ATTENTION – READ THIS FIRST!

All personnel involved with the installation, operation, or maintenance of the equipment described in this manual should read and understand the warnings and cautions provided below.

**CAUTION!** This equipment contains devices that are extremely sensitive to static electricity. Therefore, extreme care should be taken when handling them. Normal handling precautions involve the use of anti-static protection materials and grounding straps for personnel.

**WARNING!** High Voltage may be present in all parts of the system. Therefore, use caution when the electronics are removed from their containers for servicing.

**CAUTION!** Operation with improper line voltage may cause serious damage to the equipment. Always ensure that the proper line voltage is used.

Warnings, Cautions, and Notes

Where applicable, warnings, cautions, and notes are provided in this manual as follows:

**WARNING!** Denotes a potential hazard that could cause injury or death.

**CAUTION!** Denotes a potential hazard that could damage equipment or data.

**NOTE:** Recommendations or general information that is particular to the material being presented.
ABOUT THIS DOCUMENT

We, the employees at EdgeTech, would like to thank you for purchasing 2000-DSS Combined Sonar. At EdgeTech, it is our policy to provide high-quality, cost-effective products and support services that meet or exceed your requirements. We also strive to deliver them on-time, and to continuously look for ways to improve them. We take pride in the products we manufacture and want you to be entirely satisfied with your equipment.

Purpose of this Manual

The purpose of this manual is to provide the user with information on the setup and use of EdgeTech’s 2000 Series. Although this manual encompasses the latest operational features of the 2000 Series, some features may be periodically upgraded. Therefore, the information in this manual is subject to change and should be used for reference only.

 Liability

EdgeTech has made every effort to document the 2000 Series in this manual accurately and completely. However, EdgeTech assumes no liability for errors or for any damages that result from the use of this manual or the equipment it documents. EdgeTech reserves the right to upgrade features of this equipment, and to make changes to this manual, without notice at any time.

Revision History

<table>
<thead>
<tr>
<th>REV</th>
<th>DESCRIPTION</th>
<th>DATE</th>
<th>APPROVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Release to Production</td>
<td>05/22/2011</td>
<td>RM</td>
</tr>
<tr>
<td>B</td>
<td>Revamp for 2000-DSS Exclusively</td>
<td>11/18/2016</td>
<td>TS</td>
</tr>
<tr>
<td>C</td>
<td>Edited for Changes</td>
<td>02/03/2018</td>
<td>TS</td>
</tr>
<tr>
<td>D</td>
<td>Edited for updates and formatting</td>
<td>09/21/2018</td>
<td>TS</td>
</tr>
</tbody>
</table>
WARRANTY STATEMENT

All equipment manufactured by EdgeTech is warranted against defective components and workmanship for a period of one year after shipment. Warranty repair will be done by EdgeTech free of charge.

Shipping costs are to be borne by the customer. Malfunction due to improper use is not covered in the warranty, and EdgeTech disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose, and there is no warranty of merchantability. This warranty applies only if:

i. The items are used solely under the operating conditions and in the manner recommended in Seller's instruction manual, specifications, or other literature.

ii. The items have not been misused or abused in any manner, nor have repairs been attempted thereon without the approval of EdgeTech Customer Service.

iii. Written notice of the failure within the warranty period is forwarded to Seller and the directions received for properly identifying items returned under warranty are followed.

iv. The return notice authorizes Seller to examine and disassemble returned products to the extent Seller deems necessary to ascertain the cause for failure.

The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and Seller does not assume any other obligation or liability in connection with the sale or use of said products. Any product or service repaired under this warranty shall be warranted for the remaining portion of the original warranty period only.

Equipment not manufactured by EdgeTech is supported only to the extent of the original manufacturer's warranties.
HARDWARE VARIATIONS AND COMPATIBILITY

The 2000-DSS Combined Sonar contains both standard and proprietary hardware. At times, EdgeTech may change the standard components due to their availability or performance improvements. Although the component manufacturers—along with their models and styles—may change from unit to unit, replacement parts will generally be interchangeable.

EdgeTech will make every effort to see that replacement components are interchangeable and use the same software drivers (if applicable). At times, however, direct replacements may not exist. When this happens, EdgeTech will provide the necessary drivers with the replacement part, if applicable.

EdgeTech may also change certain hardware per customer requirements. Therefore, portions of this manual, such as parts lists and test features, are subject to change. These sections should be used for reference only. When changes are made that affect system operation, they will be explicitly noted. Also, some options and features may not be active in the customer’s unit at time of delivery. Upgrades will be made available when these features are implemented.

Contact EDGE TECH CUSTOMER SERVICE with any questions relating to compatibility.
EdgeTech provides software services free of charge. This software agreement does not address customer-specified modifications or enhancements. These services may be ordered separately. Furthermore, EdgeTech software upgrades are meant for the sole use of EdgeTech customers. Any reproduction of EdgeTech-supplied software or file sharing is strictly prohibited.

**Software Updates and Enhancements**

EdgeTech customers can download new software releases with all modifications and enhancements from the EdgeTech ftp site. Major software bugs, should they occur, will be reported directly to the customer. New software releases consist of the following:

- Software enhancements
- Software fixes and changes
- Product integration
- Documentation updates to on-line help
- Tests for compatibility with other modules

Software patches consist of software that has undergone the following:

- Minor software enhancements
- Software fixes and changes
- Software Telephone, Facsimile, and E-mail Support

EdgeTech customers are entitled to contact *EdgeTech Customer Service* by telephone, facsimile, or e-mail to report a difficulty, to discuss a problem or to receive advice on the best way to perform a task. When contacted, EdgeTech Customer Service will do the following:

- Calls made to the 24-hour tech support line will be answered the same day
- Email inquiries will be answered within 24 hours
- Immediately attend to serious problems affecting operations
- Attempt to find an immediate work-around
RETURNED MATERIAL AUTHORIZATION

Prior to returning any equipment to EdgeTech, a Returned Material Authorization (RMA) Number must be obtained from CUSTOMER SERVICE.

RMA Purpose

The RMA Number identifies returned equipment when it arrives at our receiving dock and enables tracking while at our facility. Refer to RMA number on all documentation and correspondences.

All returned materials must be shipped prepaid. Freight collect shipments will not be accepted. All equipment should be adequately insured for shipping, but equipment belonging to EdgeTech must be insured for full value.

If there is more than one item per consignment, include a packing with the shipment. An invoice can double as a packing slip only when the contents are clearly numbered and identified on the invoice.

CAUTION!

Never attempt to ship a Portable Topside in its Storm Case™ alone. Although rugged, these cases are not intended to be used as shipping containers and the delicate internal components could be damaged. Shipping in this manner will void any warranties.

NOTE: All shipping charges shall be the responsibility of the customer, unless under warranty, as EdgeTech will pay for return shipping.

NOTE: For International Shipments valued over $1000, the following Shipper’s oath must be sent with the invoice.

Shipper’s Oath:

"I,__________________________, declare that the articles herein specified are the growth, produce, or manufacture of the United States; that they were exported from the United States from the port of ____________________, on or about _____________; that they are returned without having been advanced in value or improved in condition by any process of manufacture or any other means; and that no drawback, or allowance has been paid or admitted hereof."

Signed ____________________________
CUSTOMER SERVICE

Customer service personnel at EdgeTech are always eager to hear from users of our products. Your feedback is welcome, and is a valuable source of information which we use to continually improve these products. Therefore we encourage you to contact EdgeTech Customer Service to offer any suggestions or to request technical support:

NOTE: Please have your system Serial Number available when contacting Customer Service.

E-mail: service@edgetech.com

Mail: 4 Little Brook Road
      West Wareham, MA 02576

Telephone: (508) 291-0057

Facsimile: (508) 291-2491

24-Hour Emergency Technical Support Line: (508) 942-8043

For more information please go to www.Edgetech.com.
COMPANY BACKGROUND

EdgeTech (formerly EG&G Marine Instruments) traces its history in underwater data acquisition and processing back to 1966. EdgeTech has designed, developed, and manufactured products, instruments, and systems—for the acquisition of underwater data, including marine, estuarine, and coastal applications—for over 45 years.

The company has responded to the needs of the scientific, Naval, and offshore communities by providing equipment—such as sub-bottom profilers, side scan sonar, acoustic releases, USBL positioning systems, and bathymetric systems—that have become standards in the industry.

EdgeTech has also consistently anticipated and responded to future needs through an active research and development program. Current efforts are focused on the application of cutting-edge CHIRP and acoustic technology.
# TABLE OF CONTENTS

**ATTENTION – READ THIS FIRST!**

Warnings, Cautions, and Notes ........................................................................................................ iii

**ABOUT THIS DOCUMENT**

Purpose of this Manual ................................................................................................................ iv
Liability ............................................................................................................................................... iv
Revision History .............................................................................................................................. iv

**WARRANTY STATEMENT** ............................................................................................................... v

**HARDWARE VARIATIONS AND COMPATIBILITY** ........................................................................ vi

**SOFTWARE SERVICE OVERVIEW**

Software Updates and Enhancements .............................................................................................. vii

**RETURNED MATERIAL AUTHORIZATION** .................................................................................... viii

RMA Purpose ..................................................................................................................................... viii

**CUSTOMER SERVICE** .................................................................................................................. ix

**COMPANY BACKGROUND** .......................................................................................................... x

**TABLE OF CONTENTS** .................................................................................................................. xi

**LIST OF FIGURES** .......................................................................................................................... xvi

**LIST OF TABLES** ............................................................................................................................ xix

### 1.0 OVERVIEW .......................................................................................................................... 1-1

1.1 2000 Series Applications ........................................................................................................ 1-1

1.2 Main System Components ........................................................................................................ 1-2

1.2.1 Topside Processor ............................................................................................................... 1-2

1.2.2 2000 Digital Telemetry Link ............................................................................................... 1-3

1.2.3 2000-DSS Tow Vehicle ....................................................................................................... 1-4

1.2.4 Tow Cables .......................................................................................................................... 1-5

1.3 Optional Equipment .................................................................................................................. 1-5

1.3.1 Magnetometer .................................................................................................................... 1-6

1.3.2 Acoustic Tracking System ................................................................................................ 1-6

1.3.3 Pressure Sensor .................................................................................................................. 1-6

1.3.4 Power Loss Pinger ............................................................................................................. 1-6

1.3.5 Responder .......................................................................................................................... 1-6
1.4 Full Spectrum Chirp Technology Overview ................................................................. 1-6
  1.4.1 Separate Sub-Bottom Acoustic Projectors and Receivers ........................................ 1-7
  1.4.2 High Signal-to-Noise Ratio ...................................................................................... 1-7
  1.4.3 High Repeatability .................................................................................................. 1-7
  1.4.4 High Resolution ...................................................................................................... 1-7
  1.4.5 Reduction of Side Lobes ......................................................................................... 1-8
  1.4.6 Additional Processing Gain .................................................................................... 1-8
  1.4.7 Gaussian Shaped Amplitude Spectrum Outgoing Pulse ......................................... 1-8

2.0 SPECIFICATIONS ........................................................................................................ 2-1
  2.1 Topside Processor ....................................................................................................... 2-1
  2.2 2000 Digital Telemetry Link ...................................................................................... 2-3
  2.3 2000-DSS Tow Vehicles ............................................................................................ 2-4
  2.4 Cables ......................................................................................................................... 2-6

3.0 SETUP AND ACTIVATION ........................................................................................ 3-1
  3.1 Unpacking and Inspection ......................................................................................... 3-1
  3.2 Power Requirements ................................................................................................. 3-2
    3.2.1 Use of an Uninterruptable Power Supply ............................................................... 3-2
    3.2.2 Changing to a Non-US Power Plug ....................................................................... 3-2
  3.3 Navigation Interface .................................................................................................. 3-3
  3.4 Topside Location—Best Practices ............................................................................. 3-3
  3.5 Rack Mount Topside Connections, Controls, and Indicators ..................................... 3-3
    3.5.1 Topside Computer Connections .......................................................................... 3-3
    3.5.2 Topside Computer Controls and Indicators ......................................................... 3-6
    3.5.3 2000 Digital Telemetry Link Connections ............................................................. 3-6
    3.5.4 2000 Digital Telemetry Link Controls and Indicators .......................................... 3-6
  3.6 TCP/IP Address Settings .......................................................................................... 3-7
  3.7 Connecting the System Components ....................................................................... 3-8
    3.7.1 Connecting and Attaching the Tow Cable to the Tow Cable .................................. 3-9
    3.7.2 Connecting the 2000 Topside Processor ............................................................... 3-10
  3.8 System Activation and Test ....................................................................................... 3-11
    3.8.1 Activating the System .......................................................................................... 3-11
6.3.7 Tow Vehicle ........................................................................................................................ 6-7
  6.3.7.1 Preliminary .................................................................................................................... 6-7
  6.3.7.2 No Sonar Data ............................................................................................................. 6-8
  6.3.7.3 Power Supplies ............................................................................................................. 6-8
  6.3.7.4 SSB Board Test Points ............................................................................................... 6-9
  6.3.7.5 DDC Test Points ........................................................................................................... 6-9
  6.3.7.6 Modem Board Test Points .......................................................................................... 6-9
  6.3.7.7 Other Checks .............................................................................................................. 6-10

6.3.8 Tow Cables ........................................................................................................................ 6-10
  6.3.8.1 Shorted Wire .............................................................................................................. 6-10
  6.3.8.2 Open Wire .................................................................................................................. 6-11
  6.3.8.3 Insulation Resistance Breakdown .............................................................................. 6-11
  6.3.8.4 Damaged Tow Cable Connector ............................................................................... 6-11

6.4 Part Numbers for Major Topside Components ................................................................. 6-12

6.5 Part Numbers for Major 2000-DSS Tow Vehicle Components ........................................ 6-12

A.0 SYSTEM RESTORE .............................................................................................................. A-1

B.0 PRINTERS ................................................................................................................................. B-1

C.0 TOWING CHARACTERISTICS .......................................................................................... C-1
  C.1 Configuration 1 .................................................................................................................. C-3
  C.2 Configuration 2 .................................................................................................................. C-4
  C.3 Configuration 3 .................................................................................................................. C-5
  C.4 Configuration 4 .................................................................................................................. C-6
  C.5 Configuration 5 .................................................................................................................. C-7
  C.6 Configuration 6 .................................................................................................................. C-8
  C.7 Configuration 7 .................................................................................................................. C-9
  C.8 Configuration 8 .................................................................................................................. C-10
  C.9 Configuration 9 .................................................................................................................. C-11
  C.10 Configuration 10 ............................................................................................................. C-12
  C.11 Configuration 11 ............................................................................................................. C-13
  C.12 Configuration 12 ............................................................................................................. C-14
  C.13 Configuration 13 ............................................................................................................. C-15
C.14 Configuration 14......................................................................................................................C-16
C.15 Configuration 15......................................................................................................................C-17
C.16 Configuration 16......................................................................................................................C-18
C.17 Configuration 17......................................................................................................................C-19
C.18 Configuration 19......................................................................................................................C-20
C.19 Configuration 20......................................................................................................................C-21
C.20 Configuration 21......................................................................................................................C-22
C.21 Configuration 22......................................................................................................................C-23
C.22 Configuration 23......................................................................................................................C-24
C.23 Configuration 24......................................................................................................................C-25
C.24 Configuration 25......................................................................................................................C-26
C.25 Configuration 26......................................................................................................................C-27
C.26 Configuration 27......................................................................................................................C-28
C.27 Configuration 28......................................................................................................................C-29
C.28 Configuration 29......................................................................................................................C-30
C.29 Configuration 30......................................................................................................................C-31
C.30 Configuration 31......................................................................................................................C-32
C.31 Configuration 32......................................................................................................................C-33
LIST OF FIGURES

