MACTEC

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October 2, 2006

Mr. Joe Martella
Rhode Island Department of Environmental Management
Office of Waste Management
235 Promenade Street
Providence, Rhode Island 02908

RE: Submittal of Technical Report, Geophysical Survey
Former Gorham Manufacturing Facility
33 Adelaide Avenue
Providence, RI
MACTEC PN: 3650050041.02

Dear Mr. Martella:

MACTEC Engineering and Consulting, Inc. (MACTEC) is providing, on behalf of Textron, Inc., the Technical Report, Geophysical Survey for the Former Textron Gorham Manufacturing Facility. A draft version of this report was submitted to Rhode Island Department of Environmental Management (RIDEM) on July 31, 2006, with the Supplemental Site Investigation Report due to the time constraints under the Superior Court Consent Order dated March 29, 2006. The subcontractor that performed the geophysical survey, Aqua Survey, Inc. of Flemington, New Jersey, just completed their final report and MACTEC is forwarding this to RIDEM for their records.

Please feel free to contact either of the undersigned (781-245-6606) if you have any questions regarding the enclosed Slag Removal Summary Report and we look forward to our meeting on October 4, 2006 at RIDEM.

Sincerely,
MACTEC Engineering and Consulting, Inc.

Daron G. Kurkjian
Staff Engineer

David E. Heislein
Project Manager

MACTEC Engineering and Consulting, Inc.
107 Audubon Road • Suite 301 • Wakefield, MA 01880 • Phone: 781-245-6606 • Fax: 781-246-5060
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Enclosures: Technical Report, Geophysical Survey, September 29, 2006 (3 copies and 1 CD)

cc: Senator Juan Pichardo, District 2 (1 copy)
Representative Thomas Slater, (1 copy)
Thomas Deller, City of Providence (1 copy)
Peter Grivers, EA Engineering, Science and Technology, Inc. (1 electronic copy)
Greg Simpson, Textron, Inc. (electronic copy)
David McCabe, Textron, Inc. (electronic copy)
Repository - Knight Memorial Library
MACTEC Project Files [P/W2/Textron/Gorham/Slag Removal/ RIDEM 0906 Response Documents/Cover Letter 100206.doc]

Technical Report
Geophysical Survey,
Textron Gorham Manufacturing Facility,
Providence, Rhode Island

SPONSOR

MACTEC Engineering and Consulting
107 Audubon Road
Suite 301
Wakefield, Massachusetts 01880

SURVEY COMPANY

Aqua Survey Inc.
469 Point Breeze Rd.
Flemington, NJ 08822

ASI Project Number 26-186

September 29, 2006

Technical Report
Geophysical Survey,
Textron Gorham Manufacturing Facility,
Providence, Rhode Island

SPONSOR

MACTEC Engineering and Consulting
107 Audubon Road
Suite 301
Wakefield, Massachusetts 01880

ASI Project Number 26-186

This report, as well as all records and raw data were audited and found to be an accurate reflection of the study. Copies of raw data will be maintained by Aqua Survey, Inc., 469 Point Breeze Road, Flemington, NJ 08822.

Kenneth Hayes **Date**
President

James Nickels **Date**
Vice President

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I. EXECUTIVE SUMMARY

The primary goal of the geophysical survey was to perform a bathymetric and geophysical survey of the shallow freshwater Mashapaug Cove at the former Gorham Manufacturing Facility in Providence, Rhode Island.

The survey work encompassed the entire bottom of the cove from bank to bank, and a short distance out into the main body of Mashapaug Pond. The survey work results were produced in Rhode Island State Plane feet NAD83 for the horizontal datum North American Vertical Datum 1988 (NAVD88) for the vertical datum.

The geophysical survey was conducted between June 19, 2006 and June 22, 2006. Technologies and techniques employed included side scan sonar, sub-bottom profiler, fathometer, magnetometer, real-time kinematic differential global positioning (RTK-DGPS), and vibracoring. Survey lines were run across the cove using the side scan sonar and magnetometer. Survey lane spacing for the magnetometer and side scan sonar surveys was 20 feet. Survey lines were subsequently run using the fathometer and sub-bottom profiler. Survey lane spacing for the fathometer and sub-bottom profiler was 10 feet.

An Innerspace Technologies model 455 fathometer was used to conduct the hydrographic survey. A Trimble RTK-DGPS system was used for both horizontal positioning and vertical positioning in order to collect vertical corrections for any variations in the water level of the cove. Positioning data was collected from the RTK-DGPS and electronically paired with the soundings from the Innerspace Technologies IT-455 fathometer in Hypack Max 4.3a survey control software. Following the survey, the data was processed, point plotted, and contoured with elevations presented in depth of water at the time of the survey. Pond level during the survey was constant at an elevation of 34.9 feet NAVD88.

An Edgetech 4200-FS dual frequency 100kHz/500kHz side scan sonar system was used for this survey. Range scale was set to 25 meters, which resulted in greater than 300 percent insonification of the lake bed. Following the survey, the individual records were analyzed to detect any man-made targets that might be present. Four sonar targets were found during the survey. Three of these appear to be pieces of pipe. The other appears to be a small cluster of targets off the point in the South-Eastern corner of the cove. The sonar records were mosaiced using Chesapeake Technologies SonarWeb Pro software to provide a better overall view of the survey area and to produce a single geo-referenced image of the survey area.

The magnetic survey was conducted using a Geometrics G-882 marine cesium magnetometer system. The primary objective was to detect exposed and buried ferrous objects within the survey area. During the survey, the sensor was deployed off the bow of an all-aluminum vessel to allow it to be towed through very shallow water and yet have no interference from the vessel itself. The magnetometer survey identified 16 magnetic anomalies during the survey. Of those, three were associated

with side scan sonar targets. Of the magnetic anomalies that were not associated with a sonar target, none were found to have signatures indicative of a potentially significant submerged cultural resource.

An ODEC Stratabox sonar system was used to collect the sub-bottom profiling data during the survey of the cove. The principal objective of the survey was to collect sub-bottom images to identify the depth of bedrock, sediment thickness, subsurface sediment stratification, as well as to possibly locate buried objects. During the survey, the sensor was deployed at a depth between 1 and 3 feet to minimize interference from the vessel and to help avoid hitting rocks and other debris.

Penetration over the entire survey area was typically less than 2 feet. The sub-bottom profiling was unsuccessful in terms of its ability to detect buried debris or to generate geologic cross-sections of the sub-bottom sediments or bedrock. The principal limiting factors to the quality of the sub-bottom data were the presence of organic, gaseous, materials in the shallow sub-bottom, the relatively shallow water depths, and the similar nature of the sub-bottom sediments in the survey area. Depth of penetration of the sub-bottom acoustic signal was limited primarily by the presence of organic-rich silts along the cove bottom. Decomposition of the leafy and organic material in these sediments produces gas. Since gases are characterized by very high acoustic impedance (the product of a material's density and sound velocity) contrasts with surrounding materials, when trapped, they limit the passage of sound waves deeper into the sub-surface. During the vibracoring activities, it was apparent that there was significant gas in the sediment as an area about 20 feet in diameter around the vibracore would bubble as the sample was being taken. The shallow waters exacerbated the problem of multiples in the sonar data. Multiples are generated by sound energy reverberating in the water column as opposed to penetrating into the sub-bottom. In the sub-bottom profiles, the presence of multiples, which essentially parallel the cove bottom, mask the presence of possible deeper reflection events.

