale.	Type a value in the provided field.

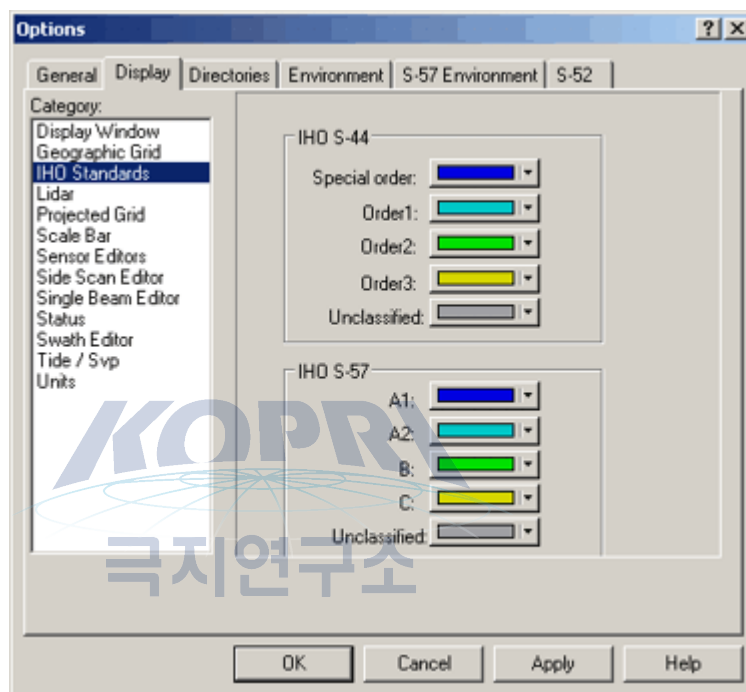
- Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.



IHO Standards

The Options - IHO Standards tab controls the colour options in the Subset Editor to display data according to International Hydrographic Organization (IHO) standards. Colours can be set for each S-44 survey order and S-57 Zone of Confidence (CATZOC). The *Unclassified* option sets the colour for soundings that exceed defined limits of the selected standard.

1. Select IHO Standards from the *Category* list.



2. Set the parameters described in the table below.

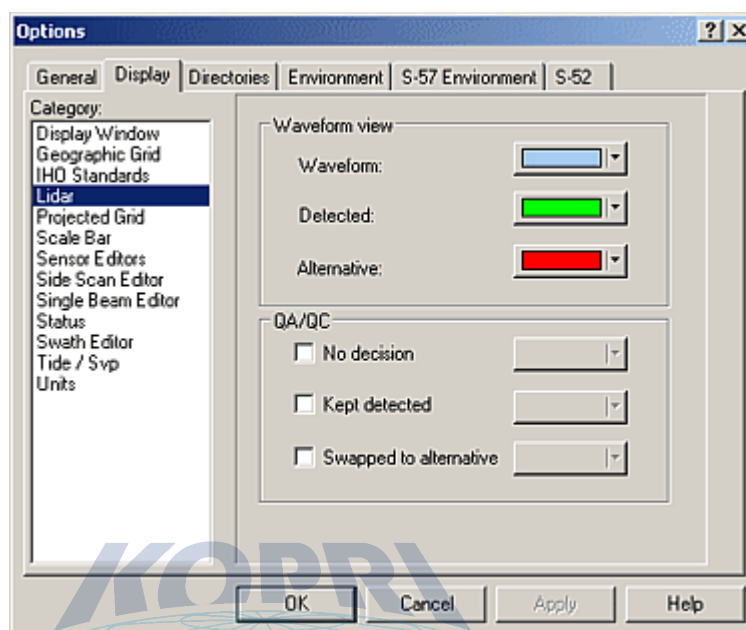
Field	Description	To assign a value...
IHO S-44	Colours for displaying soundings according to S-44 survey order.	Select a colour from the appropriate colour palette, or create a custom colour from the standard Windows colour picker.
IHO S-57	Colours for displaying soundings according to the S-57 CATZOC zones of confidence attributes.	

3. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.

Lidar

The Tools> Options - Lidar tab controls the colour options for lidar data in the Swath and Subset Editors.

1. Select Lidar from the *Category* list.



2. Set the parameters described in the table below.

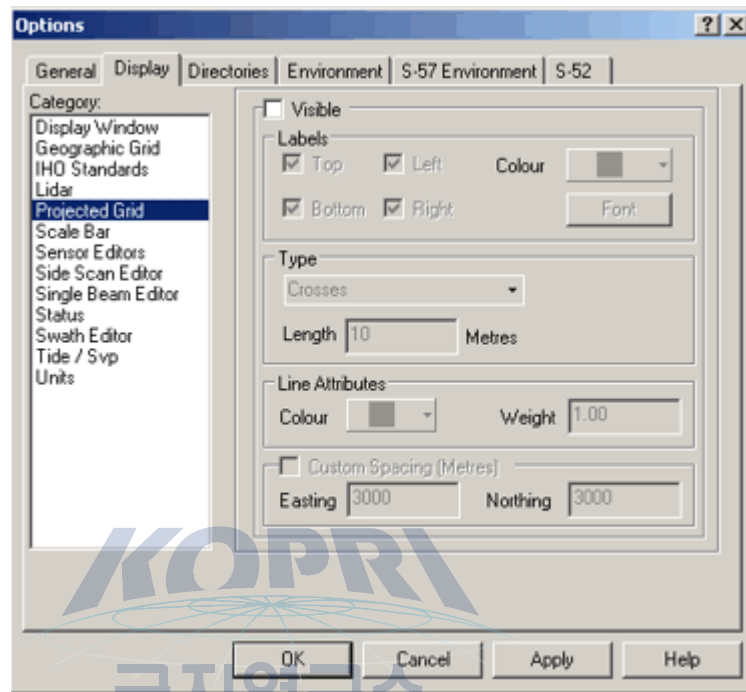
Field	Description	To assign a value...
Waveform view:		
Waveform	Selected colour for displaying waveform data.	Select a colour from the appropriate colour palette, or create a custom colour from the standard Windows colour picker.
Detected	Selected colour for displaying soundings.	
Alternative	Selected colour for displaying soundings with an alternative depth.	
QA/QC:		
No Decision	Display soundings that have a detected and alternative depth (Quality 1 flag)	Display or hide soundings with specific quality flag by selecting or clearing any of the quality flag check boxes.
Kept Detected	Display soundings where the detected depth is retained over the alternative depth (Quality 2 flag)	
Swap to Alternative	Display soundings where the detected depth has been replaced by the alternative depth (Quality 3 flag)	Select a new colour for each of the lidar flags from the colour palette, or create a custom colour from the standard windows palette.

3. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.

Projected Grid

The Options - Projected Grid tab controls options for displaying a grid based on the selected projection.

1. Select Projected Grid from the Category list.



2. Set the parameters described in the table below.

Field	Description	To assign a value...
Visible	Show a grid based on geographic coordinates in the Display window.	Select the check box.
Top/Left/Bottom/Right	Display geographic coordinates at selected locations in the Display window	Select the check boxes.
Colour	Colour for the grid labels.	Select a colour from the colour picker, or create a custom colour from the standard Windows colour palette.
Font	Typeface and point size for grid labels	Click the Font button to open the standard Windows Font dialog box to select a font type and size.
Type	The type of markings for the geographic grid.	Select a type from the drop-down list.
Length	The length of the markings (mm at map scale).	Type the length.

Field	Description	To assign a value...
Line Attribute Colour	Colour for the geographic grid markings.	Select a colour from the colour picker, or create a custom colour from the standard Windows colour palette.
Weight	Thickness of the markings	Type a value into the field.
Custom Spacing	Position the grid markings at selected locations in the workspace.	Select the check box.
Grid Spacing	Spacing of grid markers in mm at map scale.	Type a value in the provided field.

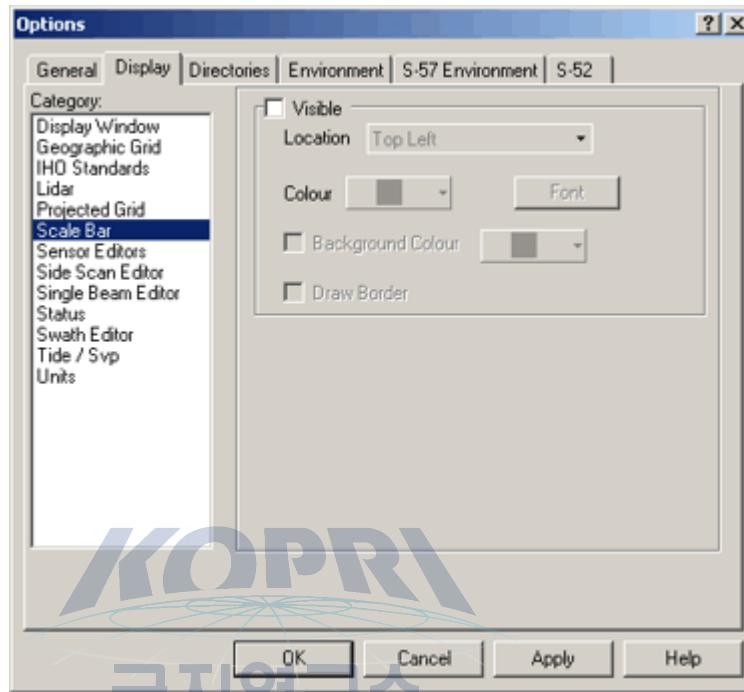
- Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.



Scale Bar

The Options - Scale Bar tab controls the options for the scale bar.

1. Select Scale Bar in the Category list.

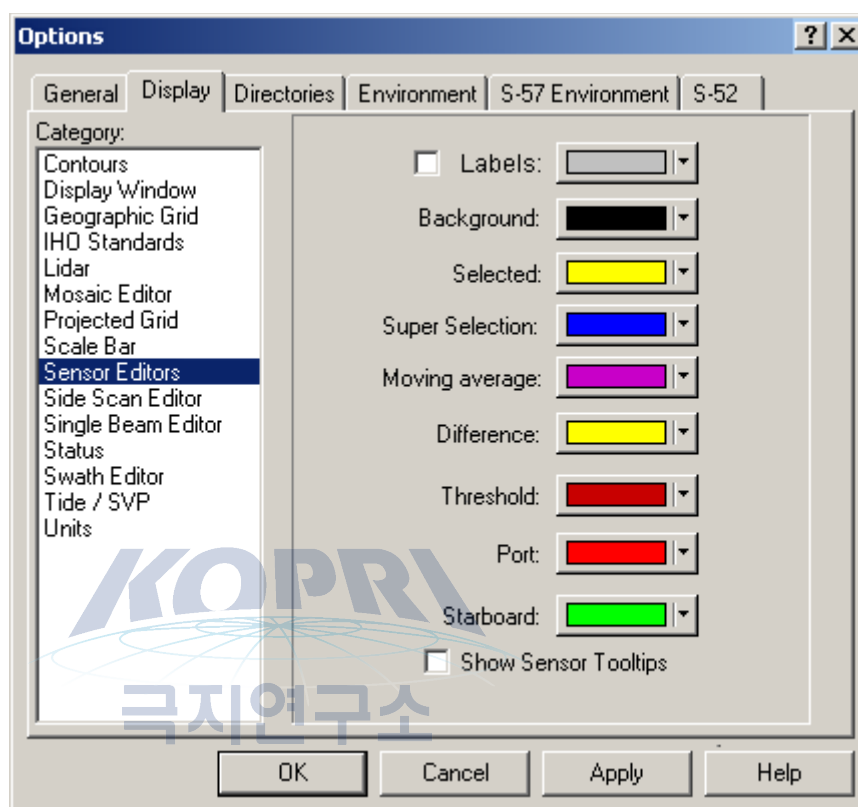


Field	Description	To assign a value...
Visible	Show a scale bar in the Display window.	Select the check box.
Location	Position of the scale bar in the window.	Select a location from the drop-down list.
Colour	Colour of the scale bar.	Select a colour from the colour picker, or create a custom colour from the standard Windows colour palette.
Font	Select the font type, style and size from the Font dialog box.	Click the Font button to open the standard Windows Font dialog box to select a font type and size.
Background Colour	Display a colour fill for the scale bar area.	Select the check box to implement this option. Select a colour from the colour picker, or create a custom colour from the standard Windows colour palette.
Draw Border	Draw a border line around the scale bar area.	Select the check box to implement this option.

Sensor Editors

The Tools >Options - Sensor Editors tab controls some of the colour settings for the editors.

1. Select Sensor Editor from the *Category* list.



2. Set the parameters described in the table below.

Field	Description	To assign a value...
Labels	Labels display the horizontal and vertical scale lines and annotations in the editors.	Show or hide labels (the labels are toggled to on when the Label box is checked). Select a colour for the labels from the colour palette, or create a custom colour from the standard Windows colour selector.
Background	Use this control to set the background colour in the editors.	Select a colour from the colour palette, or create a custom colour from the standard Windows colour selector.
Selected	The colour for highlighted data in the Display window and in the editors.	
Superselection	Sets the colour for superselected lidar data in the Swath and Subset Editors.	

Field	Description	To assign a value...
Moving Average	Sets the colour for the Moving Average line in the Attitude and Single Beam Editors.	Select a colour from the colour palette, or create a custom colour from the standard Windows colour selector.
Difference	Sets the colour for Difference line in the Attitude and Single Beam Editors.	
Threshold	Sets the colour for the Threshold line in the Attitude and Single Beam Editors.	
Port	Sets the colour for the port side of the side scan coverage outline in the Side Scan display, or the port soundings in the Plan View of Swath Editor.	Select a colour from the colour palette, or create a custom colour from the standard Windows colour selector.
Starboard	Sets the colour for the starboard side of the side scan coverage outline in the SideScan display, or the port soundings in the Plan View of Swath Editor.	
Show Sensor ToolTips	ToolTips are used in the Attitude and Navigation Editors for displaying data values as the cursor moves over the graphs.	Show or hide tools tips by clicking the <i>Tool Tips</i> check box (checked means this feature is visible).

3. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.

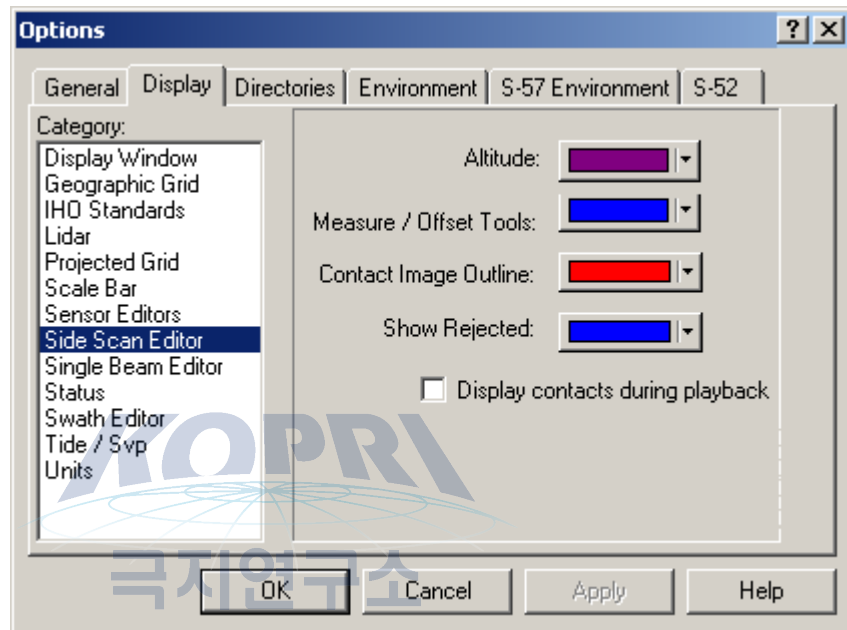


Side Scan Editor

The Tools > Options - Side Scan Editor Display tab controls the colours used for the Side Scan Editor.

The Port and Starboard colour palettes are set in Tools > Options > Display > “**SENSOR EDITORS**” ON PAGE 667.

1. Select Side Scan Editor from the *Category* list.



2. Set the parameters described in the table below.

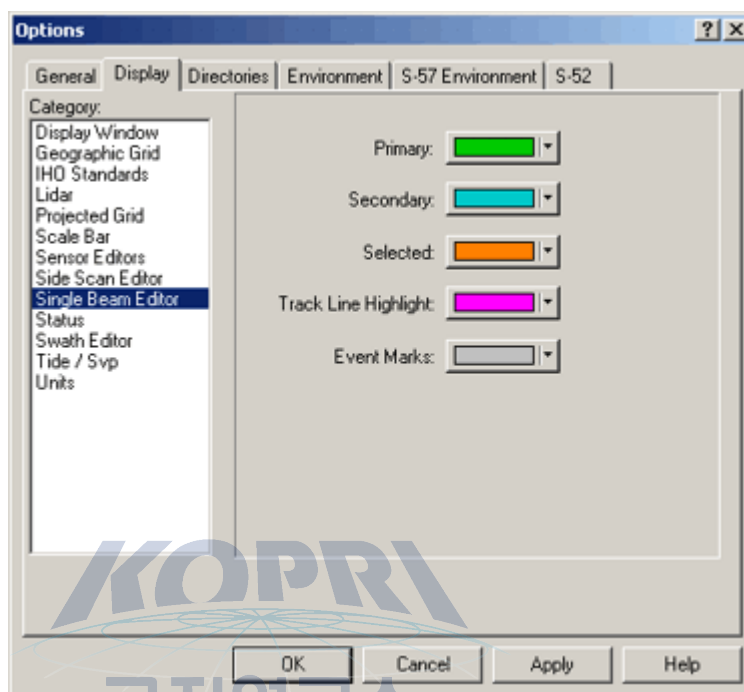
Field	Description	To assign a value...
Altitude	Sets the colour of the digitized line along the seabed that is used determine the height of the towfish from nadir when slant-range correction is performed.	Select a colour from the appropriate colour palette, or create a custom colour from the standard Windows colour picker.
Measure /Offset Tools	Sets the colour for displaying the values when using the Measure Distance and Measure Shadow tools, and the colour of the range display.	
Contact Image Outline	Sets the colour for displaying the outline of a contact.	
Show Rejected	Sets the colour of rejected pings (which are visible when the Show Rejected button on the Toolbar is activated)	
Display contacts during playback	Makes contacts visible in waterfall window during scrolling or playback.	Select the check box.

3. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.

Single Beam Editor

The Options - Single Beam Editor tab controls the colours for the Single Beam Editor.

1. Select Single Beam Editor from the *Category* list.



2. Set the parameters described in the table below.

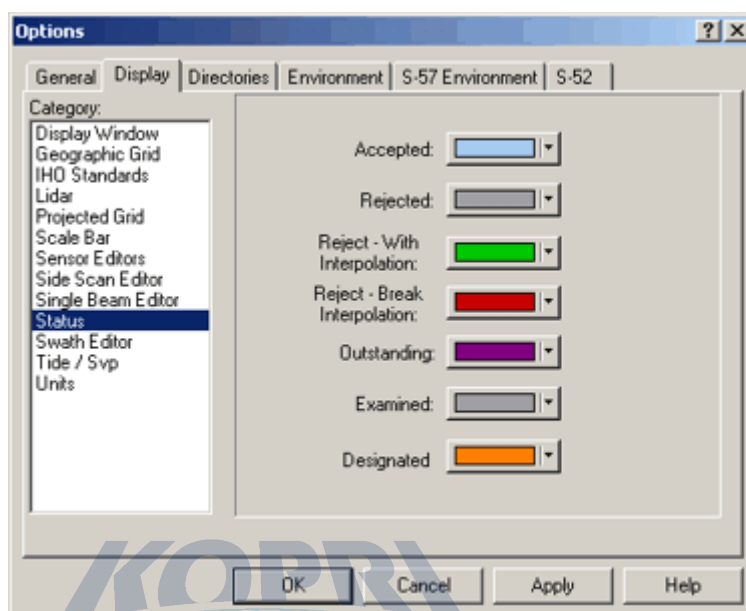
Field	Description	To assign a value...
Primary	Colour of primary frequency soundings in a dual-frequency system.	Select a colour from the appropriate colour palette, or create a custom colour from the standard Windows colour picker.
Secondary	Colour for secondary frequency soundings in a dual-frequency system.	
Selected	Colour for soundings that are selected for further processing. Selected data begins as a copy of primary frequency data, but can be modified to include secondary frequency data.	
Track Line Highlight	The colour in the Display window for the section of track line visible in the editor.	
Event Marks	A unique marker placed at regular intervals in the survey.	

3. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.

Status

The Tools > Options - Status tab controls the status colours for soundings.

1. Select Status from the *Category* list.



2. Set the parameters described in the table below.

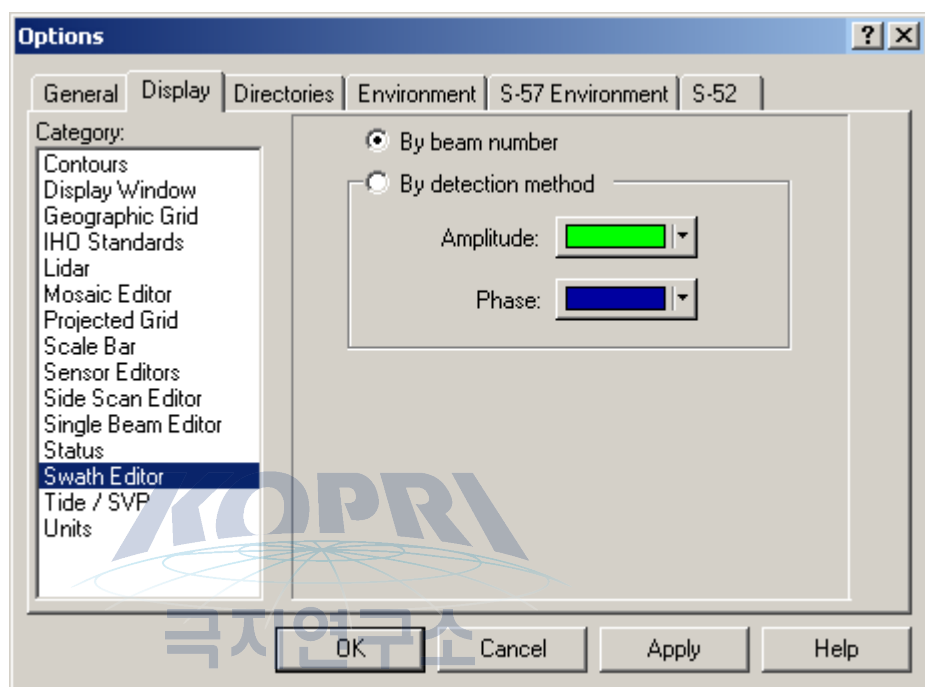
Field	Description	To assign a value...
Accepted	Colour for data that is flagged as ready for processing.	Select a colour from the colour palette, or create a custom colour from the standard Windows colour selector.
Rejected	Colour for data that is flagged as rejected and excluded from further processing.	
Reject - With Interpolation	Colour for attitude and navigation data that has been flagged as rejected but where associated soundings can still be processed.	
Reject - Break Interpolation	Colour for attitude and navigation data that has been flagged as rejected and where associated soundings are also rejected.	
Outstanding	Colour for soundings in the Subset Editor that have been flagged as needing further examination.	
Examined	Colour for soundings in the Subset Editor that have been flagged as examined and verified.	
Designated	Colour for the sounding that has been flagged in the Swath or Subset Editors as being the shoalest sounding on a feature.	

3. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.

Swath Editor

The Options - Swath Editor tab is for selecting colours for the Plan View display. Soundings can be coloured by location in the swath or by detection method. Soundings in the Rear, Side, and Profile Views are always coloured by their location in the swath.

1. Select Swath Editor from the *Category* list.



2. Set the parameters described in the table below.

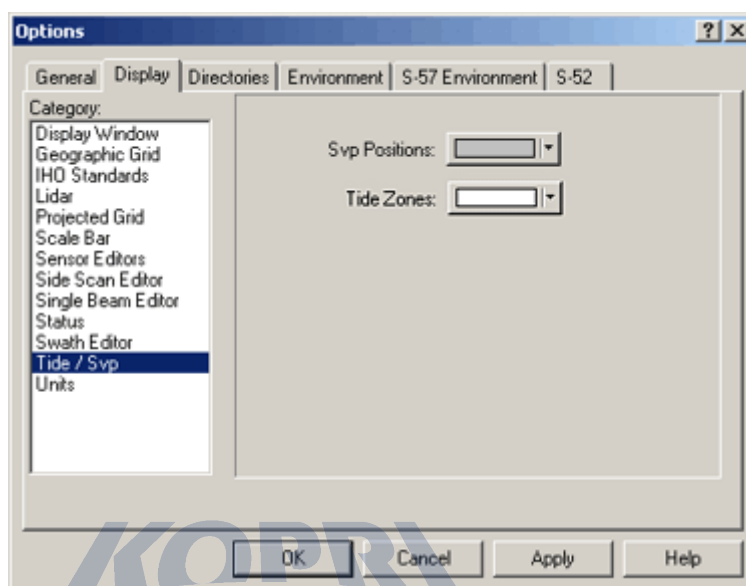
Field	Description	To assign a value...
By Beam Number	Colours soundings in the Plan View by their location in the swath (port and starboard).	Click the <i>By Beam Number</i> box so the port and starboard colour options are enabled. Port and Starboard colour palettes are set in Tools > Options > Display > "SENSOR EDITORS" ON PAGE 667.
By Detection Method	Colours soundings in the Plan by the detection method used by the sonar.	Click the <i>By Detection Method</i> box so the amplitude and phase colour options are enabled. Use the <i>Phase</i> and <i>Amplitude</i> colour palettes to select a colour, or create a custom colour from the standard Windows colour selector.

3. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.

Tide/SVP

The Options - Tide/SVP tab controls colour options for Sound Velocity Profile location symbols and tide zone lines.

1. Select Tide/SVP from the *Category* list.



2. Set the parameters described in the table below.

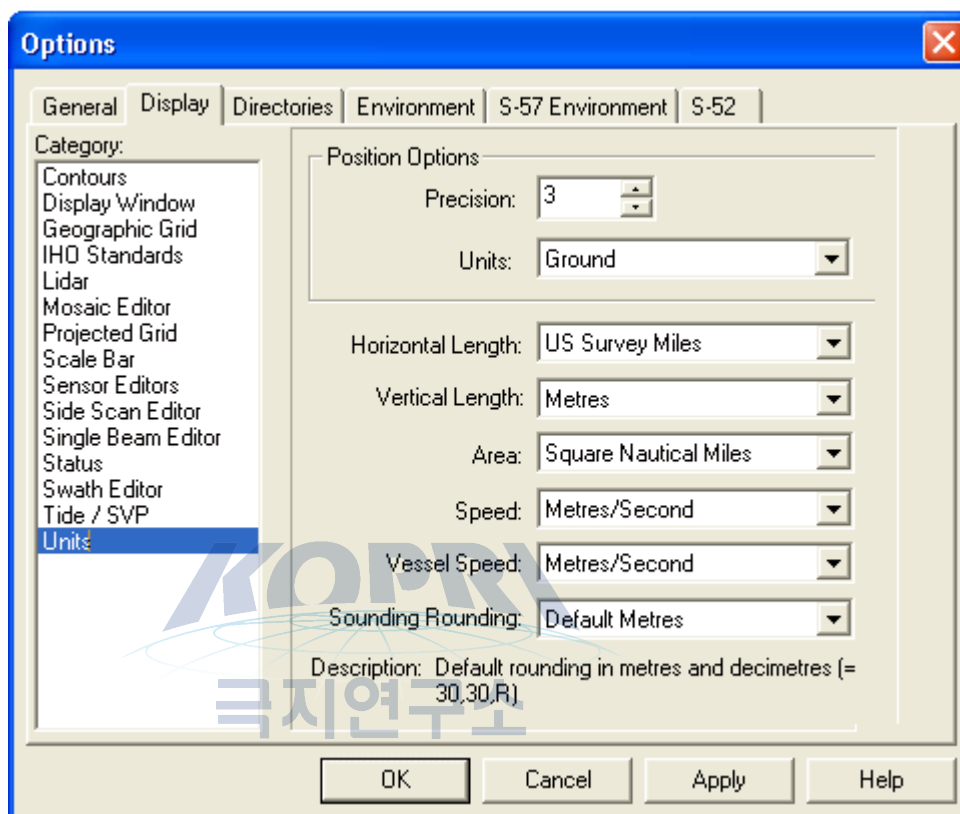
Field	Description	To assign a value...
SVP Positions	Colour for Symbols and text labels show the positions of sound velocity profiles.	Select a colour from the appropriate colour palette, or create a custom colour from the standard Windows colour picker.
Tide Zones	Colour for outline of tide zone areas.	

3. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.

Units

The Options - Units tab controls the measurement units that are used in all HIPS and SIPS applications.

1. Select *Units* from the *Category* list.



2. Set parameters described in the table below.

Field	Description	To assign a value...
Units	There are four types of units: • Geographic DD (Decimal Degrees). Example (to 3 decimal places): 50.361N; 4.135W • Geographic DM (Degrees, Minutes). Example: 50-21.650N; 004-08.423W • Geographic DMS (Degrees, Minutes, Seconds). Example: 50-21-39.058N; 004-08-04.671W • Ground (ground units). Example (in US Miles) : 548.734; 2116.214	Select a unit from the pull-down menu. If you select Ground units you may set the unit of measure using the Horizontal Length field.
Precision	The number of decimal places to the right of the decimal point that are displayed in expressing the value for the position of the cursor in the display.	Click the up or down arrow buttons beside the Precision field, or type a value in the field.

Field	Description	To assign a value...
Horizontal Length	Length, height and area settings in metric or imperial units	Select a unit setting from the pull-down menus.
Vertical Length		
Area		
Vessel Speed	Speed units for Navigation Editor.	Select a unit setting from the pull-down menu.
Sounding Rounding	Set the rounding method to be used when displaying soundings, as well as the units to use to display sounding depths, e.g., in metres or feet.	Select a rounding/truncating rule from the drop-down list. A brief description of the selected rule is displayed below the selection.

- Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.



Directories

The Directories tab lets you set the directories to be used by the system for finding and processing data.

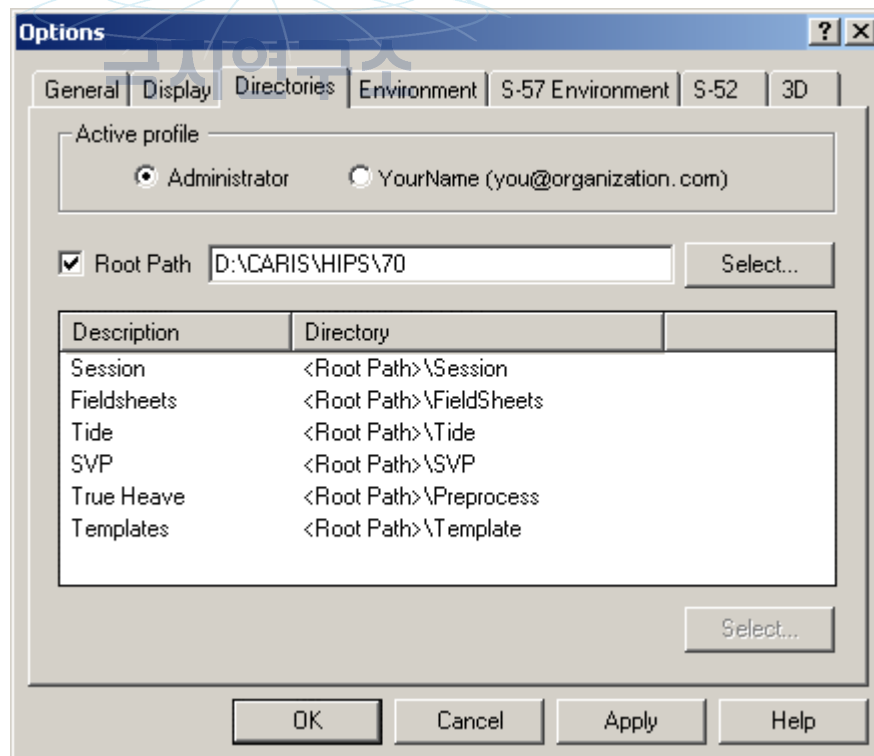
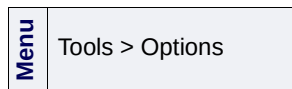
The *Active Profile* options control where the directory settings are written to and read from in the Windows registry. The default setting for directory locations is *Administrator*. When this profile is selected, all environment settings are written to and read from the system-wide settings in the Windows registry. Changing these settings effects all users on the same machine who are using the *Administrator* option.

Only persons with a Power User or Administrator Groups account can make changes to directories while this option is selected. However, you can override the *Administrator* settings and select the directories you want to access. When your user name (your login name) is selected as the *Active Profile*, all environment settings are written to and read from your account settings in your Windows registry. Changes made using this option effect only the user that is currently logged in.

1. Select the Options command.

The Options - Directories dialog box is displayed.

2. Select the Directories tab.



3. Select the login name option to access directory locations in the application. The default setting is *Administrator*.

The *Root Path* option lets you select a file path to access a complete set of HIPS/SIPS directories. When this box is first checked, you are prompted to enter a path on your computer. This location is remembered by the program.

4. Select the *Root Path* check box if you want to switch to another set of directories on a network.
5. Type the path for the directory or enter the path by clicking **Select**.

The list in the directories tab is updated to show the new location. If a directory is not available then the directory at the previous location is used.

6. To change an individual directory, select it and double-click or click **Select**.

The Browse for Folder dialog box is displayed.

7. Click the expand icon to view the file that you want to select, if needed.
8. Select the file or folder.
9. Click **OK** to close the Browse for Folder dialog box.
10. The selected file path is displayed in the Options dialog box.
11. If you want to view the amount of disk use by a selected repository, click the appropriate check box.
12. The percentage of disk use is shown in the status bar.
13. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.

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Environment

The Environment tab controls the files or values used by HIPS and SIPS for ellipsoids, colour maps, feature codes, etc. All files are by default located in the System directory.

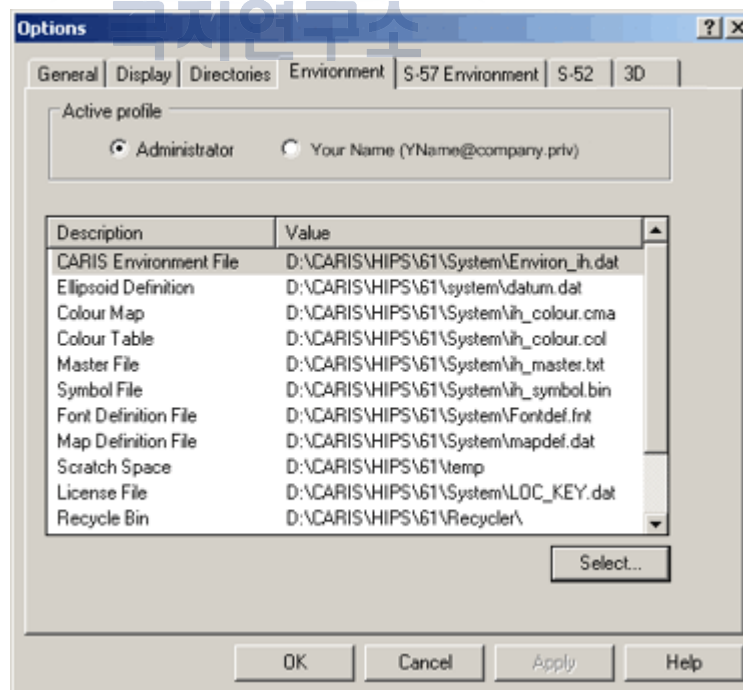
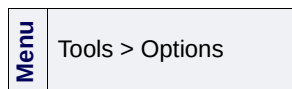
The *Active Profile* options control where the directory settings are written to and read from in the Windows registry. The default setting for directory locations is *Administrator*. When this profile is selected, all environment settings are written to and read from the system-wide settings in the Windows registry. Changing these settings effects all users on the same machine using the *Administrator* option.

Only persons with a Power User or Administrator Groups account can make changes to directories while this option is selected. However, you can select your login name to override the Administrator settings and select the directories you want to access. When your user name is selected as the *Active Profile*, all environment settings are written to and read from your account settings in the Windows registry. Changes made using this option will affect only the user that is currently logged in.

1. Select the Options command.

The Options - Environment dialog box is displayed.

2. Select the Environment tab.



3. Select your login name option to change files and values. The default setting is *Administrator*.

Change default
environment settings

1. Select the file path displayed in the window.
2. Click **Select**.

The Open dialog box is displayed.

3. Select another file and click **Open**.

The selected file is displayed in the Environment tab.

4. Click **Apply** to implement the settings without closing the dialog box, or click **OK** to save the settings and close the dialog box.



S-57 Environment

The S-57 Environment tab controls the files and values used for displaying S-57 data in the Display window. The default directory for S-57 display files is \HIPS\System\S57Config.

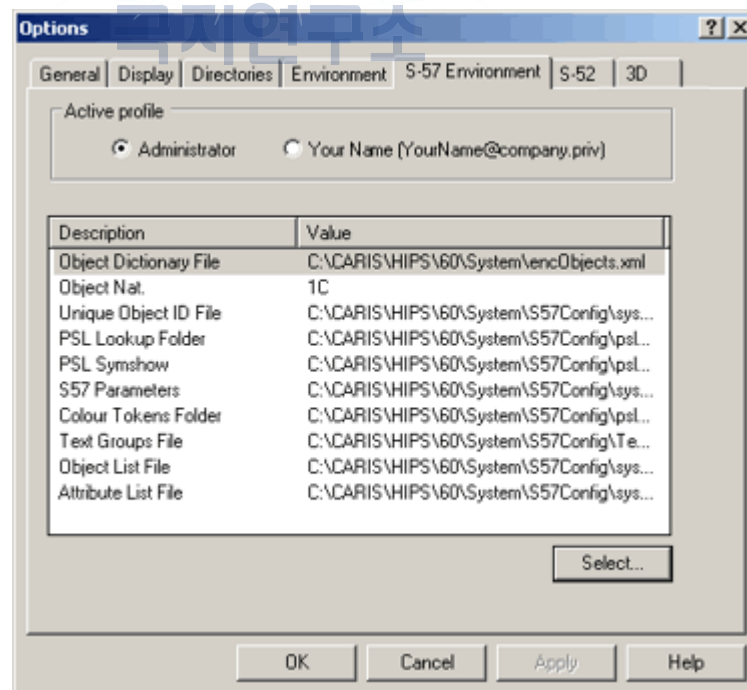
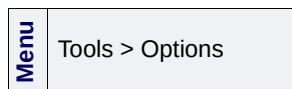
The *Active Profile* options control where the directory settings are written to and read from in the Windows registry. The default setting for directory locations is *Administrator*. When this profile is selected, all environment settings are written to and read from the system-wide settings in the Windows registry. Changing these settings effects all users on the same machine using the *Administrator* option.

Only persons with a Power User or Administrator Groups account can make changes to directories while this option is selected. However, you can select your login name to override the *Administrator* settings and select the directories you want to access. When your user name is selected as the *Active Profile*, all environment settings are written to and read from your account settings in the Windows registry. Changes made using this option will effect only the user that is currently logged in.

1. Select the Options command.

The Options - S-57 Environment dialog box is displayed.

2. Select the S-57 Environment tab.



3. Select your login name option to change files and values. The default setting is *Administrator*.

1. Select the file path displayed in the window.

2. Click **Select**.

The Open dialog box is displayed.

3. Select another file and click **Open**.

The selected file is displayed in the S-57 Environment tab.

4. To change back to the original file path that was used when HIPS and SIPS was installed, click **Default**.
5. Click **Apply** to implement the settings without closing the dialog box, or click **OK** to save the settings and close the dialog box.