Figure 1-1: 2000-DSS Tow Vehicle being Prepared for Deployment ............................................................ 1-2
Figure 1-2: 2000 Topside Processor with Keyboard, Trackball, and two LCD Monitors ................................. 1-3
Figure 1-3: 2000-DSS Tow Vehicle ................................................................................................................ 1-4
Figure 1-4: Kevlar Reinforced Tow Cable ..................................................................................................... 1-5
Figure 3-1: Rack Mount Topside Front Panel ................................................................................................. 3-4
Figure 3-2: Rack Mount Topside Back Panel ................................................................................................. 3-5
Figure 3-3: System Cables ............................................................................................................................ 3-8
Figure 3-4: Tow Vehicle with Tow Cable Connected and Attached ............................................................... 3-9
Figure 3-5: DISCOVER 2000-C Dual Frequency Side Scan & DISCOVER Sub-Bottom Windows .................. 3-12
Figure 3-6: Lower Control Panel, Transmit Tab—DISCOVER Side Scan ..................................................... 3-13
Figure 3-7: Options Dialog Box, Sonar Control Tab—DISCOVER Sub-Bottom ............................................. 3-14
Figure 3-8: Options Dialog Box, Display Tab—DISCOVER Sub-Bottom ....................................................... 3-14
Figure 3-9: 2000-DSS Tow Vehicle being Deployed .................................................................................... 3-17
Figure 3-10: Lower Control Panel, Bottom Track Tab—DISCOVER 200-C Dual Frequency Side Scan ....... 3-17
Figure 4-2: Location of Jumper JP6 on the Power Board of the FSIU ............................................................ 4-21
Figure 4-4: 2000 Digital Telemetry Link Electronics Block Diagram .......................................................... 4-22
Figure 4-5: 2000 Digital Telemetry Link Wiring Diagram ............................................................................. 4-23
Figure 4-7: Tow Vehicle Electronic Block Diagram ...................................................................................... 4-25
Figure 4-8: Tow Vehicle Interconnect Drawing ........................................................................................... 4-26
Figure 4-9: Armored Cable, PMI Grip, Unterminated Topside ...................................................................... 4-29
Figure 4-10: Test Cable .................................................................................................................................. 4-30
Figure 5-1: 2000-DSS Tow Vehicle with Upper Half of Fiberglass Shell Removed ........................................ 5-3
Figure 5-2: Electronics Bottle Connector End Cap ................................................................. 5-4
Figure 5-3: Remote Desktop Icon .......................................................................................... 5-5
Figure 5-4: Remote Desktop Splash Screen ....................................................................... 5-5
Figure 5-5: Remote Desktop Warning Screen .................................................................... 5-6
Figure 5-6: Closing Sonar.exe ............................................................................................. 5-6
Figure 5-7: Tera Term Icon .................................................................................................. 5-7
Figure 5-8: Tera Term Splash Screen ................................................................................ 5-7
Figure 5-9. Terra Term Port Set-up ...................................................................................... 5-8
Figure 5-10. Motion Sensor Serial Output ......................................................................... 5-8
Figure 5-11. Motion Sensor Calibration Result ................................................................. 5-9
Figure 5-12. Motion Sensor Serial Output ......................................................................... 5-9
Figure 5-13: Compass Calibration Table ........................................................................... 5-10
Figure 5-14 ......................................................................................................................... 5-11
Figure 5-15 ......................................................................................................................... 5-12
Figure 5-16: Magnetic Declination Estimated Value Screen ............................................ 5-13
Figure 5-17: Angle of Declination Calculated ................................................................. 5-14
Figure 5-18 ......................................................................................................................... 5-15
Figure 6-1: sockBlast Window .......................................................................................... 6-7
Figure C-1: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 500 Meters............................ C-3
Figure C-2: Tow Cable Length Versus Depth—Cable A320327, 500 Meters ............................................. C-3
Figure C-3: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 1000-Meters ......................... C-4
Figure C-4: Tow Cable Length Versus Depth—Cable A320327, 1000 Meters ........................................... C-4
LIST OF TABLES

Table 2-1: Topside Specifications ............................................................................................................... 2-2
Table 2-2: 2000 Digital Telemetry Link Specifications ............................................................................... 2-3
Table 2-3: 2000-DSS Towfish Specifications .............................................................................................. 2-6
Table 3-1: AC Power Cord Wiring .............................................................................................................. 3-2
Table 3-2: Topside Computer TCP/IP Addresses ...................................................................................... 3-8
Table 3-3: 2000 Digital Telemetry Link Devices TCP/IP Addresses ............................................................ 3-8
Table 6-1: 2000 Digital Telemetry Link Troubleshooting Guide ................................................................. 6-2
Table 6-2: 2000 Digital Telemetry Link Troubleshooting Guide ................................................................. 6-4
Table 6-3: Major Topside Components and Part Numbers ..................................................................... 6-12
Table 6-4: Major 2000-DSS Tow Vehicle Components and Part Numbers .............................................. 6-13

Table B-1: Printer Requirements ............................................................................................................... B-1
Table C-1: Tow Cable Characteristics ........................................................................................................ C-2
1.0 OVERVIEW

The EdgeTech 2000-DSS Combined Side Scan Sonar and Sub-Bottom Profiling System is a combination frequency modulated (FM) dual frequency side scan sonar and a high resolution FM sub-bottom profiler that uses EdgeTech’s proprietary Full Spectrum “chirp” technologies to simultaneously generate both high resolution side scan imagery at longer ranges and high resolution cross sectional images of the seabed at deeper penetrations than conventional continuous wave (CW) systems.

The 2000-DSS Combined Side Scan Sonar and Sub-Bottom Profiling System is available with a choice of two dual frequency configurations for the side scan sonar: 100/400 kHz and 300/600 kHz. The 2000-DSS uses a high frequency, 2–16 kHz sub-bottom sonar for higher resolution sub-bottom imaging in water depths up to 2000 meters.

The two side scan frequencies and the sub bottom frequency are transmitted simultaneously as linearly swept wide band high energy acoustic pulses (also called "chirp pulses") over a full spectrum frequency range, and the received echoes are processed into high signal-to-noise (SNR) images, which can be directly displayed as shades of gray or color on a computer monitor and printed on a continuous feed thermal printer. The data can also be stored in real time onto a large capacity hard drive and archived onto a DVD.

1.1 2000 Series Applications

Applications for the 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System are many, a few of which are the following:

- Archeological surveys
- Geological/geophysical surveys
- Sediment classification
- Buried cable and pipeline surveys
- Dredging and coastal studies
- Pre/post dredging surveys
- Scour/erosion investigation
- Marine construction surveys
1.2 Main System Components

The 2000-DSS Combined Side Scan Sonar and Sub-Bottom Profiling System is composed of two main components: the Rack Mount Topside and the 2000-DSS Tow Vehicle. The Rack Mount Topside is made up of a Topside Processor and a 2000 Digital Telemetry Link installed in a 19-inch rack enclosure, along with a keyboard, a trackball and two LCD monitors. These components are shown in Figure 1-2. The 2000-DSS Tow Vehicle is shown in Figure 1-3. Optionally included is a tow cable up to 6000 meters in length. (Contact EdgeTech Customer Service for cable type versus length).

1.2.1 Topside Processor

The Topside Processor is a PC contained within a ruggedized 19-inch 4U chassis. It provides control of the tow vehicle sonars and processes, stores and displays received side scan and sub-bottom data, sensor data and status information. A keyboard, a trackball, two LCD monitors, a DVD/RW drive, a 1-TB hard drive for data storage, and a 500-GB hard drive for the operating system are included with the Topside Processor. An optional printer can also be connected. The Topside Processor interfaces with the 2000 Digital Telemetry Link over a 10/100/1000BaseT Ethernet connection and includes EdgeTech’s DISCOVER 2000-C Dual Frequency Side Scan Sonar software and DISCOVER Sub Bottom software preinstalled along with the Windows XP operating system.
1.2.2 2000 Digital Telemetry Link

The 2000 Digital Telemetry Link provides downlink telemetry to the tow vehicle for sonar control and receives uplink side scan and sub bottom data, sensor data and status information from the tow vehicle. It interfaces with the Topside Processor over a 10/100/1000BaseT Ethernet connection and includes tow vehicle and DC power supplies, an asynchronous digital subscriber line (ADSL) modem and an Ethernet switch, all within a single 19-inch 2U chassis.

Figure 1-2: 2000 Topside Processor with Keyboard, Trackball, and two LCD Monitors
1.2.3 2000-DSS Tow Vehicle

The 2000-DSS Tow Vehicle contains the side scan transducer arrays, the sub bottom transducer, and the sub-bottom hydrophone arrays along with the electronics required to transmit and to receive the sonar signals, to receive the downlink commands from the 2000 Topside Processor and to provide the uplink side scan data, sensor data and status information to the 2000 Topside Processor. The tow vehicle is available with a choice of 100/400 kHz or 300/600 kHz dual linear FM chirp operating frequencies for the side scan sonar.

The sonar electronics are contained inside a single electronics bottle, which includes a double O-ring sealed end cap on each end. The aft end cap contains bulkhead connectors for connecting the transducers, the hydrophone arrays and optional equipment. The tow vehicle interfaces with the 2000 Topside Processor over an Ethernet connection using digital subscriber line (ADSL) modems in both the tow vehicle and the processor. The 2000-DSS Tow Vehicle is shown in Figure 1-3.

The 2000-DSS Tow Vehicle sub-bottom sonar operates over a frequency range of 2–16 kHz, has a 2000-meter depth rating, and is designed primarily for applications requiring higher resolution sub-bottom imagery. It is hydrodynamically stabilized and includes the sub-bottom transducer and two sub bottom hydrophone arrays mounted under an acoustic baffle.

This assembly, along with the connecting cable harnesses and the electronics bottle, is mounted to a wing plate and contained inside a two-piece fiberglass shell. The upper and lower halves of the shell bolt directly to the wing plate. The aft section of the wing plate forms the horizontal tail fins, and a vertical tail fin is attached to the upper half of the shell. Lead ballast is included inside the lower half. The port and starboard side scan transducer arrays are mounted to the lower half of the shell, and a hinged tow bridle provides the mechanical connection for the tow cable. The bridle can be adjusted fore and aft along a pair of tow brackets, one port and one starboard, to accommodate different tow vehicle speeds and depths.

![Figure 1-3: 2000-DSS Tow Vehicle](image)
1.2.4 Tow Cables

Both Kevlar reinforced and armored tow cables are available separately, terminated at both ends or just at the tow vehicle end. The tow cables are used to connect to and tow the tow vehicle. A Kevlar reinforced tow cable is shown Figure 1-4.

Figure 1-4: Kevlar Reinforced Tow Cable

Both cable types include a single conductor and a shield. They also include an MCIL6F female wet pluggable connector on the tow vehicle end. At the topside end the Kevlar reinforced tow cables include a 5-pin connector for connecting to the 2000 Digital Telemetry Link. The armored tow cables include either an MCIL4M male wet-pluggable connector or an open termination for connection to the slip rings of a winch. A cable grip is also included for attaching the tow cable to the tow bridle of the tow vehicle. To connect an armored tow cable to the 2000 Digital Telemetry Link, a tow cable adapter is required. The adapter is a jumper cable that connects from the MCIL4M connector on the tow cable to the 5-pin bulkhead connector on the back panel of the 2000 Digital Telemetry Link.

1.3 Optional Equipment

Optional equipment that can be installed and used with a 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System include the following:

- Magnetometer
- Acoustic tracking system
- Pressure sensor
- Power loss pinger
- Responder
1.3.1 Magnetometer

A magnetometer can be user specified or supplied and is available from a number of manufacturers.

1.3.2 Acoustic Tracking System

An acoustic tracking system, such as an ORE BATS or Trackpoint 3, can be used to continuously provide tow vehicle position. A responder is installed on the tow vehicle and a ship mounted hydrophone and deck unit are used to receive and process position data.

1.3.3 Pressure Sensor

A pressure sensor can be installed in the tow vehicle to provide tow vehicle depth data. This type of pressure sensor is designed for continuous use in a corrosive liquid environment and has a 3000-psi pressure range.

1.3.4 Power Loss Pinger

A power loss pinger activates when tow vehicle power is lost and the tow vehicle is submerged. Should this event occur, the pinger will continuously transmit an acoustic pulse which can be received by a pinger locator. The pinger is fully self-contained in a stainless steel or aluminum housing and includes an internal battery.

1.3.5 Responder

The responder functions with an optional acoustic tracking system to provide tow vehicle positioning. The tracking system deck unit provides a trigger which is input to the 2000 Topside Processor, and the 2000 Topside Processor outputs the trigger signal to the tow vehicle by combining the signal with the downlink command and uplink sonar data signals.

1.4 Full Spectrum Chirp Technology Overview

EdgeTech's Full Spectrum Chirp technology has several distinct advantages over conventional side scan and sub-bottom profiling systems. These benefits include the use of separate sub-bottom acoustic projectors and receivers to enable simultaneous transmission and reception of acoustic signals, high signal-to-noise ratio (SNR) for improved side scan and sub-bottom imagery, high repeatability of the transmitted signals from pulse to pulse for high signal definition, high resolution for measurement of fine
sediment layering and display of along track and across track imagery, reduction of side lobes for minimal reception of undesired echoes, additional processing gain for energy efficiency, and a Gaussian shaped amplitude spectrum of the outgoing pulse to preserve resolution and bandwidth with attenuation.

1.4.1 Separate Sub-Bottom Acoustic Projectors and Receivers

The side scan sonar uses a line array of piezoelectric elements to both transmit and receive the acoustic signals, one on the port side of the tow vehicle and one on the starboard side. The sub-bottom sonar uses separate acoustic projectors and receivers. The projectors are wide band piston type transducers, and the receivers are hydrophone arrays composed of lead zirconate titanate (PZT) crystals. The transducers are mounted in the forward section of the tow vehicle, and the hydrophone arrays are mounted aft. The use of separate transmitting transducers and receiving hydrophone arrays preserves linearity and allows the simultaneous transmission and reception of the acoustic signals. The transducers and hydrophone arrays are mounted beneath acoustic baffles which minimize direct path, tow vehicle and surface reflections.

1.4.2 High Signal-to-Noise Ratio

Full Spectrum Chirp technology does not use a conventional matched filter, the correlation filter that is widely used to compress FM signals, to process wide band signals. Rather it uses proprietary amplitude and phase weighting functions for the transmitted pulse and a pulse compression filter that maximizes the SNR of the acoustic images over a wide band of operating frequencies. These functions provide a significant SNR improvement in the imagery over other pulse and chirp side scan and sub-bottom sonars with band limited components that are limited in dynamic range.

1.4.3 High Repeatability

The frequency range of operation is determined by the acoustic characteristics of the transmitter and receiver mounted in the towed vehicle. For the side scan sonar, the transmit frequency is selected based on the desired range and resolution required. For sub-bottom profiling, the frequency is selected based on the sub-bottom conditions at the survey site and the type of sub-bottom features that need to be imaged. The FM pulses are generated by a D/A converter with a wide dynamic range and a transmitter with linear components. Therefore, the energy, amplitude and phase characteristics of the acoustic pulses can be precisely controlled. This precision produces high repeatability and signal definition.

1.4.4 High Resolution

Normally, when using long pulses, resolution is reduced. However, after correlation processing the received signals, a very sharp wavelet is produced that has a duration equal to the inverse of the sweep bandwidth. Therefore, the more bandwidth that is used, the sharper this pulse will become. Side scan and sub-bottom signals received at the surface pass through a software controlled programmable gain amplifier before being digitized with a 16-bit analog-to-digital (A/D) converter. The FM pulse is then
compressed using a digital compression filter. This correlation process is implemented in real time with forward and inverse Fast Fourier Transforms (FFTs). The compressed pulse has a time duration approximately equal to the inverse of the bandwidth of the FM pulse which results in high resolution across track side scan sonar images and measurements of fine sediment layering in the sub-bottom profiles, an important factor for sediment classification.

1.4.5 Reduction of Side Lobes

Use of Full Spectrum chirp technology reduces the side lobes in the effective transducer aperture, enabling high along track resolution and high attenuation of unwanted echoes. The wide bandwidth of the sweep frequency has the effect of smearing the side lobes of the transducer and thus achieving a beam pattern with virtually no side lobes. The effective spatial beam width obtained after processing a full spectrum 2–10 kHz sub bottom signal, for example is 20 degrees measured at the -3db points.

1.4.6 Additional Processing Gain

In addition to the resolution improvement, correlation processing achieves a signal processing gain over the background noise by using a broad bandwidth transmission pulse that sweeps out over a range of frequencies instead of trying to operate with one very sharp acoustic peak pulse as is done with CW side scan and sub-bottom sonar systems. This technique generates a lot of acoustic energy in the water that results in a processing gain that is approximately ten times the log of the time bandwidth product. This improvement is due to the signal having a time duration longer than the inverse of the bandwidth, thus increasing the signal energy without increasing the power of the outgoing pulse. To equal the typical performance of the full spectrum sonar pulse, conventional pulse side scan and sub-bottom sonars would have to operate at a peak pulse power of 100 times greater than a full spectrum pulse.