Sediment cores were taken using a Rossfelder P-3 vibracorer and 4-inch diameter steel barrel with a flexible liner. Cores were taken at 17 locations inside the cove and 6 locations outside of the cove to a depth of over 8 feet below the surface of the sediment. Cores were turned over to MACTEC personnel inside their flexible liners for characterization and sample extraction.

II. MATERIALS, METHODS, AND RESULTS

A. Horizontal and Vertical Positioning

All aspects of the remote sensing survey were conducted using a real-time kinematic differential global positioning system (RTK-DGPS). This system consisted of a stationary base station operating over a known control point. Positioning corrections calculated by the base station were transmitted at 10 times per second via radio modem to another GPS receiver on the survey vessel. This allows the positioning accuracy for the survey vessel to be on the order of 3-cm in the horizontal and 2-cm in the vertical planes.

The base station, consisting of a Trimble 5700 24-channel dual frequency GPS receiver, Trimble TSCe survey controller, and Trimble Trimmark 3 radio modem, was set up over benchmark 'Control Point #4' provided by Bryant Associates. This is a suvey control point used in the construction of the High School nearby. The vertical elevation of 66.53 feet NAVD88 was supplied for the control point. As there were no horizontal coordinates available for this point, it was decided to allow the base station to average the horizontal positions over a period of time. This typically results in a horizontal accuracy for the control point of less than 1 foot. The rover, consisting of a Trimble MS-750 9-channel dual frequency GPS receiver and Teledyne radio modem, was set-up on the survey vessel and supplied positioning data to all the survey instruments during the geophysical remote sensing surveys.

During the survey, the PDOP as well as the status of the RTK-DGPS was monitored. If the PDOP exceeded 5.0 or the RTK-DGPS lost fix, survey activities were suspended or data was not used. Pond level during the survey was found to be constant at an elevation of 34.9 feet NAVD88.

B. Bathymetric Data Collection and Post-Processing

A bathymetric survey was conducted along the entire length of the project area. Survey lines spaced 10 feet apart were to ensure high-resolution coverage of the entire survey area. Horizontal positioning was collected from the RTK-DGPS and electronically paired with soundings from an Innerspace Technologies IT-455 single beam fathometer in Hypack Max 4.3a survey control software at a rate of 10 points per second. The survey was conducted in Rhode Island State Plane feet NAD 83 horizontal datum and vertical datum NAVD88.

Prior to the commencement of survey operations, a bar check was conducted to adjust for draft and speed of sound in order to ensure accurate sounding data. A bar check was also conducted at the end of each day to be sure the settings continued to be correct. The antennae for the RTK-DGPS was mounted directly above the transducer, eliminating any positioning offset errors. Soundings and positions that were collected when the RTK-DGPS was not in 'fix' mode or the PDOP exceeded 5.0, were discarded as the horizontal or vertical corrections are not accurate or reliable enough to be included in the survey.

Post processing involved removing bad sounding points created by gas and aquatic vegetation. The data was then sorted to eliminate points closer than 10 feet apart and to reduce the data to an X, Y, Z file. Finally, the sorted data was point plotted and contoured on geo-referenced AutoCAD and GIS drawings. The bottom of the cove was found to be fairly flat, with the deepest point being 3.8 feet near the mouth of the cove.

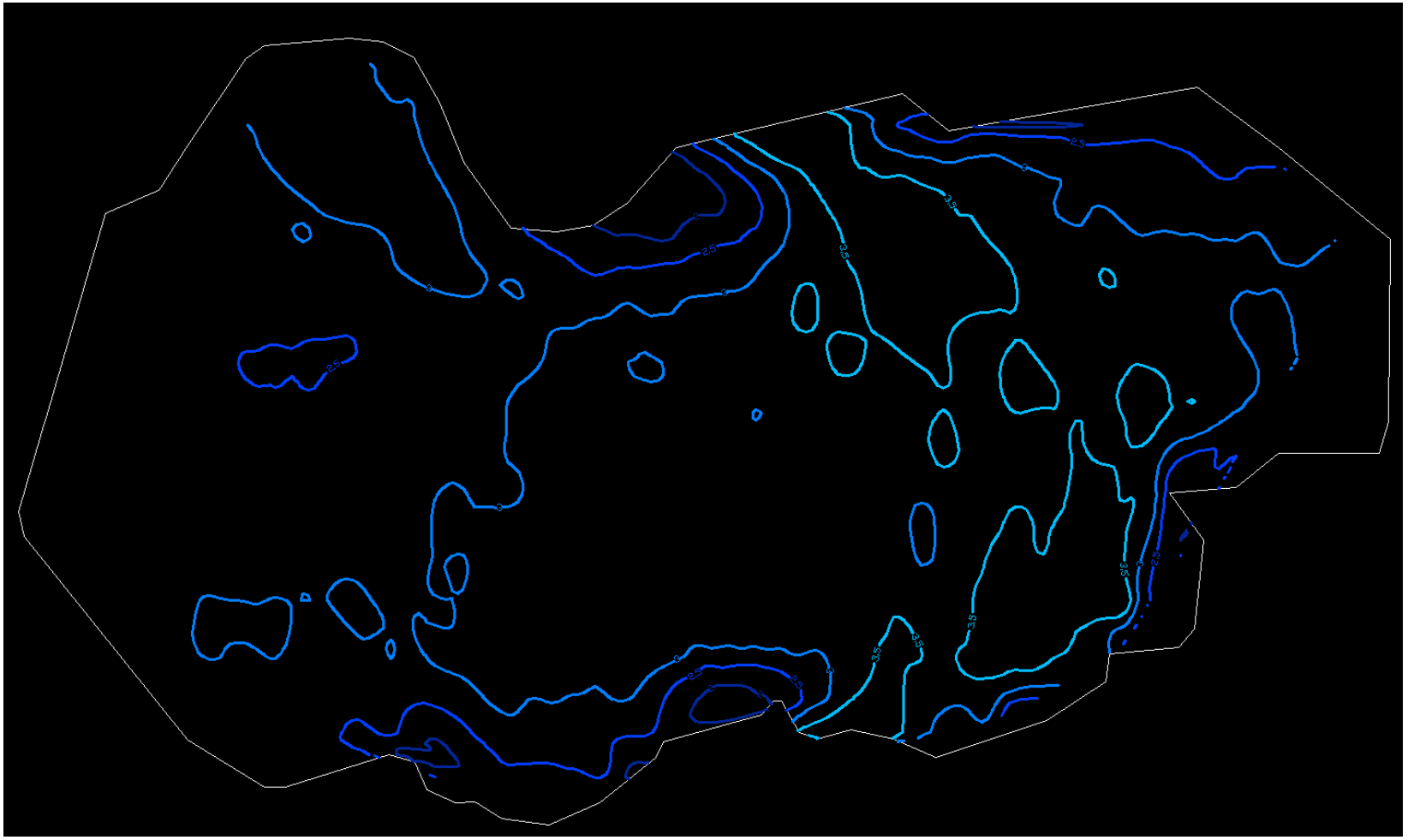

Figure 1 Bathymetric survey results. Water depths are in relation to a lake water elevation of 34.9 feet.