S-52 Display

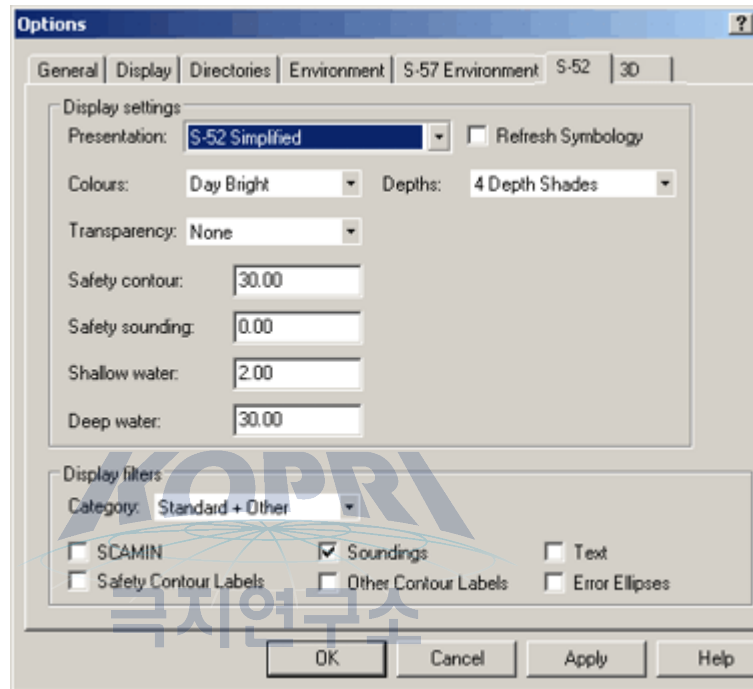
The S-52 Display tab controls the appearance of S-57 Ed. 3.1 data shown as background data in the Display window

1. Select the Options command.

The Options - S-52 dialog box is displayed.

2. Select the S-52 tab.

Menu	Tools > Options



3.Set the parameters described in the table below..

Field	Description	To assign a value...
Presentation	Display S-57 and HOB data in S-52 or INT1 format.	Select a presentation format from the drop-down list.
Refresh Symbology	Automatically refresh the display to show the symbology associated with the selected presentation library.	Select the check box to make this option active.
Colours	Select the time-of-day colour scheme in which to display S-57 data: Day Bright, Day Dark, Day White, Dusk, Night Filtered, Night No Filter.	Select the appropriate item from the drop-down list.
Points	Select <i>Simplified</i> (default), which means to symbolize using the S-52 Presentation Library; or <i>Full Chart</i> , which means to symbolize using IHO (International Hydrographic Organization) chart specifications (the way an IHO-compliant paper chart appears).	
Depths	Select the number of depth shades to use: 2 or 4 (default). This value works in conjunction with Safety Contour Depth, Shallow Water and Deep Water	
Areas	Select <i>Plain Boundaries</i> (default), which means to symbolize using the S-52 Presentation Library; or <i>Symbolized Boundaries</i> , which means to symbolize using IHO chart specifications (the way an IHO-compliant paper chart appears).	
Transparency	Select a transparency setting (none, 25, 50, 75, or 100 percent) for polygon fills in the display.	
Safety Contour	The areas that have sufficient depth for safe navigation. The safety contour is symbolized as a thick solid line. It also defines the boundary of shallow and deep-water areas for the purpose of area symbolization.	Type a value in the appropriate field.
Shallow Water	The contour boundary between the two darker colours used for water shallower than the Safety Contour.	
Safety Soundings	The safety depth is used in the symbolization of soundings. Soundings whose depth is less than the safety depth are displayed in bold text.	
Deep Water	Define the contour boundary between the two lighter colours used for water deeper than the Safety Contour.	
Categories	Pre-defined categories of objects to be displayed	Select a category from the drop-down menu.

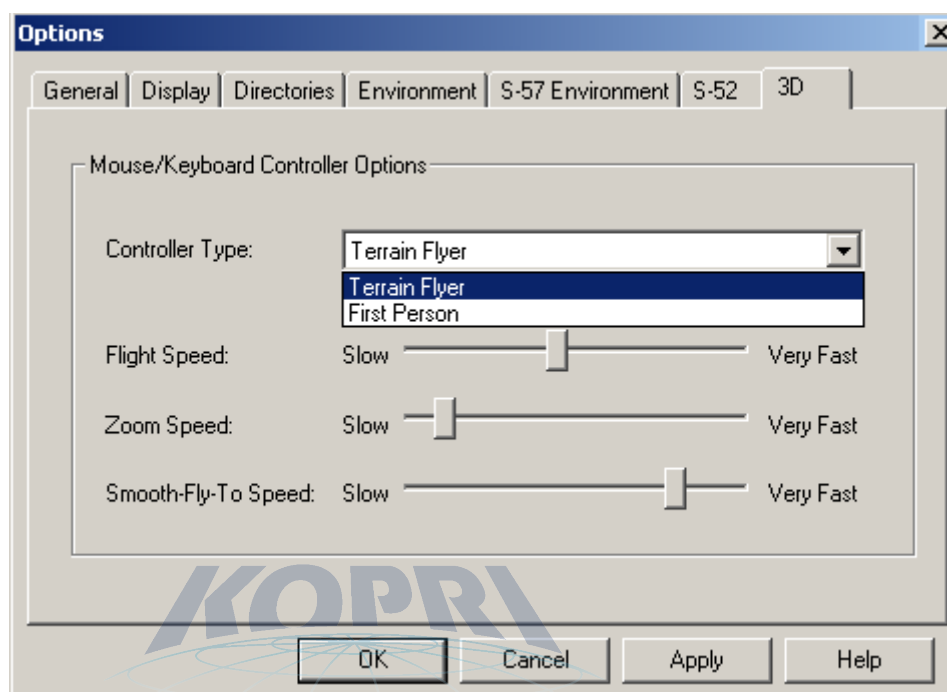
Field	Description	To assign a value...
SCAMIN	Select this option to filter features from the Display window display that have SCAMIN values less than the display scale. These features are however, still drawn in the selection/superselection colours if they are selected or superselected.	Select or clear the check box to turn the display on or off
Safety Contour Labels/Contour Labels	Show labels on safety contours and/or other contours.	
Soundings	Control the display of soundings.	
Text	Control the display of text.	
Error Ellipses	Enable the display of the Errell (error ellipse) attribute.	

4. Click **Apply** to implement the changes without closing the dialog box, or **OK** to implement the changes and close the dialog box.



3D Tab

The 3D tab provides options for adjusting the settings of the keyboard and mouse controllers used when navigating the 3D View.



The following options are available:

- **Controller Type:** Select the type of controls to use when navigating the 3D View.
 - **Terrain Flyer:** allows you to navigate from the perspective of the height source.
 - **First Person:** allows you to navigate from a camera view of the current 3D scene.
- **Flight Speed:** Controls the speed at which you move through the display during a fly-through. Move the bar left or right on the slider to increase or decrease flying speed.
- **Zoom Speed:** Controls how fast the view is changed when using the zoom controls. Move the bar left or right on the slider to increase or decrease zooming speed.
- **Smooth-Fly-To Speed:** Controls how fast the view is changed when a user double-clicks an area of the 3D View. Move the bar left or right on the slider to increase or decrease zooming speed.

B

Data Directories



Introduction

The structure of the HIPS and SIPS data directories is designed to maximize data access efficiency during processing. By definition, these directories include only those used to store raw or processed data and products, not the HIPS and SIPS applications nor their associated system files and libraries. The data directories are listed in the following table.

Data Type	Default Directory Location
Projects	..\Caris\Hips\HDCS_Data
Raw data	..\Caris\Hips\Preprocess
Session files	..\Caris\Hips\Session
Field sheets	..\Caris\Hips\Fieldsheets
Tide	..\Caris\Hips\Tide
SVP	..\Caris\Hips\Svp

For reasons of consistency with older code contained within HIPS and SIPS, directory names and paths should not contain any spaces or special Windows characters (\, /, :, *, ?, ", <, >, and |).



Projects

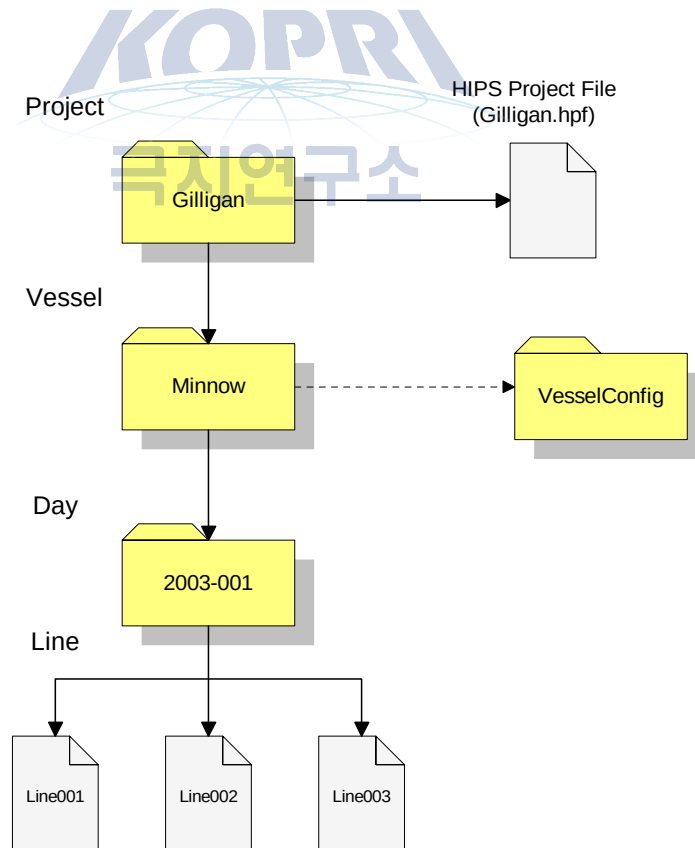
The Projects directory holds all of the converted data. The Project directory contains two main components:

- HIPS and SIPS data (“[HIPS AND SIPS DATA](#)” ON PAGE 693)
- Vessel files (“[VESSELCONFIG DIRECTORY](#)” ON PAGE 694)

HIPS and SIPS Data

Converted data in HIPS and SIPS is stored in a Project/Vessel/Day/Line (P/V/D/L) structure. Each survey project is divided into one or several vessels (for example, survey launches), contributing to the same project. The data can be from different generations of surveys, or different hardware collection platforms. Each vessel folder is divided into separate survey days and each survey day contains one or more survey lines.

Below is an outline of the P/V/D/L structure for a project called Gilligan with a vessel called Minnow. The project contains three line files.



In the Project directory, in addition to the folder(s) containing the vessel(s), there is also a HIPS Project file (HPF) that

contains the projection information used by the HIPS and SIPS interface to define the default projection for that project. When HIPS and SIPS accesses the navigation data (which is stored in unprojected latitude and longitude), the data is projected using the projection stored in this file. The HPF is given the same name as the project. For more information on creating a new project see [“CREATE A NEW PROJECT” ON PAGE 115](#).

The name of the vessel in the P/V/D/L path provides the link to the actual HIPS Vessel File and therefore must be spelled the same as the HVF in the VesselConfig directory. The data cannot be processed if the HVF is not present or if the vessel name in the P/V/D/L path is misspelled.

The survey day in the P/V/D/L structure is composed of two components separated by a hyphen—the four-digit year and the three-digit Julian date. The date used in the Day directory name does not actually play a role in data processing—it is used as a convenient mechanism for organizing survey data.

When a new project is created, this directory structure is built and the HPF is generated. The vessel file must exist in the VesselConfig directory at the time the project is defined, however it can be modified at any time (providing the name is not changed).

VesselConfig Directory

The VesselConfig directory contains the HIPS Vessel File (HVF) used in the vessel component of the P/V/D/L path. The name of this directory must not be changed and it always has to be located inside the Raw Data directory on the same level as the project directories.

For more information about the HVF see [“VESSEL FILES” ON PAGE 80](#).

Raw Data

The raw data directory is used to store unprocessed files that are used as input into HIPS via the Conversion Wizard.

Unprocessed files can be stored in any order and in any location on your system. However it is recommended that you store these files in a folder structure that mimics the P/V/D/L structure of the Projects folder.

Not only does the P/V/D/L structure provide a consistent path for data retrieval. You can also take advantage of a feature in the Conversion Wizard that lets you open for conversion at any level of the P/V/D/L folder structure and maintain that structure through conversion.

For example, a new project called "Gilligan" is created by the New Project wizard without adding a vessel or survey days to the project definition.

Raw data is then converted to HIPS and SIPS format through the Conversion Wizard. The File Selection Type is set to "Project" in Step 2 of wizard. The converter then knows that data is stored in the P/V/D/L structure and that you are loading from the Project level. All folders on the next level are interpreted as vessel names and the level after that as survey days.

Each vessel name must exist in the VesselConfig directory, otherwise the converter will report errors. In this example, there is only one vessel folder, called "Minnow" and it contains several survey days. There happens to be a HVF in the VesselConfig directory called "Minnow," so the converter creates the vessel folder beneath the project name "Gilligan" in the Project directory and also all of the survey days that are necessary. If the survey days or the vessel are already present, the converter uses them.

Finally, all of the lines found are converted.

To convert raw data that is not stored in the P/V/D/L structure, simply set the file selection type to "Raw" and select the files individually.

For more information on converting data to HIPS/SIPS format see [“RENAME DAY AND LINE FOLDERS” ON PAGE 120](#).

SVP and Tide

SVP

The SVP directory contains all of the sound velocity profile files. They can be stored in subdirectories of this directory if desired.

Tide

The Tide directory contains all of the tide files. They can be stored in subdirectories if desired.



C

HIPS Status Flags



Status Flags and Values

Within HIPS and SIPS data structure each sensor data value has a series of status flags. Each profile in the depth and side scan formats also has status flags, and each survey line has status flags. The status flag settings are determined during data cleaning and processing. They are used to control the generation of new data layers such as BASE surfaces, tiles, and selected soundings.

Status Flag	Value
Accepted	The default status of sounding.
Rejected	True if the sounding is rejected for any reason.
Examined	Indicates that the sounding was verified.
Designated	Indicates that the sounding is the shoalest in a cluster of soundings.
Outstanding	Indicates that the sounding needs further examination.
Rejected by Swath Editor or Single Beam Editor	True if sounding was rejected in the Swath Editor or Single Beam Editor, or by the swath or single beam filters.
Rejected by Hydrographer	True for soundings rejected manually by the hydrographer within the Subset Editor.
Rejected by Surface Cleaning	True if sounding was rejected during surface cleaning
Rejected by Depth Gate	True for soundings rejected by the depth gate during conversion.
Rejected by Disabled Beam	True for soundings rejected at conversion time because a disabled beam flag in the VCF or due to a pre-flagged bad sounding in the original raw data format.
Rejected by TPU	True for soundings rejected during Total Propagated Uncertainty filtering.
Rejected by surface filter.	True for soundings rejected during surface filtering.
Rejected by Auto Classification	True if the sounding fails the auto classification tests filter contained in the HIPS v4.3.3 subset mode. This flag is not used in v5.x software.
Rejected by Bad Navigation	True if the profile was rejected for bad navigation.
Rejected by Bad Gyro	True if the profile was rejected for bad gyro.
Rejected by Bad Heave	True if the profile was rejected for bad heave.
Rejected by Bad Pitch	True if the profile was rejected for bad pitch.
Rejected by Bad Roll	True if the profile was rejected for bad roll.

Status Flag	Value
Rejected by Bad Tide	True if the profile was rejected for bad tide.





C

Calibration



Overview

Calibration is performed by visually comparing the effects of various sensor offsets on calibration survey lines. The initial parameters are extracted from the HIPS Vessel File (HVF) and modifications can be written to the same HVF.

Calibration surveys are performed to allow adjustments of the survey data for parameters such as transducer mounting offsets (pitch, roll, yaw), and navigation latency. Other parameters, such as heave latency, can also be adjusted.

Calibration lines

Calibration lines are a set of survey lines specifically designed to allow for calculation of minor sensor deviations from established parameters. By running the vessel over known sea bottom topography, at different speeds and directions, correction factors can be derived for various devices on the ship. These corrections are then used for the duration of the survey mission to ensure correct processing of data.



Calibration Workflow

In HIPS and SIPS, Calibration is a six-stage process.

1. Open the calibration lines in HIPS and SIPS.
2. Select a pair of lines that were surveyed for a specific parameter.
3. Use the Calibration function to launch the Hydrographic Data Cleaning System (HDCS) directly into the Subset mode.
4. Create the subset in HDCS.
5. Use the Calibration tool in HDCS to measure and view the effects of the adjustments.
6. Make a note of the final adjustment values or save them directly into the HVF.

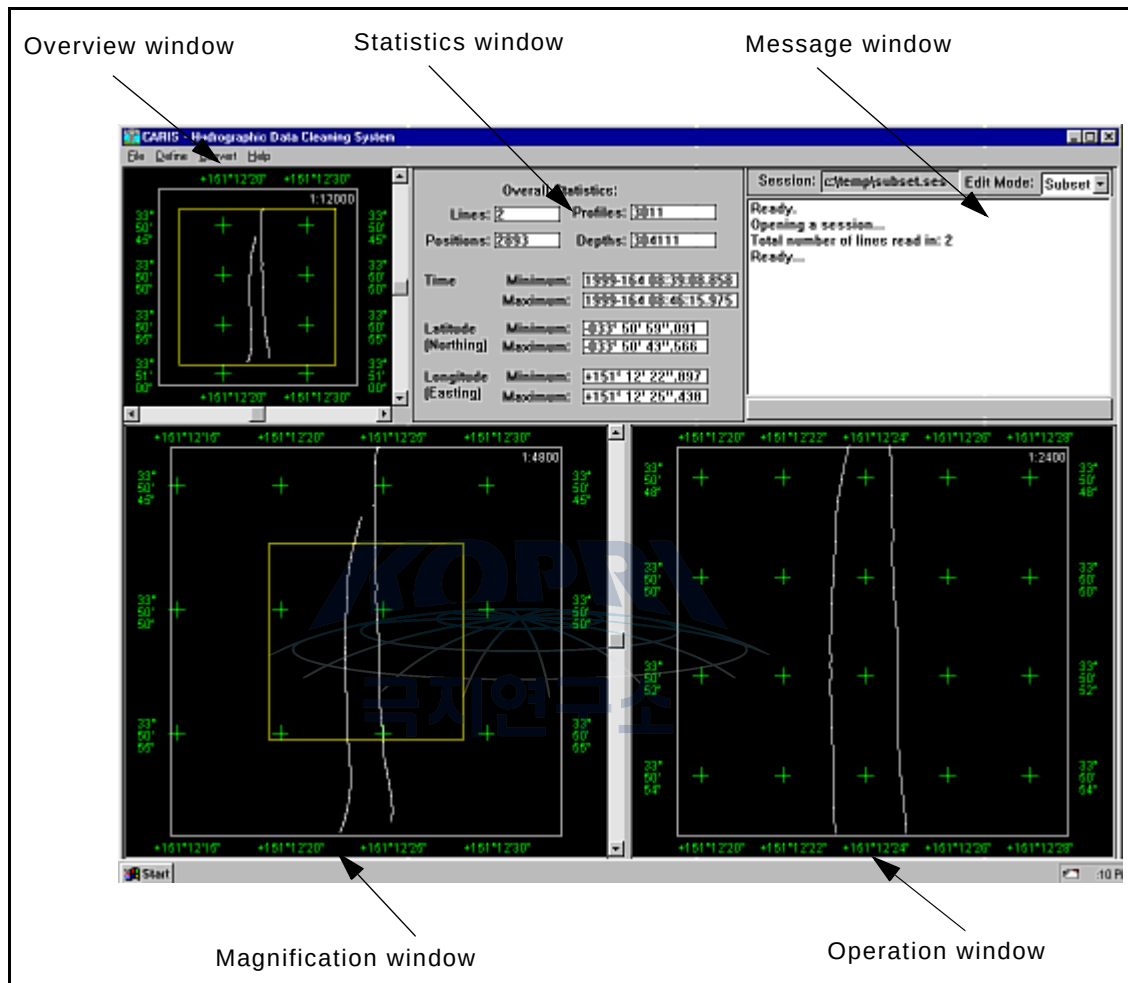


Create Subsets in HDCS

Menu	Tools > Calibration

1. In HIPS and SIPS, select the track line(s) you want to calibrate.
2. Select the Calibration command.

The HDCS interface is opened in Subset mode.



The track lines are shown in the HDCS interface. The Magnification window controls the track line display in the Operation window

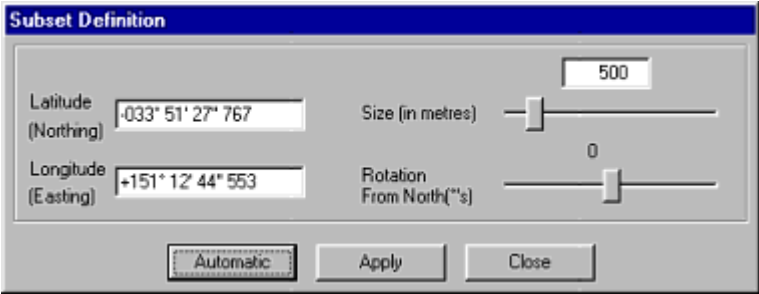
3. Position the cursor in the Magnification window.
4. Press and hold the mouse button while dragging the bounding box corners to the edge of the window so all the track line area is displayed in the Operation window.

Define a subset

Pop-up	Define Subset
Key	<Insert>

5. In the Operation window, right-click the mouse and select the Define Subset command from the pop-up menu.

The Subset Definition dialog box is displayed and a subset area bounding box is opened in the Operation window.



- 6. To determine the subset area, use the mouse to move the *Size* slider control to the desired position.
As the slider is moved, the subset area is resized.
- 7. To determine the subset angle, use the mouse to move the *Rotation From North* slider control to the desired angle.
As the slider is moved, the subset is rotated.
- 8. Register the subset by positioning the cursor in the subset area of the Operation window and clicking the right mouse button.
The subset area is highlighted in blue and automatically numbered.
- 9. If you are creating more than one subset area, position the cursor on the subset. Then use the mouse to drag the subset bounding box to an adjacent survey area (make sure there is some overlap between the two areas).
- 10.Repeat Steps 8 and 9 until all the survey area is registered as subsets.

Clean subset

Data must be displayed in the spatial subset mode before calibration can begin.

- 1. Click a subset so it is highlighted in yellow.
- 2. Select the Clean Subset command.

The soundings are now displayed in spatial subset mode.

Pop-up	Clean Subset
Key	<F2>

Perform Calibration

Pop-up	Calibration

1. Right-click in the Operation window and select the Calibration command.

The Calibration dialog box is displayed.

When Calibration mode is in effect, the display in the Operations window reflects the locations of soundings as if they were merged using the on-screen parameters.

In the Operations window, you retain the ability to switch view points, pixel sizes, and depth range, but not the ability to select soundings for query or rejection.

The Magnification display is not updated with calibration-adjusted soundings until the parameters are saved to the HVF, and the lines are re-merged. You can still generate mean and standard deviation maps, but only with unadjusted soundings. When Calibration mode is started, the current values from the HVF are accessed and displayed.

2. Select any of the following options:
 - *Current Line:* Select the line to apply calibration adjustments. Usually all calibration lines are from the same vessel (and, therefore, the same HVF). However, you are not restricted to using lines with the same HVF. Other lines can also be opened in dialog box. If the parameters with that line are associated with other lines then those lines are updated too.
 - *Apply Refraction Coefficients:* Select this option to apply refraction coefficients. The effects of the Refraction Editor data on the final depths can be changed at any time by editing the coefficients and re-merging. The effects can be removed by re-merging and choosing not to apply the coefficients.

- *Apply GPS Tide*: Select this option to apply GPS tide. The effects of GPS tide data on the final depths can be changed at any time by editing the Sounding Datum Height and re-merging. The effects can be removed by re-merging and choosing not to apply the GPS Tide.
 - *Up/Down Arrow Buttons*: Use these buttons to increment/decrement parameter values. The first row of buttons adjusts the integer portion of the value, the second column adjusts in 0.1 increments, and the third column adjusts in 0.01 increments.
3. Once data has been selected or modified, you can select from among the following options:
- *Apply*: Effect all changes immediately.
 - *Reset*: Reset all HVF parameters to their original settings.
 - *Compute Average*: Append the settings to an internal buffer to compute the average settings. This is done because one set of parameters may work well in one area of a survey, but not in another area of the same survey. You can then have a set of averaged settings for the entire line.
 - When calibration mode is started, the buffer is empty. Values extracted from the HVF are *not* put into it.
 - If selected without any changes being made, the buffer is not updated (i.e., it remains empty).
 - The first value entered (not the value extracted from the HVF) is the first value put into the buffer (after *Compute Average* is selected), and subsequent values is averaged with it.
 - You are prompted to save settings in the HVF only if you submitted values for averaging. Even if only one number was entered, you must select *Compute Average* if you want the setting to be saved in the HVF when you exit.
 - **Quit**: Submit the values to the buffer for averaging or close the calibration session. A calibration session remains in effect until **Quit** is selected. You cannot leave Subset mode while in Calibration mode.

If **Quit** is selected, a dialog box prompts you to update the HVF with the modified values.

4. Click **Yes**, to confirm the modification.

When you exit the Calibration mode, you must merge the line(s) again for the calibration adjustments to take effect (see “[MERGE](#)” ON PAGE 254).

Sample Calibration Procedure

The following are sample calibration procedures¹ for adjusting sensor offsets. In this procedure Navigation Time Error, transducer Pitch offset, transducer Roll offset, and transducer Azimuth (or Yaw) offset are adjusted. Initially, all offsets are set to zero (in the HVF).

Take care in cleaning position and attitude data. Depth cleaning is not as vital because you are looking at data trends and not individual spikes. Navigation Time Error, Pitch offset, Roll offset, and Azimuth (Yaw) offset should be set to zero in the HVF. Merge all lines.

Navigation time error

The Navigation Time Error adjustment is performed on sets of two coincident lines, run at different velocities, over sloping terrain or a conspicuous topographic feature. You must view a profile of the two centre beams.

1. In Subset Edit determine the along-track horizontal displacement between the two centre beam profiles of one set of coincident lines. Repeat this at several locations.
2. Compute the mean displacement.
3. Determine the Navigation Time Error as displacement / (high speed – slow speed).
4. Enter Calibration mode and enter the mean value (select **Apply** if necessary).
5. View result of correction, if it is not to your satisfaction, use the arrow buttons to adjust the value.
6. Select **Compute Average**.
7. Move to another location within the subset and repeat Steps 5 and 6.
8. Once the subset is to your satisfaction quit the calibration, confirm the update of the HVF and merging of all lines.
9. If calibration data covers more than one subset, repeat Steps 1 through 8 for all other subsets. Be sure to write down the final correction from each subset.
10. Manually average corrections from all subsets
11. Update the HVF.
12. Re-merge all lines (see “[MERGE](#)” ON PAGE 254).

1. These procedures are taken from the document “Field Procedures for the Calibration of Multibeam Echo-sounding Systems”, by André Godin (available from CARIS).

Transducer pitch offset

This adjustment is performed on sets of two coincident lines, run at the same velocity, over sloping terrain or a conspicuous object, in opposite directions. Of the above mentioned offsets, only the Navigation Time Error should be set in the HVF. You must view a profile of the centre beams.

1. In Subset Edit determine the along-track horizontal displacement between the two centre beam profiles of one set of coincident lines. Note the depth.
2. Determine the Pitch offset as $\arctan ((\text{displacement} / 2) / \text{depth})$.
3. Enter Calibration mode and input the offset (select **Apply** if necessary).
4. View result of correction, if it is not to your satisfaction use the arrows to adjust the value.
5. Select **Compute Average**.
6. Move to another location within the subset and repeat Steps 4 and 5.
7. Once the subset is to your satisfaction quit the calibration, update the HVF and merge of all lines.
8. If calibration data covers more than one subset, repeat Steps 1 through 7 for all other subsets. Be sure to write down the final correction from each subset.
9. Manually average corrections from all subsets.
10. Update the HVF.
11. Re-merge all lines.

Transducer azimuth (yaw) offset

This adjustment is performed on sets of two lines, run over a conspicuous topographic feature. Lines should be run in opposite directions, with the same outer beams crossing the feature. Of the above mentioned offsets, only the Navigation Time Error and Pitch offset should be set in the HVF. You must view a profile of the same outer beams.

1. In Subset Edit find the desired topographic feature.
2. Observe an along-track profile that shows the same outer beams (from both passes) and the topographic feature.
3. Determine the along-track horizontal displacement between the two representations of the topographic feature.
4. Change bounding box orientation and view perspective in order to measure the across track distance for the observed outer beams.
5. Determine the Azimuth offset as $\arcsin ((\text{displacement} / 2) / \text{across-track})$.
6. Enter Calibration mode and input the offset (select **Apply** if necessary).
7. View result of correction, if it is not to your satisfaction use the arrow buttons to adjust the value.
8. Select **Compute Average**.
9. Move to another set of lines within the subset and repeat Steps 7 and 8.

10. Once the subset is to your satisfaction quit the calibration, update the HVF and merge all lines.
11. If calibration data covers more than one subset, repeat Steps 1 through 10 for all other subsets. Be sure to write down the final correction from each subset.
12. Manually average corrections from all subsets.
13. Update the HVF.
14. Re-merge all lines.

Transducer roll offset

This adjustment is performed on sets of two coincident lines, run over flat terrain, in the opposite direction. Of the above mentioned offsets, the Navigation Time Error, Pitch offset, and Azimuth offset should be set in the HVF. You must view a profile of individual swaths.

1. In Subset Edit view the across track profile of the desired lines.
2. Enter Calibration mode and adjust the Roll offset until the two profiles are coincident.
3. Select **Compute Average**.
4. Move to another location within the subset and adjust the Roll off-set until the lines are coincident.
5. Select **Compute Average**.
6. Once the subset is to your satisfaction quit the calibration, agree to update the HVF and merge all lines.
7. If calibration data covers more than one subset, repeat Steps 1 through 4 for all other subsets. Be sure to write down the final correction from each subset.
8. Manually average corrections from all subsets
9. Update the HVF
10. Re-merge all lines.

E

Generic Data Parser



Introduction

HIPS can convert almost any single beam ASCII file through the Generic Data Parser. The parser can also be used to add or replace any sensor data in an existing project, except swath and sweep bathymetry and side scan imagery.

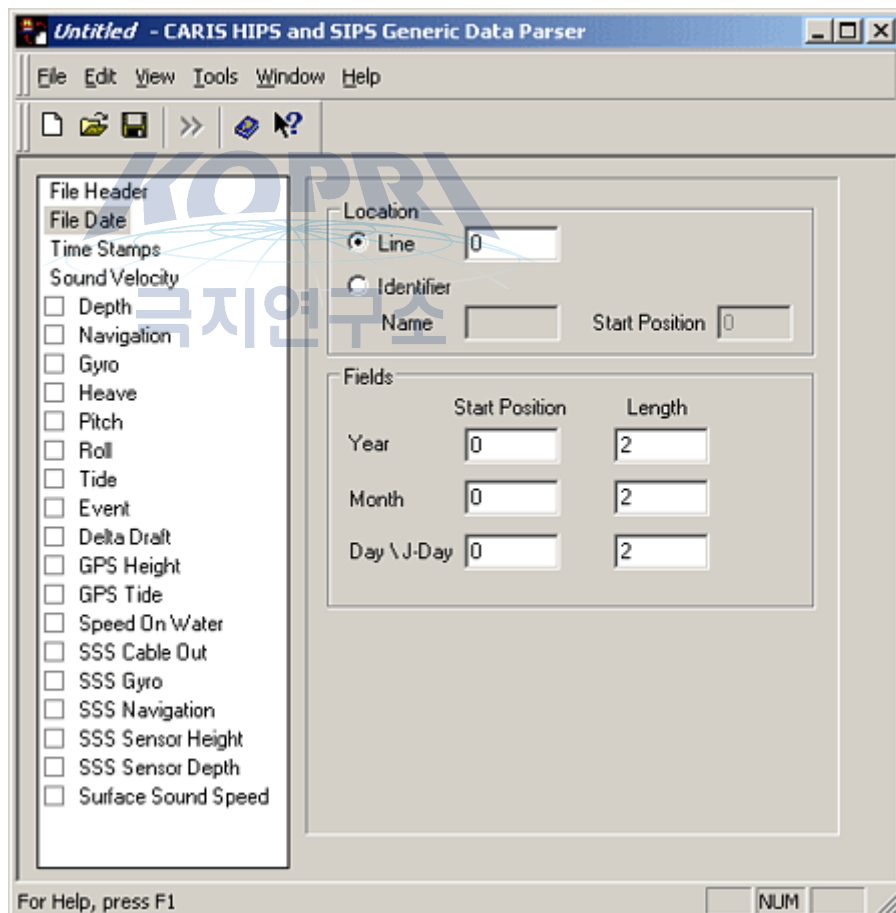
For example, if high-precision positions were obtained from a source other than the original raw data files converted into HIPS, this data could be loaded into an existing project to replace the original navigation data. The new position data must have a time stamp and be in ASCII format.

The Generic Data Parser is a separate program launched from the main HIPS and SIPS interface.

1. Select the Generic Data Parser command.

The Generic Data Parser interface is displayed, as shown in the example below.

Menu	Import > Generic Data Parser
Tool	



To open raw data to be converted with the parser,

1. Select Open Raw Data from the File menu.
2. Browse to select the *.raw or *.txt data file you want to convert.

The Raw Data window will open to display the data. This window can be sized and repositioned to the top, bottom, right or left sides of the interface.

Data Parsing Components

The parser must be told where each piece of information is located in the ASCII text file. This set of parameters is stored in a configuration file that can be saved, retrieved or modified at any time. These configuration files are stored in the ...\\Hips\\Session folder and have a .par extension.

The location of each type of data in the text file is determined using either the free form or fixed column method. In the raw data file the data fields are separated by delimiters, and lines of data are differentiated by identifiers.

Free Form

The free form method is used when data items (separated by delimiters) have fields of varying lengths. In this case, you specify a field number to show where a data item is located in the text file. The field numbering starts at one (1) and is counted from the first character following one or more delimiters.

For example, in the input string 301.12, 45, 5.66 — field number three (3) indicates the start of string 5.66.

Quotation marks can be used to offset a text string, for example, “312, 45, 5.66” is treated a single string field (regardless of any characters or spaces inside the string).

The following characters are used as delimiters by the parser:

- tab
- space
- single quote (‘)
- vertical bar (|)
- comma (,)
- semicolon (;)

These delimiters are replaced with spaces when the parser reads the file.

Fixed Column

This method specifies the absolute location of a data item in the text file. The location starts at one (1). This method is used when the location of data items does not change and where there is no

obvious separation between fields. You must supply the length of the field when using the fixed form method.

Identifier

When data items are stored in separate text lines, the program must differentiate between types of input. This is done with an identifier, which is a short text string whose location is specified as an absolute value. If an identifier is specified for a data item, the input line is tested for the item's presence to make sure that it can be extracted.

For example, some depth data lines in a Hypack data file start with the string EC2. In this case, you specify the identifier as EC2 at the location one (1). You can include spaces and other symbols in the identifier, as long as the symbols are not classified as belonging to any of the delimiters.

The use of identifiers is optional for any data item. In this case, the program extracts the data item on all input text lines.

Multiplier/Offset

Once a value has been extracted from the input text line, additional operations may be needed to transform it to its final value.

This may be necessary because:

- The value is stored with an implied decimal point (for example 1/100th of a second).
- The value is stored in a different unit (for example, decimal radians instead of degrees).
- The sign of the value is opposite of what HIPS uses.
- The value is stored with an implied offset.

You may specify additional mathematical operations in terms of a Multiplier and an Offset. The actual formula used is:

$$\text{final value} = (\text{extracted value} \times \text{Multiplier}) + \text{Offset}$$

Pseudo Time

The pseudo time stamp is a user-determined time sequence that overrides the Data Parser's time stamp requirement for record conversion. By default, the time is set to midnight at the current date, but this can be changed. An increment value attaches a new time to each record. Make sure that the pseudo time stamps are comparable with the types of data you are importing.

If you are using this feature, the Time Stamps panel information must still be completed, but the pseudo time stamp overrides this information.

Configuration File

The configuration file is a text that contains the settings for converting data through the Generic Data Parser. All configuration files have a PAR extension.

[“OPEN A CONFIGURATION FILE” ON PAGE 715](#)

[“NEW CONFIGURATION FILES” ON PAGE 716](#)

[“SAVE A CONFIGURATION FILE” ON PAGE 716](#)

Open a Configuration File

You can open an existing configuration file for editing and then convert text files with the Generic Data Parser wizard.

1. Select the Open File command.

The Open dialog box is displayed.

2. Select the configuration file you want to open.

3. Click **Open**.

The configuration file is now ready for editing or for proceeding directly to converting raw data files.

The data types included in the current configuration are shown by a check mark.

4. Optional: Select a data type and modify any parameters, as needed (see [“DATA TYPES” ON PAGE 719](#)).
5. Optional: Select or de-select a data type by clicking the check box to include or exclude data types during conversion.

Menu	File > Open
Tool	
Key	<Ctrl+O>

New Configuration Files

You can select data types and enter values for a new configuration file.

1. Select the New File command.
2. Select a data type and enter values for the parameters.

Menu	File > New
Tool	
Key	<Ctrl+N>

Remember: You must complete each section before selecting the next data type.

Menu	Edit > Reset Selected Sensor
Pop-up	Reset

3. To reset any changes to the data, select the Reset Selected Sensor command.
4. Select the check box to include the associated data during conversion.
5. Repeat Step 2 and Step 3 until all necessary data types have been added to the new configuration file.
6. Select a Save/Save As command.

The Save As dialog box is displayed.

7. Type a name for the configuration file and select a directory for the file.
8. Click **Save**.

Save a Configuration File

9. When finished, select the Save or Save As commands or start the conversion wizard (see “[GENERIC DATA PARSER WIZARD](#)” ON [PAGE 725](#)).

If you selected the Save or Save As commands, then Save As dialog box is displayed.

10. Enter a name for the file and select a location to save it.
11. Click a Save command.

Menu	File > Save/Save As
Tool	
Key	<Ctrl+S>

Raw Data Files

You can open a text file and find the exact column positions of the data you want parsed.

- 1. Select the Open Raw Data command.

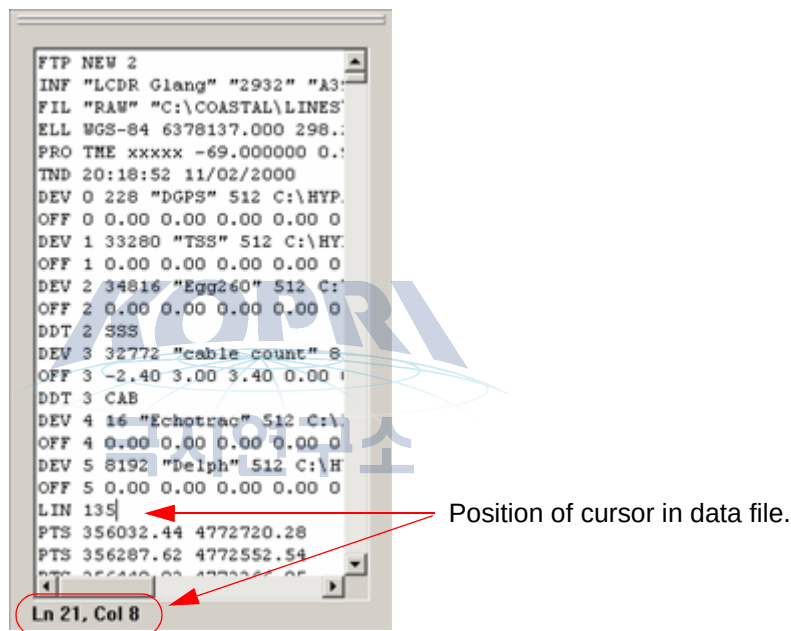
Menu	File > Open Raw Data

The Open dialog box is displayed.

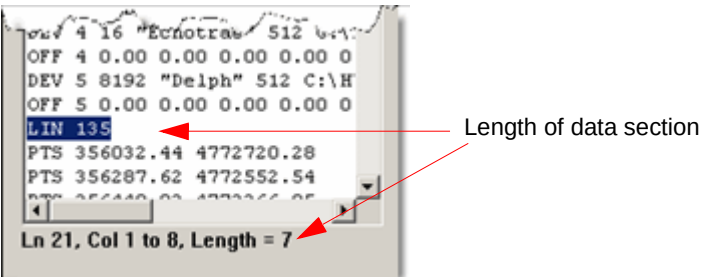
- 2. Select a text file and click **Open**.

The file is opened in the Editor.

When you position the cursor in the raw data file, the cursor location (and thus the column position) is displayed below the window.



When a section of the file is highlighted, the length (including characters and spaces) of the highlighted area is shown.



- 3. Select a data type from the list so the associated parameter fields are displayed in the parser.
- 4. Select the appropriate area in the text file by either placing the cursor in the file or highlighting a section of it.