1.4.7 Gaussian Shaped Amplitude Spectrum Outgoing Pulse

Another important feature of Full Spectrum Chirp technology is that the signal processing optimizes the performance of the side scan and sub-bottom sonars. The sonar contains many components, each with a unique dynamic range and linearity characteristic which are frequency dependent. In addition to this characteristic, the amplitude spectrum of the outgoing pulse is chosen to be approximately Gaussian in shape to limit the side lobe level and temporal resolution losses due to attenuation. As a wavelet with a Gaussian shaped spectrum is attenuated by the sediment, energy is lost but its bandwidth is nearly preserved. Therefore, even after being attenuated, the acoustic pulse has approximately the same resolution as an unattenuated pulse.
2.0 SPECIFICATIONS

The specifications for the EdgeTech 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System include electrical, mechanical and environmental characteristics for the following components:

- Topside Processor
- 2000 Digital Telemetry Link
- 2000-DSS Tow Vehicle

NOTE: All specifications are subject to change without notice.

2.1 Topside Processor

The specifications for the Topside Processor are shown in **TABLE 2-1**.

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size:</strong></td>
<td>17.8 cm (7 in.) high</td>
</tr>
<tr>
<td></td>
<td>43.2 cm (17 in.) wide</td>
</tr>
<tr>
<td></td>
<td>48.3 cm (19 in.) deep</td>
</tr>
<tr>
<td><strong>Weight:</strong></td>
<td>19.5 kg (43 lbs.)</td>
</tr>
<tr>
<td><strong>Case type:</strong></td>
<td>EIA RS-310C 19-inch standard rackmount with fully-enclosed frame,</td>
</tr>
<tr>
<td></td>
<td>removable top access cover and heavy duty front handles</td>
</tr>
<tr>
<td><strong>Case construction:</strong></td>
<td>Aluminum 19-inch rack mount</td>
</tr>
<tr>
<td><strong>Case finish:</strong></td>
<td>Black power coat</td>
</tr>
<tr>
<td><strong>Mounting:</strong></td>
<td>Standard 19-inch rack with provisions for mounting rack slides (not</td>
</tr>
<tr>
<td></td>
<td>provided)</td>
</tr>
<tr>
<td><strong>Shipping container type:</strong></td>
<td>Sealed high impact polyurethane case¹</td>
</tr>
<tr>
<td><strong>Shipping container size:</strong></td>
<td>81 cm (32 in) high</td>
</tr>
<tr>
<td></td>
<td>81 cm (32 in) wide</td>
</tr>
<tr>
<td></td>
<td>8.1 cm (32 in) deep</td>
</tr>
</tbody>
</table>

¹ Shipped in a sealed high impact polyurethane case with the 2000 Topside Processor and the 2000 Digital Telemetry Link mounted inside a 19-inch rack enclosure with the keyboard, the trackball and one monitor. The rack enclosure size is 38.1 cm (15 in.) x 50.8 cm (20 in.) x 55.9 cm (22 in.)
## 2.0 Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shipping weight:</strong></td>
<td>70 kg (155 lbs.)²</td>
</tr>
<tr>
<td><strong>Operating Temperature:</strong></td>
<td>0–45°C (32–113°F)</td>
</tr>
<tr>
<td><strong>Storage temperature:</strong></td>
<td>-30–70°C (-22–158°F)</td>
</tr>
<tr>
<td><strong>Operating relative humidity:</strong></td>
<td>0–95% (non-condensing)</td>
</tr>
<tr>
<td><strong>Non-operating storage relative humidity:</strong></td>
<td>0–100%</td>
</tr>
<tr>
<td><strong>Input voltage:</strong></td>
<td>90–260 VAC, 50/60 Hz, auto switching</td>
</tr>
<tr>
<td><strong>Processor:</strong></td>
<td>Intel P4, 2.4 GHz</td>
</tr>
<tr>
<td><strong>Memory:</strong></td>
<td>512 MB</td>
</tr>
<tr>
<td><strong>Data storage:</strong></td>
<td>DVD/RW drive</td>
</tr>
<tr>
<td></td>
<td>1-TB hard drive (data)</td>
</tr>
<tr>
<td></td>
<td>500-GB hard drive (OS)</td>
</tr>
<tr>
<td><strong>Operating system:</strong></td>
<td>Windows XP</td>
</tr>
<tr>
<td><strong>Application software:</strong></td>
<td>DISCOVER 2000-C and DISCOVER Sub-Bottom</td>
</tr>
<tr>
<td><strong>Display:</strong></td>
<td>(2) 21-inch LCD monitor</td>
</tr>
<tr>
<td><strong>Keyboard:</strong></td>
<td>High impact industrial</td>
</tr>
<tr>
<td><strong>Pointing device:</strong></td>
<td>High impact industrial trackball</td>
</tr>
<tr>
<td><strong>I/O ports:</strong></td>
<td>(1) Ethernet</td>
</tr>
<tr>
<td></td>
<td>(4) RS-232</td>
</tr>
<tr>
<td></td>
<td>(3) USB</td>
</tr>
<tr>
<td></td>
<td>(1) Parallel</td>
</tr>
<tr>
<td></td>
<td>(2) PS2</td>
</tr>
<tr>
<td></td>
<td>(1) SVGA</td>
</tr>
</tbody>
</table>

Table 2-1: Topside Specifications

² Total shipping weight of the 2000 Topside Processor and the 2000 Digital Telemetry Link mounted inside a 19-inch rack enclosure with the keyboard, the trackball and one monitor. Shipped in a sealed high impact polyurethane case. Rack enclosure weight is 41 kg (90 lb).
2.2 2000 Digital Telemetry Link

The specifications for the 2000 Digital Telemetry Link are shown in Table 2-2.

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size:</td>
<td>8.3 cm (3.25 in.) high, 48.3 cm (19 in.) wide; 43.2 cm (17 in.) deep</td>
</tr>
<tr>
<td>Weight:</td>
<td>6.4 kg (14 lbs.)</td>
</tr>
<tr>
<td>Case type:</td>
<td>EIA RS-310C 19-inch standard rackmount</td>
</tr>
<tr>
<td>Case construction:</td>
<td>Aluminum 19-inch rack mount</td>
</tr>
<tr>
<td>Case finish:</td>
<td>Anodized</td>
</tr>
<tr>
<td>Mounting:</td>
<td>Standard 19-inch rack with provisions for mounting rack slides (not provided)</td>
</tr>
<tr>
<td>Shipping container type:</td>
<td>Sealed high impact polyurethane case</td>
</tr>
<tr>
<td>Shipping container size:</td>
<td>81 cm (32 in) high</td>
</tr>
<tr>
<td></td>
<td>81 cm (32 in) wide</td>
</tr>
<tr>
<td></td>
<td>8.1 cm (32 in) deep</td>
</tr>
<tr>
<td>Shipping weight:</td>
<td>70 kg (155 lbs.)</td>
</tr>
<tr>
<td>Operating Temperature:</td>
<td>0–40°C (32–104°F)</td>
</tr>
<tr>
<td>Storage temperature:</td>
<td>-20–60°C (-4–140°F)</td>
</tr>
<tr>
<td>Operating relative humidity:</td>
<td>0–80% (non-condensing)</td>
</tr>
<tr>
<td>Non-operating storage relative humidity:</td>
<td>0–100%</td>
</tr>
<tr>
<td>Input voltage:</td>
<td>90–260 VAC, 50/60 Hz, auto switching</td>
</tr>
<tr>
<td>External trigger:</td>
<td>5 VDC TTL positive or negative leading edge triggered, selectable in DISCOVER (used to trigger external device attached to 2000 DSS Tow Fish)</td>
</tr>
<tr>
<td>I/O ports:</td>
<td>(1) Ethernet</td>
</tr>
<tr>
<td></td>
<td>(1) Trigger</td>
</tr>
<tr>
<td>Output voltage and Current:</td>
<td>90 to 132 VAC and 180 to 260 VAC</td>
</tr>
</tbody>
</table>

Table 2-2: 2000 Digital Telemetry Link Specifications

---

3 Total shipping weight of the 2000 Topside Processor and the 2000 Digital Telemetry Link mounted inside a 19-inch rack enclosure with the keyboard, the trackball and one monitor. Shipped in a sealed high impact polyurethane case. Rack enclosure weight is 41 kg (90 lbs.)
### 2.3 2000-DSS Tow Vehicles

The specifications for the 2000-DSS Tow Vehicle is shown in Table 2-3.

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL SPECIFICATIONS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Size:</strong></td>
<td>145.0 cm (57.1 in.) long 74.0 cm (29.1 in.) wide, incl. tail fins 84.0 cm (33.1 in.) high, incl. tail fin</td>
</tr>
<tr>
<td><strong>Weight in air:</strong></td>
<td>145 kg (320 lbs.)</td>
</tr>
<tr>
<td><strong>Weight in water:</strong></td>
<td>78 kg (172 lbs.)</td>
</tr>
<tr>
<td><strong>Construction:</strong></td>
<td>Fiberglass shell with Delrin wing plate</td>
</tr>
<tr>
<td><strong>Maximum tow cable length:</strong></td>
<td>6000 m (19,680 ft.) Contact EdgeTech for cable type vs. length.</td>
</tr>
<tr>
<td><strong>Depth rating:</strong></td>
<td>2000 m (6560 ft.)</td>
</tr>
<tr>
<td><strong>Tow cable type:</strong></td>
<td>Coaxial</td>
</tr>
<tr>
<td><strong>Maximum safe towing speed:</strong></td>
<td>12 knots</td>
</tr>
<tr>
<td><strong>Operating temperature:</strong></td>
<td>0–45°C (32–113°F)</td>
</tr>
<tr>
<td><strong>Storage temperature:</strong></td>
<td>-20–60°C (-4–140°F)</td>
</tr>
<tr>
<td><strong>Heading accuracy:</strong></td>
<td>&lt;1.5° RMS</td>
</tr>
<tr>
<td><strong>Heading resolution:</strong></td>
<td>0.1°</td>
</tr>
<tr>
<td><strong>Pitch and roll accuracy:</strong></td>
<td>±0.4°</td>
</tr>
<tr>
<td><strong>Pitch and roll resolution:</strong></td>
<td>0.1°</td>
</tr>
<tr>
<td><strong>Pitch and roll repeatability:</strong></td>
<td>0.2°</td>
</tr>
<tr>
<td><strong>Optional sensor port:</strong></td>
<td>RS-232</td>
</tr>
</tbody>
</table>

### Options:
- Magnetometer
- Acoustic tracking system
- Pressure sensor
- Power loss pinger
- Responder

### SIDE SCAN SONAR

<table>
<thead>
<tr>
<th><strong>Frequencies:</strong></th>
<th>100/400 kHz 300/600 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIFICATION</td>
<td>VALUE</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td><strong>Expanded Operating ranges (per side):</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>500 m (100 kHz)</td>
</tr>
<tr>
<td></td>
<td>230 m (300 kHz)</td>
</tr>
<tr>
<td></td>
<td>150 m (400 kHz)</td>
</tr>
<tr>
<td></td>
<td>120 m (600 kHz)</td>
</tr>
<tr>
<td><strong>Output pulse energy:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 j (100 kHz)</td>
</tr>
<tr>
<td></td>
<td>3 j (300 kHz)</td>
</tr>
<tr>
<td></td>
<td>2 j (400 kHz)</td>
</tr>
<tr>
<td></td>
<td>1 j (600 kHz)</td>
</tr>
<tr>
<td><strong>Pulse length:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Up to 20 ms (100 kHz)</td>
</tr>
<tr>
<td></td>
<td>Up to 12 ms (300 kHz)</td>
</tr>
<tr>
<td></td>
<td>Up to 10 ms (400 kHz)</td>
</tr>
<tr>
<td></td>
<td>Up to 5 ms (600 kHz)</td>
</tr>
<tr>
<td><strong>Across track resolution:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.3 cm (100 kHz)</td>
</tr>
<tr>
<td></td>
<td>2.8 cm (300 kHz)</td>
</tr>
<tr>
<td></td>
<td>1.8 cm (400 kHz)</td>
</tr>
<tr>
<td></td>
<td>1.4 cm (600 kHz)</td>
</tr>
<tr>
<td><strong>Along track resolution:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.9 m @ 100 m (100 kHz)</td>
</tr>
<tr>
<td></td>
<td>1.0 m @ 100 m (300 kHz)</td>
</tr>
<tr>
<td></td>
<td>0.96 m @ 100 m (400 kHz)</td>
</tr>
<tr>
<td></td>
<td>0.45 m @ 100 m (600 kHz)</td>
</tr>
<tr>
<td><strong>Horizontal beam width:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.08° (100 kHz)</td>
</tr>
<tr>
<td></td>
<td>0.6° (300 kHz)</td>
</tr>
<tr>
<td></td>
<td>0.56° (400 kHz)</td>
</tr>
<tr>
<td></td>
<td>0.26° (600 kHz)</td>
</tr>
<tr>
<td><strong>Transducer array depression angle:</strong></td>
<td>26° downward</td>
</tr>
<tr>
<td><strong>Dynamic range:</strong></td>
<td>24 bits</td>
</tr>
<tr>
<td><strong>Vertical beam width:</strong></td>
<td>50°</td>
</tr>
</tbody>
</table>

**SUB-BOTTOM SONAR**

| Frequency range:                                 | 0.5–12 kHz                         |
|                                                   | 0.5–8.0 kHz/5 ms                   |
|                                                   | 0.5–2.7 kHz/40 ms                  |
|                                                   | 0.5–6.0 kHz/20 ms                  |
|                                                   | 0.5–4.5 kHz/50 ms                  |
|                                                   | 0.5–6.0 kHz/9 ms                   |
|                                                   | 0.5–6.0 kHz/18 ms                  |
|                                                   | 0.5–7.2 kHz/30 ms                  |
|                                                   | 0.7–12.0 kHz/20 ms                 |
|                                                   | 2.0–12.0 kHz/20 ms                 |
### Table 2-3: 2000-DSS Towfish Specifications

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vertical resolution</strong>&lt;sup&gt;4&lt;/sup&gt;:</td>
<td>19 cm (1–5.0 kHz)</td>
</tr>
<tr>
<td></td>
<td>12 cm (1.5–7.5 kHz)</td>
</tr>
<tr>
<td></td>
<td>8 cm (2–12 kHz)</td>
</tr>
<tr>
<td><strong>Penetration in coarse and calcareous sand</strong>&lt;sup&gt;5&lt;/sup&gt;:</td>
<td>30 m (typ)</td>
</tr>
<tr>
<td><strong>Penetration in soft clay</strong>&lt;sup&gt;5&lt;/sup&gt;:</td>
<td>250 m</td>
</tr>
<tr>
<td><strong>Beam width</strong>&lt;sup&gt;6&lt;/sup&gt;:</td>
<td>41°, 0.5–5 kHz</td>
</tr>
<tr>
<td></td>
<td>32°, 1–6 kHz</td>
</tr>
<tr>
<td></td>
<td>24°, 1.5–7.5 kHz</td>
</tr>
<tr>
<td></td>
<td>16°, 2–12 kHz</td>
</tr>
<tr>
<td><strong>Optimum tow vehicle pitch/roll</strong>:&lt;sup&gt;6&lt;/sup&gt;:</td>
<td>&lt;16°, 0.5–5 kHz</td>
</tr>
<tr>
<td></td>
<td>&lt;13°, 1–6 kHz</td>
</tr>
<tr>
<td></td>
<td>&lt;10°, 2–8 kHz</td>
</tr>
<tr>
<td></td>
<td>&lt;8°, 2–10 kHz</td>
</tr>
<tr>
<td></td>
<td>&lt;7°, 2–12 kHz</td>
</tr>
<tr>
<td><strong>Optimum tow height</strong>:</td>
<td>3–5 m above sea floor</td>
</tr>
<tr>
<td><strong>Transmitters</strong>:</td>
<td>1</td>
</tr>
<tr>
<td><strong>Receive arrays</strong>:</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 2-3: 2000-DSS Towfish Specifications

### 2.4 Cables

For cable specifications, see the following diagrams in section 4.0:

- **FIGURE 4-9**
- **FIGURE 4-10**

<sup>4</sup> Vertical resolution is the smallest distinguishable distance between the peaks of two reflections that can be displayed on the screen as separate reflectors. Sound energy is reflected back to the sonar system when the transmitted pulse encounters a change in density. The resolution of a sonar system is measured by its ability to distinguish between two adjacent targets. The vertical resolution is dependent on the transmitted chirp pulse bandwidth. It is theoretically calculated by the product of the transmitted pulse length (inverse of the bandwidth) and half the speed of sound in water (approximately 750 m/s). For example, a full bandwidth pulse from an SB-424 Tow Vehicle has a vertical resolution of 3.75 cm (1/20,000 x 750).

<sup>5</sup> The value for sub-bottom penetration is the maximum distance beneath the sea floor that a step change of 10% in density can be seen on the sub-bottom display. This assumes that the sediment is gas free (no organic materials), that the lowest frequency of the pulse spectrum is transmitted and that the vehicle is within 5 meters of the seabed (range for maximum penetration). Lower frequencies reduce attenuation (absorption of sound). Towing the vehicle close to the sea floor reduces the acoustic footprint thereby reducing scattering (interfering reflections) from the sea floor and within the sediments.