C. Magnetometer Data Collection and Results

A magnetometer survey was conducted in order to detect the presence of submerged ferrous debris that could pose a hazard to future dredging operations, if any. The magnetometer also serves to help detect the presence and locations of buried pipes and cables. The magnetometer survey complemented and aided in the interpretation of the side scan sonar survey results regarding debris and potentially significant historic submerged cultural resources. The survey methodology was designed to provide data indicating the position and relative size of ferrous targets in the survey area, as well as archaeological data essential for complying with the National Historic Preservation Act of 1966, as amended, through 1992 (36 CFR 800, *Protection of Historic Properties*) and the Abandoned Shipwreck Act of 1987 (*Abandoned Shipwreck Act Guidelines*, National Park Service, *Federal Register*, Vol. 55, No. 3, December 4, 1990, pages 50116-50145).

A Geometrics G-882 marine cesium magnetometer system capable of plus or minus 0.01 gamma resolution was used to conduct the survey. Survey lines were run at approximately 20-foot intervals to ensure complete coverage of the survey area. Data was recorded at 0.1 second intervals and electronically paired with positioning data from the RTK-DGPS using an onboard computer running Hypack Max 4.3a survey software.

A magnetic target or anomaly is any object creating a measurable and significant disturbance in the background magnetic field. To ensure reliable target identification and assessment, analysis of the magnetic data was initially carried out as it was generated. Post-processing of the data involved examining each survey line individually and annotating anomalies detected. Using contouring software, magnetic data generated during the survey was contour plotted at 20, 50, and 200 gamma intervals for analysis and accurate location of the material generating each magnetic anomaly as well as determining the presence of clusters of targets. Analysis of each target signature also included consideration of magnetic characteristics previously demonstrated to be reliable indicators of historically significant submerged cultural resources. Of the magnetic anomalies that were not associated with a sonar target, none were found to have signatures indicative of a potentially significant submerged cultural resource that would be impacted by future dredging operations

The detectable magnetic signature created by an object varies greatly depending on many factors. The two dominant factors are the mass of the object and the distance of the sensor from the object creating the disturbance. Other factors include the orientation of the object, direction the sensor is passed over or near the object, and background magnetic fields. When searching for a specific type of object, such as a standard 55-gallon steel drum, the mass of steel (approx. 45 pounds) and detection

Figure 2. Magnetic signature of 1750 gamma target from the survey.

distance can be used to approximate the size of the detectable signature. With a minimum distance of 7 feet from the sensor (distance from sensor to the water plus water depth plus enough burial for the drum not to be exposed), a drum would be expected to have a signature of approximately 110 gammas in intensity. All of the targets detected had a signature of at least 200 gammas and up to 1750 gammas, indicating greater mass than a drum.

The magnetometer survey revealed 16 distinct magnetic anomalies, 3 of which were associated with side scan sonar targets. Targets were found near the shorelines on the Northern, Eastern, and Western sides of the cove. Material generating these signatures could often be seen as exposed pieces of pipe and other debris. Targets in the middle of the cove appeared to be scattered, fairly small objects. Only one of the magnetic anomalies had a signature indicative of a larger object. That anomaly is near the side scan sonar target consisting of a cluster of small targets off the point in the South Eastern corner of the cove. Initial probing attempts were unable to locate or identify the nature of the object generating the magnetic signature.

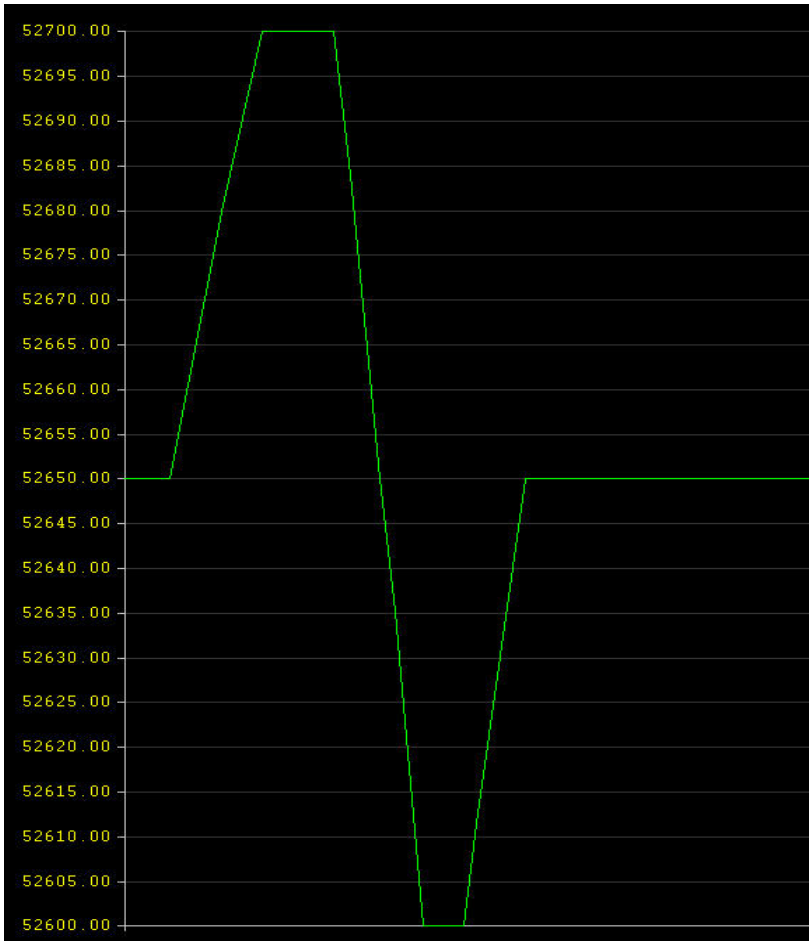

Figure 3. Magnetic signature of 100 gamma drum target.

