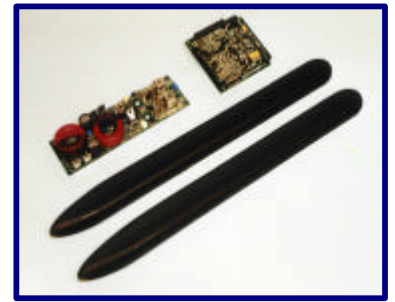




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CENTUTION™ Splash Proof



AUV and ROV System

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Sea Scan® PC Side Scan Sonar System Information/Specifications Sheet

GENERAL

Sea Scan® PC is a high-resolution side scan sonar system designed to locate large and small objects underwater as well as display bottom information used for biological research and survey operations. The system provides a near photographic sonic image, regardless of underwater visibility, and employs a state of the art personal computer (PC) for all control, display, analysis and storage functions. This sheet provides operating information and system specifications for all systems manufactured by Marine Sonic Technology, Ltd. (MSTL).

MSTL manufactures the Sea Scan® PC as a Towed System, AUV/ROV System, Submerged System, and as a combination Sea Scan® PC system and Geometrics Magnetometer known as the MagScan®. In addition, MSTL is a leader in custom side scan sonar applications, working with customers to meet their unique and demanding custom installations.

The towed system is MSTL's basic and most popular system. It is available in several different models with each providing near picture quality images, ease of operation, a powerful software package, dependability and affordability. MSTL also offers the Sea Scan® PC system components miniaturized for AUV/ROV applications. The system's electronics card is available as an ISA or PC104 card and the single and dual frequency transducers have been streamlined and miniaturized for AUV/ROV applications.

Two additional and unique side scan sonar systems produced by MSTL are the Submerged System (non-towed) and the MagScan® System (towed). The Submerged System was designed and developed to meet the requirements for a side scan sonar system, which could be operated underwater. A diver inside a wet underwater vehicle can easily operate the system.



FIELDWORKS Portable System



Submerged System

The second unique system is the MagScan[○], which is manufactured in conjunction with Geometrics[®], Inc. This system combines, in one towfish, the Sea Scan[®] PC system and the Geometrics[®] G-880 magnetometer. This unique combination allows for collection and display of real time sonar images and magnetometer data on the same screen.

Sea Scan[®] PC systems are used worldwide by law enforcement agencies including the U.S. Customs Service, state and city police departments, sheriffs departments, fire departments, dive teams and naval military forces. Additional Sea Scan[®] PC systems are employed by treasure hunters, oil companies, diving and salvage companies, survey companies, and major universities for archaeological and biological research.

MSTL has designed and manufactured custom configurations to meet unique customer needs. Some special configurations completed are:

- U.S. Customs Service for detecting illegal drug shipments.
- Woods Hole Oceanographic Institution for use in autonomous underwater vehicle (AUV) research.
- Submerged system for wet underwater manned operations.
- A dual frequency (150-600 kHz) deep system for use aboard the U.S. Navy's research submarine NR-1.
- Several 600 kHz modular transducer sets rated to Full Ocean depth.

Sea Scan[®] PC is a registered trademark and U.S. Patents 5,142,502 and 5,142,503 cover all equipment.

SYSTEM DESCRIPTIONS

TOWED SYSTEMS

A complete Sea Scan[®] PC towed system consists of a personal computer, LCD flat panel display, keyboard, mouse, two specially designed towcables and a single frequency towfish. In addition, an operator's manual, small tool kit, asset of towcable line weights, five (5) hours of factory training and a one year limited warranty are part of the system. All components are shipped in rugged, foam lined, shipping containers. The system is covered by a one year limited warranty. A complete towed system with the shipping containers weighs, on average, 100 kg (220 lbs.).

The Sea Scan[®] PC towed system is available in three different configurations:

- A Desktop Sea Scan[®] PC system includes a rack mount case computer with Windows Me and an Intel[™] based Pentium[™] III processor or equivalent CPU. Additional features: 256 MB RAM, 60 GB hard drive, 3.5" floppy drive, internal R/RW CD drive, wireless mouse and keyboard, associated power cords and a 15" LCD flat panel monitor.
- A Portable Sea Scan[®] PC system includes a portable PC (SBS 904 or Fieldworks 8000) containing a CELERON/Intel[™] Pentium[™] processor with 32/64 MB RAM, a 30/6 GB hard

drive, 3.5"/CD Rom internal drive, mouse, keyboard, associated power cords and a color active display. Neither system is considered either "Splash-proof" or "Water-proof".