<sup>6</sup> At the -3 dB points, depending on the center frequency.
3.0 SETUP AND ACTIVATION

Setup and test of the EdgeTech 2000-DSS Combined Side Scan Sonar and Sub-Bottom Profiling System encompasses unpacking, inspecting and connecting the system components, including an optional printer; connecting a navigation system and external sonar systems if required; activating the system; and verifying operation using the EdgeTech DISCOVER software. This section provides instructions on how to perform these tasks and how to deploy, tow and recover the tow vehicle.

3.1 Unpacking and Inspection

The 2000 Topside Processor, along with one LCD monitor, the keyboard, the trackball, software, and system documentation are shipped in a reusable heavy duty transport case. The tow vehicle, the second LCD monitor, a test cable, and tow vehicle accessories are shipped in a wooden shipping crate. Before unpacking the system components, inspect the shipping containers for any damage. Report any damage to the carrier and to EdgeTech.

If the shipping containers appear free of damage, carefully unpack the components and inspect them for damage. Also check the packing list and verify that all the items on the list are included. Again, if any damage is found, report it to the carrier and to EdgeTech. If any items are missing, immediately contact EdgeTech. Do not install or operate any equipment that appears to be damaged. Although the items shipped will vary, depending on the customer requirements, the 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System typically includes, as a minimum, the items listed below.

- 2000 Topside Processor
- 2000-DSS Tow Vehicle
- LCD Monitor (2)
- Keyboard
- Trackball
- Ethernet patch cable
- AC power cords (4)
- Video cable (2)
- Tow cable adapter
- Software CDs with electronic manuals

In addition to the listed components, the following optional items may be included:

- Tow cable
- Test cable
After unpacking the system components, be sure to safely store the shipping containers, including any packing materials, for later use. When transporting or storing the system, all items should be packed in their original shipping containers in the same manner in which they were originally shipped, and always store the system in a dry environment when not in use.

3.2 Power Requirements

Power to the system comes in through the Rack Mount topside, which requires 90–260 VAC, 50/60 Hz. The unit is auto switching.

3.2.1 Use of an Uninterruptable Power Supply

The AC power source should be continuously free of high amplitude, high frequency transients, as this type of interference could cause degraded performance or damage to the equipment. An uninterruptable power supply (UPS) with power surge protection is recommended for powering the equipment. However, whether or not a UPS is used, the AC power source should never be the same as that being used to power electric motors, such as pumps and winches, on the survey vessel. In addition, switching type battery chargers or DC to AC converters with square wave outputs also should not be used.

3.2.2 Changing to a Non-US Power Plug

AC power cords is provided for connecting the equipment to standard U.S. 3-pronged outlet. For non-U.S. power outlets you can modify this cord by cutting off the 3-pronged plug and attaching the appropriate plug. Refer to **Table 3-1** for connection information.

<table>
<thead>
<tr>
<th>AC POWER CORD WIRE COLOR</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>AC line</td>
</tr>
<tr>
<td>White</td>
<td>AC neutral</td>
</tr>
<tr>
<td>Green</td>
<td>Earth ground</td>
</tr>
</tbody>
</table>

*Table 3-1: AC Power Cord Wiring*

**NOTE:** The 2000 Topside Processor is shipped configured for the end user’s country voltage requirements.
3.3 Navigation Interface

The 2000-DSS Combined Side Scan Sonar and Sub-Bottom Profiling System accepts most standard National Marine Electronics Association (NEMA) 0183 message sentence formats from a connected global positioning system (GPS) or integrated navigation system.

3.4 Topside Location—Best Practices

The Rack Mount topside should be located and set up in a dry, sheltered area that is protected from weather and water spray and where the temperature is consistently between 0°C and 40°C (32°F and 104°F). However, in all cases avoid areas of direct sunlight, especially in tropical environments, as heat buildup could occur and the viewing of indicators could be difficult.

The location of the Rack Mount topside should also enable direct communications with the deck crew that is handling the tow vehicle. Secure the equipment in place, using tie downs if necessary, near the required AC power source. Also ensure that there is ample room behind the rack for connecting the cables.

3.5 Rack Mount Topside Connections, Controls, and Indicators

The Rack Mount Topside is composed of the 2000 Topside Computer and the 2000 Digital Telemetry Link. While reading the descriptions to follow, refer to FIGURE 3-1 and FIGURE 3-2 for the locations of these components.

3.5.1 Topside Computer Connections

The Topside Processor connections are made using connectors on both the front and back panels, and include the following:

- **COM 5 THRU 8:** DB-9 male connector. Available RS-232 ports to connect additional peripheral sensors/instruments requiring a serial communication interface.
- **ETHERNET 1:** RJ-45 connector. Provides the 10/100/1000BaseT Ethernet connection to the 2000 Digital Telemetry link.
- **ETHERNET 2:** RJ-45 connector. Available 10/100/1000BaseT Ethernet connection.
- **USB:** (5) USB connectors. Four USB 2.0 ports two on the back panel and two on the front. One USB 3.0 port on the back panel.
- **VAC INPUT:** CEE-type AC input. In addition, COM5–COM8 serial ports are available for use as required, each with DB-9 male connectors. These connectors are located on the back panel.
LED STATUS INDICATORS

2000-DL POWER SWITCH

2000-DL DIGITAL LINK

REMOVABLE HARD DRIVE

DVD-RW DRIVE

USB INPUTS

2000 TOPSIDE COMPUTER

SYSTEM POWER LED (LEFT) AND BUTTON (RIGHT)

HARD DRIVE LED

SYSTEM RESET BUTTON

Figure 3-1: Rack Mount Topside Front Panel
Figure 3-2: Rack Mount Topside Back Panel

- AC POWER INPUT AND SWITCH
- SYNC CONNECTOR
- 2000-DL DATA LINK INPUT
- SEA CABLE CONNECTOR
- DISPLAY PORT VIDEO (2)
- AC POWER INPUT AND SWITCH
- COM PORTS (6)
- USB 2.0 AND 3.0
- ETHERNET INPUTS
- DVI MONITOR PORT

*Figure 3-2: Rack Mount Topside Back Panel*
3.5.2 Topside Computer Controls and Indicators

The Topside Computer controls and indicators are the following:

**POWER:** Rocker switch. Switches AC power to the Topside Processor. This switch can be left in the on position at all times.

**SYSTEM POWER** *(switch)*: Push button toggle switch. Turns the Topside Processor on or off.

**SYSTEM POWER** *(indicator)*: Green indicator. Illuminated when the Topside Processor is on.

**RESET:** Momentary push button switch. Resets the Topside Processor.

**HDD:** Yellow indicator. flashes when a hard drive on the Topside Processor is being accessed.

3.5.3 2000 Digital Telemetry Link Connections

The 2000-DL connections are as follows:

**SEA CABLE:** SubConn MCBH4F female connector to the sea cable that goes down to the towfish.

**SYNC:** Provides an input connection for a TTL external trigger that is sent to the towfish (used to trigger external device attached to 2000 DSS Tow Fish).

**DATA:** RJ-45 Standard ETHERNET connection used for connecting to the topside computer below it.

**LINE VAC:** CEE-type AC input connector. Connects to 90–260 VAC, 50/60 Hz power.

3.5.4 2000 Digital Telemetry Link Controls and Indicators

The 2000 Digital Telemetry Link includes controls and indicators including the following:

**LINE:** Rocker switch. Switches AC power to the POWER switch on the front panel of the 2000-DL. This switch can be left in the on position at all times.

**POWER:** Rocker switch. Turns the 2000-DL on or off.

**PWR:** Green indicator. Illuminated when the 2000-DL is on.
LAN: Green indicator. Flashes continuously when an Ethernet connection is established.

LINK: Green indicator. Flashes while the 2000-DL is establishing a reliable communications link with the side scan sonar. Illuminates continuously when a reliable communications link with the sonar is established.

FISH POWER: Red indicator. Illuminated when the 2000-DL is on and the side scan sonar is pulsing.

**NOTE:** The 2000 Digital Telemetry Link will automatically switch off power to the tow vehicle should it be disconnected from the tow vehicle for an extended period. The power will also be turned off if an over current or under current condition exists. To reactivate the power to the tow vehicle, turn the POWER switch off and then on again.

### 3.6 TCP/IP Address Settings

The 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System includes a number of Ethernet devices connected on a common local area network (LAN), and each of these devices has a factory set TCP/IP address which under normal circumstances does not require changing. However, should any of these devices be replaced, or if upgrades are later installed, it may be required that the TCP/IP addresses be reconfigured. In addition, any computer that is to be connected to the 2000 Digital Telemetry Link must have its IP address set to 192.9.0.nnn, where nnn is any integer from 1 to 100—except for the following reserved addresses:

- 192.9.0.22
- 192.9.0.23
- 192.9.0.225
- 192.9.0.101
- 192.9.0.102

The factory IP address setting of the Topside Processor Ethernet connection is 192.9.0.99. For a list of the 2000 Digital Telemetry Link Ethernet devices and their TCP/IP addresses, refer to **TABLE 3-2**, and for the tow vehicle, to **TABLE 3-3**.
### 3.7 Connecting the System Components

Most of the system components, including some optional components, such as a printer and a navigation system, connect to the Topside Processor. The tow vehicle and any optional external sonar systems connect to the 2000 Digital Telemetry Link.

**WARNING!** Do not connect the tow cable to the 2000 Digital Telemetry Link before connecting it to the tow vehicle, otherwise injury or death can occur if the exposed connector on the tow cable is energized. Always connect the tow cable to the tow vehicle first.

When connecting the system components, refer to sub-section 3.5.1 for the location and description of the connectors. The cables used with the system are shown in **Figure 3-3**.
3.7.1 Connecting and Attaching the Tow Cable to the Tow Cable

A tow cable is shown connected and attached to a 2000-DSS Tow Vehicle in **Figure 3-4**. For shallow water surveys, a tow rope with a working load of 2000 lbs. or more and a breaking strength of at least 6000 lbs. can be used to tow the tow vehicle. It should also have an eyelet for attaching to the shackle on the tow bridle of the tow vehicle. A safety grip should also be used to strain relieve the tow cable. For deeper surveys, and armored cable should be used to tow the tow vehicle.

To connect and attach the tow cable to the tow vehicle:

1. Verify that the tow cable is not connected to the 2000 Topside.
2. Verify that the tow cable connector on the tow vehicle and the mating female connector on the tow cable are free of corrosion or dirt. If dirty, clean them with an alcohol wipe.
3. Apply a thin film of silicone grease to the pins of the tow cable connector on the tow vehicle.
4. Mate the connectors by pressing them firmly together. Do not wiggle the connectors.
5. Secure the connector locking sleeve.
6. Attach the eyelet of the tow rope and the loop of the safety grip to the shackle on the towing arm and secure the shackle bolt with seizing wire or a tie wrap.

7. Lay the tow cable over the tow bridle and secure it in three or more places with tie wraps.

3.7.2 Connecting the 2000 Topside Processor

To connect the 2000 Topside Processor:

1. Verify that the Topside Processor and the 2000 Digital Telemetry Link are not connected to AC power.

2. Verify that the tow cable is properly connected and attached to the tow vehicle, and then connect the tow cable adapter to the tow cable and to the SEA CABLE connector of the 2000 Digital Telemetry Link.

3. If an external source will be used to trigger an external device attached to 2000 DSS Tow Fish, connect the trigger output of this source to the SYNC connector.

4. Connect one LCD monitor to the MONITOR 1 connector of the Topside Processor and the second LCD monitor to the MONITOR 2 connector.

5. Connect the trackball to the USB connector.

6. Connect the keyboard to the USB connector.

7. If a printer will be used, connect it to a free USB port. For information on the printers that can be connected to the Topside Computer, refer to appendix B.0.

8. If a navigation system will be used, connect the navigation system output to the COM 1-NAV connector.

9. Connect the Ethernet patch cable to the DATA connector of the 2000 Digital Telemetry Link and to the ETHERNET 1 connector of the Topside Processor. This cable may be extended up to 100 feet using a Category 5 Ethernet crossover or straight patch cable.

10. Connect an AC power cord to the VAC INPUT connector of the Topside Processor and to the AC power source.

11. Connect an AC power cord to the LINE VAC connector of the 2000 Digital Telemetry Link and to the AC power source.

12. Connect an AC power cord to each of the LCD monitors and to the AC power source.
3.8 System Activation and Test

After the connections to the 2000 Topside Processor and the 2000 Digital Telemetry Link have been completed, the 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System can be activated and some pre-deployment checks performed prior to deployment of the tow vehicle as a test to verify that the system is operating properly.

When performing the system activation and test, refer to sub-section 3.5 RACK MOUNT TOPSIDE CONNECTIONS, CONTROLS, AND INDICATORS for the location and description of the controls and indicators. In addition, should the system not activate properly or the pre-deployment checks fail, refer to section 6.0 for assistance on how to isolate and correct the problem.

NOTE: The DISCOVER software requires license activation which is performed either directly in the tow vehicle or by inserting a dongle into an available USB port on the Topside Processor. If in the tow vehicle, no action is required.

3.8.1 Activating the System

To activate the system:

1. Turn on the LCD monitors.
2. Turn on the POWER switch on the back panel of the Topside Processor. This switch can be left in the on position at all times if desired.
3. Turn on the SYSTEM POWER switch on the front panel.
   
   The SYSTEM POWER indicator should illuminate, and the HDD indicator should flash while the Windows desktop opens. Then the EdgeTech DISCOVER 2000-C Dual Frequency Side Scan and DISCOVER Sub Bottom software open to the Main windows as shown in FIGURE 3-5.
4. Turn on the LINE switch on the back panel of the 2000 Digital Telemetry Link. This switch can be left in the on position at all times if desired.
5. Turn on the POWER switch on the front panel.

The FISH POWER indicator should illuminate; the LAN indicator should flash continuously; and the LINK indicator should flash while a reliable communications link with the tow vehicle is being established and then illuminate continuously when the link is found. In addition, the NET indicator on the Status bar at the bottom of the Main window should indicate as follows:

```
NET: ON
```
3.8.2 Performing the Pre-Deployment Checks

The pre-deployment checks should be performed after the system is activated and before the tow vehicle is deployed. These checks are performed for both the side scan and sub-bottom sonars and involve verifying that data can be recorded and played back in DISCOVER; rubbing your hand on the side scan transducer arrays and tapping the sub-bottom hydrophone arrays while observing the Sonar displays in the DISCOVER Main windows; verifying correct heading, pitch and roll outputs; and zeroing the optional pressure sensor if installed.

To perform the pre-deployment checks:

1. Activate the system as described in sub-section 3.8.1.
2. In the DISCOVER 2000-C Dual Frequency Side Scan Main window, click the Transmit tab in the Lower Control panel. This tab is shown in Figure 3-6.

![Figure 3-6: Lower Control Panel, Transmit Tab—DISCOVER Side Scan](image)

CAUTION! Do not allow the side scan transducers on the tow vehicle to continuously transmit in air for an extended period as damage to the transducers could occur.


   The side scan transducer arrays on the tow vehicle should begin transmitting and data should begin scrolling on the Sonar display in the DISCOVER 2000-C Dual Frequency Side Scan Main window.

4. Record a few minutes of data and then play back the data and verify that data can be recorded and played back.

5. Rub the port and starboard side scan transducer arrays while observing the Sonar display in the Main window.

   You should observe streaks or noise spikes in the waterfall display.
6. Verify that the heading, pitch and roll sensors are working correctly by rotating, tilting and rolling the tow vehicle and observing the Heading, Pitch and Roll displays in the Lower Indicator bar in the Main window.

7. If a pressure sensor is installed, verify that the Pressure display indication is at or nearly zero. The Pressure sensor can be zeroed on deck under External Device Controls.

8. In the DISCOVER Sub-Bottom Main window, choose Control Panel from the Sonar menu.

   The Options dialog box shown in Figure 3-7 opens to the Sonar Control tab.

   ![Figure 3-7: Options Dialog Box, Sonar Control Tab—DISCOVER Sub Bottom]

9. On the Sonar Control tab, make the required settings.

10. Click the Display tab.

    The Display tab shown in Figure 3-8 opens.

11. On the Display tab, set the Gain to either 0 or -3 dB, and then click Norm.

12. Close the Options dialog box.

   ![Figure 3-8: Options Dialog Box, Display Tab—DISCOVER Sub-Bottom]
**CAUTION!** Do not allow the sub-bottom transducer on the tow vehicle to continuously transmit in air for an extended period as damage to the transducer could occur.