5. Enter the raw data file information in the parameters area (see “[DATA TYPES](#)” ON PAGE 719).
6. Continue with Steps 3 to 5 until all information has been collected for the configuration file.

Close files

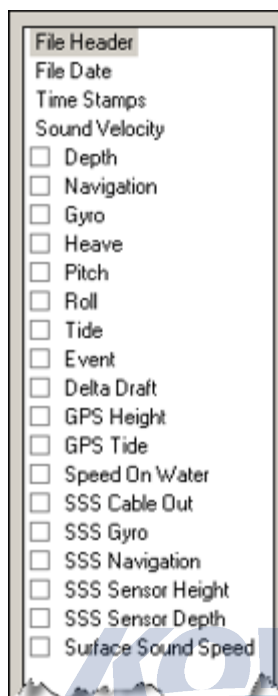
Menu	File > Close Raw Data

7. To close files without saving information, select the Close Raw Data command.



Data Types

The data types are listed on the left side of the interface.



If the check box beside the data type is selected then that data is available for conversion. Each data type has a set of parameters that are displayed when it is selected. These parameters determine what parts of the text file are parsed for the configuration file.

To view the parameters:

1. Select a data item so it is highlighted.

The parameters for the data type are displayed in the Parser. This example shows gyro data.

2. Enter data as needed.

When you select another data type, the previous type is now checked (if it has a check box). This means that when the text file is parsed, that data is included in the conversion. If you do not want to include the data in the conversion, make sure the check box is cleared.

Reset selection

Menu	Edit > Reset Selected Sensor

3. To remove changed parameters from a data item, select the Reset Selected Sensor command.

The parameters are reset to the default positions.

You must complete all the fields in each section before selecting another data type.

File Header

This section indicates the number of lines in the header. These lines are skipped when the text file is parsed. The default value is zero.

1. Type the number of lines used for the file header.

File Date

1. Select either a line number or Identifier so the file data can be located.
 - If you selected line number, type the number in the text box provided.
 - If you selected identifier, type a text string for the identifier in the *Name* field and the location on the line where the date begins.
2. Define the location of the date values within the field.
 - If the length of the year field is two (2), then the converter automatically assigns the year a value between 1951 and 2050.
 - If the length of the day field is three (3), the converter assumes the extracted value represents a Julian date.

Time Stamp

Each line must contain a time stamp. The various components in the time stamp are specified in terms of absolute positions in relation to the start of the time stamp string.

1. Select the location of the time stamp as a Fixed Column or Free Form position.
2. Include year/month/day information:
 - Select the Yes check box so the year/month/day fields are enabled.
 - Type a position for the time stamp and the length of the year parameter.
3. To add hour and minute, select the appropriate check boxes and type the position and length information.
4. Enter the start and length values for the seconds parameters.
5. Enter any Multiplier/Offset values.

Sound Velocity

You can enter a sound velocity value directly or parse it from the input file. When converting single beam depth data, the sound velocity value can be used to recover the raw travel time from the recorded depths. This raw travel time can then be used to perform full sound velocity corrections on the data during post processing.

1. Select the position for the parser to start reading data by selecting either the *Line Number* or Identifier option.
2. Enter a line number to start reading the sound velocity data, or enter an identifier and start position for the data.
3. Select the location of the SVP data as a Fixed Column or Free Form position.
4. Enter the relevant free form or column position.
5. Enter any Multiplier/Offset values.
6. Type a default sound velocity value if you want to enter the sound velocity value directly.

Depth

For each depth, indicate the location of the sounding data and whether any additional operations are needed.

1. Select the Identifier check box if the information is parsed from a specific line in the text file.
2. Type the name of the identifier and the start position for reading the depth data.
3. Select the dual frequency check box if the text file contains secondary single beam data that must also be converted.

The primary and secondary tabs contain identical fields. Enter data in one or both sections, as needed.

4. Select either Free Form or Fixed Column.
 - If *Free Form*, enter the field number where the data is located.
 - If *Fixed Column*, enter the start and length of data in the text file.
5. Enter any Multiplier/Offset values, as needed.
6. Select the *Compute Raw Travel Time* check box, if you want to calculate the raw travel time from the sonar to the seabed.
7. Select the Pseudo Time check box.
8. Type a *Start* date and type an *Increment* value (in seconds).

Navigation

The converter supports reading both ground and geographic coordinates. For geographic Latitude and Longitude values, negative values are supported as well as E/W and N/S tags.

1. Select the Identifier check box if a text string is used to identify navigation data in the text file.
2. Enter the identifier and start position for the identifier.
3. Select the type of coordinates used: geographic or ground.

The content of tabs below this section is determined by type of coordinates selected.

- If *Geographic* is selected, the Latitude and Longitude tabs are displayed.
 - If *Ground* is selected, the North and East tabs are displayed.
4. Complete the following fields for the Latitude/Longitude or the North/East tabs:
 - *Free Form*: The free form method used to locate navigation data.

- *Field*: The field where the data is located, if you selected the Free Form option.
 - *Fixed Column*: The fixed position method used to locate data.
 - *Position*: The absolute location of the latitude or longitude data if you selected the Fixed Column option.
 - *Degrees*: These fields contain the start of the coordinate field, the length of the field and any multiplier and offset values.
 - *Min*: This check box enables the Start, Length, Multiplier/Offset fields when selected (geographic coordinates only).
 - *Sec*: This check box enables the Start, Length, Multiplier/Offset fields when selected (geographic coordinates only).
 - *Tags*: A hemisphere tag (N/S/E/W) is parsed with the data when this option is checked.
 - *Position*: Position of the tag in the text file.
5. [Optional] Select the Pseudo Time check box.
 6. Type a *Start* date and type an *Increment* value (in seconds).

Attitude/Navigation/Tide

This section includes the following data types:

- Gyro
- Heave
- Pitch
- Roll
- Tide
- GPS Height
- GPS Tide
- Speed on Water
- SSS Cable Out
- SSS Gyro
- SSS Navigation

All the fields in these sections are identical.

1. Select the *Identifier* check box, if the data is going to be associated with an Identifier.
2. Enter an identifier and start position for the data.
3. Select the location of the data as a Fixed Column or Free Form position.
4. Enter the relevant free form or column position.

5. Enter any Multiplier/Offset values.

Event

Event marks are sometimes generated automatically by the logging system to indicate that a certain amount of time has elapsed, or a certain distance has been travelled. The event marks can be displayed in the Single Beam Editor. In HIPS, event mark records consist of one or more unique event numbers and textual comments. In this dialog box, you must specify where to look for the event mark number within the data record.

1. Select the *Identifier* check box, if the data is going to be associated with an Identifier.
2. Enter an identifier and start position for the data.
3. Select the location of the data as a Fixed Column or Free Form position.
4. Enter the relevant free form or column position.
5. If the Events marks contain a textual description, check the *Comments* check box.
6. Type the *Start Position* of the comments in the text file.
7. Type the *Length* of the comment.
8. Select the *Time Stamp* check box to include the time stamp that is included with the event. If this option is not checked, the time stamp parsed from the file is used.

Generic Data Parser Wizard

Single beam data or sensor data from a text file is converted to HIPS/SIPS format with a six-step wizard opened from the Generic Data Parser.

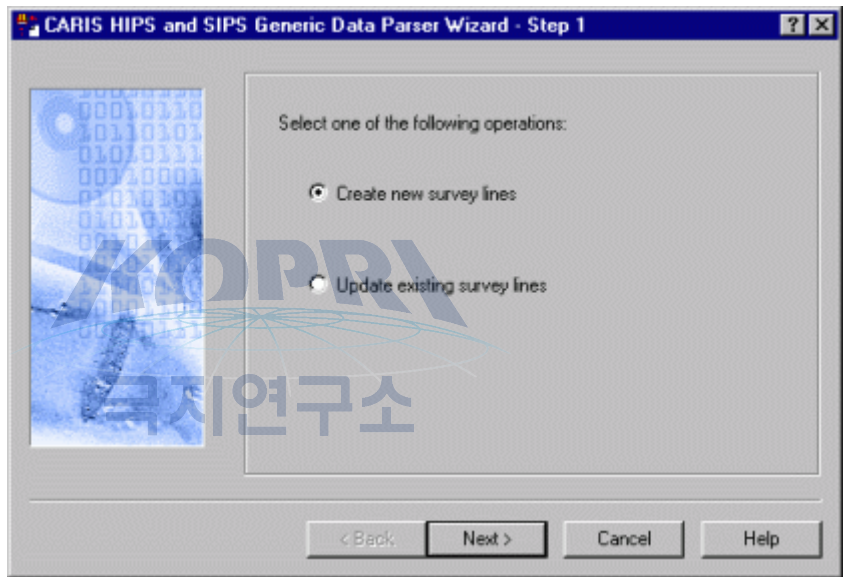
The appropriate configuration file must be open in the Parser before data can be converted.

Open the wizard

Menu	Tools > Run
Tool	

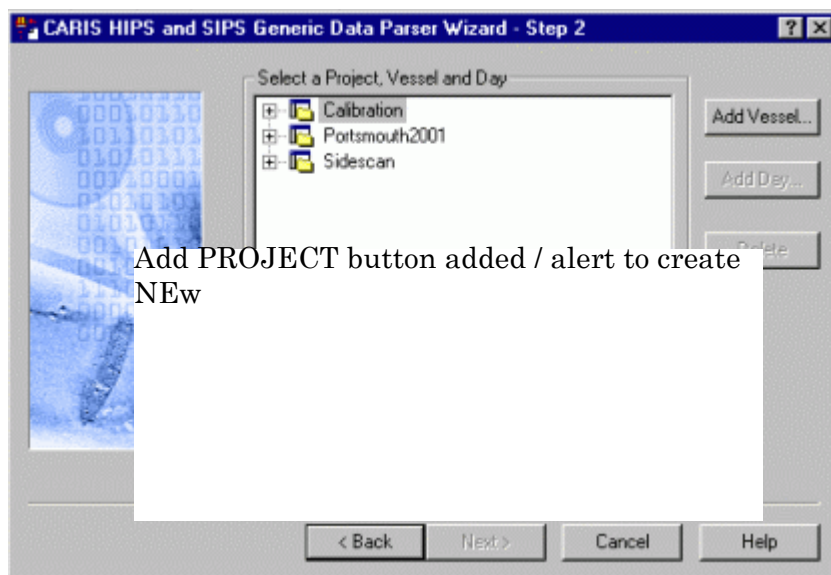
1. Make sure that a configuration file is open in the Parser.
2. Select the Run command.

The GDP Wizard - Step 1 dialog box is displayed.



3. Select one of the following operations:
 - Convert data into new CARIS HIPS/SIPS survey lines.
 - Convert data into existing CARIS HIPS/SIPS survey lines.
4. Click **Next**.

The GDP Wizard - Step 2 dialog box is displayed.



You must select a Project-Vessel-Day directory to save the converted data if creating new survey lines, or select an existing survey line if you are updating existing data.

5. Click a Project file tree so it is expanded and the Day folder or survey line is visible.

If you want to add Vessel or Day folders or delete a folder, follow Steps 5 to 9, otherwise go to Step 10.

6. To add a vessel folder, make sure the project directory is highlighted and click **Add Vessel**.

The Available Vessels dialog box is displayed.

7. Click a vessel folder and click **OK**.

The new Vessel folder is displayed in the selected project directory.

8. To add a day folder, click the Vessel folder and click **Add Day**.

The Calendar dialog box is displayed.

9. Select a year/month/day from the calendar, and click **OK**.

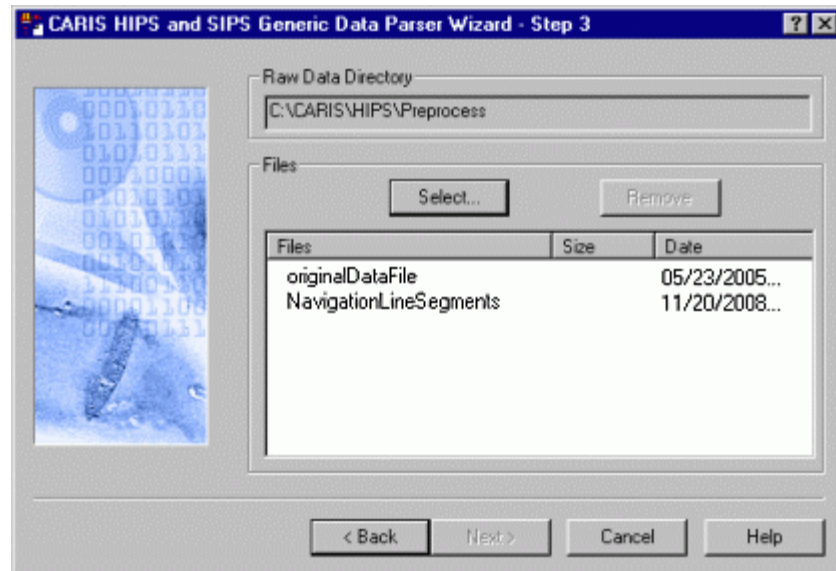
A Day folder with the selected date is stored in the Vessel folder.

10. To remove an empty Day or Vessel folder from the wizard, highlight the folder and click **Delete**. A Vessel or Day folder cannot be deleted using the **Delete** button, if its branch of the Project already has data converted into it.

11. Click the Day folder or survey line so it is highlighted.

12. Click **Next**.

The GDP Wizard - Step 3 dialog box is displayed.



In this dialog box you select the text files you want to convert.

13. If the file path in the *Raw Data Directory* box is correct, click **Select**.

The Select Files dialog box is displayed.

14. Double-click a folder to access the text files.

The files are displayed.

15. Select the files so they are highlighted.

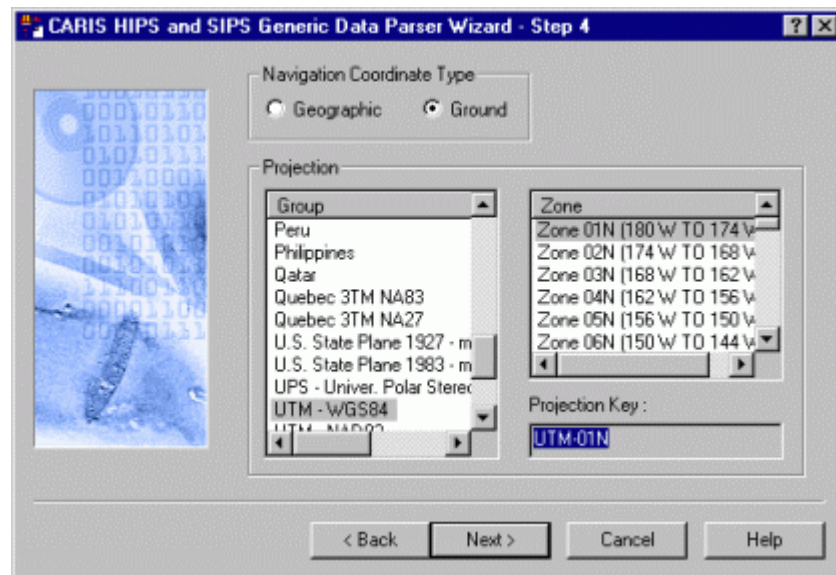
16. Click **Open**.

The selected files are displayed in the wizard dialog box.

17. To remove files, select the files and click **Remove**.

18. Click **Next**.

The GDP Wizard - Step 4 dialog box is displayed.



In this dialog box you must indicate the type of coordinate system that was used for the Navigation data during data logging.

19. Select one of the following options:

- *Geographic*: navigation data is recorded as latitude and longitude coordinates.
- *Ground*: navigation data is recorded as eastings and northings.

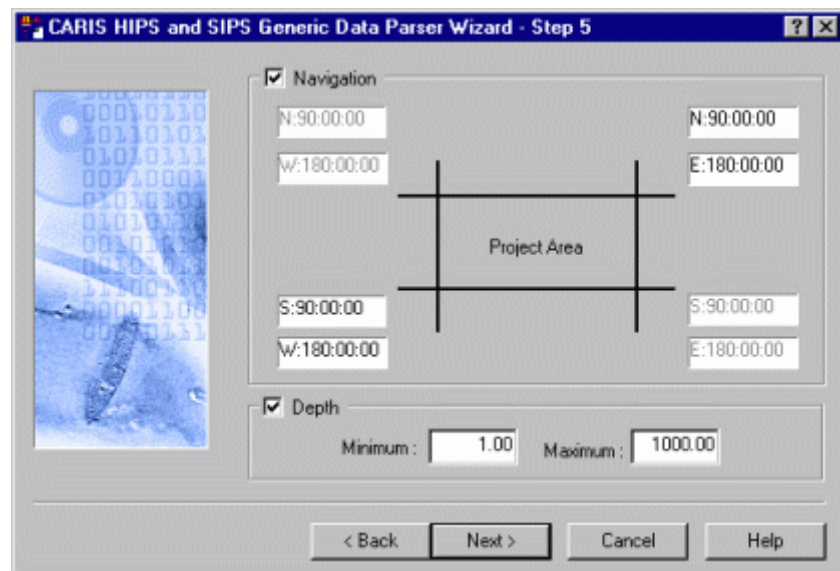
If you select *Ground*, complete the following steps:

20. Select a projection group from the *Group* list.

21. Select a zone.

22. Click **Next**.

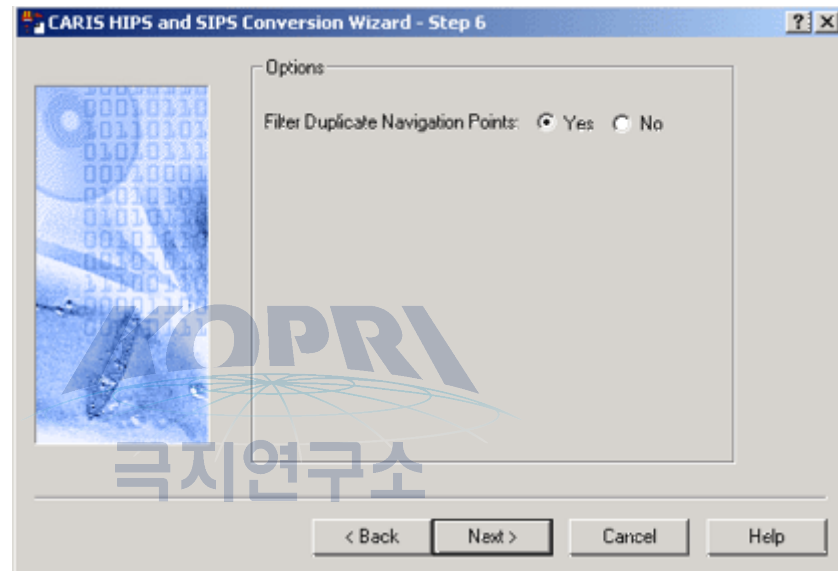
The GDP Wizard- Step 5 dialog box is displayed.



In this dialog box you can reject extremely large errors in the recorded navigation and depth data. Navigation and depth filters can be applied during conversion with the following steps:

23. Click the *Navigation* check box to enable the navigation filter.
24. Enter coordinates in the boxes to define the area:
25. Click the *Depth* check box to enable the depth filter.
26. Enter the minimum acceptable depth.
27. Enter a maximum acceptable depth.
28. Click **Next**.

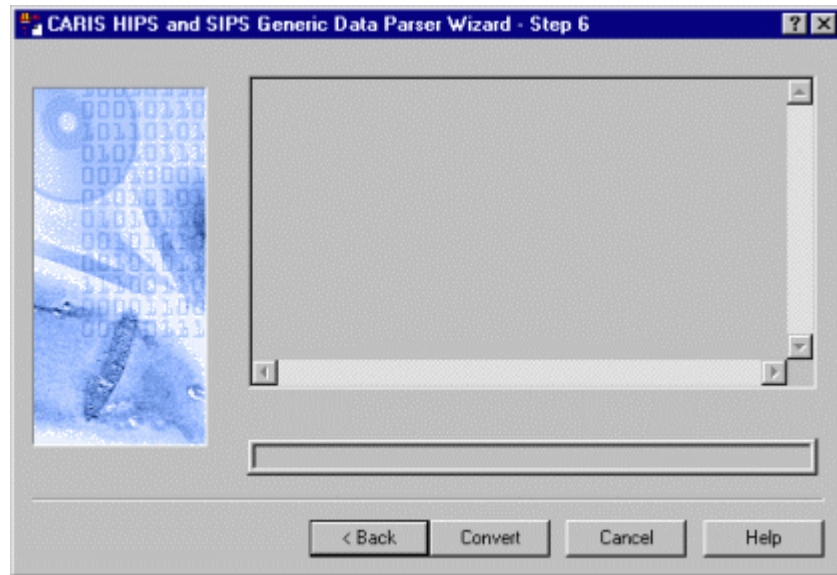
The GDP Wizard - Step 6 dialog box is displayed.



Duplicate navigation points are recorded when the vessel is stationary. The *Filter Duplicate Navigation Points* option gives you to option to remove the duplicate points during import or to include them in the HIPS file (therefore representing the vessel as stationary).

29. Select *Yes* or *No* to for the *Filter Duplicate Navigation Points* option.
30. Click **Next**.

The GDP Wizard - Step 7 dialog box is displayed.



In this dialog box you convert the text data to HIPS/SIPS format.

31. Click the **Convert** button.

32. A progress indicator bar along the bottom of the box is activated as the files are converted.

33. A text box displays the results of the conversion process.

The HIPS files are saved in the directory you selected in the second dialog box.

34. Click **Finish** to close the wizard, or click **Restart** to return to the first dialog box of the wizard.

F

Tide File Formats

HIPS supports a standard Canadian Hydrographic Service tide format called COWLIS as well as two NOS/NOAA formats. HIPS also supports a basic format consisting of just the required date, time, and tide values.

HIPS does not use predicted tide tables. The time zone of the tidal observation data must match the time zone of the bathymetry to which it will be applied.

As an alternative, a Computed GPS Tide calculation can be used with data in HIPS.

In this chapter...

“TIDE FILES (*.TID)” ON PAGE 618

“COWLIS” ON PAGE 619

“NOS PRELIMINARY TIDE DATA” ON PAGE 620

“NOS FINAL TIDE” ON PAGE 621

“TIDE ZONE DEFINITION FILES” ON PAGE 622

“GPS TIDE” ON PAGE 625

Tide files (*.tid)

TID files are ASCII files consisting of date, time, and tide values collected from a single tide station. These files can be created or edited in a text editor (such as Notepad), or in the Tide Editor.

The following tide data file formats are supported by HIPS:

- CHS Cowlis
- CHS TMS 50
- CHS TMS 1000
- NOS Preliminary Tide Data
- NOS Final Tide Data

Basic Tide Format

The basic tide format used by HIPS begins with a single line containing at least 8 dash characters, followed by tidal observation records consisting of date, time, and tide. Here is a simple example:

```
-----  
2000/11/01 00:00 0.522  
2000/11/01 01:00 0.317  
2000/11/01 02:00 0.395  
2000/11/01 03:00 0.751  
2000/11/01 04:00 1.296  
2000/11/01 05:00 1.848  
2000/11/01 06:00 2.339  
2000/11/01 07:00 2.589
```

For information on using the Tide Editor, see [“EDITING TIDE DATA”](#) ON PAGE 484.

COWLIS

```

----- LIBEX file dump -----
----- STN?????.OBS -----
----- Time Zone:  GMT ( 0.0) -----

----- Invariant Fields -----
Name                Type Size    Units Value
-----
station_id          CHAR     5
station_name        CHAR    16      Rimouski, Quebec
data_product        CHAR     3      TMS1000
start_time          INTG     4  seconds 93/06/29 18:45:00
end_time            INTG     4  seconds 91/11/16 20:45:00
file_date           INTG     4  seconds 95/12/20 15:24:24
max_water_level     REAL     4    metres   1.640
min_water_level     REAL     4    metres   0.050
-----

----- Variant Fields -----
Name                Type Size    Units
-----
time                INTG     4  seconds
water_level         REAL     4    metres
std_dev             REAL     4    metres
-----
1993/06/29 18:45:00  1.95  0.030
1993/06/29 19:00:00  1.84  0.030
1993/06/29 19:15:00  1.74  0.030
1993/06/29 19:30:00  1.63  0.030
1993/06/29 19:45:00  1.55  0.030
1993/06/29 20:00:00  1.48  0.030
1993/06/29 20:15:00  1.41  0.030
1993/06/29 20:30:00  1.37  0.030
1993/06/29 20:45:00  1.34  0.030
----- End Of LIBEX File -----

```

NOS Preliminary Tide Data

***** PRELIMINARY DATA *****

THIS RAW DATA HAS NOT BEEN SUBJECT TO THE NATIONAL OCEAN SERVICE'S QUALITY CONTROL OR QUALITY ASSURANCE PROCEDURES AND DOES NOT MEET THE CRITERIA AND STANDARDS OF OFFICIAL NATIONAL OCEAN SERVICE DATA. IT IS RELEASED FOR LIMITED PUBLIC USE AS PRELIMINARY DATA TO BE USED ONLY WITH APPROPRIATE CAUTION.

***** PRELIMINARY DATA *****

Water Level - Acoustic (A1)
 Station -- Unique seven character identifier for the station
 DCP -- A one character identifier for the data collection platform at a station
 SE -- A two character identifier for the data sensor
 Date Time -- Date and time the data were collected by the DCP
 WL_Value -- Water level height
 Sigma -- Standard deviation of 1 second samples used to compute the water level height
 Out -- Count of number of samples that fall outside a 3-sigma band about the mean
 Flat -- A flag that when set to 1 indicates that the flat tolerance limit was exceeded
 ROFC -- A flag that when set to 1 indicates that the rate of change tolerance limit was exceeded
 Temp -- A flag that when set to 1 indicates that the temperature difference tolerance limit was exceeded
 Limit -- A flag that when set to 1 indicates that either the maximum or minimum expected water level height limit was exceeded

Data are in meters above MLLW
 Times are on UTC (GMT)

9453220 1 Yakutat, AK from 19990614 to 19990618

Station	DCP	SE	Date	Time	WL_Value	Sigma	Out	Flat	RofC	Temp	Limit
9453220	1	A1	1999/06/14	00:00	1.881	0.014	0	0	0	0	0
9453220	1	A1	1999/06/14	00:06	1.814	0.025	0	0	0	0	0
9453220	1	A1	1999/06/14	00:12	1.746	0.018	0	0	0	0	0
9453220	1	A1	1999/06/14	00:18	1.692	0.014	0	0	0	0	0
9453220	1	A1	1999/06/14	00:24	1.632	0.013	0	0	0	0	0
9453220	1	A1	1999/06/14	00:30	1.560	0.015	0	0	0	0	0

NOS Final Tide

NOS SIX MINUTE WATER LEVEL HEIGHTS

Data are verified

Station -- Unique seven character identifier for the station
 Date Time -- Date and time the data were collected by the DCP
 WL_Value -- Water level height
 Sigma -- Standard deviation of 1 second samples used to
 compute the water level height
 Infer -- A flag that indicates that the water level value
 has been inferred.
 Flat -- A flag that when set to 1 indicates that the flat
 tolerance limit was exceeded
 RofC -- A flag that when set to 1 indicates that the rate
 of change tolerance limit was exceeded
 T_Flag -- A flag that when set to 1 indicates that the
 temperature difference tolerance limit was exceeded

Data are in meters above MLLW
 Times are on UTC (GMT)

9452210 Juneau, Gastineau Channel, Stephens Pass, AK, USA from 19980525 to 19980530

Station	Date	Time	WL_Value	Sigma	Infer	Flat	RofC	T_Flag
9452210	1998/05/25	00:00	2.473	0.019	0	0	0	0
9452210	1998/05/25	00:06	2.330	0.022	0	0	0	0
9452210	1998/05/25	00:12	2.200	0.019	0	0	0	0
9452210	1998/05/25	00:18	2.064	0.020	0	0	0	0
9452210	1998/05/25	00:24	1.938	0.019	0	0	0	0

Tide Zone Definition Files

The following is an example of a Zone Definition File (.zdf).

```
[ZONE_DEF_VERSION_3]

[ZONE]
PIS1,10
43.069551, -70.687251
43.061704, -70.717396
43.067896, -70.717241
43.071497, -70.712564
43.072329, -70.710498
43.075112, -70.710772
43.078966, -70.71016
43.081576, -70.708724
43.082372, -70.690817
43.069551, -70.687251

[ZONE]
PIS2,11
43.08703, -70.720529
43.07693, -70.724628
43.072765, -70.724696
43.071497, -70.712564
43.072329, -70.710498
43.075112, -70.710772
43.078966, -70.71016
43.081576, -70.708724
43.083356, -70.715428
43.086439, -70.715696
43.08703, -70.720529

[TIDE_ZONE]
PIS1,419870,PRIM,-12,1.06,0.0,0.2
PIS2,419871,PRIM,-12,1.05,0.0,0.2

[TIDE_STATION]
419870,43.067896,-70.717241,2.0,0.1,D:\HIPS\Tide\419870.tid
419871,43.072329,-70.710498,1.0,0.15,D:\HIPS\Tide\419870.tid

[TIDE_AVERAGE]
PIS1,419870,419871
PIS2,419870,419871

[OPTIONS]
Outage, 600
Interval, 10
```

Tide Zone Data

The Zone Definition File has the following components:

- The mandatory header section must consist of this text string: [ZONE_DEF_VERSION_3]. This specifies the version of the Zone Definition File.
- The section labelled [ZONE] contains the name of the zone(s) and the coordinates that define the boundary of the zone(s). All tide zone files must contain this section.

There are two fields in the first line:

- <Zone Label> contains name of the zone (the name must not be longer than 256 characters).

- number of points that define the boundary of the zone. (These are listed starting in the next line of the section.)

The remaining lines in this section list the geographic coordinates of these points, (latitude, longitude) in decimal degrees.

The last line in the list must contain the same coordinates as the first line to close the polygon.

If there is more than one zone being defined, this section is repeated with the definition information for each zone.

- The section labelled [TIDE_STATION] contains the definition of the tide stations collecting the tide observations. There are six fields in each record of this section:
 - *station label* (the name of the tidal station) - The name must not be longer than 256 characters.
 - *latitude* in decimal degrees - Valid ranges are from -90.0 to +90.0. The negative range represents the Southern Hemisphere.
 - *longitude* in decimal degrees - Valid ranges are from -180.0 to +180.0. The negative range represents the Western Hemisphere.
 - *max amplitude* (in metres) expected from the tidal station - This value will be used to compute a scaling factor during the Tidal TPU computation.
 - *uncertainty* error value associated with the data from the station (in metres)
 - [optional] full file path and name of the tide file associated with the station ID - If this is omitted, HIPS will look for an observation file in the same directory as the *.zdf, with the file name <Station_Label>.tid.
- The section labelled [TIDE_ZONE] contains specific attributes that define a zone's tidal parameters. There are seven fields in this section:
 - *tide zone label* - this must match the name of the zone(s) defined in the [ZONE] section.
 - *tide station label* - name of the tidal station associated with this entry.
 - *priority* designation of the tidal station entry: either the primary (PRIM), secondary (SEC), tertiary (TER) or preliminary (PRELIM) station for this zone.
 - *time correction* - the tide offset for this zone (in minutes)
 - *range correction* - a multiplier (for example, 1.06) used to scale the tidal value read from the observation file

- *tidal shift* - a number in metres added to the values after range correction has been applied.
- *uncertainty* value for the tidal zone (in metres) used to compute the Tidal Zone Error.
- The section labelled [TIDE_AVERAGE] assigns tide stations to zones for tide-weighted averaging. Each record has at least two station fields because each zone can be assigned one or more tide stations for the weighted average calculation.

The section has the following fields:

- *tide zone label* - the zone (as defined in the [ZONE] section) to which the averaging should be applied
- *tide station label*, (as defined in the [TIDE_STATION] section). Enter as many as needed for averaging.
- The last section labelled [OPTIONS] contains options used during tide zoning or tide averaging.
 - The limit value field contains the outage time in seconds before switching from the current station to the next priority station
 - final interval in seconds of tide data loaded into the track line.

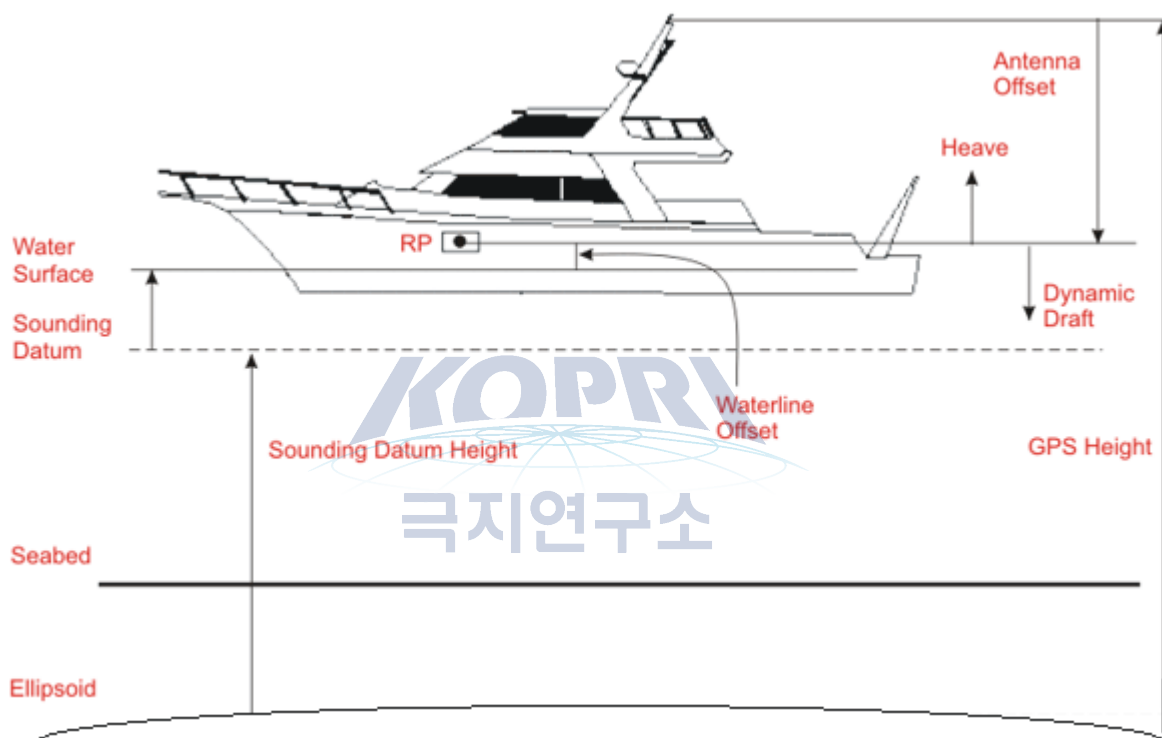
For information on applying the data in a ZDF to survey lines see "CORRECT FOR TIDE" ON PAGE 169.

GPS Tide

The Compute GPS (Global Positioning System) Tide function provides an alternative to normal tidal observation for reducing soundings to the sounding datum

It is based on the recorded GPS ellipsoid height of the navigation antenna and uses the recorded vessel motion, if available, to reduce the ellipsoid height measurements to water level.

The following image demonstrates how GPS tide is calculated. The arrows indicate the positive sense of the values.



The full formula for GPS tide is shown below.

$$\text{GPS Tide} = \text{GPS Height} - \text{Datum Height} + \text{Antenna Offset} - \text{Heave} + \text{Dynamic Draft} - \text{Waterline Offset}$$

The above diagram and equation show the complete formula for GPS tide where GPS Height needs to be motion corrected.

However, in some systems, GPS Height may already be motion corrected. Applying sensor values (such as dynamic heave) again will only distort the final GPS Tide. The Compute GPS Tide command lets you include or omit selected sensor values.

There are two options for applying the sounding datum height(s) (distance from the ellipsoid to the sounding datum) to the track line.

- apply a single height to a track line, or
- apply a binary or ASCII text file containing a grid of sounding datum heights.

Two binary sounding datum models can be used for computation of GPS tide:

- GEOID99
- EGG97 (European Gravimetric Geoid 1997)

Alternatively, an ASCII sounding datum model can also be used. The data must be in the following format: Lat,Long,Z. Values are delimited using a comma.

An example of the file is shown below.

```
-33.848326,151.192435,20.4
-33.849484,151.192370,20.1
-33.849237,151.193173,19.7
-33.849506,151.194227,19.8
-33.848298,151.193916,20.0
-33.848402,151.193149,20.2
```

ASCII datum model files must follow a specific format:

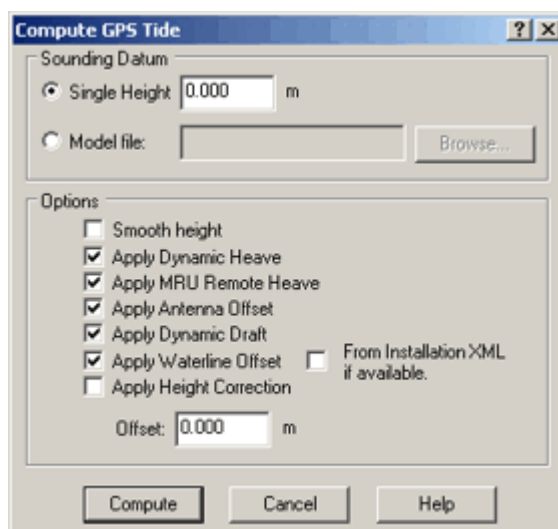
- Latitude and longitude must be in decimal degrees.
- The hyphen symbol (-) must be used to designate coordinates in the Southern or Western hemispheres.
- All files must be saved with a TXT or XYZ file extension.

To compute GPS tide, complete the following steps:

1. Select a track line or group of track lines.
2. Select the Compute GPS Tide command.

The Compute GPS Tide dialog box is displayed.

Menu	Process > Compute GPS Tide



3. Enter the *Sounding datum height* to apply a single height to a track line.
4. To apply a file containing a grid of sounding datum heights, type the path and name for the *Sounding Datum Model* file, or click **Browse** to select a file.
5. Select the *Smooth Height* check box to apply smoothed GPS heights to the track line (see “[SMOOTH DATA](#)” ON PAGE 578).

The following check boxes apply sensor values to GPS tide if GPS Height needs to be motion corrected.

6. Select *Apply Dynamic Heave* to apply dynamic heave (regular vessel heave, or true heave if exists).
7. Select *Apply MRU Remote Heave* to apply remote heave resulting from vessel roll/pitch on an offset mounted MRU.
8. Select *Apply Antenna Offset* to apply vertical offsets as a result of rotating GPS antenna by vessel roll/pitch.
9. Select *Apply Dynamic Draft* to apply dynamic draft (as a result of interpolating the draft table in HVF, or stored in HIPS as time series data).
10. Select *Apply Waterline Offset* to apply the waterline offset in the HIPS Vessel File (HVF).
11. Select *Apply Height Correction* to apply a static offset to the GPS antenna and type the value in the *Offset* field.
12. Select *From Installation XML* to apply the waterline value from the InstallationParameters.xml generated by the Simrad converter.
13. Click **Compute**.

The GPS Tide is calculated for the selected line(s). The settings in the dialog box are remembered by the application. You can open and view the GPS tide data in the Attitude Editor (“[ATTITUDE EDITOR](#)” ON PAGE 571).



G

Contact File Formats



Introduction

Contacts in SIPS are stored in ASCII files in each line directory. SIPS gathers all of these files together and produces a single set of output files that represent all contacts from all of the survey lines. The SIPS Contact export function from SIPS produces four files:

- **filename_ContactLine.txt** contains information identifying the survey line and indexes to the other files.
- **filename_ContactSingle.txt** contains all the information for single point contacts.
- **filename_ContactMulti.txt** contains all information for single point contacts.
- **filename_ContactMultiPoints.txt** contains all location information for multipoint contacts.
- **filename_ContactTiff.gat** contains all image files created during export.

Filename represents the full path and name of the output file.



ContactLine

The filename_ContactLine.txt file contains the names of the HIPS track lines and the corresponding index number. Each line in the file is a comma- delimited string terminated by the newline character (\n). Each line has the following format:

Field Name	Field Description	Description
Line Index	4-digit integer	The index number for the line.
Project Name	256 characters (maximum)	The name of the HIPS project that the line belongs to.
Vessel Name	256 characters (maximum)	The name of the HIPS vessel that the line belongs to.
Day Name	256 characters (maximum)	The name of the HIPS day that the line belongs to.
Line Name	256 characters (maximum)	The name of the HIPS line that the contact refers to.