- The "CENTURION"[○] Splash Proof Sea Scan[®] PC system, designed and manufactured by MSTL, includes a small rugged case containing a 233 MHz CPU, 128 MB RAM, a 20 GB hard drive, increased connectivity and network/USB compatible. The system comes with a keyboard and waterproof mouse, an external GARMIN "eTrex" Legend GPS plus a second JRC D/GPS system and external R/RW CD-ROM drive. The "CENTURION"[○] features a 10.4" daylight readable screen for easier target recognition and detection. All external connections are splash proof. The unit has been designed for open boat operations in a rain and seawater spray environment. The system normal operates from a 12 VDC battery source. Computer dimensions are 13" x 11" x 6" and weight is 12 pounds.

Towfish

Each of the Sea Scan[®] PC systems contain one single frequency towfish available in the following frequencies: 150, 300, 600, 900, or 1200 kHz. The towfish is certified to an operating depth of 300-meters (984-ft.).

- The fish is constructed of solid polyvinyl chloride (PVC) and other non-corrosive materials.

TOWFISH SPECIFICATIONS

kHz	150	300	600	900	1200
Length (m/in)	1.1/42	1.1/42	1.1/42	1.1/42	1.1/42
Diameter (cm/in)	10.2/4	10.2/4	10.2/4	10.2/4	10.2/4
Weight in air (kg/lbs.)	16.8/37	15.9/35	15/33	15/33	15/33
Pulse Length (µsec/cycles)	33/5	20/6	10/6	6.7/6	5/6
Typical Range Resolution – (cm/in)	58/23(300)	29/11.4(150)	9.7/3.8(50)	7.8/3(40)	3.9/1.5(20)
Axial Resolution – aperture size (cm/in)	61/24	61/24	30.5/12	22.9/9	15.2/6
Typical Maximum Range (meters)	400-500	200-300	100	40	20

Towcables

- A 100 and 30-meter cable are standard with the towed system. Optional lengths are available up to 800 meters depending on the transducer frequency operating with the cable.
- The cable is constructed using three custom coaxial cables and a 545-kg (1250 lbs.) braided Kevlar[™] strength member covered by either a polyurethane or polyethylene outer jacket to a nominal cable diameter of approximately 0.36" or less.
- 100-meters of cable weighs 9.1 kg (20 lbs.) in air, 4.1 kg (9 lbs.) in water.
- The minimum safe bending radius is 13 cm (5 in.)

Towcable Line Weights

- A set of towcable line weights is a part of each towed system that enables the towfish to achieve greater operating depths. The weights are easily attached to the towcable through the use of two large electrical ties. The weights work best when placed on the cable 8 to 10 feet in front of the towfish

Maintenance

- The Sea Scan[®] PC system is virtually maintenance free. After use in saltwater the towfish, cable, and wet end connectors should be flushed with fresh water to reduce salt buildup. During cable/towfish hookup the wet end connectors should be sprayed with WD 40 to lubricate the “O” ring seal and clean out any water or dirt that may be in the connector. During cable and towfish storage, the dust shields should be installed to reduce dirt infusion and possible connector damage. Periodically the towcable should be checked for signs of wear and abrasion. A PC technician can perform computer repairs locally. Required repairs to either the Sea Scan[®] PC system or transducer electronics card must be performed at the factory. The towfish contains no serviceable parts that require either maintenance or adjustments in the field.

AUV/ROV SYSTEMS

MSTL’s AUV/ROV systems have been designed and built to the exacting standards of today’s AUV/ROV market. The AUV/ROV system components use the same proven technology found in the towed systems but have been redesigned to make them smaller and more energy efficient. A normal AUV/ROV system will consist of the system electronics card, transducer electronics card, a pair of transducers, and connecting cables. To satisfy the uniqueness of each AUV/ROV system, MSTL can tailor a system that ranges from just the basic side scan sonar components to a complete turn-key system that includes the PC, power supply, mounting brackets, connectors, cables, and pressurized containers.