13. From the Sonar menu, choose Sonar On. When the sonar is on, a check mark appears next to the menu item.

   The transducers on the tow vehicle should begin transmitting and data should begin scrolling on the Sonar display in the DISCOVER Sub-Bottom Main window.

14. Listen for transmissions from the sub-bottom transducer and verify that they are present.

15. Tap the underside of the tow vehicle near the hydrophones with the handle of a screw driver while observing the Sonar display in the DISCOVER Sub-Bottom Main window.

   You should observe streaks or noise spikes in the waterfall display.
3.9 Tow Vehicle Deployment

Shown in Figure 3-9 is a 670D Tow Vehicle being deployed.

**CAUTION!** When lowering the tow vehicle in an area where the bottom topography is not known, be careful not to strike the bottom or a submerged object, otherwise damage to the tow vehicle may occur. In addition, at all times during the survey, be sure to carefully monitor tow vehicle altitude, as failure to do so may result in the tow vehicle hitting the bottom or becoming snagged.

**CAUTION!** Do not tow the tow vehicle too close to the survey vessel. Towing in this manner can cause the tow vehicle to be pulled in against the hull of the ship due to the low pressure of the propeller wash and the effect of the water flowing by the hull. In addition, sonar reflections from the hull may be evident in the records.

**CAUTION!** Do not tow the tow vehicle with the nose angled up or down. Doing so can degrade the sonar imagery. Verify that the tow vehicle is as level as possible when towing it.

**NOTE:** For detailed towing characteristics for the 2000-DSS Tow Vehicle with several tow cable types and lengths and tow vehicle speeds, refer to appendix C.0.

**NOTE:** For detailed information about the EdgeTech DISCOVER software, including how to record data, refer to the “DISCOVER 2000-C Dual Frequency Side Scan Software User’s Manual” or to the “DISCOVER Sub-Bottom Software User’s Manual.”
To deploy the tow vehicle:

1. With the survey vessel under way at up to two knots, slowly and carefully lower the tow vehicle into the water, well away from the propeller. Do not let the tow vehicle strike the hull of the survey vessel.

2. Lower the tow vehicle to a depth of about three meters, or just below the propeller wash.

3. In the DISCOVER 2000-C Dual Frequency Side Scan Main window, click the Transmit tab in the Lower Control panel, and then select the range for each frequency. This tab is shown in **Figure 3-6**.

4. Click the Bottom Track tab. This tab is shown in **Figure 3-10**.

   ![Bottom Track Tab](image)
   
   **Figure 3-10: Lower Control Panel, Bottom Track Tab—DISCOVER 200-C Dual Frequency Side Scan**

5. On the Bottom Track tab make the required settings to track the bottom and note the tow vehicle altitude in the Altitude display.

6. Lower the tow vehicle such that its altitude is 10–15% of the range selection.
7. Increase the survey vessel speed to the desired survey speed and adjust the amount of cable out such that the altitude of the tow vehicle remains at 10–15% of the range selection.

8. If a pressure sensor is installed, verify that the Pressure display indication is correct.

9. Secure the tow cable to the survey vessel.

10. Begin recording data.

3.10 Tow Vehicle Recovery

To recover the tow vehicle:

1. In the DISCOVER 2000-C Dual Frequency Side Scan Main window, click the Transmit tab and clear the High Sonar On and Low Sonar On check boxes. This tab is shown in Figure 3-6.

   The side scan transducers should stop transmitting.

2. In the DISCOVER Sub-Bottom Main window, choose Sonar On from the Sonar menu. When the sonar is off, no check mark should be present next to the menu item.

   The sub-bottom transducer should stop transmitting.

3. Slowly pull in the tow cable until the tow vehicle is just below the surface.

4. Slow the survey vessel speed to under two knots. However, if practical, the survey vessel should be put in neutral while the tow vehicle is brought on board.

5. Retrieve the tow vehicle from the water and carefully lower it on deck.

6. Disconnect the tow cable from the tow cable connector.

7. Install the dummy plug on the tow cable connector.

8. Refer to sub-section 5.1 for instructions on how to clean and inspect the tow vehicle, the tow cable and the underwater connectors after use.
4.0 TECHNICAL DESCRIPTION

This section provides an overall general description of the hardware elements comprising the 2000 Topside Processor and the 2000-DSS Tow Vehicle of the 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System. This information, which includes block diagrams, board descriptions, chassis photos, component callouts, and wiring diagrams, can be useful for troubleshooting purposes and installing optional equipment.

4.1 2000 Topside Processor

The 2000 Topside Processor is composed of the Topside Processor and the 2000 Digital Telemetry Link installed in a 19-inch rack enclosure along with a keyboard, a trackball and two LCD monitors.

4.1.1 Topside Processor

The Topside Processor electronics chassis is shown in FIGURE 4-1. The main hardware elements in the Topside Processor include the following components and circuit boards:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPUTER POWER SUPPLY</td>
<td>Provides DC power for the CPU Board and the hard drives.</td>
</tr>
<tr>
<td>CPU</td>
<td>The CPU board runs the Microsoft Windows XP operating system and the DISCOVER software on an Intel Pentium 4, 2.4 GHz processor and includes 512 MB of RAM. The CPU board outputs downlink commands to the tow vehicle over the Ethernet connection to the 2000 Digital Telemetry Link while it inputs the uplink sonar data from the tow vehicle over the same connection. A 500-GB hard drive contains the operating software, and a 1-TB hard drive is used for data storage. Both hard drives interface with the CPU board as do the LCD monitor, the keyboard and the trackball. Power for the CPU board is provided by the Computer Power Supply.</td>
</tr>
<tr>
<td>4-PORT RS-232 SERIAL BOARD</td>
<td>The 4-Port RS-232 Serial board plugs directly into the CPU and provides four RS-232 serial ports on RJ45 connectors. A cable connects from each connector to one of four DB-9 connectors, COM5–COM8, on the back panel.</td>
</tr>
<tr>
<td>HARD DRIVES</td>
<td>A 160-GB hard drive (C:\ drive) stores the Windows XP operating system and the application software. A 1 TB hard drive (D:\ drive) is used for data storage.</td>
</tr>
</tbody>
</table>
4.1.2 2000 Digital Telemetry Link

A block diagram of the 2000 Digital Telemetry Link electronics is shown in Figure 4-4. The wiring diagram is shown in Figure 4-5, and the electronics chassis is shown in Figure 4-3. The main hardware elements in the 2000 Digital Telemetry Link include the following components and circuit boards:

**POWER:**
The Power board inputs +24 VDC on J1 from the 24 VDC Power Supply and generates the 400 VDC tow vehicle power which is output to the tow vehicle on J13 combined with the frequency shift keyed (FSK) responder trigger signal input on J10 and the ADSL downlink command and uplink data signals. The command signals are input and the data signals are output on J14. The Power board also includes +5, +12 and +15 VDC power supplies, where +12 VDC is output on J4 to the fan and on J6 to the ADSL Modem board.

**24 VDC POWER SUPPLY:**
The 24 VDC Power Supply inputs AC power from the Power Entry module to generate +24 VDC which is output to the Power board.

**POWER ENTRY:**
The Power Entry module filters the AC power and connects it to the 24 VDC Power Supply through the front panel power switch.

**ADSL MODEM:**
The ADSL Modem board converts the uplink data ADSL signals received from the tow vehicle and input on the ADSL connector from the Power board into Ethernet 10/100/1000BaseT signals which are output to the 2000 Topside Processor. Similarly, the ADSL Modem board converts the downlink Ethernet 10/100/1000BaseT based command signals from the 2000 Topside Processor into the ADSL downlink command signals which are output on the ADSL connector to the Power board for transmission to the tow vehicle. The ADSL Modem board also serves as an Ethernet switch to provide Ethernet connections on J1 to the 2000 Topside Processor, on J3 to the Wireless Router and on J4 to the Net Burner board on the Power board, placing all of these devices on the same LAN. +12 VDC power is input on the DC connector from the Power board.

**NET BURNER:**
The Net Burner board mounts to and connects directly to the Power board to provide Power board diagnostics, tow vehicle power control, positive and negative trigger edge selection, and sensor monitoring. An Ethernet connection to the Net Burner board is provided on J3 from the ADSL Modem board. Power is input from the Power board.
4.1.2.1 Selecting Negative Edge Triggering for the Optional Responder

The 2000-DSS system has the ability to be configured with an optional responder in the tow vehicle. If ordered from the factory with a responder installed, the 2000-DL digital telemetry link will have a jumper installed in the location shown in FIGURE 4-2, and the customer does not need to take any further steps.

However, if a responder is installed later, a jumper, selecting for negative edge triggering needs to be added to JP6 on the power board of the 2000-DL as shown in FIGURE 4-2. To locate the Power board, refer to the FIGURE 4-3.
Figure 4-2: 2000 Digital Telemetry Link Electronics Block Diagram
4.2 Tow Vehicle

A photo of the 2000-DSS Tow Vehicle electronics chassis is shown Figure 4-7, and a block diagram and interconnect drawing are in Figure 4-8 and Figure 4-8, respectively. The electronics chassis contains all of the tow vehicle circuit boards along with the optional pressure sensor. The circuit boards are the following:

**POWER DISTRIBUTION**

The Power Distribution board inputs the tow vehicle 400 VDC power on J1 from the 2000 Topside Processor over the coaxial tow cable and filters it from the frequency shift keyed (FSK) responder trigger signals and the ADSL downlink command and uplink data signals. The command signals are input and the data signals are output on J2. The Power Distribution board also includes DC to DC converters which convert the 400 VDC to +48, +12, 12, and -5 VDC. The +48 VDC is output on J4 to the Amplifier boards. The other voltages are output on J6 to the ADSL Modem board, J5 to the CPU board, J7 to the Sonar Interface board, J8 to the Option connector, and J9 and J11 to the fans.

**ADSL MODEM**

The ADSL Modem board converts the downlink command ADSL signals received from the 2000 Topside Processor and input on J2 from the Power Distribution board into Ethernet 10/100/1000BaseT signals which are output on J1 to the CPU board. Similarly, the ADSL Modem board converts the uplink Ethernet 10/100/1000BaseT based data signals from the CPU board into the ADSL uplink data signals which are output on J2 to the Power Distribution board for transmission to the 2000 Topside Processor. The ADSL Modem board also outputs the FSK responder trigger signals on J5 to the Sonar Interface board and to the optional Responder board. +12 and -12 VDC power is input on J8 from the Power Distribution board.

**T/R SWITCH**

The T/R Switch board provides the transmit/receive function for the side scan transducer arrays, allowing them to be used both as acoustic transmitters and as acoustic receivers simultaneously. Transmit signals are input from the Power Amplifier board as follows:

- J1: Port low frequency transmit
- J2: Port high frequency transmit
- J3: Starboard high frequency transmit
- J4: Starboard low frequency transmit
Figure 4-4: Tow Vehicle Electronic Block Diagram
Figure 4-5: Tow Vehicle Interconnect Drawing
Amplified transmit signals are output to the transducer arrays or received signals are input from the transducer arrays as follows:

- J8: Port transducer array receive
- J14: Starboard transducer array receive

The T/R Switch board also includes four noise reducing receiver preamplifiers, one each for the high and low frequency port transducer arrays and one each for the high and low frequency starboard transducer arrays.

**POWER AMPLIFIER**

There are four identical Power Amplifier boards, one each for the port high (SSH) and low (SSL) frequency transmit signals and one each for the starboard high and low frequency transmit signals. +48 VDC is input on J2 from the Power Distribution board, and the amplified outputs are output on J3 to the T/R Switch board to drive the transducer arrays. On/off control signals, along with the low level transmit signals, are input on J1 from the Sonar Interface board.

**CPU**

The CPU board runs an embedded version of the Microsoft Windows XP operating system and includes a 512-GB flash memory with C and D partitions. The C partition contains the operating system, and the D partition contains the sonar application software. The CPU board inputs downlink commands from the 2000 Topside Processor over the Ethernet connection on J1 with the ADSL Modem board while it outputs the uplink sonar data to the 2000 Topside Processor over the same connection. In addition to these functions, the CPU provides the chirp matched filter processing, power up diagnostic self-tests, and pointing device and keyboard inputs for factory test. The COM1 serial port of the CPU board interfaces with an optional magnetometer, and the USB port interfaces with the Compass board. +12 VDC power is input from the Power Distribution board.

**SONAR INTERFACE**

The Sonar Interface board converts the digital chirp high and low frequency transmit signals for the 100/400-KHz frequency systems into corresponding low level analog signals which are output on J9 to the Power Amplifier boards. In addition, signals from an optional pressure sensor and an internal temperature sensor are input on J10, the FSK responder trigger signals are input on J4, and the digitized received sonar signals from the Side Scan board are input on J7. Test points and indicators for the transmit signals and IDE interface logic for the Side Scan board.
are also included. +5, +12 and -12 VDC power is input on J5 from the Power Distribution board.

**DDC**
The DDC board is used in place of the Sonar Interface board for the 300/600 kHz system.

**SIDE SCAN**
The Side Scan board is a four channel receiver that provides analog to digital conversion of the received sonar signals which are input on J1 from the T/R Switch board. The digitized signals are output on J2 to the Sonar Interface board. Indicators on the Side Scan board illuminate when signals are being received.

**SUB-BOTTOM**
The Sub-bottom board is a single channel receiver that provides analog to digital conversion of the received sonar signals which are input from the hydrophones on J4 on the electronics bottle connector end cap. The digitized signals are output on J2 to the Sonar Interface board. Indicators on the Sub-Bottom board illuminate when signals are being received.

**COMPASS**
The Compass board provides heading, pitch and roll outputs to the USB port of the CPU board.

### 4.3 Cables

Outline drawings of the optionally available tow cable and test cable are listed below along with their corresponding figure numbers.

- **Figure 4-9: Armored Cable, PMI Grip, Unterminated Topside**
- **Figure 4-10: Test Cable**
Figure 4-6: Armored Cable, PMI Grip, Untermimated Topside
NOTE: W1 AND W2 TO BE USED AT FULL LENGTH, AS SHIPPED BY VENDOR.

Figure 4-7: Test Cable
5.0 MAINTENANCE

The 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System is ruggedly designed and built and therefore requires little maintenance. However, to ensure long lasting and reliable service, some periodic maintenance is recommended.

This section provides some maintenance recommendations and includes instructions on how to disassemble and reassemble the 2000-DSS Tow Vehicle should it be required to access and remove the electronics chassis in the electronics bottle. In addition, lists of major components for the 2000 Topside Processor and the 2000-DSS Tow Vehicles are included.

5.1 Periodic Maintenance

Maintenance on the 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System should be performed on a regular basis or as often as necessary, depending on use. However, most of the maintenance is performed after each deployment and recovery cycle of the tow vehicle. No periodic maintenance is required for the 2000 Topside Processor.

5.1.1 Inspecting and Cleaning the Tow Vehicle and Tow Cable after Use

After retrieving the tow vehicle from the water, use a hose to wash it down, along with the tow cable, with clean, fresh water. Thoroughly spray the transducer arrays and remove any buildup of debris. Inspect the cables and connectors for any damage and check for loose connections. Also inspect the tow cable and the connectors on each end.

After washing down the tow vehicle, clean the transducer arrays using a mild, non-abrasive detergent and water. Do not use any abrasive detergents or ammonia based cleaners. After cleaning, thoroughly spray the transducer arrays again with fresh water.

5.1.2 Inspecting and Cleaning the Underwater Connectors

Regularly inspect the contacts on the male pins of each underwater connector in the tow vehicle and on the tow cable for corrosion or oxidation. To remove any oxidation, rub the contacts lightly with 800 grit emery cloth cut into strips equal to or less than the width of a contact. A pencil eraser can also be used for this purpose. The female sockets can be cleaned using a cotton swab and rubbing alcohol. A .22 caliber bore brush with only nylon bristles can be used to remove light oxidation.

To extend the life and increase the reliability of the connectors, apply a thin film of silicone dielectric grease, such as Novagard G624 general purpose silicone grease or an equivalent, to the entire surface of each male pin. A small amount of grease should also be applied to the opening of each female socket.
NOTE: Remember to always install dummy connectors on the connectors of the tow cable and the tow vehicle tow cable connector.

5.1.3 Storage

When not in use, all the components of the 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System should be packed in their original shipping containers in the same manner in which they were originally shipped and stored in a dry area.

5.1.4 Recommended Spares

Spares, such as circuit boards, power supplies, cables, and other critical items should be purchased at the same time as the system is purchased, as some original equipment manufactured (OEM) components may change. All spares are optional. For a list of recommended spares at the time of the system purchase, contact EdgeTech sales.