ContactSingle

The filename_ContactSingle.txt file contains the list of single point contact features from the export. Each line in the file is a comma (',')delimited string terminated by a newline character ('\n'). Each line in the file has the following format:

Field Name	Field Description	Description
Contact Index	4-digit integer	The index number for the contact. Index numbers are assigned sequentially from 0 when the export is performed. Guaranteed to be unique for all exported single contacts only.
Key	12 characters	The key for the contact. This is created by concatenating the line name and the contact number together. The first 8 bytes are the first 8 bytes in the line name, and the last 4 bytes are the system generated number assigned to the contact.
Line Index	4 digit integer	The line record number from the corresponding Filename_ContactLine.txt file.
Contact Number	4 digit integer	The system generated contact number assigned to the contact when it was created in the SIPS software (same as the last 4 bytes of the 'key' field).
Creation Date	10 characters	The date the contact was created. Has the mm/dd/yyyy format
Creation Time	10 characters	The time the contact was created. Has the following format: HH:MM:SS.S
Created User ID	3 characters	The user ID entered in the SIPS software at the time of contact creation (usually user initials)
Modified Date	10 characters	The last date the contact was modified. It may be the same as the Creation Date if the contact has not been modified since creation. It has the following format: mm/dd/yyyy
Modified Time	10 characters	The time of the last modification done to the contact. The time may be the same as the Creation Time if the contact has not been modified since it was created. It has the following format: HH:MM:SS.S
Modified User ID	3 characters	The user ID of the user that last modified the contact. The ID may be the same as the Created User ID if the contact has not be modified since it was created.
Contact Prefix	8 characters	The prefix assigned by the SIPS software when the user created the contact. This is normally used to generate the key for the contact.
Feature Code	12 characters	The CARIS Feature code used to represent the point contact.
Contact Type	1 character	This identifies the contact record as either a single point or multi point contact. Single point contacts are represented by a '1' and multipoint contacts are represented by a '2'.
Profile Number	4 digit integer	The profile number that the contact was picked from in the SIPS software.
Across Distance	6.2 Floating point	The across track distance recorded by the SIPS software that the point contact was picked from.
Latitude	13.7 Floating point	The latitude of the point contact.
Longitude	13.7 Floating point	The longitude of the point contact.

Field Name	Field Description	Description
Target Height	6.2 Floating point	The height of the target (in metres).
Target Width	6.2 Floating point	The width of the target (in metres).
Target Length	6.2 Floating point	The length of the target (in metres).
Image Height	4 digit integer	The height of the contact image as defined by the user in the SIPS software.
Image Width	4 digit integer	The width of the contact image as defined by the user in the SIPS software.
Status	1 digit integer	The status of the contact. 0 if the contact is Accepted, 1 if the contact is Rejected.
Remarks	85 (maximum) characters	Remarks entered by the hydrographer about the created contact.



ContactMulti

The filename_ContactMulti.txt file contains the list of multipoint contact features from the export. Each line in the file is a comma (',') delimited string terminated by a newline character ('\n'). Each line in the file has the following format:

Field Name	Field Description	Description
Contact Index	4-digit integer	The index number for the contact. Index numbers are assigned sequentially from 0 when the export is performed. It is guaranteed to be unique for all exported multi point contacts only.
Key	12 characters	The key for the contact. It is created by concatenating the line name and the contact number together. The first 8 bytes are the first 8 bytes in the line name, and the last 4 bytes are the system generated number assigned to the contact.
Line Index	4 digit integer	The line record number from the corresponding Filename_ContactLine.txt file.
Contact Number	4 digit integer	The system generated contact number assigned to the contact when it was created in the SIPS software (same as the last 4 bytes of the 'key' field).
Creation Date	10 characters	The date the contact was created. It has the mm/dd/yyyy format
Creation Time	10 characters	The time the contact was created. It has the following format: HH:MM:SS.S
Created User ID	3 characters	The user ID entered in the SIPS software at the time of contact creation (usually user initials)
Modified Date	10 characters	The last date the contact was modified. The data maybe the same as the Creation Date if the contact has not been modified since creation. It has the following format: mm/dd/yyyy
Modified Time	10 characters	The time of the last modification done to the contact. The time maybe the same as the Creation Time if the contact has not been modified since it was created. It has the following format: HH:MM:SS.S
Modified User ID	3 characters	The user ID of the user that last modified the contact. The ID maybe the same as the Created User ID if the contact has not be modified since it was created.
Contact Prefix	8 characters	The prefix assigned by the SIPS software when the user created the contact. This is normally used to generate the key for the contact.
Feature Code	12 characters	The CARIS Feature code used to represent the point contact.
Contact Type	1 character	This identifies the contact record as either a single point or multi point contact. Single point contacts are represented by a '1' and multipoint contacts are represented by a '2'.
Target Height	6.2 Floating point	The height of the target (in metres).
Target Width	6.2 Floating point	The width of the target (in metres).
Target Length	6.2 Floating point	The length of the target (in metres).

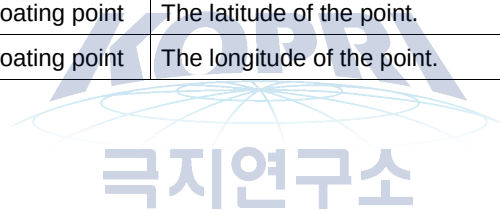
Field Name	Field Description	Description
Image Height	4 digit integer	The height of the contact image as defined by the user in the SIPS software.
Image Width	4 digit integer	The width of the contact image as defined by the user in the SIPS software.
Status	1 digit integer	The status of the contact—0 if the contact is Accepted, 1 if the contact is Rejected.
Remarks	85 (maximum) characters	Remarks entered by the hydrographer about the created contact.



ContactMultiPoints

The filename_ContactMultiPoints file contains the list of points used to construct the geometry of the multi point contacts listed in the Filename_ContactMulti.txt from the export. Each line in the file is a comma (',')delimited string terminated by a newline character ('\n'). Each line in the file has the following format:

Field Name	Field Description	Description
Record number	4-digit integer	The record number. It is unique throughout the file.
Contact Record Number	4-digit integer	The contact record number that this point belongs to. This corresponds to the Contact Index in the corresponding Filename_ContactMulti.txt file.
Profile Number	4-digit integer	The profile number that the point was computed from in the SIPS software.
Across Distance	6.2 floating point	The across-track distance recorded by the SIPS software that the point contact was picked from.
Accumulated Distance	6.2 floating point	The accumulated distance. This is the distance from the first point in the set, to this point.
Latitude	13.7 floating point	The latitude of the point.
Longitude	13.7 floating point	The longitude of the point.



Glossary

Altitude	The height of the side scan sonar transducer above the sea floor. The transducer is typically mounted on a towed body or the surface vessel, but can also be mounted on an ROV or AUV.
Angle-Varying Gain	Angle-Varying Gain (AVG) correction removes the angular response of sediment from the imagery, normalizing the mean angular intensities, ping-by-ping, with a moving average filter.
Attitude Data	Commonly used to refer to the orientation of the vessel in three dimensions as represented by the Gyro, Heave, Pitch, and Roll sensors. The Attitude Editor displays this data as well as other sensors that consists of simple “time vs. sensor value” data.
Background Data	Georeferenced vector and raster data providing visual context to the bathymetry and side scan data being processed. Examples include CARIS files, BSB raster charts, GeoTIFF orthophoto images, S-57 electronic chart data.
Backscatter	Intensity of sounding returns collected by swath multibeam sounding systems. Backscatter data creates an image of the sea floor that can indicate the bottom type.
BAG	The Bathymetric Attributed Grid (BAG) is an open-source binary file format for transferring gridded bathymetry and uncertainty values between software applications and agencies. The file contains four sections: metadata (in XML format), elevation, uncertainty, tracking, and certification. For more information on BAG, go to http://www.opennavsurf.org/ .
BASE Surface	The Bathymetry Associated with Statistical Error (BASE) Surface. A georeferenced TIFF representation of the seabed derived from processed bathymetry and computed uncertainty (error) values. The algorithm applies soundings to the grid based on beam footprint size. A customizable weighting system allows more emphasis in the mean calculation to be placed on the inner nadir beams or on soundings with lower uncertainty values.
Beam	A single depth measurement is produced from a beam. Many beams make up a profile or a ping.

Beam Pattern Correction	Beam pattern correction uniformly removes along-track banding inherent to the sonar beam. This effect is produced by each transducer uniquely. Beam pattern correction relies on a user-generated beam pattern file to identify and remove this effect.
CARIS File	The format for recording vector map data features such as lines, symbols, text, soundings, etc. The map actually consists of set of files.
CATZOC	The zone of confidence (CATZOC) attribute. The CATZOC attribute is part of the S-57 Quality of Data (M_QUAL) object class. It indicates that data meets the minimum criteria for seafloor coverage, and position and depth accuracy as defined by the attribute classification structure. There are five CATZOC classifications: A1, A2, B, C, and D.
Contacts	Point and line features identified in side scan sonar data. Attributes describing the location, size, and description or the target are recorded. Image snapshots are also generated.
CUBE Surface	A Combined Uncertainty and Bathymetry Estimator (CUBE) Surface contains multiple hypotheses representing potential depth variances on the seafloor. As soundings are propagated to nodes—based on distance and uncertainty—a hypothesis is developed. If there is a significant variation of depth at a node, a new hypothesis is created. A node can contain more than one hypothesis.
Day	One of the days for which there is survey data. Expressed as a Julian day.
Decimate	Decrease the size of the bathymetric data set to be exported to the work file.
Delta Draft	A “time vs. delta-draft” data structure that can be loaded into HIPS and used to model the dynamic squat and lift of the vessel. Also used to store the recorded depth of towfish and ROV/AUV mounted multibeam sonars.
Despeckle	Despeckling uses a calculated value based on neighbouring intensity levels to replace the current pixel’s intensity if it is outside the specified range. The value calculated from the neighbouring intensities can be derived by one of two methods mean or median.
Disambiguation	The process in CUBE of selecting one hypothesis over other hypotheses to represent the surface. Hypotheses can be selected or “nominated” by density, locale, locale and density, or by the nearest value to a previous CUBE Surface.

DpTPU	Depth Total Propagated Uncertainty. The difference between the observed or computed depth value of a sounding and its true depth value (at a 95% confidence level).
Edit Layer	A HOB layer created in CARIS Notebook to represent real-world alterations in the survey area.
Ellipsoid	The ellipsoid and datum to which logged positions in the survey refer must be stored in the HIPS vessel file, regardless of whether projection coordinates or geographic coordinates are stored in the logged file. Any ellipsoid may be used, so long as it is defined in the file referenced by the environment variable <code>uslXdatum</code> .
Field Sheet	A collection of data products, within a defined geographic area, derived from the processed bathymetry and side scan data. A common coordinate system reference is used. Some example products include BASE surfaces, mosaics, tiles, selected soundings, contours, and plot layouts.
Filtering	The process of detecting outliers in the data and setting the status flags to Rejected. Data points are not removed from the HIPS/SIPS format.
Gain	A measure of increase in amplitude of a signal.
GPS Tide	Instantaneous water level height above the sounding datum derived from the observed GPS ellipsoid heights of the navigation antenna. Reduced for sensor offsets, vessel motion, known sounding datum height above the ellipsoid, and other parameters.
Generic Data Parser	A program for converting recorded ASCII data sources into the HIPS/SIPS format. New survey lines can be generated for single beam bathymetry, or the program can update a sensor within an existing HIPS or SIPS project.
HOB	The Hydrographic Object Binary (HOB) file is a spatially referenced dataset that is used to support the internal structure of S-57 data in CARIS products. The HOB file does not require a CARIS vector map and contains the point, line, and area geometry for hydrographic objects.
HxTPU	Horizontal Total Propagated Uncertainty. The difference between the observed or computed position value of a sounding and its true position value (at a 95% confidence level).
HVF	HIPS Vessel File. A vessel configuration file in XML format that consists of a list of sensors with their physical and calibration measured offsets, plus any error values. These are applied to the observed data during processing. The HVF supersedes the Vessel Configuration File (VCF).

Hypothesis	A representation of depth in a BASE Surface. The Hypotheses that are displayed in the Surface are selected or "nominated" through disambiguation. Hypotheses that were not selected remain as alternative hypotheses and can be nominated in the Subset Editor.
Index Contour	A contour line accentuated by a heavier line weight to distinguish it from intermediate contour lines. Index contours are usually shown as every fifth contour with their assigned values, to facilitate reading elevations.
Layback	If a towed sensor is used during a survey, the position of that sensor can be calculated as a horizontal "layback" from the position of the towing vehicle. The sensor layback is computed from the tow wire length and sensor depth.
LADS	Laser Airborne Depth Sounder (LADS) is a lidar system developed by Tenix Corporation.
Lidar	Light direction and ranging uses laser technology to calculate bathymetry.
Line	A single pass of the survey vessel over some or all of the area being surveyed, during which time referenced sensor data is continuously collected. Often the line is approximately straight.
Marker Layer	A HOB layer created in CARIS Notebook for graphically identifying areas of interest and attaching notes, text and other information. The Marker layer is created as a sub-layer of an Edit layer.
Merge	The process of calculating final positions and depths for soundings, based on all relevant inputs such as observed depths, navigation information, vessel dynamics such as gyro, heave, pitch and roll, and tide. Merging is carried out after these inputs are loaded and checked.
Mosaic	A georeferenced raster image created from one or more side scan survey lines.
Outliers	Unwanted data resulting, for example, from incorrect sea floor detection.
Ping	A single output pulse of a sonar system
Profile / Swath	A set of soundings, approximately perpendicular to the ship's track, which is produced by the swath or sweep sonar over an instantaneous or very short time period. CROSS -SECTION??
Product Surface	A shoal-biased bin generated from a BASE Surface. Data is down-sampled so that finer details of the seafloor are not

visible, but the shoals are still maintained. Product surfaces can be used to create navigation products, such as Electronic Nautical Charts.

Project	A survey area with data collected by one or more survey vessels over one or more days.
Publication Designer	The Publication Designer is an application developed by CARIS for formatting templates. You can use this application to insert dictionary tags, and add text and graphics. The application is opened directly from the Start button on the Windows taskbar or from a shortcut on the desktop.
Raw Side Scan	Time indexed imagery profiles where the across-track scale is time in milliseconds.
S-44	S-44 is the international standard developed and maintained by the International Hydrographic Organization (IHO) that sets the minimum standard for hydrographic surveys. The standard classifies surveys into survey orders (Special Order, Orders 1, 2, 3) based on an area's importance for safety of surface navigation.
S-57	S-57 is the international standard developed and maintained by the International Maritime Organization (IMO). It is used by hydrographic data producers to describe how real-world entities are stored digitally for transfer among different computer platforms between the various hydrographic offices.
Session	A record of all data that is currently open in the primary application. Typically contains a list of survey line names, background raster images, and field sheets that are currently open. Used to re-open an integrated dataset from a previous working session.
SHOALS	Scanning Hydrographic Airborne Lidar Survey (SHOALS) is a lidar system owned and operated by the Joint Airborne Lidar Bathymetry Center of Expertise.
Slant Range	Raw travel time used to compute sounding depth (accompanied by receive angle).
Slant Range Corrected Side Scan	Time-indexed imagery profiles generated from raw side scan data using the measured altitude of the transducer. The across track scale is distance in metres.
Sounding	A measured depth of water.

Sound Velocity Correction	The process of applying rigorous refraction corrections to the raw travel time/angle bathymetry data using recorded sound velocity profiles.
Status Flag	The indicator of the acceptance or rejection of a data point during cleaning.
Subset	A rectangular area which encloses some or all of a survey project boundaries. It is used during sounding cleaning to limit the number and extent of soundings being processed during one session.
Surface Cleaning	A statistical process of detecting bathymetric outliers within an area. A least square polynomial regression algorithm is used.
Templates	Templates are forms that display session data. Session data is added using object tags from in the HIPS dictionary. When the template is opened in HIPS and SIPS, the object tags are filled with data from the open session. Other features, including text and graphics, can also be added. Templates can be built using the Publication Designer.
Template Editor	The Template Editor is a CARIS application for creating and modifying borders, geographic grids, and scale bars. The Template Editor is used in conjunction with the Publication Designer for creating and editing templates. It is opened as a separate application from the Start menu on the Windows taskbar, or from a shortcut on the desktop.

Tiles	A representation of the sea floor consisting of interlocking tiles of varying sizes. Tiles can make large data sets more manageable by subdividing them by user-defined criteria. Tile positions are defined by a Morton Number scheme. Tiles can carry a variety of attributes generated from the data within the area of the tile.
Time-Varying Gain	Time-Varying Gain (TVG) adjusts the signal intensity by applying a non-uniform, time-dependent gain. TVG is used to compensate for the attenuation that occurs due to absorption and spreading as the sonar beam travels back to the receiver. Since these returns are received over a predictable and constant time period, a time-varying curve can be used to increase gain to compensate for the decayed sonar return.
TrueHeave	A heave filtering function developed by Applanix. TrueHeave employs a bi-directional heave filter to remove artifacts from heave data. Values are computed from real-time data and have to be imported separately to the track line.
TPU	Total Propagated Uncertainty. TPU is derived from a combination of all individual error sources and is used to calculate horizontal and vertical uncertainties for soundings.
Vessel	A survey platform, whether it be a ship, a towfish, an ROV/AUV, or an aircraft.
Weighted Grid	A georeferenced TIFF representation of the mean sea floor depths derived from processed bathymetry, that was used in HIPS before the introduction of the BASE surface.

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부록 3.

MB-System Program List



List of MB-System Programs:

Manual Page for the MB-System package:

- [mbsystem](#)

Manual Page for the MB-System i/o library:

- [mbio](#)

These are the current MB-system programs with links to the Unix manual pages:

- [mbabsorption](#): Calculates water sound absorption as a function of water properties.
- [mbareaclean](#): Identifies and flags bad beams in swath sonar bathymetry data within a specified area.
- [mbauvloglist](#): Generate arbitrary text lists of values from MBARI AUV mission log files.
- [mbauvnavusbl](#): Merge inertial and surface tracking navigation for submerged sonar platforms (e.g. ROVs and AUVs).
- [mbbackangle](#): Generates corrections for sidescan and/or amplitude data by calculating average amplitudes as a function of the seafloor grazing angle.
- [mbclean](#): Identifies and flags bad beams in swath sonar bathymetry data.
- [mbcopy](#): Copy swath sonar data files.
- [mbctdlist](#): List CTD data in swath sonar data files.
- [mbdatalist](#): Parses recursive datalist files and outputs the complete list of data files and formats.
- [mbdefaults](#): Set or list default mbio parameters for reading and writing swath sonar data
- [mbdumpesf](#): mbdumpesf reads an MB-System edit save file and dumps the contents as an ascii table to stdout.
- [mbedit](#): Interactive editor used to flag bad beams in swath sonar bathymetry data.
- [mbeditviz](#): Interactive 3D visualization bathymetry editing and attitude bias patch test.
- [mbextractsegy](#): Extract subbottom profiler or center beam reflection data to segy files.
- [mbfilter](#): Apply one or more simple filters to sidescan and/or beam amplitude data.
- [mbformat](#): List information about swath sonar data formats supported by the MBIO library.
- [mbgetesf](#): Extract bathymetry edits in edit save file format.
- [mbgrdviz](#): Vizualize GMT grids.
- [mbgrid](#): Grid bathymetry, amplitude, and sidescan data from swath sonar data files.
- [mbhistogram](#): Obtain histogram of bathymetry, amplitude, or sidescan data from swath sonar data files.
- [mbhsdump](#): List raw information contained in Hydrosweep DS data files (formats 21 and 24).
- [mbhysweepprocess](#): Preprocess Hysweep HSX data (format 201), including applying time lag and biases to attitude and navigation data.

- [mbinfo](#): Output some basic statistics of swath sonar data files.
- [mbkongsbergpreprocess](#): performs preprocessing of data from third generation Kongsberg multibeam sonars (e.g. EM122, EM302, EM710).
- [mblevitus](#): Create a water velocity profile which is representative of the mean annual water column for a specified 1 degree by 1 degree region.
- [mblist](#): List data in swath sonar data files.
- [mbmakeplatform](#): Create or modify an MB-System platform file, which represents a survey system as a set of sensors with positional and angular offsets.
- [mbmosaic](#): Mosaic sidescan and amplitude data.
- [mbnavadjust](#): Package that solves for optimal navigation by matching bathymetry of overlapping swathes.
- [mbnavadjustmerge](#): Merge two mbnavadjust projects.
- [mbnavedit](#): Interactive editor used to fix problems with navigation in swath sonar data files.
- [mbnavlist](#): List navigation data in swath sonar data files.
- [mbneptune2esf](#): Extract bathymetry edits from Simrad Neptune software into edit save file format.
- [mbotps](#): Generate open ocean tidal model for specified time and location using the Oregon State Tidal Prediction Software (OTPS) package.
- [mbpreprocess](#): Perform preprocessing of the logged data comprising a survey, including applying lever arm corrections (if necessary) and setting up the MB-System processing environment.
- [mbprocess](#): Process swath sonar data files, including merging navigation, applying bathymetry edits, recalculating bathymetry by raytracing, and applying a variety of other corrections.
- [mbps](#): Simple perspective views of swath bathymetry in Postscript.
- [mbrollbias](#): Evaluate the roll bias of a swath sonar system using two pieces of coincident bathymetry data collected with opposing ship headings.
- [mbrolltimelag](#): Estimate attitude time lag by cross correlation of apparent bottom slope with the roll time series.
- [mbrousetime](#): Outputs a list of the times when a survey passes the waypoints of a planned survey route.
- [mbsegygrid](#): Generate time vs. trace number grids of seismic data from segy files.
- [mbsegyinfo](#): Output some basic statistics of segy seismic data files.
- [mbsegylist](#): List selected header values in segy seismic data files.
- [mbsegypsd](#): Calculates the power spectral density function of each trace in a segy data file, outputting the results as a GMT grid file..
- [mbset](#): Create and modify parameter files used to control mbprocess.
- [mbstripnan](#): Filter to remove NaN nodes.
- [mbsvpelist](#): Extract water sound velocity profiles (SVPs) from swath data files.
- [mbsvpselect](#): Select the best available sound speed model for each swath file in a survey according to user specified criteria.
- [mbswplspreprocess](#): Preprocess SwathPlus SXP data (format 222), including applying time lag and biases to attitude and navigation data.
- [mbtime](#): Converts between calendar time and unix time.
- [mbvelocitytool](#): Interactive program for modeling the affect of the water velocity

profile on swath sonar bathymetry calculations.

- [mb7k2jstar](#): Extract Jstar format (format 132) sidescan and subbottom data from Reson 7k (format 88) data files.
- [mb7k2ss](#): mb7k2ss extracts Edgetech sidescan sonar data from Reson 7k format data, bins and lays the sidescan onto the seafloor, and outputs files in the MBF_MBLDEOIH format (MBIO format id 71).
- [mb7kpreprocess](#): Preprocess Reson 7k data (format 88), including applying time lag and biases to attitude and navigation data.

MB-system also includes three plug-in modules for the GMT software package that are built as a shared library that can be called by GMT. Here are links to the Unix manual pages:

- [mbcontour](#): Generate GMT compatible Postscript color swath contour plots.
- [mbgrdtiff](#): Generate TIFF image from gridded data.
- [mbswath](#): Generate GMT compatible Postscript color and color shaded relief swath plots.

Macros are programs or shellscripts which make use of programs from the MB-System and other software packages to accomplish common tasks easily. These are the current MB-System macros:

- [mbm_arc2grd](#): Convert an ArcView ASCII grid file to a GMT grid file.
- [mbm_copy](#): Translate groups of swath data files between formats
- [mbm_bpr](#): Process data from a Seabird SBE53 pressure sensor into a tidal model for use by mbprocess.
- [mbm_fmtvel](#): Scans a Hydrosweep swath sonar data file using the program mbhsdump and generates a list in columnar format with time, date, latitude, longitude, C-mean, and C-keel entries.
- [mbm_grd2arc](#): Convert a GMT grid file to an ArcView ASCII grid file.
- [mbm_grd2geovrm](#): Create and execute commands which generate a TerraVision tileset and GeoVRML set of files that can be combined with other data and viewed in a web browser.
- [mbm_grd3dplot](#): Reads a GMT GRD grid file and writes a shellscript which will generate a GMT 3D perspective view of the data.
- [mbm_grdcut](#): Extract a subarea of a GMT grid file.
- [mbm_grdinfo](#): Get information regarding a GMT grd file when the region of interest is a subset of the area covered in the input file.
- [mbm_grdplot](#): Reads a GMT GRD grid file and writes a shellscript which will generate a GMT map of the data.
- [mbm_grdtiff](#): Reads a GMT GRD grid file and writes a shellscript which will generate a TIFF image of the data.
- [mbm_grid](#): Reads a swath sonar data file and writes a shellscript which will grid bathymetry data or mosaic sidescan (or amplitude) data using reasonable guesses at the appropriate grid bounds and bin size.
- [mbm_histplot](#): Create an executable shellscript which will generate a GMT histogram plot of a dataset.

- [mbm_makedatalist](#): Generates an MB-System datalist file referencing all identifiable swath files in the specified target directory.
- [mbm_makesvp](#): Generate a sound velocity profile model from sound speed and depth values in swath files.
- [mbm_multicopy](#): Translate groups of swath data files between formats using parallel processes.
- [mbm_multidatalist](#): Generates ancillary files used in data management using parallel processes.
- [mbm_multiprocess](#): Apply specified processing tasks to a swath data file using parallel processes.
- [mbm_plot](#): Reads a swath sonar data file and writes a shellscript which will generate a swath and/or contour plot of the data.
- [mbm_route2mission](#): Translate an mbgrdviz survey route file into an MBARI AUV mission script.
- [mbm_stat](#): Runs mbinfo on a swath sonar data file and extracts beam statistics from the output of mbinfo.
- [mbm_utm](#): Performs forward and inverse UTM projections of ASCII data triples.
- [mbm_xbt](#): Processes a Sparton XBT data file and outputs a sound velocity profile file which can be used to process swath sonar data.
- [mbm_xyplot](#): Reads one or more xy data files and writes a shellscript which will generate GMT plot of the data.

Last Updated: \$Id: mbsystem_man_list.html 2258 2015-10-06 04:57:28Z caress \$



[Back to MB-System Home Page...](#)

부록 4.

EM multibeam datagram 차례

『Kongsberg 제공』

(전체 내용은 전산 PDF 파일로만 제공)



Instruction manual

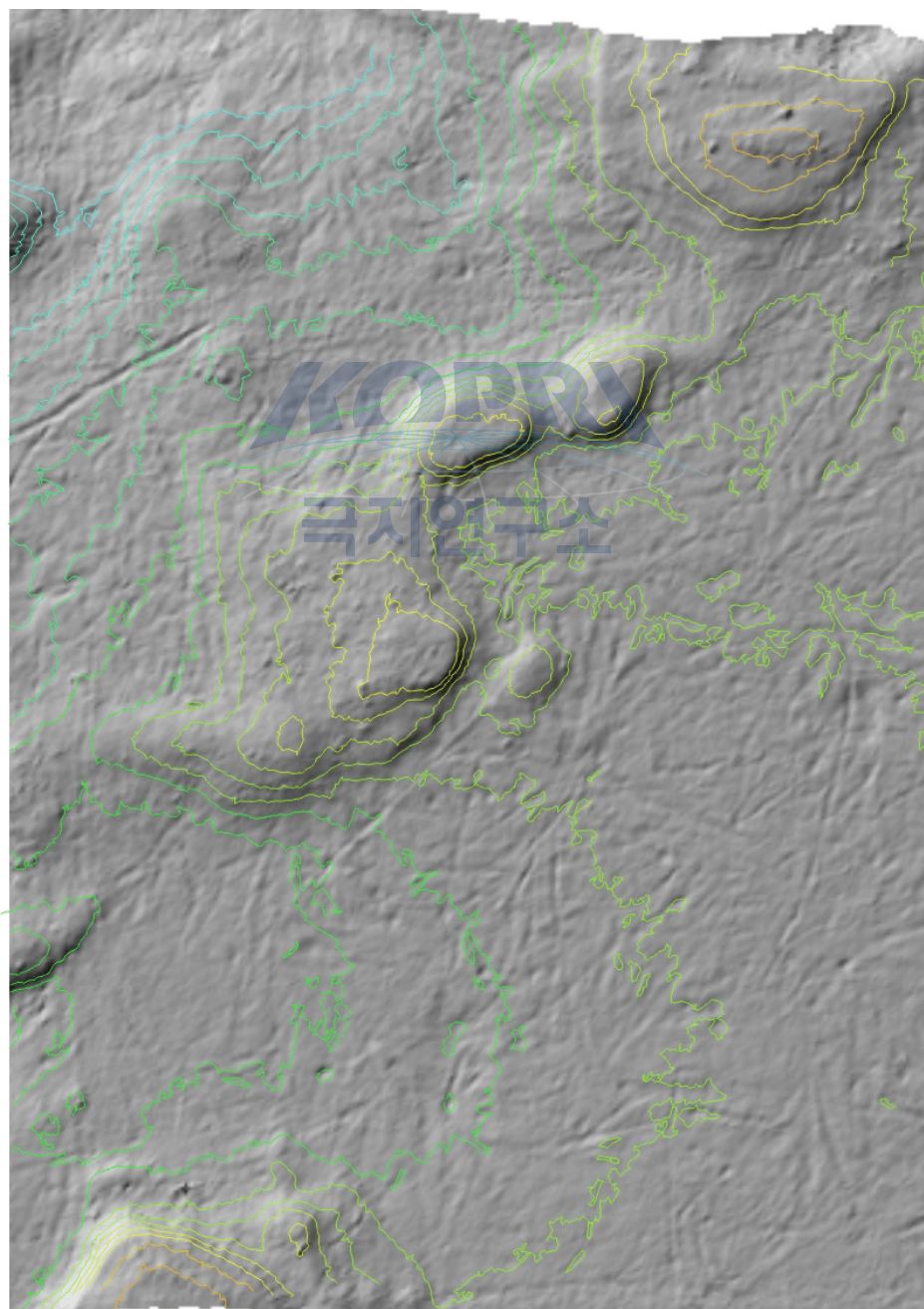


KONGSBERG

EM Series

Multibeam echo sounders

Datagram formats







KONGSBERG

Kongsberg EM Series Multibeam echo sounder

EM datagram formats



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Rev. S	May 2015	Sound speed profile datagram, Time since midnight is sent as seconds, not milliseconds. Installation parameters, System transducer configuration parameter (STC): more options added. PU ID output, System descriptor: more options added. Added Extra detections datagram. Minor text corrections.
Rev. T	June 2015	Added data in Extra detections datagram
Rev. U	June 2015	Added info. about support of Seatex binary 26 format

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Disclaimer

Kongsberg Maritime AS endeavours to ensure that all information in this document is correct and fairly stated, but does not accept liability for any errors or omissions.

Warning

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment and/or injury to personnel. All users must be familiar with the contents of the appropriate manuals before attempting to install, operate, maintain or in any other way work on the equipment. Kongsberg Maritime AS disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

Support information

If you require maintenance or repair, contact one of our offices, distributors or dealers. You can also contact us using the following address: km.hydrographic.support@kongsberg.com. If you need information about our other products, visit <http://www.km.kongsberg.com>.
See also *Support information* on page 8.

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EM datagram formats

The data input and output formats to and from the EM Series multibeam echo sounders are described in this document. The information applies to the Kongsberg Maritime multibeam echo sounders introduced after 1995.

Note

The information herein applies to the EM 3002, EM 3000, EM 2040, EM 2000, EM 1002, EM 710, EM 302, EM 122, ME70BO, EM 300 and EM 120 multibeam echo sounders. Some of the information may not be relevant for your specific system. Please disregard this.

Information for EM 2040 is valid for all models of EM 2040, unless otherwise specified.

The information in this document is not valid for the EM 12, EM 100, EM 950 and EM 1000 multibeam echo sounders.

Note

In order to meet special customer requirements, Kongsberg Maritime may have to change the datagram formats described here. The formats presented in this document may therefore be altered without prior notice, although backward compatibility will be maintained as far as possible. Before software is written in accordance with this document, it is strongly recommended to contact Kongsberg Maritime to ensure that the latest version is used, and that any planned changes are taken into account.

Presentation format

The format description is according to the **NMEA 0183 standard, Approved Parametric Sentence Structure**, with the ASCII character(s) given as follows

- “x.x” defines a variable length numerical field, with optionally included decimal point and sign.
- “c-c” defines a variable length field of printable characters.
- “x-x” defines a variable length field of numeric characters.
- “a_ _” defines a fixed length field of alphabetical characters (e.g. “aa”= two character long field).
- “x_ _” defines a fixed length field of numeric characters.

For binary fields, the length is given in number of bytes plus “U” for unsigned and “S” for signed data.

Support information

If you need technical support on the EM Series system you must contact a Kongsberg Maritime office. A list of all our support offices is provided on <http://www.km.kongsberg.com>.

You can also contact our main support office in Norway.

- **Address:** Strandpromenaden 50, 3190 Horten, Norway
- **Telephone:** +47 33 02 38 00
- **Telephone, 24h:** +47 815 35 355
- **E-mail address:** KM.Hydrographic.Support@km.kongsberg.com
- **Website:** <http://www.km.kongsberg.com>

Input datagrams

Topics

- *Position* on page 9
- *Attitude* on page 21
- *Clock datagrams* on page 27
- *Sound speed datagrams* on page 28
- *Depth input datagrams from single beam echo sounder* on page 33
- *Remote control datagrams* on page 35
- *Sound speed at transducer* on page 37

Only a limited number of input formats from external sensors are accepted. These are primarily in accordance with the NMEA 0183 specification, or based upon the principles of that specification.

Note

The majority of these formats have not been defined by Kongsberg Maritime. Thus, these formats are not controlled by Kongsberg Maritime.

Almost all input formats are ASCII. Serial line or Ethernet input to the multibeam echo sounder's Processing Unit is most common, but some datagrams - which are not time critical - are interfaced on serial line(s) or Ethernet to the Operator Station.

Position

Topics

- *Overview* on page 10
- *GGA Datagram* on page 12
- *PTNL, GKG Local coordinate position datagram* on page 14
- *Trimble GKG Datagram* on page 15
- *VTG Datagram* on page 16
- *Transponder position* on page 17
- *Simrad 90 Position* on page 18

- *Tide Input* on page 20
- *Depth, pressure or height input* on page 20

Overview

The EM Series accepts position data in the following formats

- NMEA 0183 GGA
- GGK
- PTNL, GGK
- SIMRAD 90
- Transponder position
- With the GGA and GGK datagrams, information contained in NMEA 0183 GST and VTG datagrams will also be accepted and used.

Note

The GST datagram is not used by the following multibeam echo sounders: EM 122, EM 302, EM 710, EM 2040, EM 2040C, EM 3002 and ME70BO.

- A datagram format for Sonar Head depth is provided for the EM 3002, EM 3000, EM 2040, EM 2000 and EM 710. Note that the format is the same as that used by the Paroscientific Digiquartz pressure sensor. This format may also be used for input of for example varying datum heights or other special height information on all models.
- A datagram format for input of tidal height is provided.

The GGA format given below is according to the NMEA 0183 version 2.30 description.

The GGK format was originally defined by the US Army Corps of Engineers for their tests with kinematic GPS. Trimble's proprietary version of the format, PTNL GGK, is supported. If any changes to the format are made, and if it becomes part of the NMEA standard, this will be implemented.

To preserve the inherent accuracy of the kinematic GPS data it is necessary to correct the data for vessel motion. This requires accurate timing synchronisation between the motion sensor and the GPS receiver. It is therefore imperative that

- the position datagram has a constant and known time delay,
- or
- the time stamp in the datagram is actually the time of the position fix, that synchronisation to the 1PPS signal of the GPS receiver is enabled, and that the system clock has been set correctly.

As neither of these conditions may not be possible to achieve with a sufficient accuracy, the application of motion correction is operator selectable. Motion compensation may be applied to most of the position input datagrams.

In addition to position data from the GGA or GGK datagrams, speed and course over ground from NMEA VTG datagrams may also be copied into the position output datagram. These values may be useful in filtering of the positioning during postprocessing. If a VTG datagram does not follow the GGA or GGK datagram the course and speed fields of the output datagrams will be set to their invalid values.

As an alternative to GGA, the SIMRAD 90 format position datagram may be used. The SIMRAD 90 format is intended to be the format of choice when the positioning system is not a stand-alone GPS receiver supplying GGA or GGK format datagrams. The SIMRAD 90 format can in addition to global longitude and latitude coordinates also be used for Northing and Easting type projection coordinates (e.g. UTM).

To cater for applications where the EM 2000 or EM 3000 Sonar Head is mounted on a subsea vehicle, the original SIMRAD 90 format has been expanded to allow inclusion of the depth of the vehicle in addition to its horizontal position in longitude/latitude or Northing/Easting coordinates.

SIS supports logging of all data from a Javad GPS receiver directly attached to the serial port on the HWS PC.

The Javad GPS receiver outputs binary data in addition to the NMEA datagrams. The binary can be used by third party software (like Terratec) to compute more accurate positions using post processing tools. The Javad data files are stored in a separate folder and kept separate from the other raw data to ease the post processing of the data. The operator chooses this directory in the runtime parameters in SIS.

A Trimble GPS receiver can also be attached to the serial line of the HWS PC. This is used for special purposes like land surveying.

GGA Datagram

Table 1 GGA Datagram

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	aa	Capital letters	—
Sentence formatter	Always GGA,	—	—
UTC of position	hhmmss.ss,	000000 to 235959.9...	—
Latitude in degrees and minutes, plus optional decimal minutes	llll.ll,	0000 to 9000.0...	—
Latitude – N/S	a,	N or S	—
Longitude in degrees and minutes, plus optional decimal minutes	yyyy.yy,	00000 to 18000.0...	—
Longitude – E/W	a,	E or W	—
GPS quality indicator	x,	0 to 8	1
Number of satellites in use	xx,	00 to 12	—
HDOP	x.x,	—	1
Antenna altitude re mean sea level (geoid)	x.x,	—	2
Units of antenna altitude	M,	—	—
Geoidal separation (sea level re WGS-84)	x.x,	—	2
Units of geoidal separation	M,	—	—
Age of differential GPS data	x.x,	—	—
Differential reference station id	xxxx,	0000 to 1023	—
Checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- 1 The HDOP (Horizontal Dilution Of Precision) value will be scaled and copied to the "Measure of position fix quality" field in the position output datagram. The scale factor depends upon the GPS quality indicator's value:

- 1 - (SPS or standard GPS) => 1000
- 2 - (differential GPS) => 100
- 3 - (PPS or precise GPS) => 200, but 10 if GGA is treated as RTK. (See Note 2)
- 4 - (kinematic GPS with fixed integers) => 10
- 5 - (kinematic GPS with floating integers) => 50
- 6 - (estimated or dead reckoning mode) => 1000
- 7 - (manual input mode) => 1000
- 8 - (test mode) => 1000, but 10 if GGA is treated as RTK. (See Note 2)
- The "Measure of position fix quality" field will be set to 65534 (largest valid number) if the indicator is zero (non-valid position).

This scaling is used to give at least a relatively correct position fix quality change (in the order of cm) if there are dropouts in differential, precise or kinematic measurements, although HDOP is not a metric value.

The GPS manufacturers may have different GPS quality indicators.

- 2 When the quality factor of a GGA positioning system in use is 4 or 5 a height output datagram is automatically generated, and also if the quality factor is 3 or 8 and the operator has set the GGA position to be an RTK position. The height is the sum of these two fields which are assumed positive upwards (antenna above geoid).



PTNL, GGK Local coordinate position datagram

Table 2 PTNL Datagram

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Sentence identifier	Always PTNL,	—	—
Sentence formatter	Always GGK,	—	—
Time of position	hhmmss.ss,	000000 to 235959.9...	—
Date of position	mmddyy,	010100 to 123199	—
Latitude in degrees and minutes	ddmm.mmmmmmm,	0000 to 9000.0...	—
Latitude – N/S	a,	N or S	—
Longitude in degrees and minutes	dddmm.mmmmmmm,	00000 to 18000.0...	—
Longitude – E/W	a,	E or W	—
GPS quality indicator	x,	0 to 7	1
Number of satellites in use	xx,	00 to 12	—
DOP	x.x,	—	1
Antenna/height above ellipsoid	EHT x.x,	—	—
Units of ellipsoidal height (meters)	M,	—	—
Checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- 1 The DOP (Dilution of Precision) value will be scaled and copied to the "Measure of position fix quality" field in the position output datagram. The scale factor depends upon the GPS quality indicator's value

- 1 – (Standard GPS) => 1000.0;
- 2 – (RTK float) => 50.0;
- 3 – (RTK fix) => 10.0;
- 4 – (DGPS) => 100.0;
- 5 – (WAAS/EGNOS) => 100.0;
- 6 – (Network Float) => 50.0;
- 7 – (Network fix) => 10.0;

The "Measure of position fix quality" field will be set to 65534 (largest valid number) if the indicator is zero (non-valid position).