System Electronics

- The Sea Scan[®] PC system electronics card (installed in the PC) is available in two configurations: Full size, full length, ISA card and a compact PC-104 card for embedded installations.
- System Electronics ISA Card: Size 340mm x 100mm x 19mm (13.4”x 3.9” x 0.75”), Weight: 361 gms (12.7 oz), Power consumption is 6-10 watts (Consumption is dependent on scanning speed and selected range scale).
- System Electronics PC-104 Card: Size 97mm x 92mm x 17mm (3.8” x 3.6” x 0.66”), Weight: 142 gms (5 oz), Power consumption is 4.8 watts maximum (Consumption can be lower depending on scanning speed and selected range).

Transducer Electronics Card

- The Sea Scan[®] PC transducer electronics card is available in the following frequencies: 150, 300, 600, 900 and 1200 kHz. The card can be mounted inside the AUV/ROV pressurized container or sealed as a wet version for mounting outside the vehicle. Dual frequency cards are available in any combination of frequencies desired by the customer. Standard depth rating, when the card is encased and mounted outside the AUV/ROV, is 300-meters. Greater depth ratings are available.
- Transducer Electronics Card: Size 188mm x 58mm x 23mm (7.4" x 2.3" x 0.9"), Weight 227 gms (8 oz) (unpotted card). Two cards are needed for a dual frequency system.

Transducer Modules

- Transducer modules are available in a variety of shapes, sizes and in the following frequencies: 150, 300, 600, 900 or 1200 kHz. MSTL can make custom shaped modules to meet specific applications. Standard modules are available with a 300-meter depth rating. Deep modules, with a depth rating of either 6000-meters or Full Ocean Depth, are available.

AUV/ROV TRANSDUCER SPECIFICATIONS

kHz	DF*	150	300	600	900	1200
Length (in/mm)	28/711	28/711	28/711	17.5/444	TBD	TBD
Width (in/mm)	4/102	3/76	2.25/57	1.5/38	TBD	TBD
Height (in/mm)	3/76	2/51	2/51	1.5/38	TBD	TBD
Weight (oz/gms)	16lbs/7.3kg	TBD	TBD	34.5/980	TBD	TBD

*Dual Frequency: 150/600 kHz, 300-meter depth rating.

SUBMERGED SYSTEM

MSTL manufactures a unique side scan sonar system for manned sonar operations from a wet underwater vehicle. Housed in a small pressure aluminum case, the unit is easily mounted inside with the transducers fix mounted to the hull. System features and specifications are listed below.

Features

- Sea Scan[®] PC hardware and software are housed in a pressure tested (tested to Mil Std) aluminum case.
- Windows[™] ME operating environment.
- All components have successfully passed "Out Gassing" testing.
- Single or Dual Frequency configured, hull mounted transducers.

- Industrial 233 MHz Processor, 20 GB hard drive, external R/W CD ROM drive, 10.4" Color flat screen display.
- Navigation Data via Mil-1553 interface card or NEMA 0183 data stream.
- Keyboard for setup/file transfer.
- Unique underwater tilt mouse for system operations.

MagScan SYSTEM

This is the first commercially available combined side scan sonar and cesium magnetometer system; a new and powerful tool featuring simultaneous and extremely high resolution display of both data sets using a single towfish. This system provides real time confirmation of acoustic and magnetic effects for targets of all sizes in a user-friendly Windows™ interface.

Features

- High-resolution 600 or 900 kHz sonar images in conjunction with high quality marine magnetics. Sensitivity better than 0.002 nT at 1 Hz, 0.02 nT sensitivity at 10 Hz (samples per second).
- Single tow cable, 100-meter standard with an optional length 200-meter cable.
- Magnetometer cycle rates selectable from 100 Hz to 0.01 Hz.
- Sea Scan® PC side scan sonar specifications are the same as listed for the towed systems.

STANDARD Sea Scan® PC SYSTEM COMPONENTS

Operational Toolkit - Each system comes with a toolkit containing system applicable spare fuses, cable hardware, spanner wrench and other miscellaneous tools.

Operator's Training - Five (5) hours of factory training, for up to four individuals, is included in the price of each system. This training is designed to provide the basic information necessary to safely setup and operate the system. Areas covered in the classroom training include; fundamentals of sonar operations, operations and features of the system software, system setup and testing, side scan water operations, and system troubleshooting procedures. This training is conducted at the factory in White Marsh, Virginia. Travel and living expenses associated with this training are the responsibility of the customer.