5.2 Restoring the Operating System to the Hard Drive

The Topside Processor contains a 160-GB hard drive for both the operating system and the application software. A separate 1-TB hard drive is also included for data recording. An image file of the 160-GB hard drive is provided on a CD. This CD can be used to completely restore the 160-GB hard drive to its original shipped factory configuration in the unlikely event of its failure. For instructions on how to restore the operating system, refer to APPENDIX B: “System Backup and Restore.”

5.3 Disassembling and Reassembling the Tow Vehicle

The procedures below describe how to disassemble and reassemble the tow vehicle to access and remove the electronics chassis. The tools required are a 9/16-inch wrench, a 7/16-inch wrench and a ½-inch allen key.

WARNING! High voltages that can cause injury or death are present in the tow vehicle. Turn off both the Topside Processor and the 2000 Digital Telemetry Link and disconnect the tow cable before disassembling the tow vehicle.
5.3.1 Disassembling the Tow Vehicle

To disassemble the tow vehicle: Place the tow vehicle on a clean, dry, flat surface. For the 2000-DSS Tow Vehicle, use the 9/16-inch wrench and remove the three sets of bolts, washers and self-locking nuts in the bow. Next, remove the eight sets of bolts and split lock washers from the port and starboard tow brackets and remove the tow bridle, tow brackets and bar nuts. Then remove the two sets of bolts, washers and self-locking nuts at the stern of the tow vehicle and remove the upper half of the fiberglass shell.

9. Using the 9/16-inch wrench, remove the four sets of nuts, flat washers and lock washers securing the two bottle clamps and remove the clamps.

10. Disconnect all the cables from the connector end cap of the electronics bottle and remove the bottle from the tow vehicle.

11. Using the ¼-inch allen key, remove the three socket head cap screws from the connector end cap.

12. Insert the socket head cap screws into the three end cap removal holes on the connector end cap.

13. Using the ¼-inch allen key, evenly screw each of the socket head cap screws into the end cap to extract it.

14. When the end cap is free of the housing, carefully slide the electronics chassis completely out of the housing and lay it on a clean flat surface.
5.3.2 Reassembling the Tow Vehicle

Before reassembling the tow vehicle, clean the two O-rings on the end cap with a lint free paper towel and inspect them for any scratches, nicks or dirt. If any of these conditions exist for an O-ring, discard the O-ring and install a new one. When installing a new O-ring, first clean the O-ring surfaces on both the housing and the end cap with the paper towel, and then apply a light coating of silicone lubricant to the new O-ring around its entire surface and install it. If no scratches, nicks or dirt are found when cleaning the O-rings, leave them installed and apply a light coat of silicone grease only.

To reassemble the tow vehicle, reverse the disassembly procedure. However, when reassembling the end cap to the housing, line it up as shown in Figure 5-2 with the arrow pointing up.

5.4 Calibrating the Compass

The compass is calibrated at the EdgeTech manufacturing facility. Should the compass in the towfish lose its calibration for any reason in the field, it may be necessary to recalibrate it. This is accomplished by accessing the embedded Windows installation in the towfish itself via a remote desktop application on the Rack Mount Topside.
Furthermore, it is necessary to physically move the towfish around in different positions for the compass within it to establish the necessary reference points. The support of at least two survey technicians, and a rotating table (as shown in the procedure to follow) or winch for hoisting and rotating the towfish are essential.

**NOTE 1:** Compass calibration for the 2000-TVD should only be done under the advisement of EdgeTech Customer Service.

**NOTE 2:** The following procedure is accomplished with the towfish's electronics bottle (which contains the compass). This requires the towfish to be disassembled and the bottle removed and then connected to the topside.

1. Power up the topside with towfish's electronics bottle connected.
2. Click on the Remote Desktop icon (Figure 5-3) and click Connect on the splash screen (Figure 5-4).

*Figure 5-3: Remote Desktop Icon*

*Figure 5-4: Remote Desktop Splash Screen*
3. If a warning pops up as shown in Figure 5-5, click Yes before proceeding.

![Remote Desktop Warning Screen](image)

*Figure 5-5: Remote Desktop Warning Screen*

4. In the remote desktop program, the embedded Windows installation in the towfish will become accessible. Shut down the Sonar.exe application running (see Figure 5-6 below):

![Closing Sonar.exe](image)

*Figure 5-6: Closing Sonar.exe*
5. On this desktop, click on the **Tera Term** command console icon (**FIGURE 5-7**). At the splash screen (**FIGURE 5-8**), click OK.

**Figure 5-7: Tera Term Icon**

**Figure 5-8: Tera Term Splash Screen**
6. Establish communications with the SSAHRS and verify via a serial console.

7. Stop the device and retrieve the current level 2 (factory) calibration using the following two commands.

```plaintext
stop <CR>
getLevel2CompassCalibration <CR>
```
8. Ensure that the points are 0, the error percentage is 100.0%, the hard iron values are all 0.0, and that the soft iron values are an identity matrix (see Figure 5-11).

![Figure 5-11. Motion Sensor Calibration Result]

If for some reason they are not; reset SSAHRS with the following command and then cycle power.

```
setLevel2CompassCalibration, factory2015, 0, 100.0, 50.0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1 <CR>
```

9. Restart the SSAHRS by issuing the following command, to start compass data:

```
start <cr>
```

Heading, Pitch, Roll, and Temperature should begin to scroll.

![Figure 5-12. Motion Sensor Serial Output]
10. Slowly move the electronics bottle around in such a fashion as to position the compass in as many possible orientations as possible for pitch, roll and heading directions.
   a. UUT in neutral position: Pitch/Roll ~0 degrees, rotate device through 360 degrees of heading (10 times)
   b. UUT in Pitch/Roll ~-90 degrees, rotate device through 360 degrees of heading (10 times)
   c. UUT in Pitch/Roll ~+90 degrees, rotate device through 360 degrees of heading (10 times)

11. At the serial console, execute the following commands.
   stop <CR>
   getCurrentCompassCalibration <CR>

12. The compass solution will be displayed to the user as well as the number of points, magnitude of the magnetic field at this location, and the fit error. If the solution is not viable the device should be returned to streaming with the start <CR> command and steps 8 through 10 should be repeated until the fit error is ≤ 1.0% and Points is > 100.
   a. Valid solution:

   ![Image of Compass Calibration Table]

   **Figure 5-13: Compass Calibration Table**

   b. If the solution was acceptable, Fit Error ≤ 1.0% record and provided product engineer along with the vehicle type. Finally, save the data into the factory calibration (level2) portion of the device with the following command then cycle power:

   setLevel2CompassCalibrationFromCurrent, factory2015 <CR>

   c. Verify Factory Compass Calibration has been set by issuing the following commands:

   Stop <CR>
   getLevel2CompassCalibration

13. At this point, the SSAHRS calibration is complete. Close out of remote desktop.
5.4.1 Changing the Angle of Declination

The compass' angle of declination is set to true north at the EdgeTech facility. However, to provide a more accurate target location, it is necessary to enter the known magnetic declination for the survey location into the compass as follows:

14. Repeat steps 1 through 6 in Calibration procedure in section 5.4.

15. Verify current Declination Angle of Deviation using the following command:

```
getDeclination <CR>
```
16. Enter the set declination command to get help for command:

    setDeclination <CR>

Help for command:

    setDeclination, [D]

[D]: Declination angle (degrees), which is the correction between magnetic north and true north. This value depends on geographic location.

Declination for your location can be found by going to the following website:

    http://www.ngdc.noaa.gov/geomag-web/#declination

Here is an example of how using this website can help you to determine your angle of deviation:

Zipcode 02360 was inserted, then "Get & Add Lat/Lon" was selected:
Figure 5-16: Magnetic Declination Estimated Value Screen
• "Calculate" is then selected:

![Figure 5-17: Angle of Declination Calculated](image)

The Declination Angle received was 14.47 degrees. This is the angle that will be entered into the TeraTerm command screen.

- Enter the Declination Angle using the command:
  
  setDeclination, 14.47 <CR>

  Verify entry of declination Angle using the command:
getDeclination <CR>

Figure 5-18
6.0 TROUBLESHOOTING

In the unlikely chance that some operational or performance problems occur with the 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System, it may be possible to correct them using the troubleshooting guides in the following pages. For the Topside Processor and the 2000 Digital Telemetry Link, tabular troubleshooting guides are provided in TABLE 6-1 and TABLE 6-2, respectively. These troubleshooting guides identify some symptoms that could occur and presents one or more possible causes and the recommended corrective action for each. Perform the corrective action for any given symptom in the order of possible causes, which generally corresponds to the degree of troubleshooting difficulty, from the simple to the more complex.

For the tow vehicle, detailed information is provided in “TOW VEHICLE TROUBLESHOOTING GUIDE”.

Before proceeding with any corrective action, verify that the 2000 Topside Processor is plugged into an appropriate AC or DC power source and that the unit is switched on.

NOTE: Be sure to also verify that all the cables on the 2000 Topside Processor and the tow vehicle are mated and are not loose or damaged. Most causes of operational or performance problems are a result of poor connections.

6.1 2000 Topside Processor Troubleshooting Guide

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The green SYSTEM POWER switch indicator on the 2000 Topside Processor does not illuminate when the processor is turned on.</td>
<td>The POWER switch is not turned on.</td>
<td>Verify that the POWER switch on the back panel is on.</td>
</tr>
<tr>
<td></td>
<td>No AC power.</td>
<td>Verify that the 2000 Topside Processor is connected to AC power. Check the AC power source.</td>
</tr>
<tr>
<td></td>
<td>The indicator is not operating.</td>
<td>Open the 2000 Topside Processor and check the indicator and wiring.</td>
</tr>
<tr>
<td>The yellow HDD indicator on the 2000 Topside Processor does not flash when the processor is turned on.</td>
<td>The operating system is not booting.</td>
<td>Open the 2000 Topside Processor and verify that the 160-GB hard drive is connected to power and that the ribbon cable is properly plugged in. Also verify that the ribbon cable in properly plugged into to the CPU board.</td>
</tr>
<tr>
<td></td>
<td>The indicator is not operating.</td>
<td>Open the 2000 Topside Processor and check the indicator and wiring.</td>
</tr>
<tr>
<td>The DISCOVER/ETSI reports “Cannot ping towfish.”</td>
<td>Tow cable disconnected.</td>
<td>Check tow cable connections.</td>
</tr>
</tbody>
</table>
### 6.0: TROUBLESHOOTING

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAN settings are not properly setup.</td>
<td>Refer to sub-section 3.6 for TCP/IP address settings.</td>
<td></td>
</tr>
<tr>
<td>Modem settings incorrect.</td>
<td>Check modem settings per subsection 3.6 TCP/IP ADDRESS SETTINGS</td>
<td></td>
</tr>
<tr>
<td>Modem disconnected internally on topside.</td>
<td>Check modem settings per subsection 3.6 TCP/IP ADDRESS SETTINGS</td>
<td></td>
</tr>
<tr>
<td>Improper settings in DISCOVER.</td>
<td>In <strong>DISCOVER 2000-C Dual Frequency Side Scan</strong>, choose Network from the Configuration menu and verify that the Sonar IP Address is 127.0.0.1 and the Sonar Port Number is 1602. In <strong>DISCOVER Sub-Bottom</strong>, choose Control Panel from the Sonar menu and select the Network tab from the Options dialog box. Verify that the TCP/IP Address is 127.0.0.1 and the TCP/IP Socket is 1600.</td>
<td></td>
</tr>
<tr>
<td>The tow vehicle is faulty.</td>
<td>Verify tow vehicle on a different 2000 Topside Processor. Verify 2000 Topside Processor with a different tow vehicle.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The green POWER indicator on the 2000 Digital Telemetry Link does not illuminate when the unit is turned on.</td>
<td>The POWER switch is not turned on.</td>
<td>Verify the POWER switch is on.</td>
</tr>
<tr>
<td>No AC power. When using AC power connector.</td>
<td>Verify that the 2000 Topside Processor is connected to AC power. Check the AC power.</td>
<td></td>
</tr>
<tr>
<td>5-amp fuses on rear panel of 2000 Topside Processor AC connection bad.</td>
<td>Check fuses for continuity. Replace if necessary.</td>
<td></td>
</tr>
<tr>
<td>The indicator is not operating.</td>
<td>Open the 2000 Digital Telemetry Link and check the indicator and wiring.</td>
<td></td>
</tr>
<tr>
<td>The green LAN indicator on the 2000 Digital Telemetry Link does not illuminate when the unit is turned on.</td>
<td>There is no connection between the 2000 Digital Telemetry Link and the Topside Processor.</td>
<td>Check LAN connections between the 2000 Digital Telemetry Link and the Topside Processor.</td>
</tr>
</tbody>
</table>

### 6.2 2000 Digital Telemetry Link Troubleshooting Guide
<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The indicator is not operating.</td>
<td>The green LINK indicator on the 2000 Digital Telemetry Link flashes when the unit is turned on. After 1 minute flashing should stop and indicator should remain lit.</td>
<td>Open the 2000 Digital Telemetry Link and check the indicator and wiring.</td>
</tr>
<tr>
<td>The green LINK indicator on the 2000 Digital Telemetry Link flashes when the unit is turned on. After 1 minute flashing should stop and indicator should remain lit.</td>
<td>Tow cable between the 2000 Digital Telemetry Link and tow vehicle is disconnected or faulty.</td>
<td>Check connections and tow cable.</td>
</tr>
<tr>
<td>The green LINK indicator on the 2000 Digital Telemetry Link flashes when the unit is turned on. After 1 minute flashing should stop and indicator should remain lit.</td>
<td>Modem settings on the topside are incorrect.</td>
<td>Check modem settings per subsection <a href="#">3.6 TCP/IP ADDRESS SETTINGS</a>.</td>
</tr>
<tr>
<td>The green LINK indicator on the 2000 Digital Telemetry Link flashes when the unit is turned on. After 1 minute flashing should stop and indicator should remain lit.</td>
<td>The tow vehicle is faulty.</td>
<td>Check the 2000 Digital Telemetry Link on different tow vehicle.</td>
</tr>
<tr>
<td>The red FISH POWER indicator on the 2000 Digital Telemetry Link illuminates after 10 seconds then after 20 seconds turns off.</td>
<td>Tow cable is not connected between the 2000 Digital Telemetry Link and tow vehicle.</td>
<td>Check tow cable connections to the 2000 Digital Telemetry Link and connection to tow vehicle.</td>
</tr>
<tr>
<td>The red FISH POWER indicator on the 2000 Digital Telemetry Link illuminates after 10 seconds then after 20 seconds turns off.</td>
<td>Tow cable is faulty.</td>
<td>Check continuity between connectors and proper wiring.</td>
</tr>
<tr>
<td>The red FISH POWER indicator on the 2000 Digital Telemetry Link illuminates after 10 seconds then after 20 seconds turns off.</td>
<td>Power board is faulty.</td>
<td>Verify that RED LED D2 turns on after 10 seconds.</td>
</tr>
<tr>
<td>The red FISH POWER indicator on the 2000 Digital Telemetry Link illuminates after 10 seconds then after 20 seconds turns off.</td>
<td>The tow vehicle is faulty.</td>
<td>Verify tow vehicle on a different 2000 Topside Processor. Verify 2000 Topside Processor with a different tow vehicle.</td>
</tr>
<tr>
<td>The DISCOVER reports “Cannot ping towfish”</td>
<td>LAN cable disconnected.</td>
<td>Check LAN cable connection.</td>
</tr>
<tr>
<td>The DISCOVER reports “Cannot ping towfish”</td>
<td>Tow cable disconnected.</td>
<td>Check tow cable connections.</td>
</tr>
<tr>
<td>The DISCOVER reports “Cannot ping towfish”</td>
<td>LAN settings are not properly setup.</td>
<td>Refer to sub-section <a href="#">3.6 for TCP/IP address settings</a>.</td>
</tr>
<tr>
<td>The DISCOVER reports “Cannot ping towfish”</td>
<td>Modem settings incorrect.</td>
<td>Check modem settings per subsection <a href="#">3.6 TCP/IP ADDRESS SETTINGS</a>.</td>
</tr>
<tr>
<td>The DISCOVER reports “Cannot ping towfish”</td>
<td>Modem disconnected internally on topside.</td>
<td>Check modem settings per subsection <a href="#">3.6 TCP/IP ADDRESS SETTINGS</a>.</td>
</tr>
<tr>
<td>The DISCOVER reports “Cannot ping towfish”</td>
<td>Improper settings in DISCOVER.</td>
<td>Check that under “Configuration” pull down “Network” the displayed address is 192.9.0.101 with “Port” set to 1700.</td>
</tr>
</tbody>
</table>

---

**EdgeTech**
### Table 6-2: 2000 Digital Telemetry Link Troubleshooting Guide

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tow vehicle is faulty.</td>
<td>Verify tow vehicle on a different 2000 Topside Processor. Verify 2000 Topside Processor with a different tow vehicle.</td>
<td></td>
</tr>
</tbody>
</table>

#### 6.3 Tow Vehicle Troubleshooting Guide

The tow vehicle is a computer-controlled device. Therefore, to troubleshoot such a complex piece of equipment to a sub-module level, one must have the proper test equipment and thorough knowledge of the unit’s electrical operation plus hardware aspects. The purpose of this section is not to develop those techniques nor provide a step-by-step procedure where one may start and end up at the point of failure. It is to give an operator some familiarity with the electronic hardware. The following sections provide some specific areas to check which are easily identifiable and certain clues as to what to look for in making an educated guess as to the source of the problem. This is only down to the module or PCB level.