This scaling is used to give at least a relatively correct position fix quality change (in the order of cm) if there are dropouts in differential, precise or kinematic measurements, although DOP is not a meter value.

The GPS manufacturers may have different GPS quality indicators.

Trimble GGK Datagram

Table 3 GGK Datagram

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	aa	Capital letters	—
Sentence formatter	Always GGK,	—	—
Time of position	hhmmss.ss,	000000 to 235959.99...	—
Date of position	MMDDYY,	010100 to 123199	—
Latitude in degrees and minutes, plus optional decimal minutes	IIII.IIIII,	0000 to 9000.0...	—
Latitude – N/S	a,	N or S	—
Longitude in degrees and minutes, plus optional decimal minutes	YYYYY.YYYYYY,	00000 to 18000.0...	—
Longitude – E/W	a,	E or W	—
GPS quality indicator	x,	0 to 3	1
Number of satellites in use	xx,	00 to 12	—
DOP	x.x,	—	1
Antenna ellipsoidal height	x.x,	—	—
Units of antenna ellipsoidal height	M,	—	—
Units of antenna ellipsoidal height	x.x,	—	—
Checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- The DOP (Dilution Of Precision) value will be scaled and copied to the "Measure of position fix quality" field in the position output datagram. The scale factor depends upon the GPS quality indicator's value

- 1 - (SPS or standard GPS) => 1000
- 2 - (differential GPS) => 100
- 3 - (kinematic GPS) => 10

The "Measure of position fix quality" field will be set to 65534 (largest valid number) if the indicator is zero (non-valid position).

This scaling is used to give at least a relatively correct position fix quality change (in cm) if there are dropouts in differential, precise or kinematic measurements, although DOP is not a meter value.

The GPS manufacturers may have different GPS quality indicators.

VTG Datagram

Table 4 VTG Datagram

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	aa	Capital letters	—
Sentence formatter	Always VTG,	—	—
Course over ground, degrees true	x.x,T,	0 to 359.9...	1
Course over ground, degrees magnetic	x.x,M,	0 to 359.9..	1
Speed over ground, knots	x.x,N,	0 –	1
Speed over ground, km/h	x.x,K,	0 –	1
Mode indicator	a	A,D,E,M,S or N	—
Units of antenna ellipsoidal height	x.x,	—	—
Checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- 1 Only true course and the first valid speed field will be used.



Transponder position

Table 5 SSB - SSBL Position Datagram

Data Description	Format	Valid range	Note
Start_character	\$	—	—
Address	PSIMSSB,	—	—
Time	hhmmss.ss,	—	2
TP code	B01,	—	3
Status	A,	—	4
Error code	cc_,	—	1
Coordinate system (always radians)	R,	—	—
Orientation (always north oriented)	N,	—	—
SW filter	,	—	1
X coordinate (Latitude)	X.X,	—	—
Y coordinate (Longitude)	X.X,	—	—
Depth (Sonar depth in m)	X.X,	—	—
Expected accuracy (Pos. quality in m)	X.X,	—	—
Additional info	,	—	1
First add value	,	—	1
Second add value	,	—	1
Checksum	*hh	—	—
Termination	CRLF	—	—

Notes

- 1 Not used by multibeam echo sounders.
- 2 Decoded and used if Clock Synchronisation is set from position datagram.
- 3 Only this transponder type is accepted by the multibeam.
- 4 A = OK, V will give bad positions, but datagram will be accepted for logging.

Simrad 90 Position

Table 6 Simrad 90 datagram

Data Description	Format	Length	Valid range	Note
Start identifier = \$	Always 24h	1	—	—
Talker identifier	aa	2	Capital letters	—
Sentence formatter	Always S90,	4	—	—
Date of position	DDMMYY,	7	010100 to 311299	—
UTC of position as hour, minute, second, hundredth of second	hhmmssss,	9	00000000 to 23595999	—
Latitude in degrees, minutes and decimal minutes	xxxx.xxxx	9	0000.0000 to 9999.9999	A
Hemisphere identifier	a,	2	N or S	A
Longitude in degrees, minutes and decimal minutes, or depth in meters	xxxxx.xxxx	10	00000.0000 to 18000.0000	A
Hemisphere or depth identifier	a,	2	E, W or D	A
Northing or range in meters	xxxxxxxxx.X,	12	000000000.0 to 999999999.9	B
Easting or depth in meters	xxxxxxxx.X,	10	0000000.0 to 9999999.9	B
UTM zone number	xx,	3	01 to 60	—
User defined central meridian longitude or bearing	xxxxx.xxxx	10	00000.0000 to 35999.9999	C
Hemisphere or bearing identifier	a,	2	E, W, or B	C
System descriptor	x,	2	0 to 7	1
Position fix quality indicator	x,	2	0 to 9 and A to F	2
Speed over ground in m/s	xx.x,	5	00.0 to 99.9	3
Course over ground in degrees	xxx.x	5	000.0 to 359.9	3
End of sentence delimiter = ,CRLF	Always 2Ch 0Dh 0Ah	3	—	—

Notes

- 1 The value of system descriptor defines the content of the datagram as follows.
- **0** - The position is longitude latitude in global coordinates given in the fields noted A.
 - **1** - The position is Northing Easting on the Northern hemisphere given in the fields noted B. If the projection is defined to be UTM the UTM zone number or a user definable central meridian longitude may be given in the field noted C.
 - **2** - As for system descriptor equal to 1, but the position is on the Southern Hemisphere.
 - **3** - As for system descriptor equal to 0, but in addition the depth is given in the Easting field noted B.
 - **4** - As for system descriptor equal to 1, but in addition the depth is given in the longitude field noted A.
 - **5** - As for system descriptor equal to 2, but in addition the depth is given in the longitude field noted A.

Note

The EM 12, EM 950 and EM 1000 multibeam echo sounders will only accept values less than 3.

- 2 The position fix quality given in the position output datagram will be derived from the quality indicator (this differs from the original definition of the format) as follows (in m):

Table 7

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0.01	0.02	0.05	0.1	.02.	0.5	1	2	5	10	20	50	100	200	500	1000

- 3 If these fields have valid values they will be copied to equivalent fields in the position output datagram. They may be used in filtering of the positioning during postprocessing. (The original definition of the format had line heading in the course field and its use was to orient real-time displays).

Tide Input

Table 8 Tide input datagrams

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	a	Capital letter	—
Sentence formatter	Always TIDE,	—	—
Date and time of prediction / measurement	YYYYMMDDhhmm,	199601010000 to 999912312359	—
Tide offset in meters and decimal meters	x.x	±327.66	1
Optional checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- 1 A negative number will be assumed to indicate an increase in sea level.

Depth, pressure or height input

This third party telegram definition provides a universal format to hold either depth, pressure or height information.

Table 9 Depth pressure or height input datagrams

Data Description	Format	Valid range	Note
Start identifier = *	Always 24h	—	—
Sentence identifier	ii	00 to 09	1
Talker identifier	ii	00 to 09	—
Depth or height in meters and decimal meters	x.x	—	2
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- 1 A sentence identifier equal to 00 is used for underwater vehicle depth, all other identifiers are customer specific (usually a datum height).
- 2 If input is depth, it will be used in the depth output datagram to offset the transmit transducer depth.

If input is height, which will usually imply a time or position variable datum height, its use will depend on the sentence identifier and will be implemented as required by a specific customer.

Depth is positive downwards. Depths may be scaled and offset adjusted using constants:

$$\text{output\_depth [m]} = \text{scale\_factor} * (\text{input\_depth} - \text{offset})$$

Attitude

Topics

- *Overview* on page 21
- *EM Attitude input format* on page 23
- *Network attitude velocity input format* on page 24
- *Sperry MK-39 Attitude input format* on page 25
- *HDT format* on page 26
- *SKR80 format* on page 26

Overview

Attitude data is generally accepted on one or more serial input port(s) as

- roll, pitch, heave and heading on one port,
- or
- roll, pitch and heave on one port and heading separately on another port.

The data update rate should be commensurate with the expected dynamics of the vessel (typically up to 100 Hz).

The acceptable format for roll, pitch, heave and optionally also heading is a 10 byte long message originally defined in the EM 1000 for use with digital motion sensors. It is supported by the following sensors like:

- Applied Analytics POS/MV
- Photokinetics Octans
- Seatex MRU
- Seatex Seapath
- TSS DMS-05
- Coda Octopus

Heading will be accepted in the NMEA 0183 HDT format or in the format used by the Simrad Robertson SKR80(82) gyrocompass. A current loop to RS-232 converter may then be required. The Lemkuhl LR40(60) Scan Repeater format is also accepted, as it is the same as that of the SKR80 with the exception of an extra status byte. Note that if the attitude sensor is capable of reading the gyrocompass and transfer the heading to the attitude sensor datagram (if it does not measure heading itself), this is preferable to interfacing the gyrocompass directly to the system.

Roll, pitch and heading in the Sperry Marine MK-39 MOD2 Attitude and Heading Reference System format is also accepted. A second motion sensor must then be used to supply heave.

Attitude data may be supplied from more than one sensor. All data may be logged, but only one set as chosen by the operator will be used in real time.

EM 122, EM 302, EM 710, EM 2040 and EM 2040C use frequency modulated (FM) pulses to extend the detection range while maintaining the high resolution. To properly take into account the Doppler-effect when using FM mode, real time 3D velocity input is needed from the motion sensor. The data, on proprietary format, is available via Ethernet from some of the manufacturers. Currently three manufacturers are supported.

See also *Network attitude velocity input format* on page 24.



EM Attitude input format

The EM attitude format is a 10-bytes long message defined as follows

- Byte 1: Sync byte 1 = 00h, or Sensor status = 90h-AFh
- Byte 2: Sync byte 2 = 90h
- Byte 3: Roll LSB
- Byte 4: Roll MSB
- Byte 5: Pitch LSB
- Byte 6: Pitch MSB
- Byte 7: Heave LSB
- Byte 8: Heave MSB
- Byte 9: Heading LSB
- Byte 10: Heading MSB

where LSB = least significant byte, MSB = most significant byte.

All data are in 2's complement binary, with 0.01° resolution for roll, pitch and heading, and 1 cm resolution for heave.

- Roll is positive with port side up with $\pm 179.99^\circ$ valid range
- Pitch is positive with bow up with $\pm 179.99^\circ$ valid range
- Heave is positive up with ± 9.99 m valid range
- Heading is positive clockwise with 0 to 359.99° valid range.

Non-valid data are assumed when a value is outside the valid range.

How roll is assumed to be measured is operator selectable, either with respect to the horizontal plane (the Hippy 120 or TSS convention) or to the plane tilted by the given pitch angle (i.e. as a rotation angle around the pitch tilted forward pointing x-axis). The latter convention (called Tate-Bryant in the POS/MV documentation) is used inside the system in all data displays and in logged data (a transformation is applied if the roll is given with respect to the horizontal).

Note that heave is displayed and logged as positive downwards (the sign is changed) including roll and pitch induced lever arm translation to the system's transmit transducer.

This format has previously been used with the EM 950 and the EM 1000 with the first synchronisation byte always assumed to be zero. The sensor manufacturers have been requested to include sensor status in the format using the first synchronisation byte for this purpose. It is thus assumed that

- 90h in the first byte indicates a valid measurements with full accuracy
- any value from 91h to 99h indicates valid data with reduced accuracy (decreasing accuracy with increasing number)
- any value from 9Ah to 9Fh indicates non-valid data but normal operation (for example configuration or calibration mode)
- and any value from A0h to AFh indicates a sensor error status

Network attitude velocity input format

EM 122, EM 302, EM 710, EM 2040 and EM 2040C use frequency modulated (FM) pulses to extend the detection range and still maintaining the high resolution. To properly take into account the Doppler-effect when using FM mode, real time 3D velocity input is needed from the motion sensor. The data, on proprietary format, is available via Ethernet from some of the manufacturers. Currently the following formats are supported:

- Seatex Binary format 11
- Seatex Binary format 23
- Seatex Binary format 26
- POS-MV GRP 102/103
- Coda Octopus MCOM

For details about the formats, please refer to manufacturer documentation.

The datagram will be logged in the Network Attitude Velocity 110 datagram, and the range corrections applied is documented in the raw range and angle 78 datagram.



Sperry MK-39 Attitude input format

The format is 18 bytes long, and it is organised as 9 words. The most significant byte of a word is transmitted first.

- Word 1 AA55h.
- Word 2 Status and time.
- Word 3 Heading.
- Word 4 Roll.
- Word 5 Pitch.
- Word 6 Heading rate.
- Word 7 Roll rate.
- Word 8 Pitch rate.
- Word 9 Checksum (MSB) and 1's complement of checksum (LSB).

All data are in 2's complement binary. Heading is given within $\pm 180^\circ$, roll and pitch within $\pm 90^\circ$. (Note however that the values $\pm 180^\circ$ and $\pm 90^\circ$ are not permitted, as these are one bit too high.)

Heading is measured with reference to true North, and positive when the bow points eastwards. Roll is per definition a rotation angle (Tate-Bryant) and positive when the starboard side goes up. Pitch is positive when the bow goes down.

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HDT format

Table 10 HDT Format

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	aa	Capital letters	—
Sentence formatter	Always HDT,	—	—
Heading, degrees true	x.x,T	0 to 359.9...	—
Checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

SKR80 format

The SKR80 sends out a stream of data with four bytes for each measurement. There is one byte for each digit

- The first byte for the decimal degree (Example: xxx.X)
- The second for the degree (Example: xxX.x)
- The third for the 10's degree (Example: xXx.x)
- The fourth for the 100's degree (Example: Xxx.x)

The two uppermost bits of a byte are always zero, the next two bits give the digit, 00 for the decimal, 01 for the degree, 10 for the 10's degree, and 11 for the 100's degree. The lowest four bits give the digit value in 4-bit BCD format. As an example a heading of 234.5° will give the four bytes 05h 14h 23h 32h. The LR40 adds a fifth byte at the end for status with the two upper bits of the status byte set to 11 (11000000 for OK, 11001010 for alarm). This status byte is ignored.

Clock datagrams

Topics

- *Clock* on page 27
- *ZDA format* on page 27

Clock

The system clock is used to time stamp all data output. The clock may be set upon start of new survey or power-up on the Processing Unit (recommended source is a NMEA ZDA format datagram). The clock will drift, typically some seconds per day, unless it is synchronised to a 1 PPS (pulse per second) input signal (the clock millisecond counter will be set to zero whenever a pulse is received). A fully correct clock is only necessary if the output data are later to be combined with other time critical data logged or created by other systems, for example an accuracy of up to one minute would be necessary to apply tidal changes. If the timestamp supplied in the position input datagrams is to be used, it is imperative that the system clock is correctly set and that 1 PPS synchronisation is used.

ZDA format

Table 11 ZDA format

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	aa	Capital letters	—
Sentence formatter	Always ZDA,	—	—
UTC	hhmmss.ss,	000000 to 235959.9...	—
Day	xx,	01 to +31	—
Month	xx,	01 to +12	—
Year	xxxx,	0000 to 9999	—
Local zone hours	xx,	-13 to +13	1
Local zone minutes	xx,	00 to +59	1
Optional checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- 1 Local zone time is not used. An offset time may be entered by the operator to get the system clock to show a different time than UTC.

Note

Trimble UTC format is also supported.

Sound speed datagrams

Topics

- *Overview* on page 28
- *Kongsberg Maritime SSP format* on page 29
- *AML Smart Sensor and AML Micro Sensor format* on page 32

Overview

A sound speed profile may be loaded into the Operator Station either on a serial line or on Ethernet. Formats previously used with existing Kongsberg Maritime echo sounders (Kongsberg Maritime ASCII and Binary Sound Velocity Profile input datagrams) will be accepted, but since their resolution in depth is limited to 1 m and the number of entries to 100, a newer format given below without these limitations is recommended. This format is also accepted by the Kongsberg Maritime HIPAP and HPR underwater positioning systems (but not necessarily vice-versa). Note that a complete profile may be pieced together from several datagrams and edited with the Operator Station's Sound Speed Editor.

The new format is completely in ASCII and allows 9998 entries without limitations in resolution. But the echosounder have other limitations, check note 9. In addition to depth and sound speed, it allows input of absorption coefficient, pressure, temperature and salinity or conductivity. The latter parameters may be used to calculate depth, sound speed and absorption coefficient. Use of a depth dependent absorption coefficient allows a more accurate determination of bottom backscatter strength.

Note that this datagram may also be logged as output, retaining information not included in the standard sound speed profile output datagram, such as where and when the profile has been taken.

Kongsberg Maritime SSP format

Table 12 SSP format

Data Description	Format	Length	Valid range	Note
Start identifier = \$	Always 24h	1	—	—
Talker identifier	aa	2	Capital letters	—
Datagram identifier	Always Sxx,	4	S00 to S53	1,2
Data set identifier	xxxxx,	6	00000 to 65535	—
Number of measurements = N	xxxx,	5	0001 to 9999	9
UTC time of data acquisition	hhmmss,	7	000000 to 235959	3
Day of data acquisition	xx,	3	00 to 31	3
Month of data acquisition	xx,	3	00 to 12	3
Year of data acquisition	xxxx,	5	0000 to 9999	3
N entries of the next 5 fields – See note 4				
– Depth in m from water level or Pressure in MPa	x.x,	2 –	0 to 12000.00 0 to 1.0000	4
– Sound velocity in m/s	x.x,	1 –	1400 to 1700.00	—
– Temperature in °C	x.x,	1 –	-5 to 45.00	—
– Salinity in parts per thousand or Conductivity in S/m	x.x,	1 –	0 to 45.00 or 0 to 7.000	—
Absorption coefficient in dB/km	x.x	0 –	0 to 200.00	5
Data set delimiter	CRLF	2	0Dh 0Ah	—
End of repeat cycle				
Latitude in degrees and minutes, plus optional decimal minutes	llll.ll,	Variable 5 –	0000 to 9000.0...	6
Latitude – N/S	a,	2	N or S	6
Longitude in degrees and minutes, plus optional decimal minutes	yyyyyy.yy,	Variable 6 –	00000 to 18000.0...	6
Longitude – E/W	a,	2	E or W	6
Atmospheric pressure in MPa	x.x,	1 –	0 to 1.0000	6
Frequency in Hz	xxxxxxx,	Variable	—	7
User given comments	c–c	Variable	—	6
Optional checksum	*hh	—	—	8
End of datagram delimiter = \CRLF	5Ch 0Dh 0Ah	3	—	—

Notes

- 1 The datagram identifier identifies what type of data is included. This is shown in the following table where D is depth, P is pressure, T is temperature, S is salinity, C is conductivity, c is sound speed, α is absorption coefficient, f is frequency and L is latitude. The notation c(T,S) indicates for example that the sound speed is to be calculated from the temperature and salinity input data. When pressure is used, the atmospheric pressure must be given if the pressure is absolute, otherwise the pressure must be given re the sea level and the atmospheric pressure must be zero.

Table 13 SSP format

Identifier	Input data	Data to be used	Comment
S00	D,c	D,c	Same as S10, but used immediately.
S01	D,c,T,S	D,c, α (D,T,S,L)	Same as S12, but used immediately.
S02	D,T,S	D,c(D,T,S,L), α (D,T,S,L)	Same as S22, but used immediately.
S03	D,T,C	D,c(D,T,C,L), α (D,T,S,L)	Same as S32, but used immediately.
S04	P,T,S	D(P,T,S,L),c(P,T,S,L), α (P,T,S,L)	Same as S42, but used immediately.
S05	P,T,C	D(P,T,C,L),c(P,T,C,L), α (P,T,C,L)	Same as S52, but used immediately.
S06	D,c, α	D,c, α	Same as S11, but used immediately.
S10	D,c	D,c	—
S11	D,c, α	D,c, α	—
S12	D,c,T,S	D,c, α (D,T,S,L)	—
S13	D,c, α ,f	D,c, α	Frequency dependent
S20	D,T,S	D,c(D,T,S,L)	—
S21	D,T,S, α	D,c(D,T,S,L), α	—
S22	D,T,S	D,c(D,T,S,L), α (D,T,S,L)	—
S23	D,T,S, α ,f	D,c(D,T,S,L), α	Frequency dependent
S30	D,T,C	D,c(D,T,S,L)	
S31	D,T,C, α	D,c(D,T,S,L), α	
S32	D,T,C	D,c(D,T,S,L), α (D,T,S,L)	
S33	D,T,C, α ,f	D,c(D,T,S,L), α	Frequency dependent
S40	P,T,S	D(P,T,S,L),c(P,T,S,L)	
S41	P,T,S, α	D(P,T,S,L),c(P,T,S,L), α	
S42	P,T,S	D(P,T,S,L),c(P,T,S,L), α (P,T,S,L)	
S43	P,T,S, α ,f	D(P,T,S,L),c(P,T,S,L), α	Frequency dependent
S50	P,T,C	D(P,T,C,L),c(P,T,C,L)	
S51	P,T,C, α	D(P,T,C,L),c(P,T,C,L), α	
S52	P,T,C	D(P,T,C,L),c(P,T,C,L), α (P,T,C,L)	
S53	P,T,C, α ,f	D(P,T,C,L),c(P,T,C,L), α	Frequency dependent

- 2 S00 – S06 is a special case because the sound speed profile will be taken into use immediately without further operator intervention. The checksum is then mandatory and must be correct.

Furthermore an entry for zero depth must be present and the profile must be extended to 12000m.

- 3 Note that these fields have fixed length and leading zeros must be used.
- 4 The depth or pressure field is always required while the other fields are optional except for those required by the datagram identifier. The field-delimiting commas must always be included even if the fields are empty.

- 5 Same date and time for all frequencies.
- 6 The positions, atmospheric pressure and comment fields are optional. Note that the option field must not include a \. It is recommended to include sensor type in the comment field.
- 7 The field is only present/valid for S13, S23, S33, S43, S53. These datagrams contain absorption coefficients directly and are only valid for the given frequency. If an echo sounder employs several frequencies (e.g. EM 710 uses frequencies between 60 and 100 kHz) a datagram must be sent for each frequency used with a maximum of 10 seconds between each datagram.
- 8 The checksum field is calculated between the \$ and the * delimiters by exclusive OR'ing of all bytes. The checksum is required for datagram S00, but is optional for the others.
- 9 There is a limitation on the size of the sound velocity profile. The file used by the PU must be maximum 30 kB and limited to a maximum number of depth points. Maximum 1000 points for EM 2040, EM 710, EM 302 and EM 122. Maximum 570 points for older sounders. The profile can be edited and decimated in the SIS SVP editor.

SIS will give a warning and reject the input profile if too many measurements.



AML Smart Sensor and AML Micro Sensor format

An AML Smart Sensor or AML Micro may be used directly for sound speed profile input on a serial line to the Operator Station. The sensor may also be used to measure the sound speed at the transducer depth continuously during surveying.

For the AML Micro Sensors, the fields have been swapped so the sound speed is always the first field.

The supported AML Smart Sensor message formats are:

- SV = Sound Velocity
- SV&P = Sound Velocity and Pressure
- SV&T = Sound Velocity and Temperature

Each message from the sensor is transmitted as a sequence of ASCII characters terminated by a CRLF pair.

The accepted message formats are as follows:

Table 14 SV Format

±	x	x	x	x	.	x		CR	LF

where xxxx.x is the measured sound speed in m/s.

Table 15 SV&P Format

±	x	x	x	.	x	x		±	x	x	x	x	.	x		CR	LF

where the first field is the pressure in decibars relative to the surface and the second is sound speed in m/s.

Table 16 SV&T Format

±	x	x	.	x	x	x		±	x	x	x	x	.	x		CR	LF

where the first field is the temperature in degrees Celsius and the second is sound speed in m/s.

Note

The message formats above are presented in table format to make it easier to see the location and number of spaces in each message.

Note

The '±' character should be interpreted as follows. If the number in the field immediately following this character is negative, then this character will be "-" (minus). However, if the number in the field immediately following this character is positive, then this character will be a " " (space).

Depth input datagrams from single beam echo sounder

Topics

- *DBS Format* on page 33
- *DPT Format* on page 33
- *Simrad format* on page 34

Depth datagrams from a single beam echo sounder are accepted for display and logging on the system. The following formats are supported

- NMEA 0183 DBS
- NMEA 0183 DPT
- Binary datagrams from the Kongsberg Maritime EA echo sounder series, referred to as the Simrad format.

DBS Format

Table 17 *DBS Format*

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	aa	Capital letters	—
Sentence formatter	Always DBS,	—	—
Depth in feet	x.x,f,	0.1 –	1
Depth in meters	x.x,M,	0.1 –	1
Depth in fathoms	x.x,F	0.1 –	1
Checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- 1 The decoding priority will be meter field, feet field and fathom field with the depth value extracted from the first field with valid data.

DPT Format

Table 18 *DPT Format*

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	aa	Capital letters	—
Sentence formatter	Always DPT,	—	—
Depth in meters from the transducer	x.x,	0.1 –	—
Offset of transducer from waterline in meters	x.x,	0 –	1

Table 18 DPT Format (cont'd.)

Data Description	Format	Valid range	Note
Maximum range scale in use	X.X,	—	—
Checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- 1 A negative value implying that the offset is from the keel should not be used.

Simrad format*Table 19 Simrad format*

Data Description	Format	Valid range	Note
Start identifier = D	Always 34h	—	—
Channel identifier	x,	1 to 311	1
Time as HHMMSShh	xxxxxxx,	00000000 to 23595999	1
Depth in meters from the transducer	32 bit IEEE 754 floating point	0.1 –	1
Bottom backscattering strength in dB	32 bit IEEE 754 floating point	—	—
Transducer number	32 bit integer	—	—
Athwartship slope in degrees	32 bit IEEE 754 floating point	—	—

Notes

- 1 Only the channel identifier, depth and time will be decoded by the system. The least significant byte is transmitted first (the Intel convention).

Note

The datagram must be sent on Ethernet to Processing Unit UDP2. For UDP port address, see PU information and status on page 104

Remote control datagrams

A Remote Control datagram has been implemented to allow

- the multibeam echo sounder to start logging on remote command.
- the multibeam echo sounder to send out parameter and sound speed profile datagrams, “IUR”, consisting of Installation parameters (I), sound speed profile datagram (U) and Runtime datagram (R), as a response to the remote command.
- the survey line numbers to be set from a remote location.

Note that the parameter and sound speed profile datagrams are always sent out when logging is started or any changes are made to the parameters or sound speed. They may also be sent out regularly at operator specified intervals.

In addition to the primary application of the Remote Control datagrams as described above, they are also used to report the SIS pinging and logging status to external recipients. For more information on this, see “notification of SIS pinging and logging activity” in the SIS Operator Manual (doc.no: 850-164709).

Table 20 Remote Control datagrams

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	aa	Capital letters	—
Datagram identifier	Rxx,	R00 to R20	1
EM model number	EMX=dddd,	—	—
Responsible operator	ROP=a—a,	—	2
Survey identifier	SID=a—a,	—	2
Survey line number	PLN=d..d,	—	2
Survey line identifier (planned line no)	PLL=d—d,	—	2
Comment	COM=a—a	—	3
Optional checksum	*hh	—	—
End of datagram delimiter = \CRLF	5Ch 0Dh 0Ah	—	—

Notes

- 1 Rxx defines what action the system is to take with respect to pinging and logging of data in addition to changes in the parameters. Note that logging of survey data on local storage is not affected, this is determined by operator control from the menu only.
 - R00 - System to stop pinging (and logging if on)
 - R10 - System to stop all logging (but continue or start pinging).
 - R11 - System to start logging locally and send a start sequence “IUR” consisting of an installation parameter datagram (I), sound speed profile datagram (U) and a runtime datagram (R).
 - R12 - System to start logging locally. “IUR” will be sent.
 - R13 - System to start logging on new line to local storage only.

- R20 - System to send “IUR”.
 - The current version of SIS does not support R11 and R13. On SIS, the effect of R00, R10 and R12 datagrams is exactly the same as if the operator has used the pinging and logging buttons.
- 2 The current version of SIS has no support for ROP, SID and PLN. PLL is used for R12 to indicate line number to be logged.
 - 3 Only used for “External notification of SIS pinging and logging activity”, see SIS Operator Manual.



Sound speed at transducer

In addition to receiving sound speed at transducer from sound velocity probe/sensor attached to the SIS HWS through a serial line, it is also possible to send this information through the Ethernet.

Note

The datagram format and port address etc. is also explained in the “External sensors” chapter in the SIS Reference Manual.

KSSIS 80 Datagram

Sound velocity and temperature sent over LAN (UDP) to SIS HWS

Table 21 KSSIS 80 input datagram

Data Description	Format	Valid Range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	Always KS	—	—
Sentence formatter	Always SIS,	—	—
Datagram ID	Always 80,	—	—
Sound speed (m/s)	x.x,	1400.0 – 1700.0	—
Temperature (Celsius)	x.x	—	—
End if sentence delimiter = CRLF	Always 0Dh 0Ah	—	—
End if sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Output datagrams

Topics

- *Introduction* on page 38
- *Multibeam data* on page 40
- *External sensors* on page 66
- *Sound speed* on page 77
- *Multibeam parameters* on page 80
- *PU information and status* on page 104
- *SIS generated output* on page 112

Introduction

Output datagrams are usually logged to disk on the EM Series Operator Station. The output datagrams may also be exported to user provided programs on the Operator Station or on an external Ethernet network using UDP protocol (remote logging). An NMEA DPT depth datagram may be exported on a serial line.

The output datagrams are mostly in binary format using signed or unsigned integer numbers with lengths of 1, 2 or 4 bytes.

Note

Please be aware that the following echo sounders: EM 3002, EM 710, EM 302, EM 122, EM 2040, EM 2040C and ME70BO use little endian byte order.

Note

We recommend that software written to decode EM Series data includes a check for the byte ordering with a provision for byte swapping. Suitable data fields to check on are the length field at the start of the datagram, the EM Series model number field and possibly the date and time fields.

The basic output datagram structure established with the EM 100 echo sounder is retained.

- All datagrams (except the NMEA DPT datagram) start with STX, datagram type and time tag, and end with ETX and checksum (sum of bytes between STX and ETX). In addition the total length of the datagram (not including the length field) will precede the STX byte, given as a four byte binary number.
- The length field is only included when logging to tape and/or disk, but not for datagrams logged to a remote location. The length can then be derived from the network software. Systems logging data remotely should add this length at the start of each datagram. This length is required if the data are to be used with Kongsberg Maritime post-processing systems.
- The time stamp resolution is 1 millisecond and includes the century. The time stamp is binary. The date is given as 10000*year(4 digits) + 100*month + day, for example 19950226 for February 26, 1995. All date fields in the output datagrams use this format. A time is usually given (in milliseconds) from midnight.
- The datagrams identify the multibeam echo sounder model and its serial number. The system model number is 120 for the EM 120, 300 for the EM 300, etc. For the EM 3000D (the dual head system) the model number was originally given as 3002 and the serial number is that of Sonar Head number 1. However in the depth datagram model numbers 3003-3008 are now used to also identify the actual transmit and sampling frequencies of the two heads. If only one head is activate on the EM 3000D, it is coded as a single head system. For EM 3002 the model number is 3020. The EM 3002 has separate datagrams (depth, range, seabed image, water column) for the two sonar heads.
- Due care has been taken to include all parameters needed in postprocessing in the relevant datagrams, with a minimum of data duplication. Where resolution of a data field is variable, a resolution descriptor is included.
- Invalid data are always identified by the highest positive number allowed in a field unless otherwise noted.
- A real-time parameter datagram has been added to enable logging of parameters not used in postprocessing, but which may be important in checking the quality of the logged data, or to allow tracing of reasons for possible malfunctions.
- Attitude data as time continuous records and raw ranges and beam pointing angles are logged to allow eventual postprocessing corrections. The logged attitudes are valid at the transmit transducer, and are corrected for any sensor offsets.

Systems with dual swaths (fans of receiver beams with different tilt) will have separate datagrams for each swath.

In the datagrams for EM 122, EM 302, EM 710, ME70 BO, EM 2040 and EM 2040C, both valid and invalid beams are included (The beam index then became redundant information and is therefore removed). This is done to be able to store seabed image data also for beams missing a valid detection.

Multibeam data

Topics

- *Depth datagram* on page 40
- *XYZ 88* on page 43
- *Extra detections* on page 46
- *Central beams echogram* on page 50
- *Raw range and beam angle (F)* on page 52
- *Raw range and beam angle (f)* on page 53
- *Raw range and angle 78* on page 55
- *Seabed image datagram* on page 58
- *Seabed image data 89* on page 60
- *Water column datagram* on page 62

Depth datagram

Note

This datagram is used for EM 2000, EM 3000, EM 3002, EM 1002, EM 300 and EM 120. The XYZ 88 on page 43 is used for EM 122, EM 302, EM 710, ME70 BO, EM 2040 and EM 2040C.

Table 22 Depth datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = D(epth data) (Always 44h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Heading of vessel in 0.01°	2U	0 to 35999	—
Sound speed at transducer in dm/s	2U	14000 to 16000	—
Transmit transducer depth re water level at time of ping in cm	2U	0 to 65536	1
Maximum number of beams possible	1U	48 –	—
Number of valid beams = N	1U	1 to 254	—
z resolution in cm	1U	1 to 254	—
x and y resolution in cm	1U	1 to 254	—

Table 22 Depth datagram (cont'd.)

Data Description	Format	Valid range	Note
Sampling rate (f) in Hz	2U	300 to 30000	3
or Depth difference between sonar heads in the EM 3000D	2S	-32768 to 32766	4
Repeat cycle — N entries of :	16*N	—	—
Depth (z) from transmit transducer (unsigned for EM 120 and EM 300)	2S or 2U	-32768 to +32766 or 1 to 65534	2
Acrosstrack distance (y)	2S	-32768 to 32766	2
Alongtrack distance (x)	2S	-32768 to 32766	2
Beam depression angle in 0.01°	2S	-11000 to 11000	3
Beam azimuth angle in 0.01°	2U	0 to 56999	3
Range (one - way travel time)	2U	0 to 65534	3
Quality factor	1U	0 to 254	5
Length of detection window (samples/4)	1U	1 to 254	—
Reflectivity (BS) in 0.5 dB resolution (Example: -20 dB = 216)	1S	-128 to +126	—
Beam number	1U	1 to 254	6
End of repeat cycle			
Transducer depth offset multiplier	1S	-1 to +17	1
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 The transmit transducer depth plus the depth offset multiplier times 65536 cm should be added to the beam depths to derive the depths re the water line. The depth offset multiplier will usually be zero, except when the EM 2000/3000 Sonar Head is on an underwater vehicle at a depth larger than 655.36 m. Note that the offset multiplier will be negative (-1) if the actual heave is large enough to bring the transmit transducer above the water line. This may represent a valid situation, but may also be due to an erroneously set installation depth of either the transducer or the water line.
- 2 The beam data are given re the transmit transducer or sonar head depth and the horizontal location of the active positioning system's antenna. Heave, roll, pitch, sound speed at the transducer depth and ray bending through the water column have been applied. On the EM 1002/2000/3000/3002 the beam depths must be regarded as signed values to take into account beams which may be going upwards. On the EM 120/300 the beam depths are always positive and the values are therefore unsigned.
- 3 The range, beam depression angle (positive downwards and 90° for a vertical beam) and beam azimuth angle (re vessel centerline) are given relative to the transducer (sonar head) at the ping transmit time. Heave, roll, pitch and sound speed at the transducer depth have been applied, but not ray bending. These values may thus be directly used for a new ray bending calculation with a revised sound speed profile to generate new sounding depths and positions without any need for using attitude data.

One way travel time = range / sampling rate / 4

Note that if the data need to be reprocessed with a new sound speed at the transducer depth or new roll, pitch or heave values, full reprocessing starting with the raw range and beam angle data is required. Attitude data is also required in this reprocessing, and both these data types will in the future be logged as standard.

If the beam azimuth angle has a value larger than 35999, the beam pointing angle has replaced the beam depression angle, and the raw two-way travel time has replaced the one-way heave and beam angle corrected travel time. The transmit tilt angle plus 54000 is given in the beam azimuth angle field. The use of this data definition is available on remote output to a port named as “RawDepth...” for use by other systems which do their own attitude and sound speed processing.

- 4 In an EM 3000D the transmit transducer depth is that of Sonar Head number 1, taking into account the depth offset multiplier as described in note 1. The range multiplier is replaced by the difference in depth between Sonar Head number 1 and 2, i.e. head 2 depth is equal to head 1 depth (possibly modified with depth offset multiplier) plus the depth difference. The range sampling rates in Hz of the two heads is given through the EM model number according to the following table:

Table 23 EM 3000D

EM model number	3003	3004	3005	3006	3007	3008
Sonar Head 1	13956	14293	13956	14621	14293	14621
Sonar Head 2	14621	14621	14293	14293	13956	13956

Previously the model number of the EM 3000D was given as 3002 with head sample rates of 13956 and 14621 Hz respectively. The head depths in this case should be assumed to be equal, and although the mathematical derivation of final beam depths would otherwise be the same as described above, the transmit transducer depth was not actually exactly that of the sonar heads.

- 5 The quality number's upper bit signifies whether amplitude (0) or phase (1) detection has been used. If amplitude the 7 lowest bits give the number of samples used in the centre of gravity calculation. If phase the second highest bit signifies whether a second (0) or first (1) order curve fit has been applied to determine the zero phase range, and the 6 lowest bits indicates the quality of the fit (actually the normalized variance of the fit re the maximum allowed, i.e. with a lower number the better the fit).
- 6 Beam 128 is the first beam on the second sonar head in an EM 3000D dual head system.

XYZ 88

Note

This datagram is used for the models EM 2040, EM 2040C, EM 710, EM 122, EM 302 and ME70BO. All receiver beams are included, check detection info and real time cleaning for beam status (note 4 and 5).

Table 24 XYZ 88

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = X (58h, 88d)	1U	—	—
EM model number (Example: EM 710 = 710)	2U	—	—
Date = year*10000 + month*100 + day (Example: Sep 26, 2005 = 20050926)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Heading of vessel (at TX time) in 0.01°	2U	0 to 35999	—
Sound speed at transducer in dm/s	2U	14000 to 16000	—
Transmit transducer depth in m re water level at time of ping	4F	—	1
Number of beams in datagram = N	2U	1 – 1024	—
Number of valid detections	2U	1 – 1024	—
Sampling frequency in Hz	4F	—	—
Scanning info.	1U	—	7
Spare	3U	—	—
Repeat cycle - N entries of :	20*N	—	—
Depth (z) from transmit transducer in m	4F	—	2
Acrosstrack distance (y) in m	4F	—	2
Alongtrack distance (x) in m	4F	—	2
Detection window length in samples	2U	—	—
Quality factor	1U	0 – 254	3
Beam incidence angle adjustment (IBA) in 0.1 deg	1S	-128 to 126	6
Detection information	1U	—	4
Real time cleaning information	1S	—	5
Reflectivity (BS) in 0.1 dB resolution (Example: -20.1 dB = FF37h= 65335)	2S	—	4
End of repeat cycle			
Spare (always 0)	1U	0	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 The transmit transducer depth should be added to the beam depths to derive the depths re the water line. Note that the transducer depth will be negative if the actual heave is large enough to bring the transmit transducer above the water line. This may represent a valid situation, but may also be due to an erroneously set installation depth of either the transducer or the water line.
- 2 The beam data are given re the transmit transducer or sonar head depth and the horizontal location (x,y) of the active positioning system's reference point. Heave, roll, pitch, sound speed at the transducer depth and ray bending through the water column have been applied.
- 3 Scaled standard deviation (sd) of the range detection divided by the detected range (dr):
Quality factor = $250 * sd / dr$.
- 4 This datagram may contain data for beams with and without a valid detection:
 - A) If the most significant bit (bit7) is zero, this beam has a valid detection. Bit 0–3 is used to specify how the range for this beam is calculated.
 0= Amplitude detect (0xxx 0000)
 1= Phase detect (0xxx 0001)
 2-15= Future use
 - B) If the most significant bit (bit7) is 1, this beam has an invalid detection. Bit 0–3 is used to specify how the range (and x,y,z parameters) for this beam is calculated
 0= Normal detection (1xxx 0000)
 1= Interpolated or extrapolated from neighbour detections (1xxx 0001)
 2= Estimated (1xxx 0010)
 3= Rejected candidate (1xxx 0011)
 4= No detection data is available for this beam (all parameters are set to zero) (1xxx 0100)
 5-15= Future use

The invalid range has been used to fill in amplitude samples in the seabed image datagram.