Table of Magnetic Anomalies

Name	Easting	Northing	Description
Mag-1	346848.5	259965.6	Fairly small single object
Mag-2	346954.0	259956.8	Exposed pipe seen in sonar records
Mag-3	347030.9	259967.6	Single object or possible cluster of small objects off of point
Mag-4	347101.5	259964.5	Fairly small single object
Mag-5	347194.7	259935.7	Cluster of targets located on or very near the shoreline
Mag-6	347101.9	259841.5	Large target, initial probing attempts could not identify the object creating signature
Mag-7	346991.2	259858.5	Fairly small single object
Mag-8	347033.4	259815.2	Fairly small single object
Mag-9	346996.8	259810.6	Probably a short section of pipe, seen in sonar records
Mag-10	347022.1	259778.2	Shoreline debris. Could be seen during the survey and in the sonar records
Mag-11	346897.4	259748.3	Probably a short section of pipe
Mag-12	346861.3	259828.6	Fairly small single object
Mag-13	346838.6	259785.4	Fairly small single object
Mag-14	346792.3	259780.2	Probably section of pipe
Mag-15	346737.1	259838.4	Cluster of targets located on or very near the shoreline
Mag-16	346768.5	259881.1	Single object or possible cluster of small objects

Table 1. Magnetic anomalies detected during the survey. For unknown targets, the exact nature of the material generating the target could not be determined based on the survey results. The item was not visible from the surface or visible in the sonar records.

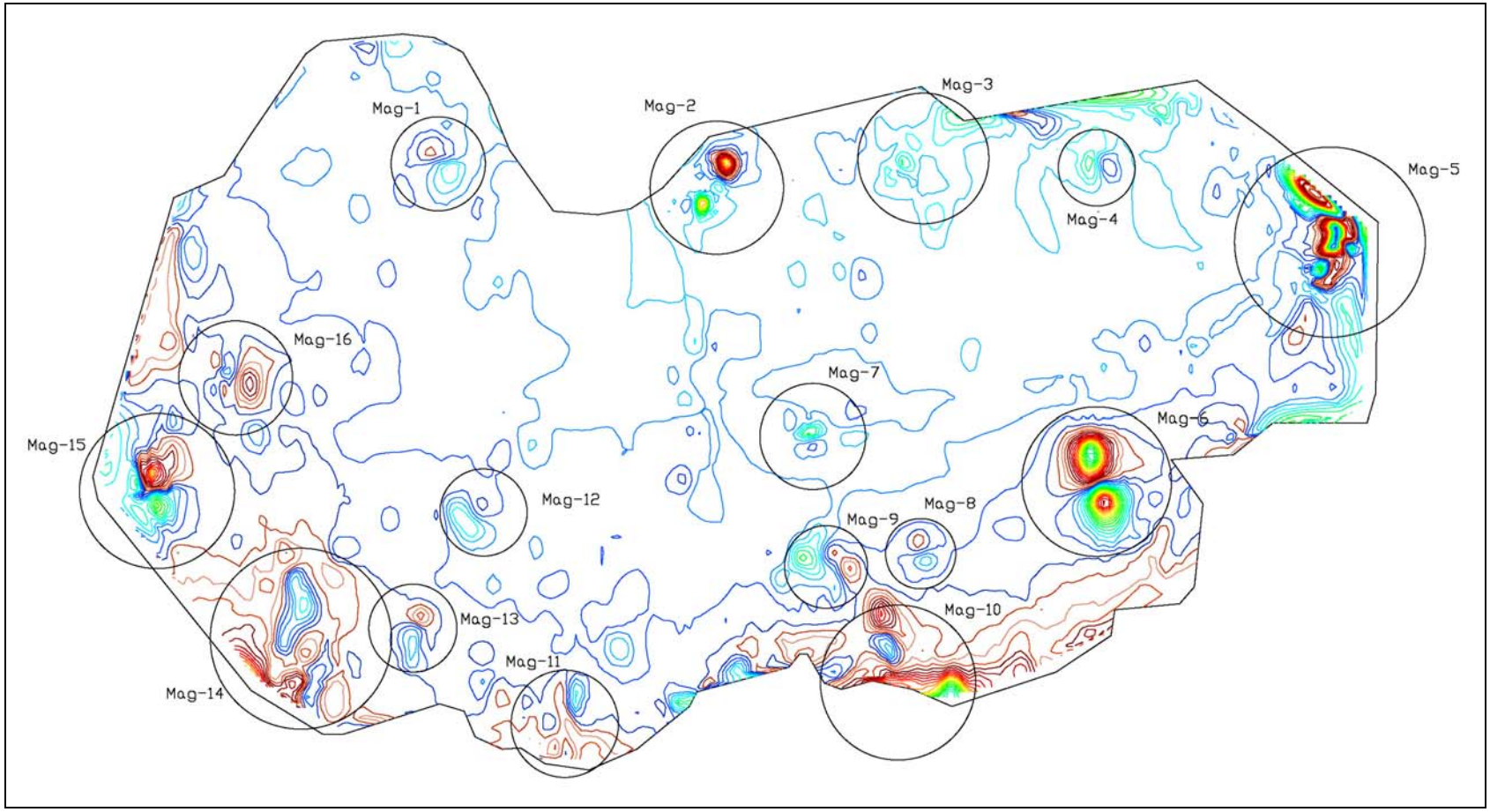

Figure 4. 50-Gamma magnetic contours from data collected during the magnetometer survey. The intensity of the magnetic field disturbance for each target is indicated by the number of contours making up the target.

D. Side Scan Sonar Survey Data Collection and Results

The side scan sonar survey encompassed the entire cove bottom within the survey area. This survey was conducted using an Edgetech 4200-FS dual frequency 100kHz/500kHz sonar system. The RTK-DGPS was used for positioning and Hypack Max survey management software was used for survey control and ship track recording. This survey was conducted by lines longitudinally across the cove spaced approximately 20-feet apart, with one line as close to each shoreline as possible. Range was set to 25 meters per side, resulting in greater than 300% coverage.

The side scan survey was designed to optimize resolution of the side scan sonar records. Prior to commencing survey operations, the sonar was tuned and adjusted to find the optimal combination of control settings that yielded the best image. Gain settings were adjusted as little as possible, to allow accurate post-processing. Data was logged to the onboard computer for later review.

Side scan sonar records were analyzed for evidence of objects exposed above the sediment of the cove. Detected features were plotted at their locations on the geo-referenced GIS drawing. Targets marked included all sonar features with significant areal extent and acoustic shadow (indicating projection above the seafloor) and seafloor topographic features that could pose a threat to or serve as an obstruction for future dredging operations. Sonar features were analyzed to determine locations, ranges, shadow lengths, scaled sizes, towfish heights and descriptions.

Four sonar targets were found during the survey. The shorelines, especially the Western shoreline, appear to have a significant number of submerged fallen trees and limbs. Three of the four sonar targets appear to be pieces of pipe and are associated with magnetic anomalies. The fourth sonar target appears to be a cluster of small targets off the point in the South-Eastern corner of the cove.