The tow vehicle is a software-controlled computer system. There are also some analog sections that interface with the tow vehicle transducers. Being a digital device, many operating portions use the same data and address lines a failure of one may result in a failure of all. This makes it very hard to isolate some digital problems without the proper equipment and a thorough knowledge of the data flow. This equipment is not normally found on a vessel.

The primary objective is to ascertain which system component is at fault. First, ensure that the system is properly installed with all connections properly mated. Next, check that the line voltages for the topside components are within specified limits and any fuses have not blown. Fuses may fail if a wrong connection has been made during setup. They have also been known to fail for no apparent reason. Always replace fuses with those of the same value. If a fuse fails again within a short time, there are more serious problems within the corresponding unit.

Open the cover of the topside electronics and check that all the cards are seated, especially if the unit has been in transit. After checking the cards, ensure that the cable connectors are properly mated. If the problem persists, disengage and then reengage all PC boards and do the same for all board cable connections, before going on to any electrical testing.

All calibration adjustments are preset at the factory and should not require any modifications in the field unless certain mechanical and/or electrical components are changed or the adjustments are inadvertently altered.

If the above checks do not identify or remedy the problem, attempt to isolate the failure to one of the major system components: the sonar processor, the modem/power unit, the tow vehicle, or the tow cable. The following presents various operational problems and general comments on where to look and what to look for.
The main objective is to get the basic system working. It is therefore good practice to disengage any option circuit cards installed in the unit and optional external system components now to reduce the number of possible trouble sources.

6.3.1 Equipment Required

Except for the topside processor/power unit, only common laboratory test equipment and tools are required for field troubleshooting. No special equipment is necessary. Typical test equipment includes:

- Digital multi-meter, Fluke or equivalent
- Oscilloscope
- Hi-pot tester
- Capacitance meter

6.3.2 Transmission Verification

The 512C and 670D Tow Vehicles are different than that of conventional side scan sonars used for many years. The early sonars were driven with a high-powered energy burst similar to hitting a bell with a hammer. The transducers are driven with a smooth rising lower power signal that matches the transducer response. Because of this, there is no pronounced clicking noise emanating from the transducers when they are firing. Therefore, the ‘listen for the clicking noise’ test cannot be used to verify sonar transmission during bench or on-deck testing.

Sniffing with an oscilloscope can be used as a substitute to check transducer firing. One way is to attach the scope probe’s ground to the tow vehicle body and hold the open probe next to the transducer under test. Set to about 20 to 50mV/Div.

A second method is to connect a several-turn wire loop across the scope probe and move it over the transducer face. Electrical pickup should be noticed on the scope screen at each transmission burst. Remember that the transducers and elements within the transducer may be firing together or in sequence. One must make sure that the electrical pickup is not from an adjacent string.

6.3.3 Sonar Processor and Data Link

It is assumed that the sonar processor is up and working to complete system test and troubleshooting. Refer to the sonar processor’s manual for its troubleshooting and diagnostic information.

The other thing is that the high-speed data must be up and running so that the topside and sub-sea units are communicating with each other. If the tow vehicle boots up correctly and passes its internal self-test, there will be a smooth sequence of rising tones going from 2 to 3.9 kHz. A set of tones jumping from 2 to 3 kHz means that self-test has failed. These tones are generated in software in the tow vehicle and replicated on the surface when an EdgeTech topside processor is used to access the Tow vehicle computer subsystem using the Remote Desktop application. The Self-Test PASS tones repeat until data linkup has
occurred between the topside DISCOVER software, and tow vehicle. Self-Test FAIL tones repeat indefinitely.

There will also be a video acknowledgement of successful self-test and linkup in the topside processor’s DISCOVER display window. Self-test status will also be displayed on an external video monitor if attached directly to the tow vehicle’s CPU board’s VGA connector.

If the topside processor is unavailable and the tow vehicle is dismantled, an external keyboard, mouse and video monitor may be connected to the tow vehicle’s CPU board to provide some diagnostic testing. An external power unit will still be required.

### 6.3.4 Topside Power Unit

Tow vehicle power is supplied either from an individual power/modem unit or from an integrated topside processor. Voltage and current to the tow vehicle are important parameters. They must be within acceptable limits for the tow vehicle to work properly. Check the tow cable output voltage with the system connected and, if possible, the current drain with an inline connection. Cable current should be between 120mA (Idle) and 250mA.

The topside units supply 400VDC to the tow cable. The voltage at the tow vehicle end of the cable must be not less than 300VDC to start the system and not be less than 200V during operation.

### 6.3.5 Command and Data Link

To check that the command and data link over the tow cable is operational, start the Remote Desktop application on the topside control computer. There is normally a shortcut on the EdgeTech Desktop for this. The tow vehicle’s PC screen should appear in a window on the Topside Processor screen. This will appear as a yellow desktop with the sonar application dialog box visible. If this is successful then the command link is working.

### 6.3.6 Data Link

A good, quick qualitative test of the data link and tow vehicle electronics is to perform a rub test on each transducer. Set the Range to 200 meters for both frequencies and start the system running in HDM mode for both. Set screen gain to +30dB for both frequencies and briskly rub each aft transducer face one at a time. A dark band should appear on the sonar processor screen corresponding to the side rubbed.

Data throughput rates on the uplink (vehicle to topside) can be critical in getting smooth data from the tow vehicle. The data throughput rate can be checked using EdgeTech supplied utilities at each end of the link.

The sockBlast application is used to test network throughput between the tow vehicle and the Topside Processor. This application is normally kept in C:\EdgeTech\Utilities folder on the topside unit, and D:\EdgeTech\Utilities folder on the tow vehicle.
Two copies must be run one on each computer. One serves as the client (topside) and the other as the server (tow vehicle). Since the client connects to the server, the Create Client (topside) address must be the TCP/IP address of the server (tow vehicle) machine, which is 192.9.0.99. The tow vehicle Create Server address should be 0.0.0.0.

After pressing the Create buttons to start the server and clients on their respective machines, the two applications hook up, then the Client count on the tow vehicle should increment from 0 to 1 and the Server count on the topside should increment to 1 as well. This indicates that there is one connection between the two applications.

Check the Server Send Data box on the tow vehicle. A performance in MB/second will be displayed. This should be more than 0.35Mbyte/s.

6.3.7 Tow Vehicle

First verify that the command and data links between the tow vehicle and topside are working per above.

**NOTE:** It is recommended that all attempts be made to see if a problem is external to the tow vehicle before opening it.

**WARNING!** High voltage (400 VDC) is always present in the electronics assembly when powered.

6.3.7.1 Preliminary

When the electronics has been removed:

1. Check that all boards are still secured to their mountings.
2. Check the matings of all connectors.
3. Check that the terminal board screw connections are tight.
4. Check for obvious hot / burn spots by sight and smell.
6.3.7.2 No Sonar Data

If the sonar display doesn’t scroll, use the ‘scope sniffing’ approach as outlined in “Transmission Verification” on page 5-18 to check transducer firing. If the transducers are firing, and the data link is working, the problem is most likely related to the topside processor and/or data modem.

If the display scrolls but is blank and the transducers are firing, the problem most likely lies with either or a combination of the tow vehicle receiver, transducer or its signal processing circuitry. Establish if the problem is on a single channel or all channels.

If data is absent in all, or individual channels, check the T/R Switch and SSB boards. If the problem is with a particular channel, also check the respective power amplifier and transducer element.

Connect to tow vehicle using REMOTE DESKTOP 192.9.0.101 login: administrator, password: admin. Sonar application should be running and there should not be any errors posted to the window. Errors reported could be: “No Sonar Device Found”, this will indicate that the CPU does not connect to the sonar processor card. “IF_DIAG” the sonar processor has detected an error and will not run. Cycle power on tow vehicle recheck error, if the error is still present check the cables running to and from the sonar interface card. “HM_Sensors” this reports the 48 volts if this error is found check output of power distribution board in tow vehicle and also the power on the power amps.

6.3.7.3 Power Supplies

Several power supplies and voltage regulators are located throughout the tow vehicle assembly. The main ones are located on the Power Distribution board. The first supply converts the 400VDC tow cable voltage to the operating +48VDC supply. Other DC/DC converters running off the 48 volts generate the low level operating supply voltages. No supplies are adjustable.

The following are the main voltage test points on the Power Distribution board.

<table>
<thead>
<tr>
<th>Supply</th>
<th>Test Point</th>
<th>Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5 VDC +/-0.2V</td>
<td>TP7</td>
<td>TP12</td>
</tr>
<tr>
<td>+12 VDC +/-0.6V</td>
<td>TP8</td>
<td>TP12</td>
</tr>
<tr>
<td>-12 VDC +/-0.6V</td>
<td>TP9</td>
<td>TP12</td>
</tr>
<tr>
<td>+27 VDC +/-0.6V</td>
<td>TP10</td>
<td>TP12</td>
</tr>
<tr>
<td>+48 VDC +/-2.0V</td>
<td>TP4</td>
<td>TP5</td>
</tr>
</tbody>
</table>

Other voltages to check on the SSB board and labeled as such are:

Supply
+3.3 VDC +/-0.1
+5 VDC +/-0.2V
+12 VDC +/-0.6V
-12 VDC +/-0.6V

Test Lights:

1. Power Distribution Board.
   Monitor the +400 volt D4 and +48 volt D8 LED's. They should be on steady.

2. SSB Board.
   There are two LED's of interest. 'LED A' flashes when 120 kHz is transmitting. 'LED B' flashes when 410 kHz is transmitting.

3. SIB Board.
   There are four LED's of interest. They have the following status when the system is operating properly.
   D1 Off     D3 (Orange)   Flashes at 2 Hz
   D2 Off     D4           (Green) On

6.3.7.4 SSB Board Test Points

1. GAIN A and B test points show the positive-going TVG ramp voltage for the low and high frequency sonar channels.

2. Four test points monitor the TVG'd analog sonar data. They are:
   ADC 0 Port   SSL   ADC2 Stbd SSL
   ADC 1 Port   SSH   ADC3 Stbd SSL
   These test points are useful when doing a rub test.

6.3.7.5 DDC Test Points

This board does not have any test points. LEDs monitors display the channels on the card that are running. Side A and Side B. In a normally operating vehicle with both channels collecting data the lights will alternate.

6.3.7.6 Modem Board Test Points

1. FSK.
   Monitors the 3200 kHz to 2800 kHz frequency-shift-keyed signal from the topside unit. This signal is used for optional commands. May not be present in all systems.
2. **Trig.**

A TTL signal that synchronizes the topside and sub-sea units with other topside equipment. Follows the SYNC signal input on the topside unit. It is not used in all system configurations.

### 6.3.7.7 Other Checks

Periodically check the integrity of the sea ground capacitor attached to the rear bulkhead.

### 6.3.8 Tow Cables

Historically, most system problems occur in the tow cable and their connectors. Before proceeding, verify cable continuity from the shipboard end of the cable to the tow vehicle. The presence of a shorted or open wire in a tow cable can be determined by using a multi-meter. An open or shorted wire can be located using the techniques described in the following subsections.

#### 6.3.8.1 Shorted Wire

The following procedure may be used to approximate the distance to a single short or a point of high leakage between a conductor pair or from a conductor to a shield.

1. Disconnect both cable ends.
2. Short the two connector pins (or wires if un-terminated) of the shorted pair at both ends and measure the total resistance between the ends.
   
   \[ R_1 + R_2 = \_\_\_\_\_\_\_\_ \]
3. Remove the shorts.
4. Measure the resistance between a shorted pair on one end with an ohmmeter on the Rx1 scale.
   
   \[ R_1 + R_s = \_\_\_\_\_\_\_\_ \]
5. Measure the resistance from the other end.
   
   \[ R_2 + R_s = \_\_\_\_\_\_\_\_ \]
6. Add the measurements of 4) and 5) above, subtract the measurement of 2), and divide the result by 2.
   
   \[ R_s = \_\_\_\_\_\_\_\_ \]
7. Subtract the value of 6) from the measured values of 4) and 5).
   
   \[ R_1 = \_\_\_\_\_\_\_\_ \]
   
   \[ R_2 = \_\_\_\_\_\_\_\_ \]
8. The distance to the short from end #1 is the ratio of \( \frac{R1}{R1+R2} \) times the total cable length. Recheck from end #2 which is \( \frac{R2}{R1+R2} \) times the cable length.

6.3.8.2 Open Wire

An open wire in a cable is much more difficult to locate than a short circuit; therefore, a capacitance bridge is recommended. Measuring the capacitance from the open wire to the shield on both ends allows two different capacitance readings to be recorded. This represents a direct ratio related to cable length and distance of break from each end. Before cutting the cable, double-check the same ratio of capacitance using an adjacent good wire in a multi-conductor cable. Capacitance may vary from wire to wire, depending on their separation.

Most breaks occur around the tow cable termination or where a previous repair has been made. A cable break may be found or confirmed by laying out the cable and attaching an ohmmeter across each end of the open wire. Then flex the cable first near the termination or repaired section and then along its entire length until the break is reached. When flexing, the ends of the broken wire may touch, giving a continuity reading on the meter.

6.3.8.3 Insulation Resistance Breakdown

Insulation breakdown is the most difficult fault to locate. Cable leakage is not necessarily located near the end terminations. However, the area near each termination receives the most abuse and is, therefore, subject to suspicion. Successive cutting of the cable end until leakage disappears will prove successful in many cases.

CAUTION! Prior to cutting the cable for any of the above reasons, a careful visual examination should be made for any signs of physical damage.

With both ends disconnected, the tow cables should measure between 100 Mega-ohms and infinity between conductors with a 500 VDC Meg ohmmeter. When using a Simpson 260 Multi-meter, all cables wire-to-wire or wire-to-shield should measure infinity. Any leakage on the multi-meter indicates cable leakage.