Bit 4 Reflectivity (used in Beam intensity display) correction for Lamberts law and for normal incidence:

 - 0= not compensated (xxx0 xxxx) (to show beam incidence angle dependency)
 - 1= compensated (xxx1 xxxx) (uses same correction as for seabed image data)
- 5 A real time data cleaning module may flag out beams.
Negative values indicates that this beam is flagged out, and is not to be used.
- 6 Due to raybending, the beam incidence angle at the bottom hit will usually differ from the beam launch angle at the transducer and also from the angle given by a straight line between the transducer and the bottom hit. The difference from the latter is given by the beam incidence angle adjustment (IBA). The beam incidence angle re the horizontal, corrected for the ray bending, can be calculated as follows:

$BAC = \text{atan}(z / \text{abs}(y)) + IBA.$

BAC is positive downwards and IBA will be positive when the beam is bending towards the bottom. This parameter can be helpful for correcting seabed imagery data and in seabed classification.

- 7 Only used by EM 2040. See appendix *EM 2040 Scanning mode* on page 121 for details.



Extra detections

Note

This datagram is used for the models EM 2040 and EM 2040C with Slim Processing Unit.

Table 25 Extra detections

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = I (6Ch, 108d)	1U	—	—
EM model number (Example: EM 710 = 710)	2U	—	—
Date = year*10000 + month*100 + day (Example: Sep 26, 2005 = 20050926)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	—	—
Datagram counter	2U	—	—
Datagram version ID	2U	—	—
Swath counter	2U	—	—
Swath index	2U	—	—
Heading in 0.01 degrees	2U	0 to 3599	—
Sound velocity at TX in dm/s	2U	—	—
Depth of reference point in meters	4F	—	—
Water Column sample rate (WCsr)	4F	—	—
Raw amplitude (Seabed Image) sample rate (SlSr)	4F	—	—
RX transducer index	2U	—	—
Number of extra detections (Nd)	2U	0 to —	—
Number of detection classes (Nc)	2U	10	—
Number of byte per class (cycle 1)	2U	—	—
Number of alarm flags	2U	—	7
Number of bytes per detection (cycle 2)	2U	—	—
Repeat cycle 1 – Detection classes (Nc):	16*Nc	1 to 10	—
Start depth (% of depth)	2U	0 to 300	—
Stop depth (% of depth)	2U	1 to 300	—
100 * QF threshold	2U	0.01 to 1	10
BS threshold (dB)	2S	-10 to -60	11
SNR threshold (dB)	2U	5 to 15	12
Alarm threshold (number of extra det. required)	2U	1 to 99, 0 = off	6
Number of extra detections	2U	0 to —	—
Show class	1U	0 to 1	13
Alarm flag 1	1U	0 or 1/16/17	5
End of repeat cycle 1			

Table 25 Extra detections (cont'd.)

Data Description	Format	Valid range	Note
Repeat cycle 2 – Extra detections (Nd):	64*Nd	—	—
Depth (z)	4F	—	—
Across (y)	4F	—	—
Along (x)	4F	—	—
Delta latitude	4F	—	—
Delta longitude	4F	—	—
Beam Pointing angle (deg. re array)	4F	—	—
Applied pointing angle correction	4F	—	—
Two time travel time (seconds)	4F	—	—
Applied two way travel time corrections (seconds, f.ex. Doppler correction)	4F	—	—
BS in 0.1 dB	2S	—	—
Beam incidence angle adjustment (IBA) in 0.1 deg	1S	-128 to 126	9
Detection info	1U	—	8
spare	2U	—	—
TX sector number/TX array index	2U	—	1
Detection window length	2U	—	—
Quality factor (old)	2U	—	—
Real time cleaning info	2U	—	—
Range factor in %	2U	—	—
Detection class number	2U	—	—
Confidence level	2U	—	—
QF * 10 (Ifremer Quality factor)	2U	—	—
Water column beam number	2U	—	—
Beam angle across re vertical (deg)	4F	—	—
Detected range in (WCsr) samples	2U	—	—
Raw amplitude samples (Ns)	2U	—	2
End of repeat cycle 2			
Repeat cycle 3 – Ns entries:	2*Ns +1	—	—
Raw amplitude samples (0.1dB)	2S	—	2,3,4
End of repeat cycle 3			
Spare	1C	—	—
Spare (Always 0)	1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 Same TX beam sector index as used in the range and angle 78 datagram. TX sector dependent info like tilt, frequency, pulse length etc. can be found in this datagram.

- 2 $2 \cdot N_s(i) + 1$ raw amplitude samples are stored, ranging from (detected range $-N_s$) to (detected range $+N_s$). The sample rate is: SIU_{sr} , i = extra detect index number (1- N_d).
- 3 BS is calculated as for Water Column data (TVG applied = $X_{logR} + 2AlpaR + C$, X and C can be found in the Water column datagram).
- 4 Raw amplitude (Seabed Image) sample rate: $SIsr$
- 5 Alarm flag 1
0 – No alarm
1 – Number of extra detections are above Alarm threshold.
- 6 Alarm threshold. This is the number of extra detections required to raise Alarm flag 1. The threshold limit is entered in SIS.
- 7 Number of Alarm flag 1 raised in Repeat cycle 1.
- 8 This datagram may contain data for beams with and without a valid detection:
A) If the most significant bit (bit7) is zero, this beam has a valid detection. Bit 0–3 is used to specify how the range for this beam is calculated.
0= Amplitude detect (0xxx 0000)
1= Phase detect (0xxx 0001)
2-15= Future use
B) If the most significant bit (bit7) is 1, this beam has an invalid detection. Bit 0–3 is used to specify how the range (and x,y,z parameters) for this beam is calculated
0= Normal detection (1xxx 0000)
1= Interpolated or extrapolated from neighbour detections (1xxx 0001)
2= Estimated (1xxx 0010)
3= Rejected candidate (1xxx 0011)
4= No detection data is available for this beam (all parameters are set to zero) (1xxx 0100)
5-15= Future use
The invalid range has been used to fill in amplitude samples in the seabed image datagram.
Bit 4 Reflectivity (used in Beam intensity display) correction for Lamberts law and for normal incidence:
0= not compensated (xxx0 xxxx) (to show beam incidence angle dependency)
1= compensated (xxx1 xxxx) (uses same correction as for seabed image data)
- 9 Due to raybending, the beam incidence angle at the bottom hit will usually differ from the beam launch angle at the transducer and also from the angle given by a straight line between the transducer and the bottom hit. The difference from the latter is given by the beam incidence angle adjustment (IBA). The beam incidence angle re the horizontal, corrected for the ray bending, can be calculated as follows:
$$BAC = \text{atan}(z / \text{abs}(y)) + IBA.$$

BAC is positive downwards and IBA will be positive when the beam is bending towards the bottom. This parameter can be helpful for correcting seabed imagery data and in seabed classification.

- 10 QF threshold: the Ifremer Quality factor is used to estimate the relative depth error. QF threshold equal to 0.1 means a 0.1% depth error threshold. At 100 m depth this the depth error threshold would be 10 cm. Valid range is 0.01 to 1 %.
- 11 BS threshold: the backscatter values for the extra detections are TVG compensated amplitude values, calculated in the same way as beam intensity values. For man made objects the backscatter values may be higher than -40 dB.
- 12 SNR threshold: for extra detections the Signal-to-Noise-Ratio is the amplitude value for the detection relative to the "neighbor" values at this range.
- 13 Show class: The show class value is set by the user to show extra detections in the various display. For SIS this means the Water Column, Geographical and Cross Track display. If the Show Class box is ticked in the extra detections tab, the value will be 1, else 0.

All classes will be stored regardless of the show class parameter. In SIS there are 7 depth classes. There is also class number eight, with the show class parameter always set to 0. This is an extra "rescue" class for extra detections outside user defined thresholds, mainly intended for Kongsberg Maritime use.



Central beams echogram

Note

This datagram is only available for EM 120 and EM 300.

Table 26 Central beams echogram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = K (Always 4Bh)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Mean absorption coefficient in 0.01 dB/km	2U	1 to 20000	1
Pulse length in μ s	2U	50 –	1
Range to normal incidence used in TVG	2U	1 to 16384	1
Start range sample of TVG ramp if not enough dynamic range (0 else)	2U	0 to 16384	—
Stop range sample of TVG ramp if not enough dynamic range (0 else)	2U	0 to 16384	—
Normal incidence BS in dB (BSN) (Example: -20 dB = 236)	1S	-50 to +10	1
Oblique BS in dB (BSO) (Example: -1 dB = 255)	1S	-60 to 0	1
Tx beamwidth in 0.1°	2U	1 to 300	1
TVG law crossover angle in 0.1°	1U	20 to 300	1
Number of included beams (N)	1U	1 –	—
Repeat cycle — N entries of :	6*N	—	
beam index number	1U	0 to 253	2
spare byte to get even length (Always 0)	1U	—	—
number of samples per beam = Ns	2U	1 –	—
start range in samples	2U	1 –	3
End of repeat cycle			
Repeat cycle – ΣNs entries of:	Σ Ns	—	
Sample amplitudes in 0.5 dB (Example: -30 dB = 196)	1S	-128 to +126	—
End identifier = ETX (Always 03h)	1U	—	—
End of repeat cycle			
Spare byte if required to get even length (Always 0 if used)	0–1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 The sample amplitudes are not corrected in accordance with the detection parameters derived for the ping, as is done for the seabed image data.
- 2 The beam index number is the beam number - 1.
- 3 The range for which the first sample amplitude is valid for this beam given as a two-way range. The detection range is given in the raw range and beam angle datagram. Note that data are provided regardless of whether a beam has a valid detection or not.



Raw range and beam angle (F)

Note

Only used for EM 3000

Table 27 Raw range and beam angle datagrams

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = F (Always 46h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Maximum number of beams possible	1U	48 –	—
Number of valid receive beams = N	1U	1 to 254	—
Sound speed at transducer in dm/s	2U	14000 to 16000	—
Repeat cycle – N entries of :	8*N	—	—
– Beam pointing angle in 0.01°	2S	-11000 to 11000	1
– Transmit tilt angle in 0.01°	2U	-2999 to 2999	1
– Range (two-way travel time)	2U	0 to 65534	1
– Reflectivity (BS) in 0.5 dB resolution	1S	-128 to 126	—
– Beam number	1U	1 to 254	—
End of repeat cycle			
Spare (Always 0)	1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	21U	—	—

Notes

- 1 The beam pointing angle is positive to port and the transmit tilt angle is positive forwards for a normally mounted system looking downwards. The range resolution in time is the inverse of the range sampling rate given in the depth datagrams.

Raw range and beam angle (f)

Note

Used for EM 120, EM 300, EM 1002, EM 2000, EM 3000 and EM 3002

Table 28 Raw range and beam angle datagrams

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = f (Always 66h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Number of transmit sectors = Ntx	2U	1 to 20	—
Number of valid receive beams = N	2U	1 to 1999	—
Sampling frequency in 0.01 Hz (F)	4U	100 to 100000 * 100	—
ROV depth in 0.01 m	4S		—
Sound speed at transducer in 0.1 m/s	2U	14000 to 16000	—
Maximum number of beams possible	2U	1 to 1999	—
Spare 1	2U		—
Spare 2	2U		—
Ntx entries of :	20*Ntx	—	—
Tilt angle ref TX array in 0.01°	2S	-2900 to 2900	—
Focus range in 0.1 m (0 = No focus)	2U	0 to 65535	—
Signal length in μ s	4U	—	—
Transmit time offset in μ s	4U	—	—
Center frequency in Hz	4U	—	—
Bandwidth in 10 Hz	2U	1 to 65535	—
Signal waveform identifier	1U	0 to 99	1
Transmit sector number	1U	0 to 99	—
N entries of :	12*N	—	—
Beam pointing angle ref RX array in 0.01°	2S	-11000 to 11000	—
Range in 0.25 samples (R)	2U	0 to 65535	2
Transmit sector number	1U	0 to 19	—
Reflectivity (BS) in 0.5 dB resolution	1S	-128 to 127	—
Quality factor	1U	0 to 254	—
Detection window length in samples (/4 if phase)	1U	1 to 254	—
Beam number	2S	-1999 to 1999	3

Table 28 Raw range and beam angle datagrams (cont'd.)

Data Description	Format	Valid range	Note
Spare	2U	—	—
Spare (Always 0)	1U	0	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	1U	—	—

Notes

- 1 0 = cw, 1 = FM
- 2 Two way travel time = $R / (4 * F / 100)$
- 3 The beam number normally starts at 0.



Raw range and angle 78

Note

Used for EM 122, EM 302, EM 710, ME70 BO, EM 2040 and EM 2040C. All receiver beams are included, check detection info and real time cleaning for beam status (see note 3 and 4).

Table 29 Raw range and beam angle 78 datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = N (4eh, 78d)	1U	—	—
EM model number (Example: EM 710 = 710)	2U	—	—
Date = year*10000 + month*100 + day (Example: Sep 26, 2005 = 20050926)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Sound speed at transducer in 0.1 m/s	2U	14000 to 16000	—
Number of transmit sectors = Ntx	2U	1 –	—
Number of receiver beams in datagram = Nrx	2U	1 –	—
Number of valid detections	2U	1 –	—
Sampling frequency in Hz	4F	—	—
Dscale	4U	—	5
Repeat cycle 1 - Ntx entries of:	24*Ntx	—	—
Tilt angle re TX array in 0.01°	2S	-2900 to 2900	6
Focus range in 0.1 m (0 = No focusing applied)	2U	0 to 65534	—
Signal length in s	4F	—	—
Sector transmit delay re first TX pulse, in s	4F	—	—
Centre frequency in Hz	4F	—	—
Mean absorption coeff. in 0.01 dB/km	2U	—	—
Signal waveform identifier	1U	0 to 99	1
Transmit sector number / TX array index	1U	—	7
Signal bandwidth in Hz	4F	—	—
End of Repeat cycle 1			
Repeat cycle 2 - Nrx entries of:	16*Nrx	—	—
Beam pointing angle re RX array in 0.01°	2S	-11000 to 11000	6
Transmit sector number	1U	—	8
Detection info	1U	—	3
Detection window length in samples	2U	—	—
Quality factor	1U	0 to 254	2

Table 29 Raw range and beam angle 78 datagram (cont'd.)

Data Description	Format	Valid range	Note
D corr	1S	—	5
Two way travel time in s	4F	—	5
Reflectivity (BS) in 0.1 dB resolution	2S	—	3
Real time cleaning info	1S	—	4
Spare	1U	—	—
End of Repeat cycle 2			
Spare (Always 0)	1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 0 = cw, 1 = FM up sweep, 2= FM down sweep.
- 2 Scaled standard deviation (sd) of the range detection divided by the detected range (dr):
Quality factor = 2500*sd/dr.
- 3 This datagram may contain data for beams with and without a valid detection:
 - A) If the most significant bit (bit7) is zero, this beam has a valid detection. Bit 0–3 is used to specify how the range for this beam is calculated.
 - 0= Amplitude detect (0xxx 0000)
 - 1= Phase detect (0xxx 0001)
 - 2-15= Future use
 - B) If the most significant bit (bit7) is 1, this beam has an invalid detection. Bit 0–3 is used to specify how the range (and x,y,z parameters) for this beam is calculated
 - 0= Normal detection (1xxx 0000)
 - 1= Interpolated or extrapolated from neighbour detections (1xxx 0001)
 - 2= Estimated (1xxx 0010)
 - 3= Rejected candidate (1xxx 0011)
 - 4= No detection data is available for this beam (all parameters are set to zero) (1xxx 0100)
 - 5-15= Future use

The invalid range has been used to fill in amplitude samples in the seabed image datagram.

Bit 4 Reflectivity (used in Beam intensity display) correction for Lamberts law and for normal incidence:

 - 0= not compensated (xxx0 xxxx) (to show beam incidence angle dependency)
 - 1= compensated (xxx1 xxxx) (uses same correction as for seabed image data)

- 4 For future use. A real time data cleaning module may flag out beams. Bit 7 will be set to 1 if the beam is flagged out. Bit 0-6 will contain a code telling why the beam is flagged out.
- 5 The Doppler correction applied in FM mode is documented here to allow the uncorrected slant ranges to be recreated if desired. The correction is scaled by a common scaling constant for all beams and then included in the datagram using a signed 8 bit value for each beam. The uncorrected range (two-way travel time) can be reconstructed by subtracting the correction from the range in the datagram:

$$T(\text{uncorrected}) = T(\text{datagram}) - D(\text{corr})/D(\text{scale})$$

- 6 The angles are relative to the transducer array, except for ME70BO, where the angles are relative to the horizontal plane
- 7 Transmit sector number / TX array index parameter in the TX loop.
For EM 2040, this parameter is used to specify which of the three separate TX arrays is used for the actual sector. See appendix *EM 2040 transducer installation offsets* on page 115 for details. For other echo sounders, the parameter is a loop index (0-(Ntx-1)).
- 8 Transmit sector number parameter in the RX loop

This parameter is an index to the TX loop, see note 7. For use in EM 2040, see appendix *EM 2040 transducer installation offsets* on page 115 for details.



Seabed image datagram

Note

This datagram is used for EM 2000, EM 3000, EM 3002, EM 1002, EM 300 and EM 120.

Table 30 Seabed image datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = (Seabed image data) (Always 53h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Mean absorption coefficient in 0.01 dB/km	2U	1 to 20000	1
Pulse length in μ s	2U	50 –	1
Range to normal incidence used to correct sample amplitudes in no. of samples	2U	1 to 16384	—
Start range sample of TVG ramp if not enough dynamic range (0 else)	2U	0 to 16384	—
Stop range sample of TVG ramp if not enough dynamic range (0 else)	2U	0 to 16384	—
Normal incidence BS in dB (BSN) (Example: -20 dB = 236)	1S	-50 to 10	—
Oblique BS in dB (BSO) (Example: -1 dB = 255)	1S	-60 to 0	—
Tx beamwidth in 0.1°	2U	1 to 300	—
TVG law crossover angle in 0.1°	1U	20 to 300	—
Number of valid beams (N)	1U	1 to 254	—
Repeat cycle – N entries of :	6*N	—	
beam index number	1U	0 to 253	2
sorting direction	1S	-1 or 1	3
number of samples per beam = Ns	2U	1 –	—
centre sample number	2U	1 –	4
End of repeat cycle			
Repeat cycle – ΣNs entries of:	Σ Ns	—	—
Sample amplitudes in 0.5 dB (Example: -30 dB = 196)	1S	-128 to 126	—
End of repeat cycle			
Spare byte if required to get even length (Always 0 if used)	0 – 1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 These fields have earlier had other definitions.
- 2 The beam index number is the beam number -1.
- 3 The first sample in a beam has lowest range if 1, highest if -1. Note that the range sampling rate is defined by the sampling rate in the depth output datagram and that the ranges in the seabed image datagram are all two-way from time of transmit to time of receive.
- 4 The centre sample number is the detection point of a beam.



Seabed image data 89

Note

Used for EM 122, EM 302, EM 710, ME70 BO, EM 2040 and EM 2040C.

Table 31 Seabed image data 89 datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = Y (59h, 89d)	1U	—	—
EM model number (Example: EM 710 = 710)	2U	—	—
Date = year*10000 + month*100 + day (Example: Sep 26, 2005 = 20050926)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Sampling frequency in Hz	4F	—	—
Range to normal incidence used to correct sample amplitudes in no. of samples	2U	1 to 16384	—
Normal incidence BS in 0.1 dB (BSN)	2S	—	—
Oblique BS in 0.1 dB (BSO)	2S	—	—
Tx beamwidth along in 0.1°	2U	1 to 300	—
TVG law crossover angle in 0.1°	2U	20 to 300	—
Number of valid beams (N)	2U	1 –	—
Repeat cycle – N entries of :	6*N	—	—
Sorting direction	1S	-1 or 1	1
Detection info	1U	—	2
Number of samples per beam = Ns	2U	1 –	—
Centre sample number	2U	1 –	3
End of repeat cycle			
Repeat cycle – ΣNs entries of:	ΣNs	—	—
Sample amplitudes in 0.1 dB (Example: -30.2 dB = FED2h = 65234d)	2S	—	—
End of repeat cycle			
Spare (Always 0)	1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 The first sample in a beam has lowest range if 1, highest if -1. Note that the ranges in the seabed image datagram are all two-way from time of transmit to time of receive.
- 2 This datagram may contain data for beams with and without a valid detection:

A) If the most significant bit (bit7) is zero, this beam has a valid detection. Bit 0–3 is used to specify how the range for this beam is calculated.

0= Amplitude detect (0xxx 0000)

1= Phase detect (0xxx 0001)

2-15= Future use

B) If the most significant bit (bit7) is 1, this beam has an invalid detection. Bit 0–3 is used to specify how the range (and x,y,z parameters) for this beam is calculated

0= Normal detection (1xxx 0000)

1= Interpolated or extrapolated from neighbour detections (1xxx 0001)

2= Estimated (1xxx 0010)

3= Rejected candidate (1xxx 0011)

4= No detection data is available for this beam (all parameters are set to zero) (1xxx 0100)

5-15= Future use

The invalid range has been used to fill in amplitude samples in the seabed image datagram.

- 3** The centre sample number is the detection point of a beam.



Water column datagram

Note

Used for EM 122, EM 302, EM 710, EM 2040, EM 3002 and ME70BO.

The receiver beams are roll stabilized.

Table 32 Water column datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	48 to 65535	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = k (Always 6Bh)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Number of datagrams	2U	1 to Nd	2
Datagram numbers	2U	1 to Nd	2
Number of transmit sectors = Ntx	2U	1 to 20	—
Total no. of receive beams	2U	1 to Nd	—
Number of beams in this datagram = Nrx	2U	1 to Nd	—
Sound speed in 0.1 m/s (SS)	2U	14000 to 16000	—
Sampling frequency in 0.01 Hz resolution (SF)	4U	1000 to 4000000	1
TX time heave (at transducer) in cm	2S	–1000 to 1000	—
TVG function applied (X)	1U	20 to 40	4
TVG offset in dB (C)	1S	—	4
Scanning info.	1U	—	7
Spare	3U	—	—
Ntx entries of :		—	
Tilt angle re TX array in 0.01°	2S	–1100 to 1100	—
Center frequency in 10 Hz	2U	1000 to 50000	—
Transmit sector number	1U	0 to 19	—
Spare	1U	—	—
Nrx entries of :			
Beam pointing angle ref vertical in 0.01°	2S	–11000 to 11000	—
Start Range sample number	2U	0 to 65534	—
Number of samples (Ns)	2U	0 to 65534	6
Detected range in samples (DR)	2U	0 to 65534	3
Transmit sector number	1U	0 to 19	—
Beam number	1U	0 to 254	5

Table 32 Water column datagram (cont'd.)

Data Description	Format	Valid range	Note
Ns entries of: Sample amplitude in 0.5 dB resolution	1S	-128 to 126	—
Spare byte if required to get even length (always 0 if used)	0 – 1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 The sample rate is normally decimated to be approximately the same as the bandwidth of the transmitted pulse.
- 2 Maximum 64 kB in one datagram. More than 1 datagram may be required to transfer the data. Example: 500 m range * 160 beams * 1 Byte / 0.1 m per sample gives 800 kB. This requires 13 datagrams. A number of complete beams will be transferred in each datagram.

For EM 3002 the maximum number of datagrams Nd is 16 and the maximum number of beams Nb is 254. For EM 122, EM 302, EM 710, ME70BO, EM 2040 and EM 2040C this is increased to allow for up to 32 datagrams and 512 beams.
- 3 $\text{Total Range in meters} = \text{Sound speed} * \text{detected range} / (\text{sample rate} * 2) = \text{SS10} * \text{DR} / (\text{FS100} * 2) = 5 * \text{SS} * \text{DR} / \text{FS}$ (FS100= FS/100, SS10= SS/10). The range is set to zero when the beam has no bottom detection.
- 4 The TVG function applied to the data is $X \log R + 2 \text{ Alpha } R + \text{OFS} + C$. The parameters X and C is documented in this datagram. OFS is gain offset to compensate for TX Source Level, Receiver sensitivity etc.
- 5 The 1U beam number (valid range 0-254) is redundant information and is limited to a maximum of 255 beams. For systems with more than 255 beams this parameter will be set to 255 (invalid).
- 6 From 01.01.2008, this number will always be an even number, due to alignments
- 7 Only used by EM 2040. See appendix *EM 2040 Scanning mode* on page 121 for details.

Quality factor datagram 79

Note

Used for EM 122, EM 302, EM 710, EM 2040, EM 2040C, EM 3002 and ME70BO.

Table 33 Quality factor datagram 79

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	
Start identifier = STX (Always 02h)	1U	–	
Type of datagram = O (4fh, 79d)	1U	–	
EM model number (Example: EM 710 = 710)	2U	–	
Date = year*10000 + month*100 + day (Example: Jan 23, 2012 = 20120123)	4U	–	
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	
Ping counter (sequential counter)	2U	0 to 65535	
System serial number	2U	100 –	
Number of receive beams = Nrx	2U	1 –	
Number of parameters per beam = Npar	1U	1 –	2
Spare	1U	–	
Repeate cycle. Nrx entries of:	4*Nrx*Npar		2
IFREMER quality factor	4F	>=0	1
(More parameters may be added in the future)			
End of repeate cycle.			
Spare (Always 0)	1U	–	
End identifier = ETX (Always 03h)	1U	–	
Check sum of data between STX and ETX	2U	–	

Notes

- The Quality Factor is an estimate of the standard deviation of the detected depth.

$$QF = -\log \left(\frac{\text{Est}(\partial z)}{z} \right)$$

Examples:

QF = 3.0 means an estimated standard deviation of 0.1% of the detected depth.

QF = 2.0 means an estimated standard deviation of 1.0% of the detected depth.

QF = 0 means that the Quality Factor could not be computed.

The Quality Factor is calculated by the echo sounder according to formulas provided by IFREMER.

References:

- a** Lurton X., Augustin J.M., "A Measurement Quality Factor for Swath Bathymetry Sounders", IEEE Journal Of Oceanic Engineering, 35 (4), pp.852-862 (2010)
 - b** Lurton X., Ladroit Y., Augustin J.M., "A Quality Estimator of Acoustic Sounding Detection" The International Hydrographic Review, Nov.2010, vol.4, pp 35-45 (2010)
- 2** Currently, only one parameter is defined, i.e. $N_{par} = 1$. In the future, the datagram format may be expanded with additional parameters. Software decoding the datagram should take into account N_{par} when decoding the datagram. If N_{par} is larger than expected, additional parameters should be ignored. If N_{par} is smaller than expected, some parameters are not available. Note there may be data collected with preliminary echosounder software with N_{par} set to zero, even though there is one parameter per beam (i.e. $N_{par} = 0$ and $N_{par} = 1$ both means 1 parameter per repeat cycle). Each parameter is assumed to be 4 bytes long.



External sensors

Topics

- *Attitude datagram* on page 66
- *Network attitude velocity datagram 110* on page 68
- *Clock* on page 70
- *Depth (pressure) or height datagram* on page 71
- *Heading* on page 72
- *Position* on page 73
- *Single beam echo sounder depth* on page 75
- *Tide datagram* on page 76

Attitude datagram

Table 34 Attitude datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = A(ttitude data) (Always 041h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Attitude counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Number of entries = N	2U	1 –	—
Repeat cycle – N entries of:	12*N	—	—
– Time in milliseconds since record start	2U	0 to 65534	—
– Sensor status	2U	—	1
– Roll in 0.01°	2S	-18000 to 18000	—
– Pitch in 0.01°	2S	-18000 to 18000	—
– Heave in cm	2S	-1000 to 10000	—
– Heading in 0.01°	2U	0 to 35999	—
End of repeat cycle			
Sensor system descriptor	1U	—	2
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 The sensor status will be copied from the input datagram's two sync bytes if the sensor uses the EM format. See the input format description for further details.
- 2 The sensor system descriptor will show which sensor the data is derived from, and which of the sensor's data have been used in real time by bit coding:
 - xx00 xxxx – motion sensor number 1
 - xx01 xxxx – motion sensor number 2
 - xxxx xxx1 – heading from the sensor is active
 - xxxx xx0x – roll from the sensor is active
 - xxxx x0xx – pitch from the sensor is active
 - xxxx 0xxx – heave from the sensor is active



Network attitude velocity datagram 110

Table 35 Network attitude velocity datagram 110

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = n(etwork data) (Always 6Eh, 110d)	1U	—	—
EM model number (Example: EM 710 = 710)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 08, 2007 = 20070208)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Network Attitude counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Number of entries = N	2U	1 –	—
Sensor system descriptor	1S	—	1
Spare	1U	—	—
Repeat cycle – N entries of:	—	—	—
– Time in milliseconds since record start	2U	0 to 65535	—
– Roll in 0.01°	2S	-18000 to 18000	—
– Pitch in 0.01°	2S	-18000 to 18000	—
– Heave in cm	2S	-1000 to 10000	—
– Heading in 0.01°	2U	0 to 35999	—
– Number of bytes in input datagram (Nx)	1U	1 to 254	—
– Network attitude input datagram as received	Nx x 1U	—	2
End of repeat cycle	—	—	—
Spare byte if required to get even length (always 0 if used)	0 – 1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- The sensor system descriptor shows which sensor the data is derived from, and which of the sensor's data have been used in real time by bit coding:
 - 0x10 xxxx – attitude velocity sensor 1 (UDP5)
 - 0x11 xxxx – attitude velocity sensor 2 (UDP6)
 - 01xx xxxx – velocity from the sensor is active
 - 0xxx xxx1 – heading from the sensor is active
 - 0xxx xx0x – roll from the sensor is active
 - 0xxx x0xx – pitch from the sensor is active
 - 0xxx 0xxx – heave from the sensor is active
 - 1111 1111 – (-1) function is not used

2 Complete input datagram. Header is kept for identification:

POS M/V: \$GRP102 or \$GRP103 (ASCII)

CodaOctopus MCOM: E8h

Seapath binary 11: q (ASCII)

Seapath binary 23: AAh 51h

An extra byte is added at the end of the input datagram if needed for alignment.



Clock

Table 36 Clock datagrams

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = C(lock data) (Always 043h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Clock counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Date = year*10000 + month*100 + day (from external clock input) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (from external clock datagram) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
1 PPS use (active or not) (0 = inactive)	1U	—	1
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1** Shows if the system clock is synchronised to an external 1 PPS signal or not.

Depth (pressure) or height datagram

Table 37 Depth (pressure) or height datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = h(eight data) (Always 068h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Height counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 —	—
Height in cm	4S	- 4294967296 to 4294967295	—
Height type	1U	0 to 200	1
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 0:** The height is derived from the GGK or GGA datagram and is the height of the water level at the vertical datum (possibly motion corrected).
Height is derived from the active position system only.
- 1 - 99:** The height type is as given in the Depth (pressure) or height input datagram.
- 100:** The input is depth taken from the OwnShipsData/S90.
- 200:** Input from depth sensor.

Heading

Table 38 Heading datagrams

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = H(heading data) (Always 048h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Heading counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Number of entries = N	2U	1 –	—
Repeat cycle – N entries of:	4*N	—	—
– Time in milliseconds since record start	2U	0 to 65534	—
– Heading in 0.01°	2U	0 to 35999	—
End of repeat cycle			
Heading indicator (active or not) (0 = inactive)	1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Position

Table 39 Position datagrams

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = P(osition data) (Always 050h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Position counter (sequential counter)	2U	0 to 65535	—
System / serial number	2U	100 –	—
Latitude in decimal degrees*20000000 (negative if southern hemisphere) (Example: 32°34' S = -65133333)	4S	—	—
Longitude in decimal degrees*10000000 (negative if western hemisphere) (Example: 110.25° E = 1102500000)	4S	—	—
Measure of position fix quality in cm	2U	—	1
Speed of vessel over ground in cm/s	2U	0 –	1
Course of vessel over ground in 0.01°	2U	0 to 35999	1
Heading of vessel in 0.01°	2U	0 to 35999	—
Position system descriptor	1U	1 to 254	2
Number of bytes in input datagram	1U	– 254	—
Position input datagram as received	Variable	—	3
Spare byte if required to get even length (Always 0 if used)	0 – 1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- These data will be valid only if available as input.
The calculation is done according to the selected position input format.
See *Position* on page 9.
- The position system descriptor shows which source this data is from and its real-time use by bit coding:
 - xxxx xx01 - position system no 1
 - xxxx xx10 – position system no 2
 - xxxx xx11 – position system no 3
 - 10xx xxxx – the position system is active, system time has been used
 - 11xx xxxx - the position system is active, input datagram time has been used

- xxxx 1xxx – the position may have to be derived from the input datagram which is then in SIMRAD 90 format.
- 3 Complete input datagram except header and tail (such as NMEA 0183 \$ and CRLF).



Single beam echo sounder depth

This datagram will contain the profile actually used in the real time raybending calculations to convert range and angle to xyz data. It will usually be issued together with the installation parameter datagram.

Table 40 Single beam echo sounder depth datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = E(cho sounder data) (Always 045h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Echo sounder counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Date = year*10000 + month*100 + day (from input datagram if available) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (from input datagram if available) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Echo sounder depth from waterline in cm	4U	0 to 1200000	—
Source identifier (S, T, 1, 2 or 3)	ASCII		1
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 Identifies the source datagram type, i.e. NMEA DBS, NMEA DPT or EA 500 series channel 1-3 respectively.

Tide datagram

Table 41 Tide datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = T(ide data) (Always 054h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Tide counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 —	—
Date = year*10000 + month*100 + day (from input datagram) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (from input datagram) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Tidal offset in cm	2S	-32768 to 32766	—
Spare (Always 0)	1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Sound speed

Topics

- *Surface sound speed* on page 77
- *Sound speed profile datagram* on page 78
- *Kongsberg Maritime SSP output datagram* on page 79

Surface sound speed

Table 42 *Surface sound speed datagram*

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = G (Always 047h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Sound speed counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Number of entries = N	2U	1 –	—
Repeat cycle – N entries of:	4*N	—	—
– Time in seconds since record start	2U	0 to 65534	—
– Sound speed in dm/s (incl. offset)	2U	14000 to 15999	—
End of repeat cycle			
Spare (Always 0)	1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Sound speed profile datagram

This datagram will contain the profile actually used in the real time raybending calculations to convert range and angle to xyz data. It will usually be issued together with the installation parameter datagram.

Table 43 Sound speed profile datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = U (Always 055h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Profile counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Date = year*10000 + month*100 + day (when profile was made) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in seconds (when profile was made) (Example: 08:12:51 = 29571)	4U	0 to 86399	—
Number of entries = N	2U	1 –	—
Depth resolution in cm	2U	1 to 254	—
Repeat cycle — N entries of:	8*N	—	—
– Depth	4U	0 to 1200000	—
– Sound speed in dm/s	4U	14000 to 17000	—
End of repeat cycle			
Spare byte to get even length (Always 0)	1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Kongsberg Maritime SSP output datagram

This datagram will contain the profile actually used in the real time raybending calculations to convert range and angle to xyz data.

Table 44 Kongsberg Maritime SSP output datagram

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = W (Always 057h)	1U	—	—
EM model number (Example: EM 3000 = 3000)	2U	—	—
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
SSP counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Input datagram starting with Sentence formatter and ending with Comment	Variable	—	—
Spare byte if required to get even length (Always 0 if used)	0 – 1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Multibeam parameters

Topics

- *Installation parameters* on page 80
- *Runtime parameters* on page 89
- *Mechanical transducer tilt* on page 98
- *ExtraParameters datagram* on page 99

Installation parameters

This datagram is an ASCII datagram except for the header which is formatted as in all other output datagrams. The datagram is issued as a start datagram when logging is switched on and as a stop datagram when logging is turned off, i.e. at the start and end of a survey line. It may also be sent to a remote port as an information datagram. It is usually followed by a sound speed profile datagram.

In the datagram all ASCII fields start with a unique three character identifier followed by “=”. This should be used when searching for a specific field as the position of a field within the datagram is not guaranteed. The number or character part following is in a variable format with a minus sign and decimal point if needed, and with “,” as the field delimiter. The format may at any time later be expanded with the addition of new fields at any place in the datagram.

Table 45 *Installation parameters*

Data Description	Example	Format	Valid range	Note
Number of bytes in datagram	—	4U	—	—
Start identifier = STX	Always 02h	1U	—	—
Type of datagram = l or i(installation parameters) or r(remote information)	Start = 049h Stop = 069h Remote info = 70h	1U	—	—
EM model number	EM 3000 = 3000	2U	—	—
Date = year*10000 + month*100 + day	Feb 26, 2009 = 20090226	4U	—	—
Time since midnight in milliseconds	08:12:51.234 = 29570234	4U	0 to 86399999	—
Installation datagram counter	—	2U	0 to 65534	—
System serial number	—	2U	100 –	24
Secondary system serial number	—	2U	100 –	24
Water line vertical location in m	WLZ=x.x,	ASCII	—	—
System main head serial number	SMH=x.x,	ASCII	100 –	1
Hull Unit	HUN=x,	ASCII	0 or 1	—
Hull Unit tilt offset	HUT=x.x,	ASCII	—	—
TX serial number	TXS=x-x,	ASCII	100 –	25
TX no. 2 serial number	T2X=x-x,	ASCII	100 –	25
RX no. 1, serial number	R1S=x-x,	ASCII	100 –	—

Table 45 Installation parameters (cont'd.)

Data Description	Example	Format	Valid range	Note
RX no. 2, serial number	R2S=x-x,	ASCII	100 –	—
System transducer configuration	STC=x,	ASCII	0– 6	26
Transducer 0 vertical location in m	S0Z=x.x,	ASCII		19
Transducer 0 along location in m	S0X=x.x,	ASCII		19
Transducer 0 athwart location in m	S0Y=x.x,	ASCII		19
Transducer 0 heading in degrees	S0H=x.x,	ASCII		19
Transducer 0 roll in degrees re horizontal	S0R=x.x,	ASCII		19
Transducer 0 pitch in degrees	S0P=x.x,	ASCII		19
Transducer 1 vertical location in m	S1Z=x.x,	ASCII	—	19
Transducer 1 along location in m	S1X=x.x,	ASCII	—	19
Transducer 1 athwart location in m	S1Y=x.x,	ASCII	—	19
Transducer 1 heading in degrees	S1H=x.x,	ASCII	—	19
Transducer 1 roll in degrees re horizontal	S1R=x.x,	ASCII	—	19
Transducer 1 pitch in degrees	S1P=x.x,	ASCII	—	19
Transducer 1 no of modules	S1N=x-x,	ASCII	—	19
Transducer 2 vertical location in m	S2Z=x.x,	ASCII	—	19
Transducer 2 along location in m	S2X=x.x,	ASCII	—	19
Transducer 2 athwart location in m	S2Y=x.x,	ASCII	—	19
Transducer 2 heading in degrees	S2H=x.x,	ASCII	—	19
Transducer 2 roll in degrees re horizontal	S2R=x.x,	ASCII	—	19
Transducer 2 pitch in degrees	S2P=x.x,	ASCII	—	19
Transducer 2 no of modules	S2N=x-x,	ASCII	—	19
Transducer 3 vertical location in m	S3Z=x.x,	ASCII	—	19
Transducer 3 along location in m	S3X=x.x,	ASCII	—	19
Transducer 3 athwart location in m	S3Y=x.x,	ASCII	—	19
Transducer 3 heading in degrees	S3H=x.x,	ASCII	—	19
Transducer 3 roll in degrees re horizontal	S3R=x.x,	ASCII	—	19
Transducer 3 pitch in degrees	S3P=x.x,	ASCII	—	19
TX array size (0=0.5°, 1=1°, 2=2°)	S1S=x,	ASCII	—	—
RX array size (1=1°, 2=2°)	S2S=x,	ASCII	—	—
System (sonar head 1) gain offset	GO1=x.x,	ASCII	—	—
Sonar head 2 gain offset	GO2=x.x,	ASCII	—	—
Outer beam offset	OBO=x.x,	ASCII	—	—
High/Low Frequency Gain Difference	FGD=x.x,	ASCII	—	—
Transmitter (sonar head no1) software version	TSV=c-c,	ASCII	—	2
Receiver (sonar head 2) software version	RSV=c-c,	ASCII	—	2
BSP software version	BSV=c-c,	ASCII	—	2
Processing unit software version	PSV=c-c,	ASCII	—	2
DDS software version	DDS=c-c,	ASCII	—	2

Table 45 Installation parameters (cont'd.)