Operation of the Sea Scan® PC system is easily learned by anyone who has a basic familiarity with computers and Windows™ operation. A training mode is also included in the operational software that provides the customer with the ability to practice all controls and functions, in the office or at home, prior to going to sea. Interpretation of the data collected is relatively easy since the image quality is near photographic. As operators gain experience with the system, minor details, shadows, etc. will become more apparent and meaningful.

Operator's Manual - A detailed operator's manual is shipped with each system. The manual provides information regarding sonar operations, system setup and testing, the Sea Scan[®] PC Software, and the Sea Scan[®] PC Review Program.

Shipping /Storage Cases - Rugged shipping/storage cases are provided with each system except the AUV/ROV systems, which are shipped in protective cartons. The cases contain foam inserts, which provide increased shock protection during handling and shipping.

Limited Warranty -All equipment provided by Marine Sonic Technology, Ltd. is warranted to be free from defects in materials or workmanship for a period of (1) one-year from the date of the original purchase. This warranty covers the original purchaser and is not transferable. The warranty does not cover damage or loss due to abuse or improper handling/operations. Warranty repairs are normally performed at the factory but in some instances local area representatives may make repairs. The cost to return equipment for warranty repairs is the responsibility of the customer.

OPTIONAL EQUIPMENT

Extended Limited Warranty – MSTL is now offering an Extended Limited Warranty Plan that can extend the warranty period up to THREE YEARS from the date of purchase. This is a very cost-effective way of adding increased system protection.

Maintenance and Service Plan – This plan provides yearly preventive maintenance checks/services and warranty repairs when required. Depending on the plan selected maintenance and warranty coverage can be extended out to FOUR YEARS. This plan insures that the system is operating at peak performance at all times.

On-Site Training – On-site training packages, that include both classroom and on-water training, are available and can be tailored to meet specific customer needs. With on-site training, classroom and training boat are the responsibility of the customer.

On-Water Training - MSTL offers an on-water training option that provides the customer with hands-on experience operating the system under the supervision of MSTL personnel. The training is conducted in local Virginia waters aboard MSTL's 36-foot "Sonic Boom". Training includes system setup and testing, discussion of various tow point options, proper boat towing procedures, winch operations, regulating towfish depths, emergency towfish recovery, and side scan search procedures.

GPS – The "Centurion" Splash Proof system comes standard with two GPS systems. The first is a small waterproof Garmin "eTrex" Legend GPS system, which provides an accuracy of approximately 15 meters. The Legend is also WASS capable and if a WASS signal is received accuracy is less than 3 meters. The second is a JRC D/GPS system, which will provide accuracy in the 3-5 meter range. The accuracy listed is dependent on weather conditions and satellite reception.

Stand Alone GPS/DGPS Receivers – Several different GPS or DGPS options are available as stand alone systems for the Portable and Desk Top systems. These units can input navigational information to the Sea Scan[®] PC, autopilots, digital charts, plotters, and other marine instruments.

Splash Proof Battery Box – The Splash Proof System can be ordered with a self-contained battery box that provides a 12 VDC power source for 8 hrs of scanning operations. The battery box contains a charger and four 12 VDC closed cell batteries.

Removable Media Discs – Desktop models include a built in a R/RW CD drive capable of storing up to 650 MB and a 3.5” internal drive. With the R/RW CD drive the customer can quickly transfer large quantities of image data to other computers for analysis or archive purposes. Since the Sea Scan[®] PC system operates in a PC, virtually any mass storage device available will interface with the system.

Additional Towfish – One single frequency towfish comes standard with each towed system. Additional frequency towfish should be considered to maximize the capabilities of the system and to provide a backup in case of loss or damage to the primary towfish. A combination that works well together is to have a long-range towfish (150 – 300 kHz) and a high-resolution shorter-range towfish (600, 900 or 1200 kHz). It takes only a few minutes to retrieve and change to a different towfish.

Spare Towcables – Two cables (100-meter and 30-meter) come standard with each towed system. When scanning depths are greater than 50-meters, a cable length longer than 100-meters is needed. Cable lengths up to 800-meters are available, depending on the transducer frequency being used.

12 VDC to 115 VAC Inverters – Several of the Sea Scan[®] PC systems require 115 or 230 VAC power from either an onboard generator or a DC to AC inverter. High quality inverters are available, which are fully tested for noise free operation.

Analog Output – In certain situations a real time hard copy printout of the images is desired. MSTL offers an analog output capability for operation with a paper recorder on our Desk Top and Portable systems. This option is not available with the Centurion[™].