6.3.8.4 Damaged Tow Cable Connector

The tow vehicle has a trip line that prevents the vehicle from hanging up on a snag. When the line trips, the cable connection to the vehicle disconnects exposing the high voltage pins to seawater. Pin corrosion will start to occur as long as power is still applied. If the power is not immediately removed, and the cable is not immediately retrieved and the connector flushed out with fresh water, there may be permanent damage to the connector. This will require cable re-termination.
6.4 Part Numbers for Major Topside Components

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION</th>
<th>EDGETECH PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOPSIDE COMPUTER</strong></td>
<td></td>
</tr>
<tr>
<td>CPU</td>
<td>0018399</td>
</tr>
<tr>
<td>500GB HDD</td>
<td>0004983</td>
</tr>
<tr>
<td>1TB HDD</td>
<td>0007408</td>
</tr>
<tr>
<td>Graphics Card</td>
<td>0018397</td>
</tr>
<tr>
<td>Motherboard</td>
<td>0018398</td>
</tr>
<tr>
<td>Power Supply</td>
<td>0008453</td>
</tr>
<tr>
<td><strong>2000-DL DIGITAL LINK</strong></td>
<td></td>
</tr>
<tr>
<td>Modem Assembly</td>
<td>0012635</td>
</tr>
<tr>
<td>Assembly Top Power Supply</td>
<td>0011860</td>
</tr>
<tr>
<td>Power Supply</td>
<td>0006372</td>
</tr>
<tr>
<td>Ethernet Switch</td>
<td>0005088</td>
</tr>
</tbody>
</table>

Table 6-3: Major Topside Components and Part Numbers

6.5 Part Numbers for Major 2000-DSS Tow Vehicle Components

<table>
<thead>
<tr>
<th>COMPONENT DESCRIPTION</th>
<th>EDGETECH PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUDDER 2000 DSS</td>
<td>0006596</td>
</tr>
<tr>
<td>BRACKET RUDDER 2000 DSS</td>
<td>0003403</td>
</tr>
<tr>
<td>BRIDLE TOW 2000 DSS</td>
<td>0003431</td>
</tr>
<tr>
<td>WING 2000 DSS</td>
<td>0007922</td>
</tr>
<tr>
<td>BRACKET MOUNTING 2000 DSS</td>
<td>0003396</td>
</tr>
<tr>
<td>BRACKET MOUNTING 2000 DSS</td>
<td>0003396</td>
</tr>
<tr>
<td>FOOT AFT 2000 DSS RUBBER</td>
<td>0007345</td>
</tr>
<tr>
<td>PLATE SUB BOTTOM 2000 DSS HYDROPHONE</td>
<td>0006336</td>
</tr>
<tr>
<td>RAIL 2000 DSS TOW</td>
<td>0006389</td>
</tr>
<tr>
<td>SHELL SET 2000 DSS</td>
<td>0007442</td>
</tr>
<tr>
<td>ASSY TOP CABLE 2000 KEVLAR 0.375 COAX TEST 15M WET-WET</td>
<td>0011690</td>
</tr>
<tr>
<td>BALLAST LEAD 2000 DSS</td>
<td>0005830</td>
</tr>
<tr>
<td>PLATE BACKING TOW POINT 2000 DSS</td>
<td>0006310</td>
</tr>
<tr>
<td>ASSY SUB SUB BOTTOM 2000 DSS 02-16 KHZ</td>
<td>0007338</td>
</tr>
<tr>
<td>ASSY SUB SIDESCAN 2000 DSS 100-400 KHZ</td>
<td>0007339</td>
</tr>
<tr>
<td>ASSY TOP ELECTRONICS BOTTLE 2000 DSS 100-400 KHZ</td>
<td>0007337</td>
</tr>
</tbody>
</table>
## COMPONENT DESCRIPTION | EDGETECH PART NUMBER
--- | ---
**ELECTRONICS BOTTLE PARTS**
PCB ASSY TOP POWER AMP ANALOG SUB BOTTOM | 0006128
PCB ASSY POWER AMP ANALOG | 0006125
PCB ASSY TOP INTERFACE MODEM DSL | 0006104
PCB ASSY SUB 2000 DSS POWER DISTRIBUTION BOARD MODIFIED | 0009188
PCB ASSY TOP ACQUISITION PCI 2CH SUB BOTTOM TIGER DEEP | 0014232
PCB ASSY TOP DDC 4CH ACQUISITION 2.5X BOARD | 0014358
PCB ASSY TOP TR SWITCH 4200 SP 100-400 KHZ | 0006168
PCB ASSY TOP SONAR INTERFACE BOARD / USB SIBU 2000 2200 SERIES SYSTEMS | 0011638
CHASSIS 2000 05 INCH 26 INCH AL | 0008673
ASSY SUB END CAP 2000 DSS ELECTRONICS | 0009231
HOUSING PRESSURE 05 INCH DIA 26 INCH AL 3000M | 0007084
END CAP REAR 05 INCH 3000M AL | 0005069
PCB ASSY SUB CAPACITOR BANK 2000 DSS | 0009230
ASSY SUB BOARDSET CPU COMX ATOM MBT10 E3825 | 0018350
MEMORY FLASH GENERIC R-DRIVE IMAGE KONTRON E3815 CPU | 0017144

*Table 6-4: Major 2000-DSS Tow Vehicle Components and Part Numbers*
The following section outlines the procedures for backing up and restoring the system drive.

**CAUTION!** All data will be lost upon restoring the system to factory settings. Be sure to backup all data before preforming the procedure below.

1. Ensure that topside is off.
2. Insert USB3 flash drive in blue USB3 port.
3. Start topside and be prepared to press F** key when prompted:
4. If the topside is rack mount, press F11.
5. If the topside is a laptop, press F12.
6. Under Please select boot device: By using up/down arrow keys, select EUFI: Corsair Voyager 3.0 000A, then press Enter.
7. Wait for Paragon Backup & Recovery 14 Home screen to appear, then click Restore icon.
8. On Welcome to the Restore Wizard screen click Next.
9. On Browse for Archive screen, drag down menu and click on ☐ to the left of (E:). Click on folder named as a variation of V*.*.*_****R for rack mounts, or V*.*.*_****P for laptops. When Archive File Details window appears, click Next.
10. At What to restore window, click Basic MBR Hard Disk 0, click Next.
11. At Where to restore window, ensure that Basic MBR Hard Disk 0 is already selected (brown box around it). If it is not, use up/down arrow keys to select. Click Next.
12. At Restore results window, make no selection and click Next.
13. At the Ready to restore from the archive window, select O Yes, apply the changes physically. Click Next. Restoring will begin.
14. At Completing the restore wizard, click Finish. Click Shutdown.
15. Remove USB3 flash drive and restart topside.
B.0 PRINTERS

A number of different printers are available for connecting to the 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System. All of these printers connect to the USB connector on the back of the Topside Computer.

Of the available printers, the following are recommended for best results:

- iSys V8.5
- iSys V12
- Ultra 200
- Ultra 120
- Ultra 200HD
- Ultra 120HD
- EPC HSP 100
- EPC 1086-NT
- EPC 1086
- EPC 1086-old
- TDU 850
- EPC 9026
- EPC 9026-old
- Geoprinter 975

Listed in **TABLE B-1** are the required settings to properly interface a printer with the 2000 Series Combined Side Scan Sonar and Sub-Bottom Profiling System:

<table>
<thead>
<tr>
<th>REQUIREMENT</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger</td>
<td>Internal</td>
</tr>
<tr>
<td>Data input</td>
<td>USB</td>
</tr>
<tr>
<td>Sweep</td>
<td>Forward</td>
</tr>
<tr>
<td>LPI</td>
<td>200</td>
</tr>
<tr>
<td>Width</td>
<td>2048</td>
</tr>
<tr>
<td>Data type</td>
<td>6 bits</td>
</tr>
<tr>
<td>Shades</td>
<td>64</td>
</tr>
<tr>
<td>Image</td>
<td>Positive</td>
</tr>
<tr>
<td>Contrast</td>
<td>40%</td>
</tr>
</tbody>
</table>

*Table B-1: Printer Requirements*
C.0 TOWING CHARACTERISTICS

This section includes graphical plots representing the towing characteristics of the 2000-DSS Tow Vehicle for various cable lengths, tow vehicle speeds and tow vehicle depths. There are a total of 32 plot configurations as listed in TABLE C-1. These plots are available for equipment selection purposes only. In addition, when selecting a particular plot, it should be verified prior to being used for detailed survey planning.

NOTE: Some of the plots reference tow vehicle operating depths that are greater than the maximum depth rating of the 670D Tow Vehicle. These plots are for illustrative purposes only. The 670D Tow Vehicle should never be deployed at a depth that exceeds its 2000-meter depth rating.

The plots have been generated under the following assumptions:

- Sea State = 0 with no vessel heave motion
- Ocean current = 0
- Steady state tow vehicle speeds of 2–8 knots in 1-knot increments
- Armored cables A320327 - 0.32", A301241 - 0.68", and A302799 - 0.45"
- Cable lengths of 500–10,000 meters

Ocean currents will be a factor for virtually all cases in which the tow vehicle is used. By using the equations below to calculate tow vehicle relative speed, the existing plots can be used for approximating the tow vehicle depth when ocean currents are present and assuming that the current is uniform with depth.

For the tow vessel moving into the current:

\[
\text{Tow Vehicle Relative Speed} = \text{Tow Vessel Speed} + \text{Ocean Current}
\]

For example, for a tow vessel speed of 5 knots and an ocean current of 1 knot, the tow vehicle relative speed is 6 knots. Therefore use the 6-knot plot in the selected graph.

For the tow vessel moving into the current:

\[
\text{Tow Vehicle Relative Speed} = \text{Tow Vessel Speed} - \text{Ocean Current}
\]

For example, for a tow vessel speed of 5 knots and an ocean current of 1 knot, the tow vehicle relative speed is 4 knots. Therefore use the 4-knot plot in the selected graph.
<table>
<thead>
<tr>
<th>CONFIGURATION</th>
<th>CABLE TYPE</th>
<th>DEPTH</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>500</td>
<td>C-3</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>1000</td>
<td>C-4</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>2000</td>
<td>C-5</td>
</tr>
<tr>
<td>4</td>
<td>A320327</td>
<td>3000</td>
<td>C-6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>4000</td>
<td>C-7</td>
</tr>
<tr>
<td>6</td>
<td>A320327</td>
<td>5000</td>
<td>C-8</td>
</tr>
<tr>
<td>7</td>
<td>A320327</td>
<td>6000</td>
<td>C-9</td>
</tr>
<tr>
<td>8</td>
<td>A320327</td>
<td>7000</td>
<td>C-10</td>
</tr>
<tr>
<td>9</td>
<td>A301241</td>
<td>500</td>
<td>C-14</td>
</tr>
<tr>
<td>10</td>
<td>A301241</td>
<td>1000</td>
<td>C-15</td>
</tr>
<tr>
<td>11</td>
<td>A301241</td>
<td>2000</td>
<td>C-16</td>
</tr>
<tr>
<td>12</td>
<td>A301241</td>
<td>3000</td>
<td>C-17</td>
</tr>
<tr>
<td>13</td>
<td>A301241</td>
<td>5000</td>
<td>C-18</td>
</tr>
<tr>
<td>14</td>
<td>A301241</td>
<td>6000</td>
<td>C-19</td>
</tr>
<tr>
<td>15</td>
<td>A301241</td>
<td>7000</td>
<td>C-20</td>
</tr>
<tr>
<td>16</td>
<td>A301241</td>
<td>8000</td>
<td>C-21</td>
</tr>
<tr>
<td>17</td>
<td>A301241</td>
<td>9000</td>
<td>C-22</td>
</tr>
<tr>
<td>18</td>
<td>A302799</td>
<td>500</td>
<td>C-23</td>
</tr>
<tr>
<td>19</td>
<td>A302799</td>
<td>1000</td>
<td>C-24</td>
</tr>
<tr>
<td>20</td>
<td>A302799</td>
<td>2000</td>
<td>C-25</td>
</tr>
<tr>
<td>21</td>
<td>A302799</td>
<td>3000</td>
<td>C-26</td>
</tr>
<tr>
<td>22</td>
<td>A302799</td>
<td>4000</td>
<td>C-27</td>
</tr>
<tr>
<td>23</td>
<td>A302799</td>
<td>5000</td>
<td>C-28</td>
</tr>
<tr>
<td>24</td>
<td>A302799</td>
<td>6000</td>
<td>C-29</td>
</tr>
<tr>
<td>25</td>
<td>A302799</td>
<td>7000</td>
<td>C-30</td>
</tr>
<tr>
<td>26</td>
<td>A302799</td>
<td>8000</td>
<td>C-31</td>
</tr>
<tr>
<td>27</td>
<td>A302799</td>
<td>9000</td>
<td>C-32</td>
</tr>
<tr>
<td>28</td>
<td>A302799</td>
<td>10000</td>
<td>C-33</td>
</tr>
</tbody>
</table>

*Table C-1: Tow Cable Characteristics*
C.1 Configuration 1

Figure C-1: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 500 Meters

Figure C-2: Tow Cable Length Versus Depth—Cable A320327, 500 Meters
C.2 Configuration 2

Figure C-3: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 1000-Meters

Figure C-4: Tow Cable Length Versus Depth—Cable A320327, 1000 Meters
C.3 Configuration 3

Figure C-1: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 2000 Meters

Figure C-2: Tow Cable Length vs Depth—Cable A320327, 2000 Meters
C.4 Configuration 4

Figure C-3: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 3000 Meters

Figure C-4: Tow Cable Length Versus Depth—Cable A320327, 3000 Meters
C.5 Configuration 5

Figure C-5: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 4000 Meters

Figure C-6: Tow Cable Length vs Depth—Cable A320327, 4000 Meters
C.6 Configuration 6

Figure C-7: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 5000 Meters

Figure C-8: Tow Cable Length Versus Depth—Cable A320327, 5000 Meters
C.7 Configuration 7

Figure C-9: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 6000 Meters

Figure C-10: Tow Cable Length Versus Depth—Cable A320327, 6000 Meters
C.8 Configuration 8

*Figure C-11: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 7000 Meters*

*Figure C-12: Tow Cable Length Versus Depth—Cable A320327, 7000 Meters*
C.9 Configuration 9

Figure C-13: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 8000 Meters

Figure C-14: Tow Cable Length Versus Depth—Cable A320327, 8000 Meters
C.10 Configuration 10

Figure C-15: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 9000 Meters

Figure C-16: Tow Cable Length Versus Depth—Cable A320327, 9000 Meters
C.11 Configuration 11

Figure C-17: Tow Cable Shape and Tow Vehicle Position—Cable A320327, 10000 Meters

Figure C-18: Tow Cable Length Versus Depth—Cable A320327, 10000 Meters
C.12 Configuration 12

Figure C-19: Tow Cable Shape and Tow Vehicle Position—Cable A301241, 500 Meters

Figure C-20: Tow Cable Length Versus Depth—Cable A301241, 500 Meters
C.13 Configuration 13

Figure C-21: Tow Cable Shape and Tow Vehicle Position—Cable A301241, 1000 Meters

Figure C-22: Tow Cable Length Versus Depth—Cable A301241, 1000 Meters
C.14 Configuration 14

Figure C-23: Tow Cable Shape and Tow Vehicle Position—Cable A301241, 2000 Meters

Figure C-24: Tow Cable Length Versus Depth—Cable A301241, 2000 Meters
C.15 Configuration 15

Figure C-25: Tow Cable Shape and Tow Vehicle Position—Cable A301241, 3000 Meters

Figure C-26: Tow Cable Length Versus Depth—Cable A301241, 3000 Meters
C.16 Configuration 16

Figure C-27: Tow Cable Shape and Tow Vehicle Position—Cable A301241, 5000 Meters

Figure C-28: Tow Cable Length Versus Depth—Cable A301241, 5000 Meters
C.17 Configuration 17

*Figure C-29: Tow Cable Shape and Tow Vehicle Position—Cable A301241, 6000 Meters*

*Figure C-30: Tow Cable Length Versus Depth—Cable A301241, 6000 Meters*
C.18 Configuration 19

**Figure C-31:** Tow Cable Shape and Tow Vehicle Position—Cable A301241, 7000 Meters

**Figure C-32:** Tow Cable Length Versus Depth—Cable A301241, 7000 Meters
C.19 Configuration 20

Figure C-33: Tow Cable Shape and Tow Vehicle Position—Cable A301241, 8000 Meters

Figure C-34: Tow Cable Length Versus Depth—Cable A301241, 8000 Meters
C.20 Configuration 21

Figure C-35: Tow Cable Shape and Tow Vehicle Position—Cable A301241, 9000 Meters

Figure C-36: Tow Cable Length Versus Depth—Cable A301241, 9000 Meters
C.21 Configuration 22

Figure C-37: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 500 Meters

Figure C-38: Tow Cable Length Versus Depth—Cable A302799, 500 Meters
C.22 Configuration 23

Figure C-39: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 1000 Meters

Figure C-40: Tow Cable Length Versus Depth—Cable A302799, 1000 Meters
C.23 Configuration 24

Figure C-41: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 2000 Meters

Figure C-42: Tow Cable Length Versus Depth—Cable A302799, 2000 Meters
C.24 Configuration 25

Figure C-43: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 3000 Meters

Figure C-44: Tow Cable Length Versus Depth—Cable A302799, 3000 Meters
C.25 Configuration 26

Figure C-45: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 4000 Meters

Figure C-46: Tow Cable Length Versus Depth—Cable A302799, 4000 Meters
C.26 Configuration 27

Figure C-47: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 5000 Meters

Figure C-48: Tow Cable Length Versus Depth—Cable A302799, 5000 Meters
C.27 Configuration 28

**Figure C-49**: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 6000 Meters

**Figure C-50**: Tow Cable Length Versus Depth—Cable A302799, 6000 Meters
C.28 Configuration 29

**Figure C-51:** Tow Cable Shape and Tow Vehicle Position—Cable A302799, 7000 Meters

**Figure C-52:** Tow Cable Length Versus Depth—Cable A302799, 7000 Meters
C.29 Configuration 30

Figure C-53: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 8000 Meters

Figure C-54: Tow Cable Length Versus Depth—Cable A302799, 8000 Meters
C.30 Configuration 31

Figure C-55: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 9000 Meters

Figure C-56: Tow Cable Length Versus Depth—Cable A302799, 9000 Meters
C.31 Configuration 32

Figure C-57: Tow Cable Shape and Tow Vehicle Position—Cable A302799, 10000 Meters

Figure C-58: Tow Cable Length Versus Depth—Cable A302799, 10000 Meters