Data Description	Example	Format	Valid range	Note
Operator station software version	OSV=c-c,	ASCII	—	2
Datagram format version	DSV=c-c,	ASCII	—	2
Depth (pressure) sensor along location in m	DSX=x.x,	ASCII	—	—
Depth (pressure) sensor athwart location in m	DSY=x.x,	ASCII	—	—
Depth (pressure) sensor vertical location in m	DSZ=x.x,	ASCII	—	—
Depth (pressure) sensor time delay in millisec	DSD=x-x,	ASCII	—	—
Depth (pressure) sensor offset	DSO=x.x,	ASCII	—	—
Depth (pressure) sensor scale factor	DSF=x.x,	ASCII	—	—
Depth (pressure) sensor heave	DSH=aa,	ASCII	IN or NI	3
Active position system number	APS=x,	ASCII	0 to 2	7
Position system 1, quality check of position, 0=off, 1=on	P1Q=x,	ASCII	0 or 1	27
Position system 1 motion compensation	P1M=x,	ASCII	0 or 1	4
Position system 1 time stamp used	P1T=x,	ASCII	0 or 1	5
Position system 1 vertical location in m	P1Z=x.x,	ASCII	—	—
Position system 1 along location in m	P1X=x.x,	ASCII	—	—
Position system 1 athwart location in m	P1Y=x.x,	ASCII	—	—
Position system 1 time delay in seconds	P1D=x.x,	ASCII	—	—
Position system 1 geodetic datum	P1G=c-c,	ASCII	—	—
Position system 2, quality check of position, 0=off, 1=on	P2Q=x,	ASCII	0 or 1	27
Position system 2 motion compensation	P2M=x,	ASCII	0 or 1	4
Position system 2 time stamp use	P2T=x,	ASCII	0 or 1	5
Position system 2 vertical location in m	P2Z=x.x,	ASCII	—	—
Position system 2 along location in m	P2X=x.x,	ASCII	—	—
Position system 2 athwart location in m	P2Y=x.x,	ASCII	—	—
Position system 2 time delay in seconds	P2D=x.x,	ASCII	—	—
Position system 2 geodetic datum	P2G=c-c,	ASCII	—	—
Position system 3, quality check of position, 0=off, 1=on	P3Q=x,	ASCII	0 or 1	27
Position system 3 motion compensation	P3M=x,	ASCII	0 or 1	4
Position system 3 time stamp use	P3T=x,	ASCII	0 or 1	5
Position system 3 vertical location in m	P3Z=x.x,	ASCII	—	—
Position system 3 along location in m	P3X=x.x,	ASCII	—	—
Position system 3 athwart location in m	P3Y=x.x,	ASCII	—	—
Position system 3 time delay in seconds	P3D=x.x,	ASCII	—	—
Position system 3 geodetic datum	P3G=c-c,	ASCII	—	—
Position system 3 on serial line or Ethernet	P3S= x,	ASCII	0 for Ethernet	—
Motion sensor 1 vertical location in m	MSZ=x.x,	ASCII	—	—

Table 45 Installation parameters (cont'd.)

Data Description	Example	Format	Valid range	Note
Motion sensor 1 along location in m	MSX=x.x,	ASCII	—	
Motion sensor 1 athwart location in m	MSY=x.x,	ASCII	—	
Motion sensor 1 roll reference plane	MRP=aa,	ASCII	HO or RP	
Motion sensor 1 time delay in milliseconds	MSD=x-x,	ASCII	—	
Motion sensor 1 roll offset in degrees	MSR=x.x,	ASCII	—	
Motion sensor 1 pitch offset in degrees	MSP=x.x,	ASCII	—	
Motion sensor 1 heading offset in degrees	MSG=x.x,	ASCII	—	
Motion sensor 2 vertical location in m	NSZ=x.x,	ASCII	—	6
Motion sensor 2 along location in m	NSX=x.x,	ASCII	—	6
Motion sensor 2 athwart location in m	NSY=x.x,	ASCII	—	6
Motion sensor 2 roll reference plane	NRP=aa,	ASCII	HO or RP	6
Motion sensor 2 time delay in milliseconds	NSD=x-x,	ASCII	—	6
Motion sensor 2 roll offset in degrees	NSR=x.x,	ASCII	—	6
Motion sensor 2 pitch offset in degrees	NSP=x.x,	ASCII	—	6
Motion sensor 2 heading offset in degrees	NSG=x.x,	ASCII	—	6
Gyrocompass heading offset in degrees	GCG=x.x,	ASCII	—	—
Roll scaling factor	MAS=x.x,	ASCII	—	—
Transducer depth sound speed source	SHC=x,	ASCII	0 or 1	8
1PPS clock synchronization	PPS=x,	ASCII	0 to 2	20
Clock source	CLS=x,	ASCII	(0), 1 to 3	9
Clock offset in seconds	CLO=x,	ASCII		
Active attitude velocity sensor	VSN =x,	ASCII	0 – 2	10
Attitude velocity sensor 1 UDP port address (UDP5)	VSU =x-x,	ASCII	1024 – 65535	11
Attitude velocity sensor 1 Ethernet port	VSE =x,	ASCII	0 to 2	12
Attitude velocity sensor 2 UDP port address (UDP6)	VTU =x-x,	ASCII	1024 – 65535	11
Attitude velocity sensor 2 Ethernet port	VTE =x,	ASCII	0 to 2	12
Active roll/pitch sensor	ARO =x,	ASCII	2, 3, 8, or 9	22
Active heave sensor	AHE =x,	ASCII	2, 3, 8, or 9	22
Active heading sensor	AHS =x,	ASCII	0 to 9	23
Ethernet 2 address	VSI= xxx.xxx.xxx.xxx,	ASCII	—	13
Ethernet 2 IP network mask	VSM= xxx.xxx.xxx.xxx,	ASCII	—	13
Multicast sensor IP multicast address (Ethernet 2)	MCAn= xxx.xxx.xxx.xxx,	ASCII	—	15
Multicast sensor UDP port number	MCUn=x-x,	ASCII	1024 – 65535	15
Multicast sensor identifier	MCIn=aaaah,	ASCII	See PU Setup command	15
Multicast position system number	MCPn=x,	ASCII	0 – 3	16
Ships noise level	SNL =x,	ASCII	0 to 2	21
Cartographic projection	CPR=aaa,	ASCII	—	—

Table 45 Installation parameters (cont'd.)

Data Description	Example	Format	Valid range	Note
Responsible operator	ROP=c-c,	ASCII	—	—
Survey identifier	SID=c-c,	ASCII	—	—
Raw File Name	RFN=c-c	ASCII	—	17
Survey line identifier (planned line no)	PLL=x-x,	ASCII	—	Not used
Comment	COM=c-c,	ASCII	—	18
Spare byte if required to get even length	Always 0 if used	0-1U	—	—
End identifier = ETX	Always 03h	1U	—	—
Check sum of data between STX and ETX	—	2U	—	—

Notes

- EM 3000D: Serial number of head no 2 if that head is the only one in use, otherwise the serial number of head no 1.
EM 3000: Serial number of the head.
- A version number is given as 3 alphanumerical fields separated by decimal points, plus date as yymmdd (for example 3.02.11 991124).
- IN = the heave of an underwater vehicle is presumed to be measured by the vehicle's depth sensor and the heave sensor input is not used by system.
- 1 = the positions are motion compensated
0 = the positions are not motion compensated
- 0 = the system has used its own time stamp for the valid time of the positions
1 = the system has used the time stamp of the position input datagram (external time).
- If entries for a second motion sensor are not included although two sensors are being used, they are presumed to have the same parameters.
- Position system number -1.
- 0 = Transducer depth sound speed is used as the initial entry the sound speed profile used in the raytracing calculations.
1 = Transducer depth sound speed is NOT used for raytracing calculations.
Note that the source of the sound speed at the transducer depth (and this sound speed is always used to calculate beam pointing angles if required) is logged in the runtime datagram.
- (0 - not set)
1 – ZDA
2 – Active POS
3 – Operator station

- 10** 0 – Attitude velocity sensor not used.
1 – Attitude velocity sensor 1 active.
2 – Attitude velocity sensor 2 active.
(If VSN = 0, the other VSx parameters are not relevant and need not to be sent.)
It is assumed that attitude velocity sensor 1 and motion sensor 1 is the same physical unit and share the installation parameters MSx. It is also assumed that attitude velocity sensor 2 and motion sensor 2 is the same physical unit and share the installation parameters NSx.
- 11** Value depends on sensor type.
- 12** 0 – Not in use
1 – Use the existing Ethernet port used for communication to topside (SIS).
2 – Use Ethernet 2 (if available). Network address and mask are set up by VSI and VSM.
- 13** Ethernet 2 on the transceiver unit is configured with IP address and network mask according to VSI and VSM.
- 14** Not used.
- 15** Sensor input datagrams to be provided on given formats.

Note

Available from SIS version 3.7.

xxxx xxxx xxxx xxxx xxxx xx1x	—	NMEA GGA
xxxx xxxx xxxx xxxx xxx1 xxxx	—	NMEA ZDA
xxxx xxxx 1xxx xxxx xxxx xxxx	—	NMEA GLL
xxxx xxx1 xxxx xxxx xxxx xxxx	—	Own Ship's Data, position
xxxx xx1x xxxx xxxx xxxx xxxx	—	ROV Depth and Sound speed from Own Ship's Data
xxxx x1xx xxxx xxxx xxxx xxxx	—	Sound Velocity (SOUNDVELOCITYPROFILE_DATA)
xxxx 1xxx xxxx xxxx xxxx xxxx	—	Attitude Sagem format

- 16** This number indicates which position system that will arrive via this multicast.
0 – no position will be received from Multi cast, default value.
1 – position system 1
2 – position system 2
3 – position system 3
- 17** The RFN parameter has been reintroduced specifically for customers converting from Merlin to SIS. This parameter contains the name of the raw data file used for normal logging and for watercolumn logging (i.e. the .all and .wcd files). The RFN parameter is included in the Installation Parameters ('I') datagram found at the start of the logged file and in the Stop datagram ('i') datagram found at the end of the logged file. This RFN parameter is also included in the distributed 'I' and 'i' datagrams.

Note

The RFN parameter contains the file name with the extension (.all or.wcd), but not the storage path.

Raw File Name convention:

LineNo_YYYYMMDD_HHMMSS (UTC)_ShipName.all

- 18** The comment field may contain any ASCII characters.
- 19** Transducer 1–3 (S0–S3) will have different function depending on type of echo sounder used:

Echo sounder	S0–Transducer 0	S1–Transducer 1	S2–Transducer 2	S3–Transducer 3
EM 122, EM 302, EM 710	Not used	TX transducer	RX transducer	Not used
EM 2040	Not used	TX transducer	RX transducer	Not used
EM 2040 dual RX	Not used	TX transducer	RX transducer port	RX transducer starboard
EM 2040 dual TX	TX transducer port	TX transducer starboard	RX transducer port	RX transducer starboard
EM 3002/EM 2040C	Not used	Sonar head 1	Sonar head 2	Not used
ME70BO	Transducer	Not used	Not used	Not used

The installation parameters refer to the centre of the transducer faces. For EM 2040, the physical transducer arrays are offset relative to the centre of the transducer faces. Please refer to appendix *EM 2040 transducer installation offsets* on page 115 for details.

For EM 2040C, the physical transducer arrays are offset relative to the centre of the sonar head face. Please refer to appendix *EM 2040C installation offsets* on page 123.

- 20** 1PPS setup:
- 0 – not in use
 - 1 – falling edge detect
 - 2 – rising edge detect
- 21** Ships noise level to be entered under System Parameter in the Installation menu.
- 0 – Normal
 - 1 – High
 - 2 – Very high
- 22** Specifies input port for active sensor.
- 2 – COM2 (motion sensor1)
 - 3 – COM3 (motion sensor2)
 - 8 – UDP5 (attitude velocity sensor 1)
 - 9 – UDP6 (attitude velocity sensor 2)

23 Specifies input port for active heading sensor.

- 0 – UDP2 (position system 3)
- 1 – COM1 (position system 1)
- 2 – COM2 (motion sensor 1)
- 3 – COM3 (motion sensor 2 or position system 2)
- 4 – COM4 (position system 3)
- 5 – Multicast 1
- 6 – Multicast 2
- 7 – Multicast 3
- 8 – UDP5 (attitude velocity sensor 1)
- 9 – UDP6 (attitude velocity sensor 2)

24 For EM 3002 Dual Head, EM 2040 Dual RX and EM 2040C Dual Head: Multibeam datagrams related to Head 1 / RX 1 (port) is labelled with "System serial number". Multibeam datagrams related to Head 2 / RX 2 (starboard) is labelled with "Secondary system serial number".**25** For an EM 2040 dual TX configuration, “TX serial number” is used for serial number for TX1 (port), while “TX no. 2 serial number” is used for TX2 (starboard).**26** System transducer configuration parameter (STC) in the Installation datagram contains system info:

STC	Transducer configuration	Example systems
0	Single TX + single RX	EM 122, EM 302, EM 710, EM 2040 Single
1	Single Head	EM 3002 Single head, EM 2040C Single head
2	Dual Head	EM 3002 Dual head, EM 2040C Dual head
3	Single TX + Dual RX	EM 2040 Dual RX
4	Dual TX + Dual RX	EM 2040 Dual TX
5	Portable single head	EM 2040P Single head
6	Modular	EM 2040M
7	Portable dual head	EM 2040P Dual head

If present, the STC parameter can be used in decoding of the transducer installation parameters.

	S0X/Y/Z/R/P/H	S1X/Y/Z/R/P/H	S2X/Y/Z/R/P/H	S3X/Y/Z/R/P/H
STC=0	–	TX	RX	–
STC=1	–	Head	–	–
STC=2	–	Head 1	Head 2	–
STC=3	–	TX	RX 1	RX 2
STC=4	TX 1	TX 2	RX 1	RX 2
STC=5	–	Head 1	–	–
STC=6	–	Head 1	–	–
STC=7	–	Head 1	Head 2	–

- 27** 0 – The quality check is performed by the operator station. If there is height info in the data, height datagram will be created.
1 – The quality check is performed in the TRU/PU



Runtime parameters

Table 46 Runtime parameters

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = R(untime parameter) (Always 052h)	1U	—	—
EM model number (Example: EM 710 = 710)	2U	—	—
Date = year*10000 + month*100 + day (at start of data record) (Example: june 26, 2009 = 20090626)	4U	—	—
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter	2U	0 to 65535	—
System serial number	2U	100 –	—
Operator Station status	1U	—	1
Processing Unit status (CPU)	1U	—	1
BSP status	1U	—	1
Sonar Head or Transceiver status	1U	—	1
Mode	1U	0 –	2
Filter identifier	1U	0 to 255	3
Minimum depth in m	2U	0 to 10000	—
Maximum depth in m	2U	1 to 12000	—
Absorption coefficient in 0.01 dB/km	2U	1 to 20000	4
Transmit pulse length in μ s	2U	1 to 50000	13
Transmit beamwidth in 0.1 degrees	2U	1 to 300	—
Transmit power re maximum in dB	1S	0 to – 50	—
Receive beamwidth in 0.1 degrees	1U	5 to 80	—
Receive bandwidth in 50 Hz resolution	1U	1 to 255	10
Mode 2 or Receiver fixed gain setting in dB	1U	— 0 to 50	12
TVG law crossover angle in degrees	1U	2 to 30	—
Source of sound speed at transducer	1U	0 to 3	5
Maximum port swath width in m	2U	10 to 30000	8
Beam spacing	1U	0 to 3	6
Maximum port coverage in degrees	1U	10 to 110	8
Yaw and pitch stabilization mode	1U	—	7
Maximum starboard coverage in degrees	1U	10 to 110	8
Maximum starboard swath width in m	2U	10 to 30000	8

Table 46 Runtime parameters (cont'd.)

Data Description	Format	Valid range	Note
Transmit along tilt in 0.1 deg. or Durotong speed in dm/s	2S 2U	-300 to 300 20000 to 25000	9
Filter identifier 2 or HiLo frequency absorption coefficient ratio	1U	0 to 255 0 to 120	11
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- The table below shows the system error status coded by one bit for each detected error. The status bit is set to one if error is detected.

Table 47 Multi beam system status

Operator Station status		
Bit number	Function	Model
xxxx xxxx	For future use	—
Processing Unit status (CPU)		
Bit number	Function	Model
xxxx xxx1	Communication error with BSP (or CBMF)	All models except ME70BO
xxxx xx1x	Communication error with Sonar Head or Transceiver	All models except EM 2040 and ME70BO
	Communication error with slave PU	EM 2040/EM 2040C
	Problem with communication with ME70	ME70BO
xxxx x1xx	Attitude not valid for this ping	All models
xxxx 1xxx	Heading not valid for this ping	All models
xxx1 xxxx	System clock has not been set since power up	All models
xx1x xxxx	External trigger signal not detected	All models except ME70BO
x1xx xxxx	CPU temperature warning	All models except EM 1002
	Hull Unit not responding	EM 1002
1xxx xxxx	Attitude velocity data not valid for this ping	EM 122, EM 302, EM 710, EM 2040, EM 2040C
BSP status EM 2000, EM 3000 and EM 3002		
Bit number	Function	Model
xxxx xxx1	Error on RX data received by BSP 1 (May be a bad high speed link)	EM 2000, EM 3000, EM 3000D, EM 3002, EM 3002D
xxxx xx1x	Too much seabed image data on BSP1	EM 3000, EM 3000D
xxxx x1xx	Invalid command received by BSP1	EM 3000, EM 3000D
xxxx 1xxx	Errors on BSP1	EM 3002, EM 3002D

Table 47 Multi beam system status (cont'd.)

xxx1 xxxx	Error on RX data received by BSP 2 (May be a bad high speed link)	EM 3000D, EM 3002D
xx1x xxxx	Too much seabed image data on BSP2	EM 3000D
x1xx xxxx	Invalid command received by BSP2	EM 3000D
1xxx xxxx	Errors on BSP2	EM 3002, EM 3002D
BSP status EM 1002		
Bit number	Function	Model
xxxx xxx1	Sample number error in RX data received from SPRX	—
BSP status EM 120 and EM 300		
xxxx xxx1	Sample number error in RX data received from SPRX	—
xxxx xx1x	Missing RX header data from SPRX	—
xxxx x1xx	Missing sample data from SPTX	—
xxxx 1xxx	Missing second RX header data from SPTX	—
xxx1 xxxx	Bad sync TRU – PU – BSP	—
xx1x xxxx	Bad parameters received from PU	—
x1xx xxxx	Internal sync problem in BSP	—
1xxx xxxx	Checksum error in header from SPTX	—
BSP status EM 122, EM 302 and EM 710		
Bit number	Function	Model
xxxx xxx1	Error on RX data received by BSP 1	—
xxxx xx1x	Error on RX data received by BSP 3	—
xxxx x1xx	Errors on BSP 3	—
xxxx 1xxx	Errors on BSP 1	—
xxx1 xxxx	Error on RX data received by BSP 2	—
xx1x xxxx	Error on RX data received by BSP 4	—
x1xx xxxx	Errors on BSP 4	—
1xxx xxxx	Errors on BSP2	—
BSP status EM 2040/EM 2040C		
Bit number	Function	Model
xxxx xxx1	Error on data from BSP 1 – master PU	—
xxxx xx1x	Error on data from BSP 2 – master PU	—
xxxx x1xx	Error on data from BSP 3 – master PU	—
xxxx 1xxx	Error on data from BSP 4 – master PU	—
xxx1 xxxx	Error on data from BSP 1 – slave PU	—
xx1x xxxx	Error on data from BSP 2 – slave PU	—
x1xx xxxx	Error on data from BSP 3 – slave PU	—
1xxx xxxx	Error on data from BSP 4 – slave PU	—
CBMF status EM 2040/EM 2040C		
xxxx xxx1	Error on data from CBMF 1 – master PU	
xxxx xx1x	Error on data from CBMF 2 – master PU	
xxxx x1xx	Error on data from CBMF 3 – slave PU	

Table 47 Multi beam system status (cont'd.)

xxxx 1xxx	Error on data from CBMF 4 – slave PU	
Sonar Head status EM 2000, EM 3000 and EM 3002		
Bit number	Function	Model
xxxx xxx1	Temperature to high on Sonar Head 1	EM 2000, EM 3000, EM 3000D, EM 3002, EM 3002D
xxxx xx1x	Data link failure on Sonar Head 1	EM 2000, EM 3000, EM 3000D, EM 3002, EM 3002D
xxxx x1xx	DC Supply Voltages in Sonar Head 1 is out of range	EM 2000, EM 3000, EM 3000D, EM 3002, EM 3002D
xxxx 1xxx	Spare	—
xxx1 xxxx	Temperature to high on Sonar Head 2	EM 3000D, EM 3002D
xx1x xxxx	Data link failure on Sonar Head 2	EM 3000D, EM 3002D
x1xx xxxx	DC Supply Voltages in Sonar Head 2 is out of range	EM 3000D, EM 3002D
1xxx xxxx	Spare	—
Transceiver status EM 120 and EM 300		
Bit number	Function	Model
xxxx xxx1	Transmit voltage (HV) out of range	—
xxxx xx1x	Low voltage power out of range	—
xxxx x1xx	Timeout error (SPRX waits for SPTX)	—
xxxx 1xxx	Receive channel DC offset(s) out of range	—
xxx1 xxxx	Illegal parameter received from PU	—
xx1x xxxx	Internal communication error (SPTX – SPRX sync)	—
x1xx xxxx	Timeout error (SPTX waits for SPRX)	—
1xxx xxxx	Defective fuse(s) in transmitter	—
Transceiver status EM 122, EM 302 and EM 710		
Bit number	Function	Model
xxxx xxx1	Transmit voltage (HV) out of range	—
xxxx xx1x	Low voltage power out of range	—
xxxx x1xx	Error on Transmitter	—
xxxx 1xxx	Error on Receiver	—
xxx1 xxxx	Not implemented	—
xx1x xxxx	Not implemented	—
x1xx xxxx	Not implemented	—
1xxx xxxx	Not implemented	—
Transceiver status EM 1002		
Bit number	Function	Model
xxxx xxx1	Transmit voltage (HV) out of range	—
xxxx xx1x	Low voltage power out of range	—

Table 47 Multi beam system status (cont'd.)

xxxx x1xx	Transmit voltage (HV) to high	—
xxxx 1xxx	Error in command from PU (Illegal parameter)	—
xxx1 xxxx	Error in command from PU (Bad checksum)	—
xx1x xxxx	Error in command from PU (Bad datagram length)	—
Transceiver status EM 2040		
Bit number	Function	Model
xxxx xxx1	Transmit power (HV) out of range	—
xxxx xx1x	Communication error with TX	—
xxxx x1xx	Communication error with RX 1 (port)	—
xxxx 1xxx	Communication error with RX 2 (starboard)	—
xxx1 xxxx	Communication error with IO2040 – master PU	—
xx1x xxxx	Communication error with IO2040 – slave PU	—
x1xx xxxx	Spare	—
1xxx xxxx	Spare	—
Sonar Head status EM 2040C		
Bit number	Function	Model
xxxx xxx1	Transmit power (HV) out of range SH1	—
xxxx xx1x	Communication error with TX SH1	—
xxxx x1xx	Communication error with RX SH1	—
xxxx 1xxx	Temperature to high SH1	—
xxx1 xxxx	Transmit power (HV) out of range SH2	—
xx1x xxxx	Communication error with TX SH2	—
x1xx xxxx	Communication error with RX SH2	—
1xxx xxxx	Temperature to high SH2	—

2 Mode

Ping mode (EM 3000)

- xxxx 0000 - Nearfield (4°)
- xxxx 0001 - Normal (1.5°)
- xxxx 0010 - Target detect

Ping mode (EM 3002)

- xxxx 0000 - Wide Tx beamwidth (4°)
- xxxx 0001 - Normal Tx beamwidth (1.5°)

Ping mode (EM 2000, EM 710, EM 1002, EM 300, EM 302, EM 120 and EM 122)

- xxxx 0000 - Very Shallow
- xxxx 0001 - Shallow
- xxxx 0010 - Medium
- xxxx 0011 - Deep
- xxxx 0100 - Very deep

- xxxx 0101 - Extra deep

Ping mode (EM 2040)

- xxxx 0000 - 200 kHz
- xxxx 0001 - 300 kHz
- xxxx 0010 - 400 kHz

TX pulse form (EM 2040, EM 710, EM 302 and EM 122)

- xx00 xxxx - CW
- xx01 xxxx - Mixed
- xx10 xxxx - FM

Frequency (EM 2040C)

Frequency = 180 kHz + 10 kHz * parameter

Examples:

- xxx0 0000 - 180 kHz
- xxx0 0001 - 190 kHz
- xxx1 0110 - 400 kHz

TX pulse form (EM 2040C)

- xx0x xxxx - CW
- xx1x xxxx - FM

Dual Swath mode (EM 2040, EM 710, EM 302 and EM 122)

- 00xx xxxx - Dual swath = Off
- 01xx xxxx - Dual swath = Fixed
- 10xx xxxx - Dual swath = Dynamic

3 *The filter identifier byte is used as follows:*

- xxxx xx00 - Spike filter set to Off
- xxxx xx01 - Spike filter is set to Weak
- xxxx xx10 - Spike filter is set to Medium
- xxxx xx11 - Spike filter is set to Strong
- xxxx x1xx - Slope filter is on
- xxxx 1xxx - Sector tracking or Robust Bottom Detection (EM 3000) is on
- 0xx0 xxxx - Range gates have Normal size
- 0xx1 xxxx - Range gates are Large
- 1xx0 xxxx - Range gates are Small
- xx1x xxxx - Aeration filter is on
- x1xx xxxx - Interference filter is on

4 The used absorption coefficient should be derived from raw range and angle 78 datagram or, for older systems, from the seabed image or central beams echogram datagram if it is automatically updated with changing depth or frequency.

This absorption coefficient in this datagram is valid at the following frequency

- EM 120/EM 122: 12 kHz
- EM 300/EM 302: 31.5 kHz
- EM 710: 85 kHz
- ME70BO: 85 kHz
- EM 1002: 95 kHz
- EM 2000: 200 kHz
- EM 3000/EM 3002: 300 kHz
- EM 2040/EM 2040C: 300 kHz

5 *The sound speed (at the transducer depth) source identifier is used as follows :*

- 0000 0000 - From real time sensor
- 0000 0001 - Manually entered by operator
- 0000 0010 - Interpolated from currently used sound speed profile
- 0000 0011 - Calculated by ME70BO TRU
- xxx1 xxxx - Extra detections enabled
- xx1x xxxx - Sonar mode enabled
- x1xx xxxx - Passive mode enabled
- 1xxx xxxx – 3D scanning enabled

6 *The beamspacing identifier is used as follows:*

- 0000 0000 - Determined by beamwidth (FFT beamformer of EM 3000)
- 0000 0001 - Equidistant (Inbetween for EM 122 and EM 302)
- 0000 0010 - Equiangle
- 0000 0011 - High density equidistant (In between for EM 2000, EM 120, EM 300, EM 1002)

EM 3002:

	bit 7	bit 6 – 4; head 2	bit 3 – 0; head 1
Only one sonar head is connected. If two heads are connected, both have the same beam spacing.	0	0 = always (no head 2)	1 = equidistant 2 = equiangle 3 = high density
Two sonar heads are connected. Individual beam spacing is possible.	1	1 = equidistant 2 = equiangle 3 = high density	1 = equidistant 2 = equiangle 3 = high density

7 *The yaw and pitch stabilization identifier is set as follows:*

- xxxx xx00 - No yaw stabilization
- xxxx xx01 - Yaw stabilization to survey line heading (Not used)
- xxxx xx10 - Yaw stabilization to mean vessel heading

- xxxx xx11 - Yaw stabilization to manually entered heading
 - xxxx 00xx - Heading filter, hard
 - xxxx 01xx - Heading filter, medium
 - xxxx 10xx - Heading filter, weak
 - 1xxx xxxx - Pitch stabilization is on.
- 8** Port swath width and coverage was in earlier versions the sum of port and starboard
- 9** *EM 3002, EM 2040, EM 3000, EM 710, EM 302, and EM 122:*
 Transmit along tilt value, used to offset the along-ship tilting of transmit fan (called “Along Direction” in SIS and can be set from the Runtime parameters – Sounder Main menu).
EM 1002:
 Sound speed in Durotong (SSD) for the EM 1002 transducer. This value (set to zero if not available) depends on the water temperature. SSD can be used to calculate the water temperature in degree C:
 • $\text{Temp} = -0.013913 * \text{SSD} + 313.565$
- 10** Receiver bandwidth values 1 to 254 for receiver bandwidth 50 Hz to 12.7 kHz. A value of 255 indicates bandwidth larger than 12.7 kHz.
- 11** *Filter identifier 2 or HiLo frequency absorption coeff:*
Penetration filter (EM 2040, EM 710, EM 302 and EM 122)
- xxxx xx00 - Penetration filter = Off
 - xxxx xx01 - Penetration filter = Weak
 - xxxx xx10 - Penetration filter = Medium
 - xxxx xx11 - Penetration filter = Strong
- Detect mode (EM 3002 and EM 2040)*
- xxxx 00xx - Detect mode: Normal
 - xxxx 01xx - Detect mode: Waterway
 - xxxx 10xx - Detect mode: Tracking
 - xxxx 11xx - Detected mode: Minimum depth
- Phase ramp (EM 2040, EM 3002, EM 710, EM 302 and EM 122)*
- xx00 xxxx - Short phase ramp
 - xx01 xxxx - Normal phase ramp
 - xx10 xxxx - Long phase ramp
- Special TVG (EM 3002 and EM 2040)*
- x0xx xxxx - Normal TVG
 - x1xx xxxx - Special TVG
- Special amp detect / soft sediments*
- 0xxx xxxx - Normal amp detect
 - 1xxx xxxx - Special amp detect or soft sediments (EM 3002)

HiLo frequency absorption coefficient ratio (EM 1002)

0 – 120

12 *Mode 2 or RX fixed gain*

RX array use (EM 2040)

- xxxx xx00 - Off (RX inactive)
- xxxx xx01 - RX 1 (port) active
- xxxx xx10 - RX 2 (starboard) active
- xxxx xx11 - Both RX units active

Sonar head use (EM 2040C)

- xxxx xx00 - Off (Both inactive)
- xxxx xx01 - SH 1 (port) active
- xxxx xx10 - SH 2 (starboard) active
- xxxx xx11 - Both active

Pulselength (EM 2040)

- xxxx 00xx - Short CW
- xxxx 01xx - Medium CW
- xxxx 10xx - Long CW
- xxxx 11xx - FM

Pulselength (EM 2040C)

- x000 xxxx - Very Short CW
- x001 xxxx - Short CW
- x010 xxxx - Medium CW
- x011 xxxx - Long CW
- x100 xxxx - Very Long CW
- x101 xxxx - Extra Long CW
- x110 xxxx - Short FM
- x111 xxxx - Long FM

Receiver fixed gain setting in dB (EM 2000, EM 1002, EM 3000, EM 3002, EM 300, EM 120)

13 *Transmit pulse length*

The transmit pulse length may not be the same for all TX sectors, and the pulsforms may vary. The pulselength given here is 1/(transmit bandwidth) for the centre sector. FM pulse: 1/sweep bandwidth. The total TX pulselength for each sector can be found in the range and angle datagram.

Mechanical transducer tilt

Table 48 Mechanical transducer tilt datagrams

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = J (Always 4Ah)	1U	—	—
EM model number (Example: EM 1002 = 1002)	2U	—	—
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	—	—
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Tilt counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	100 –	—
Number of entries = N	2U	1 –	—
Repeat cycle – N entries of:	4*N	—	—
– Time in milliseconds since record start	2U	0 to 65534	—
– Tilt in 0.01 degrees	2S	-1499 to +1499	1
End of repeat cycle			
Spare (Always zero)	1U	—	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

- 1 This tilt angle is the measured mechanical tilt of a hull unit such as that often supplied with the EM 1002. It is positive when the transducer is tilted forwards.

ExtraParameters datagram

This datagram is used to give supplementary information, and contains information as specified by the Content identifier.

Table 49 *ExtraParameters 3*

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	—	—
Start identifier = STX (Always 02h)	1U	—	—
Type of datagram = 3 (33h, 51d)	1U	—	—
EM model number (Example: EM 710 = 710)	2U	—	—
Date = year*10000 + month*100 + day (Example: Sep 26, 2005 = 20050926)	4U	—	—
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	—
Ping counter (sequential counter)	2U	0 to 65535	—
System serial number	2U	—	—
Content identifier	2U	—	1
Array of variable length	variable	—	2
Spare byte if required to get even length (Always 0)	0 – 1U	—	—
Spare (always 0)	1U	0	—
End identifier = ETX (Always 03h)	1U	—	—
Check sum of data between STX and ETX	2U	—	—

Notes

1 Content identifier.

Ident.	Information contents
1	Calib.txt file for angle offset
2	Log all heights
3	Sound velocity at transducer
4	Sound velocity profile
5	Multicast RX status
6	Bscorr.txt file for back scatter corrections.

2 Array of variable length. This array is described for each content identifier.

Content identifier = 1: The Calib.txt file

The ‘Array of variable length’ contains a text field of 100 characters, containing the file name “calib.txt”. Thereafter, the contents of the file follows.

File layout

The angular correction table is made with 1 degree step, from 100 degrees port to 100 degrees starboard (201 elements). The angular offset in this file has been added to the beam angles in the raw range and angle datagram.

File	Comment
EM 300	Name of echo sounder
Line1	For comments
Line2	— " —
Line3	— " —
Line4	— " —
Line5	— " —
100 0.0 x.x	Info BS offset Angle offset
.....	
-100 0.0 x.x	

Content identifier = 2: Log all heights

This datagram configuration is used for logging parameter settings related to the definition of additional approved position quality factors. Each of the three positioning systems available in the PUs has a set of parameters.

The 'Array of variable length' is used as follows:

Data Description	Format	Valid range	Note
Active positioning system	4S	0 – 2	
Quality factor setting for pos. system 1, 2, 3.	3 *4S	1=PU decodes Q-factor. Default 0=External PU decode	1
Number of quality factors for pos. system 1, 2, 3	3 *4S	0 – n	2
Variable no of entries follows = total number of all quality factors:			3
Quality factor	4S	0 – m	4
Limit	4S	0 cm default = not used	5

Notes

- Each positioning system has its own individual setting.
Value '1' indicates that the PU should decode the quality factors in the traditional way. This is the default.
Value '0' indicates that the PU should skip quality factor decoding as this is performed externally. The PU should always transmit the height datagram 'h'.
- Each positioning system have an independent set of additional quality factors. The number of quality factors for each system must be specified. Default value is 0.
- Each quality factor is described by two entries, the quality factor itself and a limit, forming a pair. This results in a variable number of such pairs, depending on how many additional quality factors is set by the operator. If no quality factors are

defined, no pairs are included. The sequence of pairs is important. First, all pairs for positioning system 1 is listed, if any. Next any pairs for positioning system 2 and at the end, any pairs for positioning system 3.

- 4 A quality factor is a positive number. Currently no upper limit is imposed.
- 5 Uncertainty in position fix in cm. This uncertainty is associated with the quality factor value. Currently not used.

Tip

The use of Log all heights is also explained in the SIS Reference Manual.

Content identifier = 3: Sound velocity at transducer

The array of variable length will contain the received datagram containing the sound velocity at transducer.

Table 50 Current sound velocity

Data Description	Format	Valid range	Note
Spare	2U	0 if unused	
Sound velocity	4F	m/s	—

Content identifier = 4: Sound velocity profile

The array of variable length will contain the received datagram containing the sound velocity profile.

Table 51 SOUNDSPEEDPROFILE_DATA

Name	Type	Data Description
Spare	2U	0 if unused
<i>header</i>		
header, messageID	int32	unique message ID across the PSS-CSI2 interface
header, time, seconds	int32	Seconds since 1970-01-01 00:00:00 UTC
header, time, microSeconds	int32	Microseconds
header, size	int32	the size in bytes of the entire message (including header)
header, sourceID	int32	the ID of the component sending the message.
header, destinationID	int32	the ID of the component receiving the message.
sequenceNumber	int32	A number incremented for each transmission of this message.
<i>The current sound speed including depth</i>		
soundSpeedPoint, depth	real32	Depth in meters
soundSpeedPoint, speed	real32	Sound speed in m/s.
<i>The current temperature including depth</i>		
TemperaturePoint, depth	real32	Depth in meters
TemperaturePoint, temperature	real32	Temperature in degrees Celsius

Table 51 *SOUNDSPEEDPROFILE_DATA (cont'd.)*

Name	Type	Data Description
<i>The time the official SSP was recorded.</i>		
time, seconds	int32	Seconds since 1970-01-01 00:00:00 UTC
time, microSeconds	int32	Microseconds
numberOfPointsInOfficialSSP	int32	The number of elements in the 'officialSSP' array.
Repeat cycle - N entries of SSP:	12*N	Array containing the official sound speed points sorted with ascending depth order.
soundSpeedPoint, depth	real32	Depth in meters
soundSpeedPoint, speed	real32	Sound speed in m/s.
End of repeat cycle		
<i>The time the official TP was recorded.</i>		
time, seconds	int32	Seconds since 1970-01-01 00:00:00 UTC
time, microSeconds	int32	Microseconds
numberOfPointsInOfficialTP	int32	The number of elements in the 'officialTP' array.
Repeat cycle - N entries of TP:	12*N	Array containing the official temperature points sorted with ascending depth order.
TemperaturePoint, depth	real32	Depth in meters
TemperaturePoint, temperature	real32	Temperature in degrees Celsius
End of repeat cycle		

Table 52 *Common data types*

Basic data types	Size (bytes)	Description
int32	4	32-bit signed integer (two's complement)
real32	4	32-bit floating point (IEEE 754)

Content identifier = 5: Multicast input status

The array of variable length will contain the status of received data via multicast.

Table 53 *Multicast input status*

Name	Type	Data Description
Multicast 1 status	4U	1) used for position system 1
Multicast 2 status	4U	1) used for position system 1
Multicast 3 status	4U	1) used for position system 1
Multicast 4 status	4U	1) used for sound velocity profile
Multicast 5 status	4U	1)
Multicast 6 status	4U	1)
Multicast 7 status	4U	1)
Multicast 8 status	4U	1)
Multicast 9 status	4U	1)
Multicast 10 status	4U	1)

Notes

- 1 The sensor input status is coded in accordance with that given in the PU Setup datagram, but indicates which sensor datagram types are actually being received on the respective ports.

Content identifier = 6: Bscorr.txt file

In order to calibrate real-time back scatter levels, correction values may be incorporated in a file called bscorr.txt and downloaded to the TRU (or PU). The contents of this file will be stored in the *.all files using the Extra Parameters datagram.

The exact format of the file may vary from echo sounder to echo sounder. Please refer to the documentation for the specific echo sounder for further details.

In this case, "Array of variable length" has the following format:

Data description	Format	Valid range
Nc = Number of bytes in text string	2U	–
Text string containing contents of bscorr.txt file	1*Nc	–



PU information and status

Topics

- *PU ID output* on page 104
- *PU Status output* on page 107
- *PU BIST result output* on page 110

PU ID output

The PU Id datagram is broadcasted every second after the PU is powered up, until a host processor takes command of the Processing Unit through a PU0 datagram. The PU0 datagram may however order the broadcast of this datagram to continue. The broadcast is sent to Ethernet address 157:237:255:255 on Port 1999. The broadcast will resume if the host processor sends a P00 datagram which releases its control of the PU.