SEA SCAN[®] PC SYSTEM FEATURES:

All sonar functions, regardless of the Sea Scan[®] PC system, are software controlled. The features listed below apply to all systems manufactured by MSTL.

Controls:

- **Power** – Selectable on/off
- **Acoustic Range Scales** - 5, 10, 20, 50, 75, 100, 150, 200, 300, 500 meters (Range listed is out from each side of the transducer. Multiply x 2 to determine total swath scanned). Additional ranges of 30 and 40-meters are available where the PC 104 card is installed.
- **Magnetometer Range Scales** (Only applicable to MagScan System) -1/10, 1/20, 1/50, 10/50, 10/100, 20/100, 50/500, 100/500, gamma per division.
- **Display Color Scales** - Gray, Brown, Bronze, Gold, Mixed, HSV, Hot, Pink, Cool, Bone, Jet, Copper, and Custom. All color scales can be viewed inverted.
- **Time Gain Compensation (TGC)** – Automatic or manual.
- **Speed Control** – Automatically controlled with GPS/DGPS input or manual input.

- **Zoom** – Click and drag zoom window or centered. Both support multiple zooms.
- **Length Measurement** – Distances measured on images in feet, yards, or meters.
- **Area Measurement** – Areas measured in square feet, yards, or meters.
- **Height Measurement** – Shadows created by objects, displayed in the images, can be triangulated to determine height above the sea floor.
- **Channel Selection** – Displays either left or right channels or both left and right channels.
- **Annotations** – Notes regarding details of observed images can be added to images in real time or during post processing analysis.
- **Markers** – Objects in the acoustic image or anomalies in the magnetometer strip chart can be marked in the plotter, which stores the target location, target height, water depth and the magnetic field of information for post analysis. All data is stored in a text file
- **Event Markers** – Event markers can be input by an external source via the serial port or automatically by the system software using selectable ranges.
- **Range Delay** – Range scales can be delayed to eliminate the water column or offset range for optimum viewing/collection.
- **Navigation Plotter** – The integrated full-featured navigation plotter correlates all acoustic information to geographic positions. Up to 100 navigation waypoints can be entered into the plotter. Objects in the acoustic image can be quickly transferred to the plotter. Plotter information can be displayed simultaneously and overlaid on the sonar image in real time.
- **Filter** – More than 50 mathematical filters are available to enhance the acoustic images. These filters are located in the Sea Scan[®] PC Review Program.

Inputs

- **Desktop Systems** – Operate on either 115 or 230 VAC.
- **Portable and MagScan[®] Systems** – Operate on either 115/230 AC and/or 12 VDC. Operating voltage depends on the model selected.
- **“Centurion” Splash Proof**- Operates on 12 VDC.
- **AUV and Submerged Systems** – Operate on voltages from 10 to 36 VDC (5.5 amps at 12 VDC, 2.5 amps at 24 VDC)
- **Navigation Input** – Accepts a NEMA 0183 stream from the GPS/DGPS.
- **Analog Inputs** – The towfish provides analog image data that is converted, displayed and stored as digital data.
- **Host/Remote Control** – This feature allows the system, installed in an AUV/ROV, to be controlled from a remote computer using a standard serial port communication.
- **Fathometer** – Water depth data can be input into the system from a Fathometer outputting a NEMA 0183 depth information string. This information can be inputted into the computer from the Fathometer through a standard serial port communication. The depth data can be displayed onscreen overlaid on the image.
- **Event Markers** – Either the operating system or an external source using the standard serial port communication can enter event markers.

Outputs

- **Acoustic Data** – All acoustic data is stored digitally in a MST file format.
- **TIFF Files** – Images can be converted to the standard TIFF file format from the Sea Scan[®] PC Review Program for use in publishing programs.
- **Navigation Data** – All navigation information is stored digitally in the SVY (Survey) file format (text file).

- **Fathometer Data** – All Fathometer data is stored digitally in the DPT (Depth) file format (text file).
- **Marker** – All marker information is stored digitally in the MKR format (text file).
- **Magnetometer Data** – All magnetometer data is stored digitally in the MAG file format (text file).
- **Printer** – Images can be printed from any PC compatible printer.
- **Analog Output** – As an option, analog output can be provided so that real time, hard copy images can be printed during scanning operations.

Revised September 9, 2002