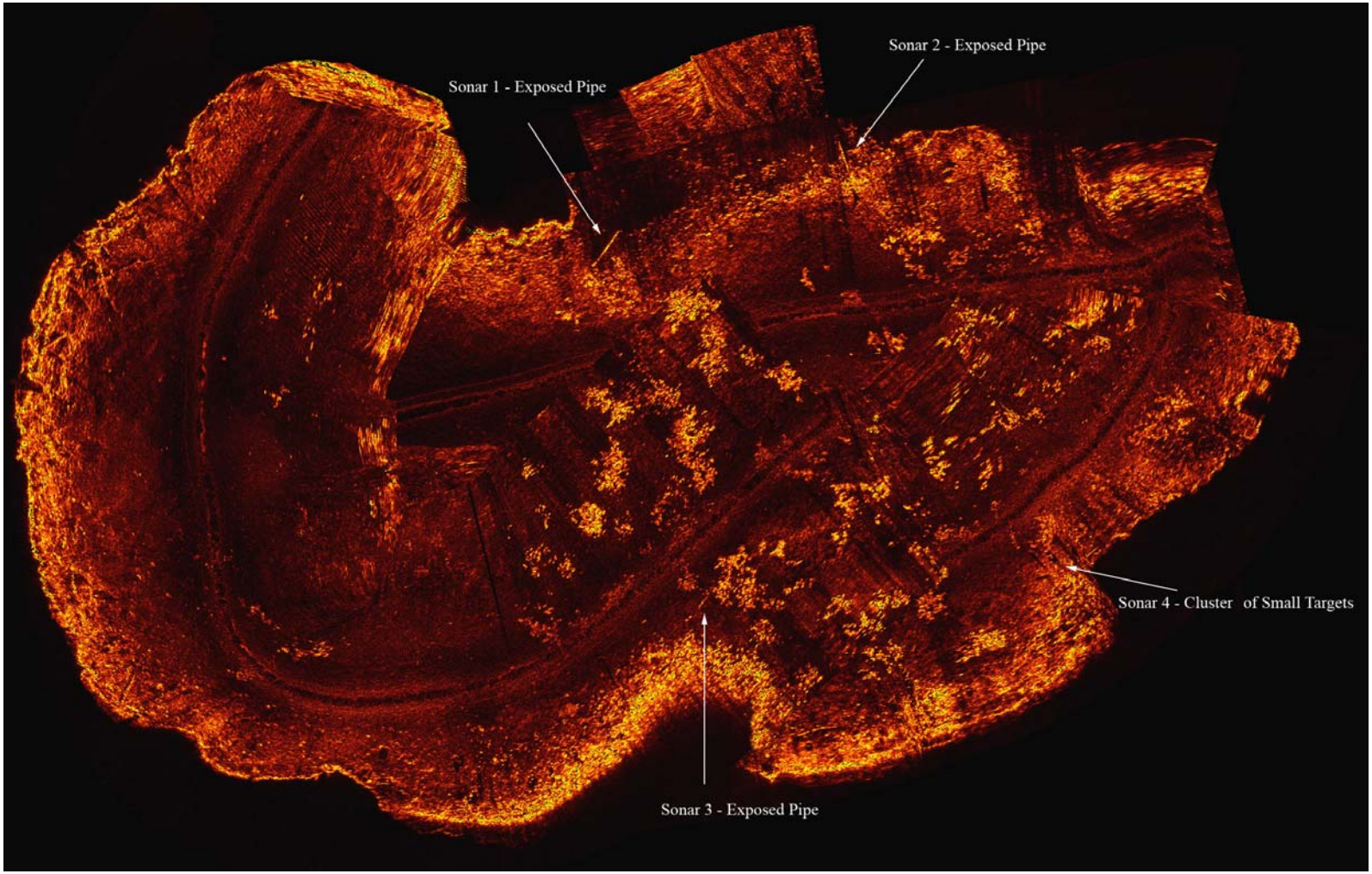

Figure 5. Side scan sonar mosaic with sonar targets indicated. Light patches in the cove are clusters of aquatic vegetation. Fallen trees and debris can be seen along the shorelines.

E. Sub-Bottom Profiler Survey

An ODEC Stratabox sonar system was used to collect the sub-bottom profiling data during the survey. The principal objective of the survey was to collect sub-bottom images to identify the depth of bedrock, sediment thickness, subsurface sediment stratification, as well as to possibly locate buried objects.

During the survey, the transducer was hard-mounted to the side of the survey vessel with the navigational antenna mounted directly over the transducer, eliminating offset errors. The sensor was deployed at a depth between 1 and 3 ft to minimize interference from the vessel and to help avoid hitting rocks and other debris. The navigational data was logged at one-second intervals by the ODEC Stratabox digital recording system

During the sub-bottom survey, the data was observed in "real-time" on the Stratbox monitor. The data displayed included the reflection coefficient of the sediment surface (a measure of the acoustic impedance contrast at the water/sediment interface), the relative amplitude of bottom and sub-bottom reflections, a cross-sectional image of the last ~600 sub-bottom pulses that were recorded, as well as the current position, time, date, course and speed of the survey vessel.

The depths of the sub-bottom reflections were calculated assuming a sound velocity of 1500 m/s. This is a typical velocity for sediments that are water-saturated, which is a reasonable assumption given the rather shallow depths of penetration of the sub-bottom system that was used. Even if velocities varied on the order of 50 m/s, as a function of the different types of sediments and their water content, the possible errors in depth estimations would vary only on the order of tenths of feet for the depth intervals over which the reflections were observed.

An initial test line indicated that the penetration into the sediment was very limited. The seismic data as seen in the electronic records is strongly indicative of gas in the sediments at the immediate water/sediment interface. This conclusion was supported by the number of strong multiples often up to six being seen in the seismic section.

No interpretable sub-bottom reflectors are seen either before or after the arrival of the first multiple reflector. The weak bottom-parallel reflectors seen on the analog records are residuals from the source signal and include reflecting modes caused by the system geometry. They are prominent because of the very high reflection characteristics of the gas-entrained bottom sediments. These bottom conditions existed in all the survey lines undertaken.

Penetration over the entire survey area was typically less than 2 feet. The sub-bottom profiling was unsuccessful in terms of its ability to detect buried debris or to generate geologic cross-sections of the sub-bottom sediments or bedrock. The principal limiting factors to the quality of the sub-bottom data were the presence of organic, gaseous, materials in the shallow sub-bottom, the relatively shallow water depths, and the similar nature of the sub-bottom sediments in the survey area. Depth of penetration of the sub-bottom acoustic signal was limited primarily by the presence of organic-rich silts along the cove bottom. Decomposition of the leafy and organic material in these sediments produces gas. Since gases are characterized by very high acoustic impedance (the product of a material's density and sound velocity) contrasts with surrounding materials, when trapped, they limit the passage of sound waves deeper into the sub-surface. During the vibracoring activities, it was apparent that there was significant gas in the sediment as an area about 20 feet in diameter around the vibracore would bubble as the sample was being taken. The shallow waters exacerbated the problem of multiples in the sonar data. Multiples are generated by sound energy reverberating in the water column as opposed to penetrating into the sub-bottom. In the sub-bottom profiles, the presence of multiples, which essentially parallel the cove bottom, mask the presence of possible deeper reflection events.