Table 54 PU Id output datagrams

Data Description	Example	Format	Valid range	Note
Start identifier = STX	Always 02h	1U	—	—
Type of datagram = 0	Always 30h	1U	—	—
EM model number	1002	2U	—	1)
Date = year*10000 + month*100 + day	Feb 26, 1995 = 19950226	4U	—	2)
Time since midnight in milliseconds	08:12:51.234 = 29570234	4U	0 to 86399999	2)
Byte order flag	Always 1	2U	—	3)
System serial number	—	2U	100 –	—
UDP port no 1	—	2U	—	4)
UDP port no 2	—	2U	—	4)
UDP port no 3	—	2U	—	4)
UDP port no 4	—	2U	—	4)
System descriptor	—	4U	—	5)
PU software version	—	16U	ASCII string	6)
BSP software version	—	16U	ASCII string	6)
Sonar Head/Transceiver software version	Sonar head 1 software version	16U	ASCII string	6)
Sonar Head/Transceiver software version	Sonar head 2 software version	16U	ASCII string	6)
Host IP address	—	4U	—	7)
TX Opening angle	0	1U	0, 1, 2 or 4	8)
RX Opening angle	1	1U	1, 2 or 4	9)
Spare	0 if not used	6U	—	
Spare	0 if not used	1U	—	
End identifier = ETX	Always 03h	1U	—	
Check sum of data between STX and ETX		2U	—	

Notes

- 1 “1002” must be replaced with the name of the system. 1002 is for EM 1002, 120 for EM 120, 300 for EM 300, 710 for EM 710, 2000 for EM 2000, 3000 for EM 3000, 3020 for EM 3002, 302 for EM 302, 122 for EM 122, 121 for EM 121A, 850 for ME70BO, 2040 for EM 2040, 2045 for EM 2040C.
The EM model number and checksum are required.
- 2 The system time and date will start at 0 on power up, i.e. the host processor must always set the clock in its first setup command.
- 3 The byte order of the whole datagram is indicated by this flag.
- 4 Datagrams are to be sent to the different PU UDP ports as follows (in addition to use of PU serial ports):
 - Port 1: Command datagrams
 - Port 2: Sensor datagrams except motion sensor
 - Port 3: First motion sensor
 - Port 4: Second motion sensor
- 5 System descriptor (Information for internal use) :

CPU configuration (hex format):

- 00 xx xx xxh – Old CPU card
- 01 xx xx xxh – VIPer or CoolMonster
- 02 xx xx xxh – CT7
- 03 xx xx xxh – Kontron
- 04 xx xx xxh – Kontron and BSP67B for EM 710
- 05 xx xx xxh – Concurrent Technologies PP432
- 06 xx xx xxh – EM2000 AUV
- 07 xx xx xxh – Concurrent Technologies PP 833

For EM 122, EM 302, EM 710, EM 2040 and EM 2040C (binary format, 16 LSB shown):

- xxxx xxxx xxxx xxx0b – Single RX / Single Head
- xxxx xxxx xxxx xxx1b – Dual RX / Dual Head
- xxxx xxxx xxxx xx0xb – Single swath
- xxxx xxxx xxxx xx1xb – Dual swath
- xxxx xxxx xxxx x0xxb – BSP 67B
- xxxx xxxx xxxx x1xxb – CBMF
- xxxx xxxx xxxx 1xxxb – PTP (IEEE 1588 clock sync) supported
- xxxx xxxx xxx0 xxxxb – Deep water sonar head
- xxxx xxxx xxx1 xxxxb – Shallow water sonar head
- xxxx xxxx xx1x xxxxb – Extra detections supported
- xxxx xxxx x1xx xxxxb – RS 422 serial lines supported

- xxxx xxx0 0xxx xxxxb – EM 2040 Normal
- xxxx xxx0 1xxx xxxxb – EM 2040 Dual TX (2*TX and 2*RX)
- xxxx xxx1 0xxx xxxxb – spare
- xxxx xxx1 1xxx xxxxb – EM 2040P
- xxxx x00x xxxx xxxxb – EM 710
- xxxx x01x xxxx xxxxb – EM 710–MK2

Old sounders (hex format):

- xx xx xx 01h – EM 1002S
 - xx xx xx 02h – EM 952
 - xx xx xx 03h – EM 1002: with Hull Unit
 - xx xx xx 04h – EM 1002S: with Hull Unit
 - xx xx xx 05h – EM 952: with Hull Unit
 - xx xx xx 08h – EM 3001
 - xx xx xx 09h – EM 3002 long pulse available
 - xx xx x1 xxh – EM 3002 Rx gain not available
- 6** The first two elements, PU software version and BSP software version, are the same for all echo sounders. The last two will vary, depending on which echo sounder you have:
- EM 120 / EM 300: SPRX software version and SPTX software version.
- EM 710 / EM 302 / EM 122: RX32 software version and TX36 software version.
- EM 1002: SPRX software version and Hull Unit software version.
- EM 2000: Sonar Head software version on the third element and number four is empty.
- EM 2040 / EM 2040C: RX and TX software version
- EM 3000 / EM 3002: Sonar Head 1 software version and Sonar Head 2 software version.
- 7** This is the address derived from the source of the first PU0 datagram, it is 0.0.0.0 if the PU is not controlled by a host processor.
- 8** TX Opening angle:
- 0 = 0.5 degrees, valid for EM 122, EM 302 and EM 710.
- 1 = 1 degree, valid for EM 122, EM 302 and EM 710.
- 2 = 2 degrees, valid for EM 122, EM 302 and EM 710.
- 4 = 4 degrees, valid for EM 122 and EM 302.
- 9** RX Opening angle:
- 1 = 1 degree, valid for EM 122, EM 302 and EM 710.
- 2 = 2 degrees, valid for EM 122, EM 302 and EM 710.
- 4 = 4 degrees, valid for EM 122 and EM 302.

PU Status output

The PU Status datagram is sent out every second if requested by the host processor. It has two functions, to indicate that the system is alive and receiving sensor data, and to give sensor data regularly for a potential screen update.

Table 55 PU Status output

Data Description	Example	Format	Valid range	Note
Start identifier = STX	Always 02h	1U	—	—
Type of datagram = 1	Always 31h	1U	—	—
EM model number	1002	2U	—	1)
Date = year*10000 + month*100 + day	Feb 26, 1995 = 19950226	4U	—	—
Time since midnight in milliseconds	08:12:51.234 = 29570234	4U	0 – 86399999	—
Status datagram counter	—	2U	0 – 65535	—
System serial number	—	2U	100 –	—
Ping rate in centiHz	—	2U	0 – 3000	—
Ping counter of latest ping	—	2U	0 – 65535	—
Distance between swath in 10%	10	4U	0 – 255	2)
Sensor input status, UDP port 2	—	4U	—	3)
Sensor input status, serial port 1	—	4U	—	3)
Sensor input status, serial port 2	—	4U	—	3)
Sensor input status, serial port 3	—	4U	—	3)
Sensor input status, serial port 4	—	4U	—	3)
PPS status	—	1S	—	4)
Position status	—	1S	—	4)
Attitude status	—	1S	—	4)
Clock status	—	1S	—	4)
Heading status	—	1S	—	4)
PU status	—	1U	—	11)
Last received heading in 0.01°	—	2U	0 – 35999	5)
Last received roll in 0.01°	—	2S	-18000 – 18000	5)
Last received pitch in 0.01°	—	2S	-18000 – 18000	5)
Last received heave at sonar head in cm	—	2S	-999 – 999	5)
Sound speed at transducer dm/s	—	2U	14000 – 16000	6)
Last received depth in cm	—	4U	0 –	5)
Along-ship velocity in 0.01 m/s	—	2S	—	—
Attitude velocity sensor status	0x81	1U	—	12)
Mammal protection ramp	—	1U	—	13)
Backscatter at Oblique angle in dB	-30	1S	—	7)
Backscatter at normal incidence in dB	-20	1S	—	7)
Fixed gain in dB	18	1S	—	7)

Table 55 PU Status output (cont'd.)

Data Description	Example	Format	Valid range	Note
Depth to normal incidence in m	27	1U	—	7), 8)
Range to normal incidence in m	289	2U	—	7), 9)
Port Coverage in degrees	—	1U	—	7), 9)
Starboard Coverage in degrees	—	1U	—	7), 9)
Sound speed at transducer found from profile in dm/s	—	2U	14000 – 16000	9)
Yaw stabilization angle or tilt used at 3D scanning, in centideg.	—	2S	—	9)
Port Coverage in degrees or Across-ship velocity in 0.01 m/s	—	2S	—	10)
Starboard Coverage in degrees or Downward velocity in 0.01 m/s	—	2S	—	10)
EM2040 CPU temp in °C	0 if not used	1S	—	—
End identifier = ETX	Always 03h	1U	—	—
Check sum of data between STX and ETX	—	2U	—	—

Notes

- 1 “1002” must be replaced with the name of the system: 1002 is for EM 1002, 120 for EM 120, 300 for EM 300, 710 for EM 710, 2000 for EM 2000, 3000 for EM 3000, 3020 for EM 3002, 302 for EM 302, 122 for EM 122, 121 for EM 121A, 850 for ME70BO, 2040 for EM 2040, 2045 for EM 2040C.

The EM model number and checksum are required.

- 2 Achieved swath distance in percent of required swath distance. The value is shown in 10% steps, and the range is 0 – 255. 0 indicates that the function is not used. 10 indicates 100% (achieved swath distance equals required swath distance).
- 3 The sensor input status is coded in accordance with that given in the PU Setup datagram, but indicates which sensor datagram types are actually being received on the respective ports.
- 4 0 or a negative number indicates that the quality of the data received is not acceptable, positive OK.
- 5 These values are all from sensor input (active motion sensor or depth sensor).
- 6 Not implemented on release 5.1u25 or older.
- 7 Automatic tracking info used by the echo sounder.
- 8 Spare except for releases made before January 2004 (EM 3000, EM 2000).
- 9 Not included for releases made before January 2004 (EM 3000, EM 2000).
- 10 For EM 3002: From January 2005 used for port and starboard coverage.
EM 710, EM 302, EM 122: Across and downward velocity
Other sounders: Spare
- 11 0 = off
1 = active

2 = simulator

10 = ME70BO TRU – disconnected

11 = ME70BO TRU – mode change

12 The two most significant bit (MSB) indicates sensor status:

00xx xxxx = no data received

10xx xxxx = data received from attitude velocity system 1

01xx xxxx = data received from attitude velocity system 2

11xx xxxx = data received from both attitude velocity systems

The six least significant bits (LSB) are used to indicate sensor input datagram type:

xx00 0000 = velocity attitude sensor not connected

xx00 0001 = Seatex binary format 11 / binary format 23

xx00 0010 = Applanix Group 102/103

xx00 0011 = CodaOctopus MCOM

(List may be expanded in the future to include more sensor types.)

13 Mammal protection: High voltage power supply remaining ramp up time in %.



PU BIST result output

The PU BIST (built in self test) result datagram is sent out as a result of a BIST command. The test result is given as an ASCII string plus a status value. For a dual EM 3000 / EM 3002 and BIST # 99 (used for startup), two datagrams are used, one for each head.

Table 56 PU BIST result output

Data Description	Example	Format	Valid range	Note
Start identifier = STX	Always 02h	1U	—	—
Type of datagram = B	Always 42h	1U	—	—
EM model number	1002	2U	—	1)
Date = year*10000 + month*100 + day	Feb 26, 1995 = 19950226	4U	—	—
Time since midnight in milliseconds	08:12:51.234 = 29570234	4U	0 to 86399999	—
BIST result counter (sequential counter)	—	2U	0 – 65535	—
System serial number	—	2U	100 –	—
Test number	—	2U	—	—
Test result status	—	2S	—	2)
Test result description, terminated with “/0”, total length is variable (max = 5000)	—	NU	ASCII string	3)
Spare byte if required to get even length	Always 0 if used	0–1U	—	—
End identifier = ETX	Always 03h	1U	—	—
Check sum of data between STX and ETX	—	2U	—	—

Notes

- 1 “1002” must be replaced with the name of the system.
1002 is for EM 1002, 120 for EM 120, 300 for EM 300, 710 for EM 710, 2000 for EM 2000, 3000 for EM 3000, 3020 for EM 3002, 302 for EM 302, 122 for EM 122, 121 for EM 121A, 850 for ME70BO, 2040 for EM 2040 and 2045 for EM 2040C.

The EM model number and checksum are required.

- 2 A negative number or zero indicates an error, 1 that result is OK and test is finished, while 2 indicates that result so far is OK, but the test is not finished.

The test result status interpretation is special for EM 1002 in some cases:

When 'Test number' is 15:

0 = error

1 = OK (no hull unit)

2 = OK (hull unit error)

3 = OK (hull unit OK)

When 'Test number' is 99:

-2 = OK (hull unit error/missing)

0 = error

1 = OK

- 3 The text will always start with an identifying mnemonic.



SIS generated output

Topics

- *APB Datagram* on page 112
- *DPT Datagram* on page 112
- *RTE Datagram* on page 113
- *WPL Datagram* on page 113
- *KSSIS 31 Datagram* on page 114

APB Datagram

APB Autopilot sentence according to NMEA 0183 version 2.3.

Table 57 APB output datagram

Data Description	Format	Valid Range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	Always KM	—	—
Sentence formatter	Always APB,	—	—
Status	Always A,	—	—
Status	Always A,	—	—
Magnitude of XTE (cross track error)	x.x,	—	—
Direction to steer	a,	L or R	—
XTE units (nautical miles)	Always N,	—	—
Status 1	a,	A or empty	—
Status 2	a,	A or empty	—
Bearing origin to waypoint	x.x,	0.0 to 359.9	—
Bearing type	a,	M or T	—
Destination waypoint ID	Always wid,	—	—
Bearing, present position to destination	x.x,	0.0 to 359.9	—
Bearing type	a,	M or T	—
Heading to steer to destination waypoint	x.x	0.0 to 359.9	—
Bearing type	a,	M or T	—
Mode indicator	Always A,	—	1
Checksum	*hh	—	—
End if sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

- 1 Field does not exist if the system is configured to use NMEA version prior to 2.30

DPT Datagram

DPT sentence according to NMEA 0183 version 2.3 contains depth relative to the transducer and offset from transducer.

Table 58 DPT output datagram

Data Description	Format	Valid Range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	Ka	KA to KJ	1
Sentence formatter	Always DPT,	—	—
Water depth relative to transducer, meters	x.x,	0 to 12,000	—
Offset from transducer, meters	x.x,	—	—
Maximum range scale in use	Always 12000.0	—	—
Checksum	*hh	—	—
End of sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

RTE Datagram

The RTE routes datagram is part of the DynPos datagram set. Two datagrams are sent when DynPos output is enabled and a planned line is activated

Table 59 RTE output datagram

Data Description	Format	Valid Range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	Always KM	—	—
Sentence formatter	Always RTE,	—	—

WPL Datagram

This datagram is part of the DynPos datagram set. Two datagrams are sent when DynPos output is enabled and a planned line is activated

The WPL datagram contains the coordinates of the activated line. One datagram is sent for each point on the line.

Table 60 WPL output datagram

Data Description	Format	Valid Range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	Always KM	—	—
Sentence formatter	Always WPL,	—	—
Waypoint latitude	lll.ll,	—	—
Latitude — N/S	a,	N or S	—
Waypoint longitude	yyyy.yy,	—	—
Longitude — E/W	a,	E or W	—
Waypoint ID	c-c		

KSSIS 31 Datagram

Datagram from SIS HWS sent to external applications containing a combined set of information per ping.

Table 61 KSSIS 31 output datagram

Data Description	Format	Valid Range	Note
Start identifier = \$	Always 24h	—	—
Talker identifier	Always KS	—	—
Sentence formatter	Always SIS,	—	—
Datagram ID	Always 31,	—	—
Model number	X,	—	—
Serial number	X,	—	—
Beams sent	X,	—	—
Beams received	X,	—	—
Depth from surface to seafloor(cm)	X.X,	—	—
Depth from surface to transducer (cm)	X.X,	—	—
Across distance (cm)	X.X,	—	—
Across distance, port (cm)	X.X,	—	—
Across distance, starboard (cm)	X.X,	—	1
Last tide (m)	X.X,	—	—
Last geoid undulation (m)	X.X,	—	—
Last distance from the geoid to the vertical reference (m)	X.X,	—	—
Minimum depth in swath (cm)	X.X,	—	—
Maximum depth in swath (cm)	X.X,	—	—
End if sentence delimiter = CRLF	Always 0Dh 0Ah	—	—

Notes

1 0 if the total across is to the opposite side

Appendix A

EM 2040 details

EM 2040 transducer installation offsets

For most EM type echo sounders, all elements in the TX and RX transducer arrays are used for all beams, giving a common x,y,z location for each transducer. But for the EM 2040 this is different. The TX transducer has 3 separate arrays, used for port, centre and starboard sectors, and the RX array has an along-ship offset.

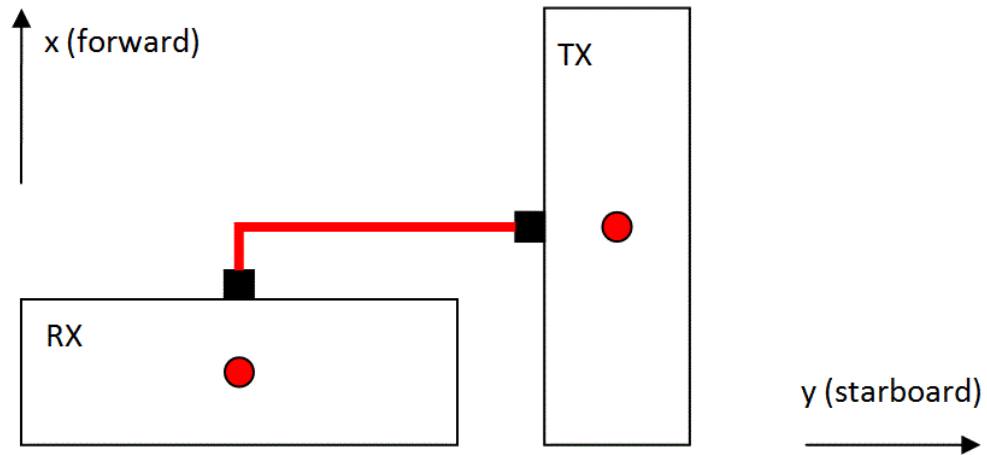
The transducer x,y,z offsets are taken into account by the PU when calculating the “XYZ 88” datagram. If it is needed to recalculate XYZ data in post-processing from the “Raw Range and angle 78” datagram, these offsets should also be taken into account.

For the EM 2040, the transducer installation coordinates refers to the center of the transducer faces. The installation coordinates are given in the “Installation parameters” datagram:

TX:	S1X, S1Y, S1Z	
RX1:	S2X, S2Y, S2Z	(single RX/port RX)
RX2:	S3X, S3Y, S3Z	(starboard RX)

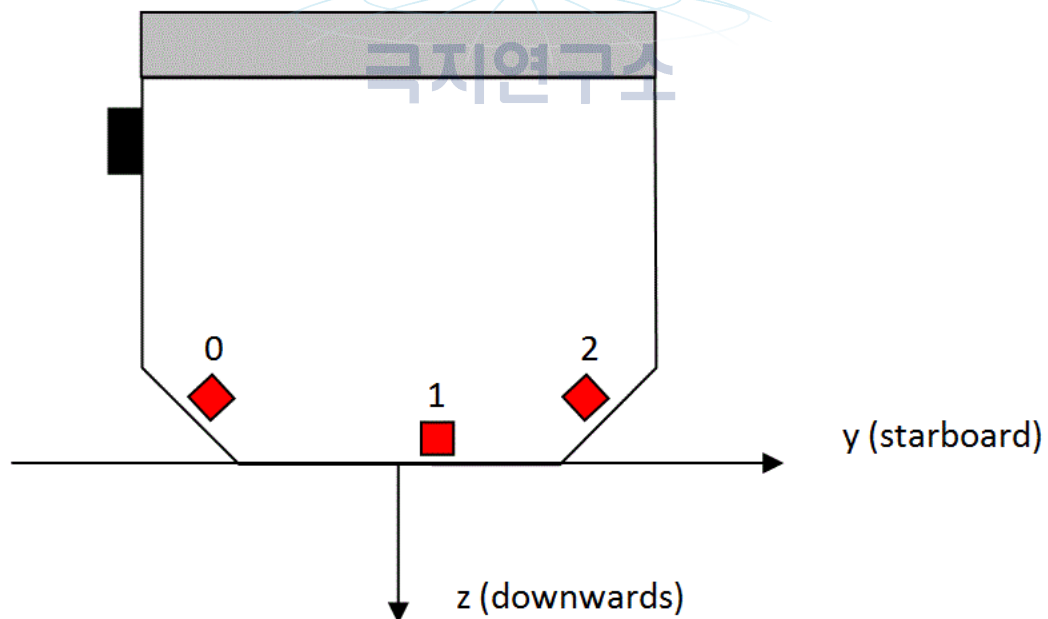
The coordinates are given in the Vessel Coordinate System, where x is forward, y is starboard and z is downward.

Figure 1 Typical EM 2040 transducer configuration viewed from above (single RX)



TX array offsets:

Figure 2 TX transducer seen from behind (default orientation):

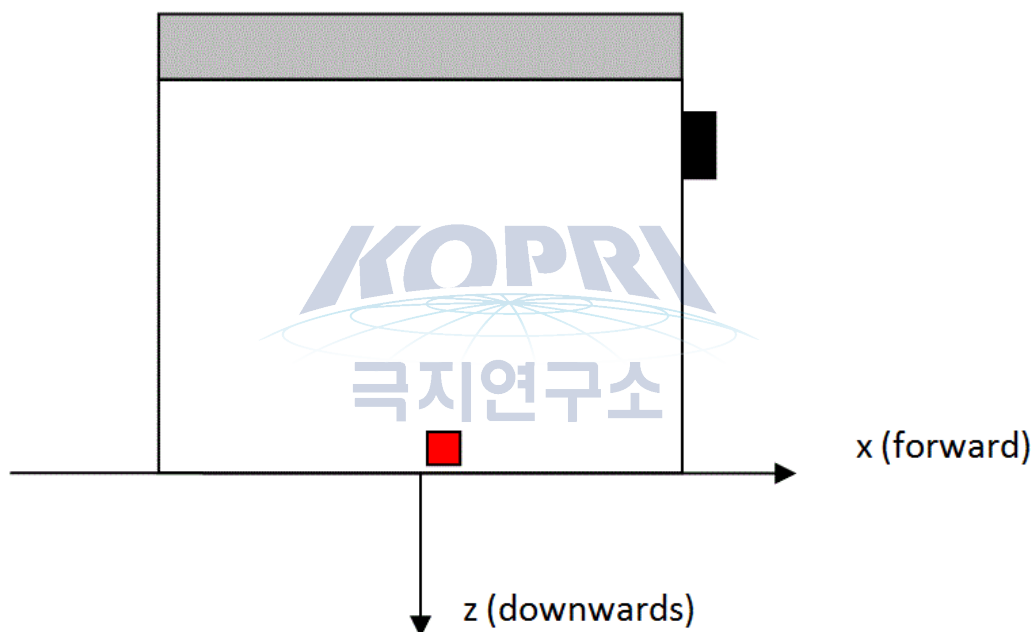


When the TX array is mounted at default orientation, i.e. plug on port side, element # 1 at aft, the x,y,z positions for the 3 TX line arrays relative to the centre of the array face are:

	Index	Forward (x)	Starboard (y)	Downwards (z)
Port array	0	0 mm	-55.4 mm	-12.0 mm
Centre array	1	0 mm	13.15 mm	-6.0 mm
Starboard array	2	0 mm	55.4 mm	-12.0 mm

RX array offsets:

Figure 3 RX transducer seen from starboard (default orientation):



When the RX array is mounted at default orientation, ie plug on front side, element # 1 at port side, the X,Y,Z positions of the line array re centre of the RX array face are:

Forward (x)	Starboard (y)	Downwards (z)
11.0 mm	0 mm	-6.0 mm

Use of TX array index in the “Raw range and angle 78” datagram

In order to take into account TX array offsets when processing data from the “Raw range and angle 78” datagram, the actual array being used is coded into the transmit sector section of the datagram (Repeat cycle 1), using the “Transmit sector number / TX array index” parameter. I.e. for the EM 2040, this parameter does not mean transmit sector, but array index. The transmit sector number can be derived implicitly by counting number of

“Repeat cycle 1” entries – first cycle is transmit sector 0, second cycle is transmit sector 1 etc. Note that in the receive beam section of the datagram (Repeat cycle 2), “Transmit sector number” still means just that – transmit sector.

Example:

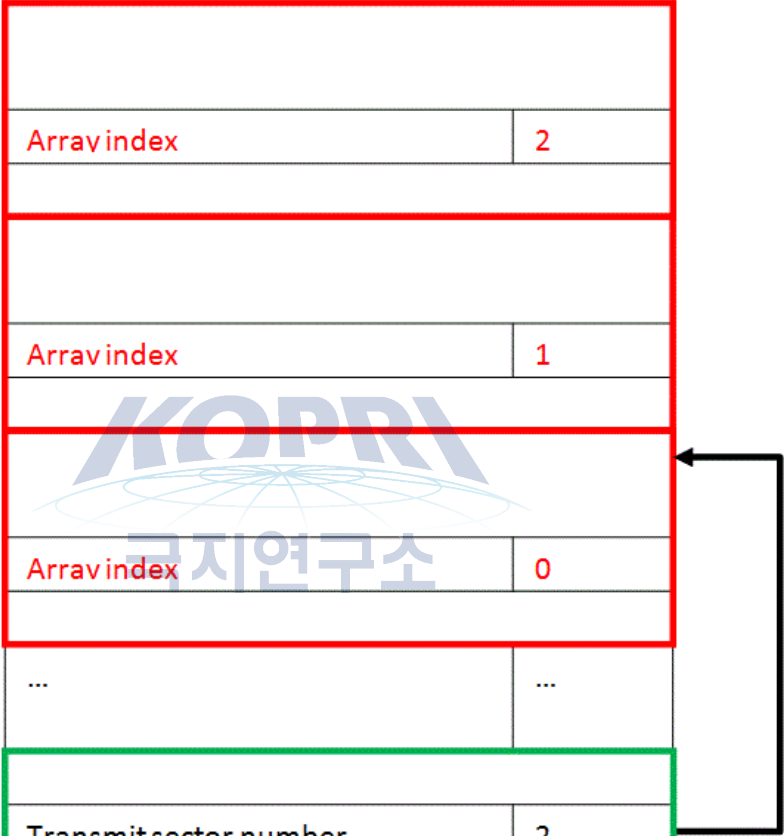
- Three sectors – sector 0, 1 and 2.
- Array indexes are 2, 1 and 0 respectively (which typically implies that the TX is installed with a 180° heading offset).
- One of the beams has the “Transmit sector number” parameter set to 2, i.e. it is pointing to the last TX block (Repeat cycle 1) in the datagram. For this TX sector, the array index is 0.



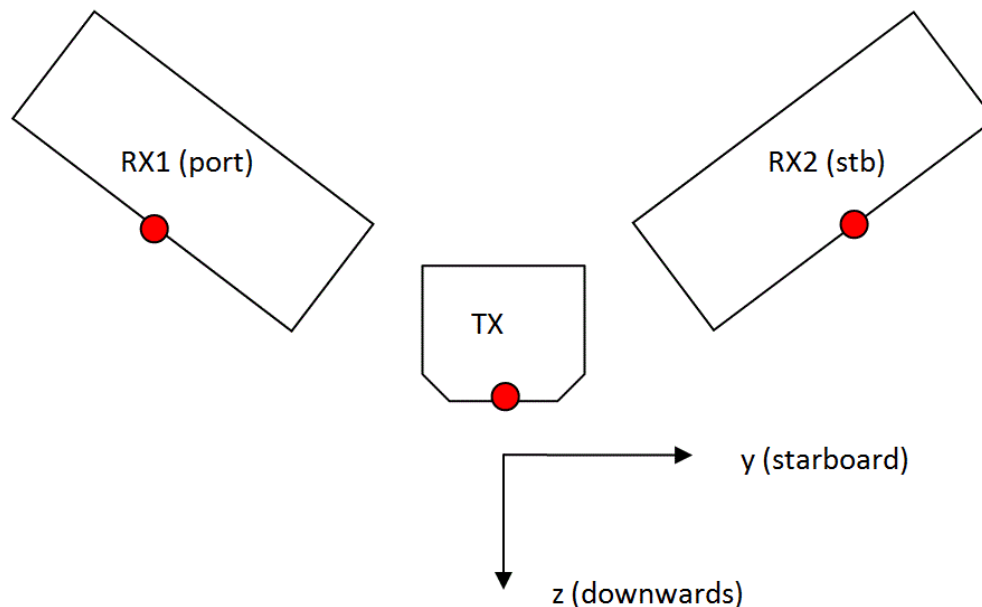
•

Figure 4 Excerpt of the “Raw range and angle 78” datagram:

	...	
	Number of transmit sectors = Ntx	3
	...	
TX sector 0		
	Arrav index	2
TX sector 1		
	Arrav index	1
TX sector 2		
	Arrav index	0
	...	...
RX beam <i>nnn</i>		
	Transmit sector number	2
	...	...



EM 2040 Dual RX



For Dual RX, the installation coordinates (x, y, z) and angles (roll, pitch, heading) are given by the following parameters in the “Installation parameters” datagram:

TX:	S1X, S1Y, S1Z, S1R, S1P, S1H
RX1 (port):	S2X, S2Y, S2Z, S2R, S2P, S2H
RX2 (starboard):	S3X, S3Y, S3Z, S3R, S3P, S3H

Note that the installation coordinates refer to the center of the transducer faces. For information about the location of the physical transducer arrays inside the transducer units, see appendix *EM 2040 transducer installation offsets* on page 115.

For EM 2040 Dual RX, data from RX1 (port) and RX2 (starboard) are stored in separate datagrams. This relates to the following datagrams:

- *XYZ 88* on page 43
- *Raw range and angle 78* on page 55
- *Seabed image data 89* on page 60
- *Water column datagram* on page 62

The datagrams from the different RX units are differentiated by the parameter “System serial number”. The “System serial numbers” for the two RX units are found in the header of the “Installation parameters” datagram. The parameters called “System serial number” is valid for RX1 (port), while the parameter called “Secondary system serial number” is valid for RX2 (starboard).

Data description	Example	Format	Valid range	Note
Number of bytes in datagram	–	4U	–	1
Start identifier = STX	Always 02h	1U	–	
Type of datagram = l, L or r	49h, 69h, 70h	1U	–	
EM model number	EM 2040 = 2040	2U	–	
Date = year*10000 + month*100 + day		4U	–	
Time since midnight in milliseconds		4U	0 to 86399999	
Survey line number	—	2U	0 to 65534	
System serial number	123	2U	100 –	
Secondary system serial number	10123	2U	100 –	

Using the example above, multibeam datagrams (XYZ etc) for RX1 (port) will have the “System serial number” parameters set to 123, while multibeam datagrams for RX2 (starboard) will have the “System serial number” parameter set to 10123.

Note

Note that the “Installation parameters” datagram also contains information about transducer serial numbers in parameters TXS, R1S and R2S. These will generally be different from the “System serial number” parameter used in the datagram headers and are included for reference only.

EM 2040 Scanning mode

When running in Scanning mode, one of two or three sectors is transmitted per ping. This means that data from two or three pings need to be coupled together to form the complete swath. This can be done using the “Scanning info” parameter which is coded into the “XYZ 88” and “Water Column” datagrams. In the “Scanning info” parameter, the total number of scanning sectors is coded into the four least significant bits, while the actual scanning sector (counting from zero) is coded into the four most significant bits.

If the “Scanning info” parameter is set to 0, scanning is not used.

Example: Scanning with 3 sectors.

Ping counter	Scanning info	Swath number
1	03h	1
2	13h	
3	23h	
4	03h	2
5	13h	
6	23h	

Due to lack of spare bytes, the Scanning info is not directly coded into “Raw range and angle 78” and “Seabed image data 89” datagrams. In order to couple together data from these datagram types, the “Scanning info” parameter has to be extracted from the corresponding “XYZ 88” datagram using the “Ping counter” as a common reference.



Appendix B

EM 2040C installation offsets

For the EM 2040C, the TX and RX arrays are integrated into a common sonar head. The transducer arrays are not placed at the centre of the sonar head. The EM 2040C can have one or two sonar heads. For most EM echo sounders separate x,y,z installation parameters are given for the RX and the TX arrays. For EM 2040C the installation parameters entered by the operator refers to the centre of the face of the sonar head(s). The transducer x,y,z offsets are taken into account by the Processing Unit when calculating the “XYZ 88” datagram. If it is needed to recalculate XYZ data in post-processing from the “Raw Range and angle 78” datagram, these offsets should also be taken into account.

The sonar head installation coordinates are given in the “Installation parameters” datagram:

- SH 1: S1X, S1Y, S1Z
- SH 2: S2X, S2Y, S2Z

The coordinates are given in the Vessel Coordinate System, where x is forward, y is starboard and z is downward. The x,y,z positions for the RX and TX transducer arrays relative to the centre of the sonar head face are:

	Forward (x)	Starboard (y)	Downwards (z)
TX	3.8 mm	40.0 mm	-6.0 mm
RX	-45.5 mm	0.0 mm	-6.0 mm

For EM 2040C with dual sonar heads, data from SH1 and SH2 are stored in separate datagrams, using different serial numbers. This relates to the following datagrams:

- XYZ 88
- Raw range and angle 78
- Seabed image data 89
- Water column
- Stave display

The “System serial numbers” for the two sonar heads are found in the header of the “Installation parameters” datagram. The parameters called “System serial number” is valid for SH1, while the parameter called “Secondary system serial number” is valid for SH2.

Data Description	Example	Format	Valid range	Note
Number of bytes in datagram	-	4U	-	1
Start identifier = STX	Always 02h	1U	-	-
Type of datagram = I, I or r	49h, 69h, 70h	1U	-	-
EM model number	EM 2040C=2045	2U	-	-
Date = year*10000 + month*100 + day		4U	-	-
Time since midnight in milliseconds		4U	0 to 86399999	-
Survey line number	-	2U	0 to 65534	-
System serial number	0123	2U	100 -	-
Secondary system serial number	0125	2U	100 -	

Using the example above, multibeam datagrams (XYZ etc) for SH1 will have the “System serial number” parameters set to 0123, while multibeam datagrams for SH2 will have the “System serial number” parameter set to 0125.

Appendix C

Handling of .all-files

The Seafloor Information System, SIS, is responsible for logging all the data from the Kongsberg multibeam echosounder systems, MBES. In addition SIS will display real time digital terrain models made from these data.

SIS runs on a PC-architecture computer running Windows. Data from the MBES arrives at the PC via an Ethernet connection as UDP packets of variable length.

The data is stored in files with the extension .all. The prefix is normally nnnn_YYYYMMDD_HHMMSS, with the name of the ship appended if the operator has chosen to: nnnn_YYYYMMDD_HHMMSS_Shipname. The letters nnnn is the line number, while the time in the first datagram in the file is decoded and used to make the rest of the prefix. (Note that the clock in the PC is not used).

The storage locations of the .all-files are defined by the operator. First a general location is set, i.e. c:\sisdata\rawdata with the name of the survey appended to the path. The rest of the path can be defined by the operator in SIS to be a tree-structure or not. Typically the rest of the path is year/month/day so the complete path may be: c:\sisdata\rawdata\my_survey\2006\10\20\0001_20061020_123456_Shipname.all.

Because the tree-structure can be chosen freely, it is necessary to find all the files below the general location and the survey, c:\sisdata\rawdata\my_survey, and then sort all the files by their date and time, YYYYMMDD_HHMMSS, to find the chronological sequence of files.

The datagrams from the MBES arrives at the PC in one stream. The timestamp of the data may not be strictly sequential. For example motion sensor data is grouped together and sent from the MBES to SIS in one datagram containing 100 motion sensor measurements with individual timestamps, and then they may arrive one second behind the depth datagram. This makes it necessary to read several motion sensor datagrams to find the correct one to be used when applying motion to the depth data. The individual datagram types must be handled separately and the interpolation to other datagram types must be done based on the timestamps.

When one survey line is closed and a new survey line is opened, the stream of datagrams is cut exactly when the operator chooses to create a new line. The result is that the datagram needed to merge data at the end of the previous line may be found in the beginning of the next line. One typical situation is that one position datagram is followed

by one depth datagram in the previous line, and the next position datagram is found in the beginning of the next line. To interpolate the correct position for the last depth datagram, the position datagram just before it must be used together with the position datagram in the following line.

The content of the datagrams is described in the datagram description. When the datagrams are written to file, the size of the datagram is written before the datagram in two bytes (one short integer). Thus to read the file, first read two bytes (one short), then read that number of bytes from the file which is then one datagram. The datagram is easily decoded by inspecting the header information in each datagram.



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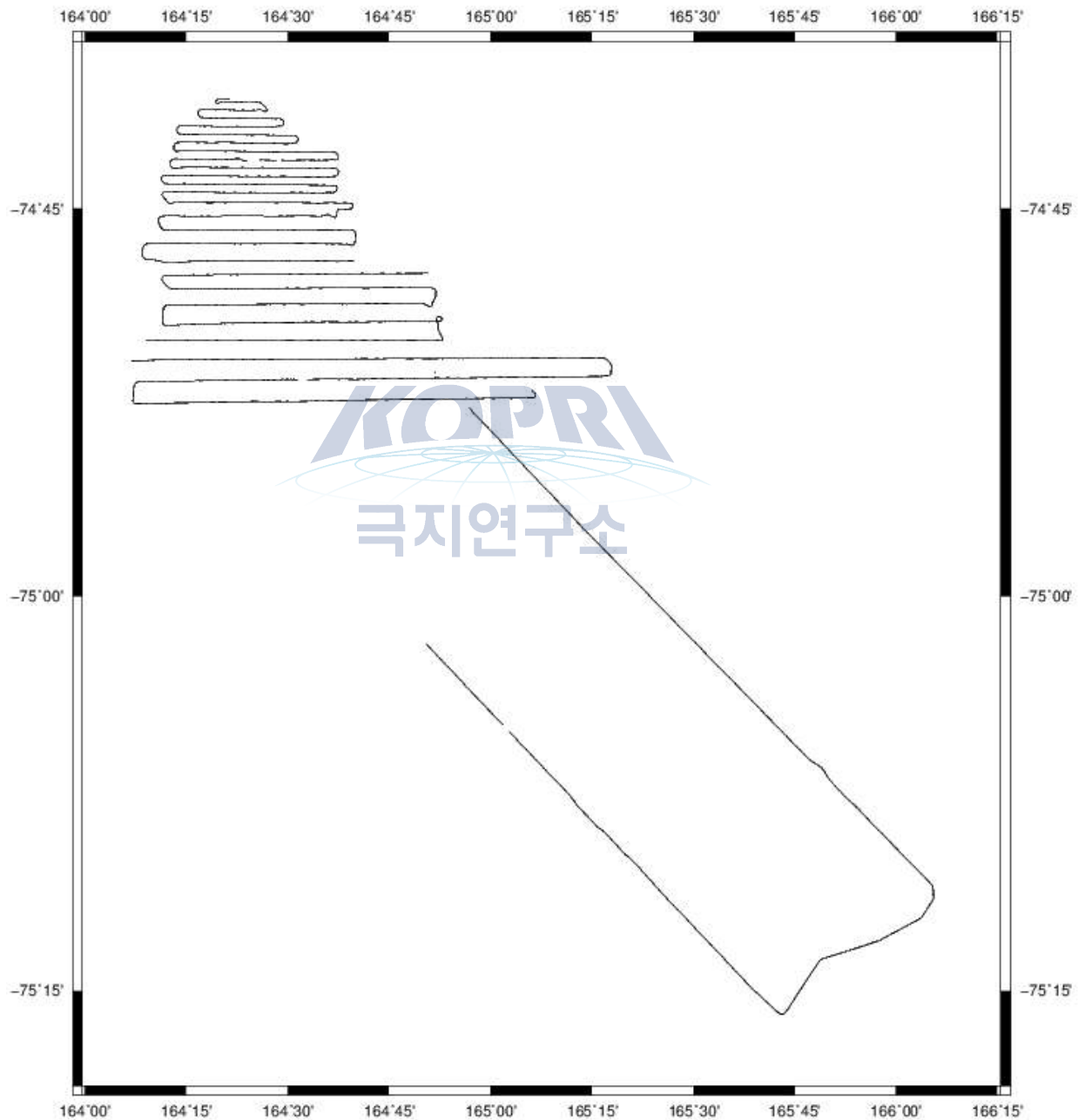
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부록 5.

남극 장보고 인접 로스해 멀티빔

조사 상세 측선도 (2012년 1월 조사 수행)





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