F. Vibracoring Activities

Sediment cores were taken and analyzed to help ground-truth the sub-bottom profiler results and help characterize the subsurface geology. A Rossfelder P-3 vibracorer was used in order to get penetrations over 8 feet below the surface of the sediment. Cores were taken at 17 locations inside the cove and 6 locations outside of the cove. A 4-inch diameter steel barrel was used in conjunction with soft liner to facilitate sample analysis and inspection. All cores were logged and field classified by geologists from MACTEC.

III. PROJECT CONCLUSIONS

The primary goal of the geophysical survey was to perform a bathymetric and geophysical survey of the shallow freshwater Mashapaug Cove at the former Gorham Manufacturing Facility in Providence, Rhode Island.

The survey work encompassed the entire bottom of the cove from bank to bank, and a short distance out into the main body of Mashapaug Pond. The survey work results were produced in Rhode Island State Plane feet NAD83 for the horizontal datum North American Vertical Datum 1988 (NAVD88) for the vertical datum.

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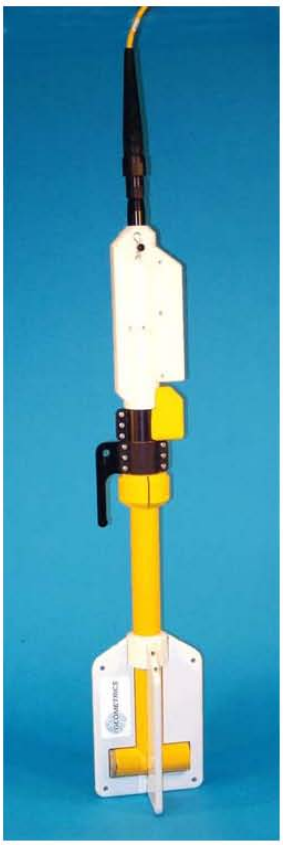
Appendix A

Equipment Specifications

G-882 MARINE MAGNETOMETER

- *CESIUM VAPOR HIGH PERFORMANCE – Highest detection range and probability of detecting all sized ferrous targets*
- *NEW STREAMLINED DESIGN FOR TOW SAFETY – Low probability of fouling in lines or rocks*
- *NEW QUICK CONVERSION FROM NOSE TOW TO CG TOW – Simply remove a stainless steel locking pin, move tow point and reinsert. New easy carry handle built in!*
- *NEW INTERNAL CM-221 COUNTER MODULE – Provides Flash Ram for storage of default parameters set by user*
- *NEW ECHOSOUNDER / ALTIMETER OPTION*
- *NEW DEPTH RATING – 4,000 psi !*
- *HIGHEST SENSITIVITY IN THE INDUSTRY – 0.004 nT/Hz RMS with the internal CM-221 Mini-Counter*
- *EASY PORTABILITY & HANDLING – no winch required- single man operation, 44 lbs with 200 ft cable (without weights or depressor wing)*
- *COMBINE TWO SYSTEMS FOR INCREASED COVERAGE – Internal CM-221 Mini-Counter provides multi-sensor data concatenation allowing side by side coverage which maximizes detection of small targets and reduces noise*



G-882 with Weight Collar Depth Option

Very high resolution Cesium Vapor performance is now available has been incorporated into a low cost, small size system for professional surveys in shallow or deep water. High sensitivity and sample rates of total field measurements are maintained for all applications. The well proven Cesium sensor is combined with a unique new CM-221 Larmor counter and ruggedly packaged for small or large boat operation. Use your computer and standard printer with our MagLog Lite™ software to log, display and print GPS position and magnetic field data. Model G–882 is the lowest priced - highest performance fully operational marine mag system ever offered.

The G-882 is flexible for operation in small boat, shallow water surveys as well as deep tow applications (4,000 psi rating, telemetry over steel coax available to 10Km). Being small and lightweight (44 lbs net, no weights) it is easily deployed and operated by one man. But add several no-foul weight collars and the system can quickly weigh in at more than 100 lbs. Power may be supplied from a 24 to 30 VDC battery supply or the included 110/220 VAC power supply. The tow cable uses high strength Kevlar and it's length is standard at 200 ft (61 m) with optional cable up to 500m (no telemetry). The shipboard end of the tow cable is attached to a junction box or on-board cable for quick and simple hookup to power and output of data into any IBM PC computer. A rugged fiber-wound fiberglass housing provides selectable orientation of the sensor and therefore maintains operations throughout the world with only small limitations as to direction of survey in equatorial regions.

The G-882 Cesium magnetometer provides the same operating sensitivity and sample rates as the larger deep tow model G-880. MagLogLite™ Logging Software is offered with each magnetometer and allows recording and display of data and position with Automatic Anomaly Detection! Additional options include: MagMap2000 plotting and contouring software and post acquisition processing software MagPick™ (free from our website.)

The G-882 system is particularly well suited for the detection and mapping of all sizes of ferrous objects. This includes anchors, chains, cables, pipelines, ballast stone and other scattered shipwreck debris, munitions of all sizes, aircraft, engines and any other object with magnetic expression. Objects as small as a 5 inch screwdriver are readily detected provided that the sensor is close to the seafloor and within practical detection range.(Refer to table at right).

The design of this special marine unit is directed toward the largest number of user needs. It is not intended to meet all marine requirements such as deep tow through long cables or monitoring fish altitude. Rugged design with highest performance at lowest cost are the goals.

Typical Detection Range For Common Objects

Ship 1000 tons	0.5 to 1 nT at 800 ft (244 m)
Anchor 20 tons	0.8 to 1.25 nT at 400 ft (120 m)
Automobile	1 to 2 nT at 100 ft (30 m)
Light Aircraft	0.5 to 2 nT at 40 ft (12 m)
Pipeline (12 inch)	1 to 2 nT at 200 ft (60 m)
Pipeline (6 inch)	1 to 2 nT at 100 ft (30 m)
100 KG of iron	1 to 2 nT at 50 ft (15 m)
100 lbs of iron	0.5 to 1 nT at 30 ft (9 m)
10 lbs of iron	0.5 to 1 nT at 20 ft (6 m)
1 lb of iron	0.5 to 1 nT at 10 ft (3 m)
Screwdriver 5 inch	0.5 to 2 nT at 12 ft (4 m)
1000 lb bomb	1 to 5 nT at 100 ft (30 m)
500 lb bomb	0.5 to 5 nT at 50 ft (16 m)
Grenade	0.5 to 2 nT at 10 ft (3 m)
20 mm shell	0.5 to 2 nT at 5 ft (1.8 m)

MODEL G-882 CESIUM MARINE MAGNETOMETER SYSTEM SPECIFICATIONS

OPERATING PRINCIPLE:	Self-oscillating split-beam Cesium Vapor (non-radioactive)
OPERATING RANGE:	20,000 to 100,000 nT
OPERATING ZONES:	The earth's field vector should be at an angle greater than 6° from the sensor's equator and greater than 6° away from the sensor's long axis. Automatic hemisphere switching.
CM-221 COUNTER SENSITIVITY:	<0.004 nT/√Hz rms. Typically 0.02 nT P-P at a 0.1 second sample rate or 0.002 nT at 1 second sample rate. Up to 10 samples per second
HEADING ERROR:	±1 nT (over entire 360° spin and tumble)
ABSOLUTE ACCURACY:	<3 nT throughout range
OUTPUT:	RS-232 at 9600 Baud
MECHANICAL:	
Sensor Fish:	Body 2.75 in. (7 cm) dia., 4.5 ft (1.37 m) long with fin assembly (11 in. cross width), 40 lbs. (18 kg) Includes Sensor and Electronics and 1 main weight. Additional collar weights are 14lbs (6.4kg) each, total of 5 capable
Tow Cable:	Kevlar Reinforced multiconductor tow cable. Breaking strength 3,600 lbs, 0.48 in OD, 200 ft maximum. Weighs 17 lbs (7.7 kg) with terminations.
OPERATING TEMPERATURE:	-30°F to +122°F (-35°C to +50°C)
STORAGE TEMPERATURE:	-48°F to +158°F (-45°C to +70°C)
ALTITUDE:	Up to 30,000 ft (9,000 m)
WATER TIGHT:	O-Ring sealed for up to 9000 ft (2750 m) depth operation
POWER:	24 to 32 VDC, 0.75 amp at turn-on and 0.5 amp thereafter
ACCESSORIES:	
Standard:	CM-201 View Utility Software operation manual and ship case
Optional:	Telemetry to 10Km coax, gradiometer (longitudinal or transverse)
MagLog Lite™ Software:	Logs, displays and prints Mag and GPS data at 10 Hz sample rate. Automatic anomaly detection and single sheet Windows printer support

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE *4/03*

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GEOMETRICS China Laurel Industrial Co. Inc. - Beijing Office, Room 2509-2511, Full Link Plaza #18
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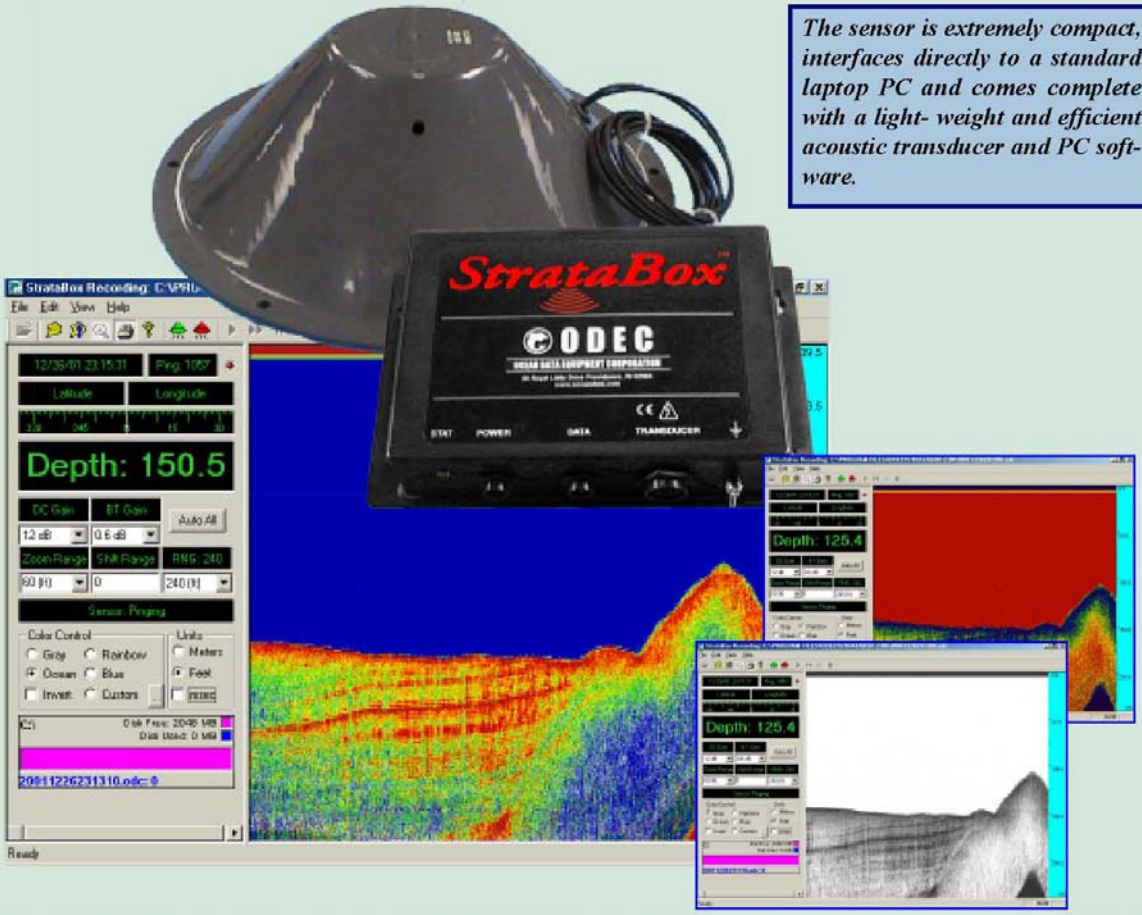
GEOMETRICS

StrataBox ™
Marine Geophysical Instrument

The StrataBox ™ is a portable high- resolution marine sediment imaging instrument capable of delivering 6 cm of marine sediment strata resolution with bottom penetration of up to 40 meters. It is designed exclusively for inshore and coastal geophysical marine survey up to 150 meters of water depth.

The sensor is extremely compact, interfaces directly to a standard laptop PC and comes complete with a light- weight and efficient acoustic transducer and PC soft-ware.



Extreme ease of use, portability, and cost efficiency make this device a perfect choice for shallow water marine geophysical applications

FEATURES

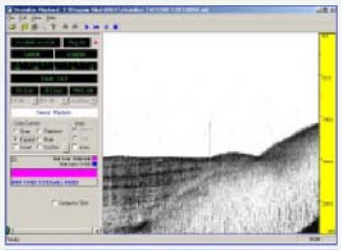
- **Strata Resolution: 6 cm with up to 40 meters bottom penetration.**
- **Depth Accuracy: ± 0.5%**
- **Geographic Position Input, NMEA Compatible**
- **Hypack & HydroPro Compatible**
- **Data Storage & Playback**
- **Zoom Modes**
- **Event Marks**
- **Low Input Power**

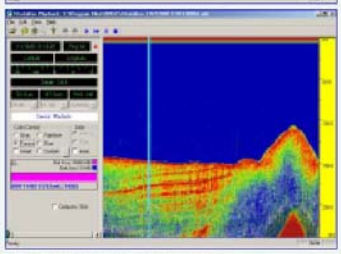
OCEAN DATA EQUIPMENT CORPORATION

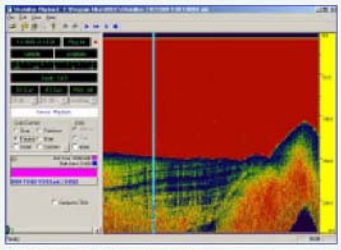
www.oceandata.com

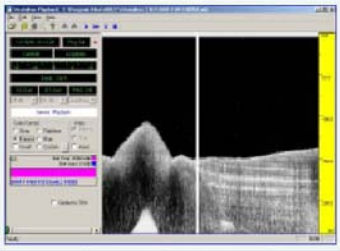
SPECIFICATIONS

StrataBox - Marine Geophysical Instrument









Units:	Feet or Meters
Depth Ranges:	0-15, 0-30, 0-60, 0-120, 0-240, 0-450 Feet. 0-5, 0-10, 0-20, 0- 40, 0- 80, 0-150 Meters. Millisecond Range-scale available in either Feet or Meters. Auto-ranging Modes in all units.
Shift Range:	0-450 feet in 1 foot increments 0-150 meters in 1 meter increments
Zoom Range:	15, 30, 60, 120, 240 feet 5, 10, 20, 40, 80 meters
Zoom Modes:	Bottom Zoom, Bottom Lock, Marker Zoom, GUI Zoom (Playback Only)
Display:	Normal Data, Zoom Data, Navigation, Depth, Command/Status Color Control for Data: 4 selections or Custom (User Input), Data Invert possible.
Strata Resolution:	6 cm with up to 40 Meters bottom penetration.
Depth Resolution:	0.1 foot, 0.1 meters.
Depth Accuracy:	±0.5%
Speed of Sound:	1500 Meters/Second or 4800 Feet/Second.
Navigation Input:	NMEA 0183, GLL, GGA, RMC, VTG, VHW, HDT. Selectable Baud Rate, RS-232 COM2.
StrataBox Interface:	Serial data, 57.6Kbaud, RS-422, COM1.
Printer Output:	Centronics (Parallel Port) interface to TDU Series Thermal Printers.
Shallow Water Operation:	< 2.5 meters; bottom type dependant
Transmit Rate:	Up to 10 Hz, depth and operator mode dependent.
Event Marks:	Manual or Periodic (selectable in 1 minute intervals)
Data File Storage:	Saves Depth, Navigation, and Graphic Data in ODEC format (Proprietary). Normal Data and Zoom Data stored is Pixel Data and can be played back and printed.
Data File Playback:	Files played back and printed at Normal or Rapid Advance Speed, with Pause and GUI Zoom available.
Frequency Output:	10 Khz.
Transmit Output Power:	300 Watts (Pulsed), 1000 Watts capable.
Input Power:	10-30 Volts DC, Nominal Power 8 watts, Reverse Polarity and Over Voltage Protected.
Dimensions:	25.4 cm (10") Length, 15.876 cm (6.25") Width, and 6.25 cm (2.5") Height.
Weight:	0.9 kg (2.0 lbs).
Environmental:	-25°C to +60°C Operating Temperature (-55°C to +90°C Storage) Water Resistant to EN60529 IP65 EMC meets EN60945 Emissions, CE Compliant

All specifications subject to change without notice.

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MS750

Dual Frequency RTK Receiver for Precise Dynamic Positioning

Key features and benefits

- **20 Hz position update rate**
- **Less than 20 milliseconds position latency**
- **Centimeter-level position accuracy**
- **Front panel display & keypad for status monitoring and configuration**
- **User-defined local coordinates direct from receiver**
- **Industry standard CAN bus interface**

The MS750™ represents the highest level of accuracy and response available from a dual frequency GPS receiver. The receiver is specifically designed to allow the easy integration of reliable centimeter-level positions to any guidance or control application.

Accuracy and Response Times

Dynamic platforms, require virtually instantaneous position reports multiple times per second. The MS750 delivers positions to guidance or control loop software twenty times per second with a latency of less than 20 milliseconds. This responsiveness is matched with a horizontal accuracy of two centimeters and vertical accuracy of three centimeters. For the most precise applications, the MS750 provides one centimeter accuracy horizontally at a 5 Hz rate with a small increase in latency.

Interfacing and Configuration Ease

The MS750 is designed to plug right into your application with minimal development. An easy to-use application file interface enables the user to completely program receiver operation with a single command. Alternately, the receiver can be configured via the user-friendly built-in display and keyboard interface, or by the included Windows-based Configuration Toolbox software. Multiple configurations can be stored in the receiver as files and activated when desired. Local datum and transformation parameters may be loaded directly into the receiver. Therefore, output grid coordinates are compatible with GPS and traditional survey systems that may be in use on the same site. ASCII or Binary messages may be output through any of the three bi-directional serial ports. The receiver also includes support for the industry standard CAN (Controller Area Network) interface.

Dual Frequency RTK Receiver for Precise Dynamic Positioning

Advanced Technology

The accuracies, update rates and latencies available in the MS750 are made possible through a GPS architecture specifically designed for demanding dynamic positioning applications. Reliable operation in the most adverse environments, such as radio interference experienced at construction or mining sites, is a strict requirement. Custom designed hardware with Supertrak™ multibit GPS signal technology and Everest™ advanced multipath suppression provide superior tracking especially for weaker, low elevation satellites.

Both the RTCM format for differential GPS corrections and Trimble's published Compact Measurement Record (CMR) differential data can be received simultaneously, allowing the receiver to choose the optimum source and provide seamless navigation. Available as an option is the ability to calculate the baseline vector between two moving receivers to centimeter accuracy. The MS750 addresses a vast range of applications in the field of machine positioning, guidance and control.

MS750

Dual Frequency RTK Receiver for Precise Dynamic Positioning

STANDARD FEATURES

- Centimeter accuracy, real-time positioning
- 20 Hz position updates
- < 20 ms position latency
- Front panel display & keypad
- User-defined local coordinates direct from receiver
- 3 serial I/O ports
- 2 CAN ports
- 1 PPS Output
- Trimble CMR Input/Output
- RTCM Input/Output
- One year hardware warranty
- Compact, easy mounting design
- Synchronized 5 Hz position updates

OPTIONS AND ACCESSORIES

- Moving Base RTK
- Rugged L1/L2 machine mount antenna
- Micro-Centered Antenna
- 5 m, 7.5 m, 10 m, 24 m & 30 m antenna cables
- Data extension cable
- Extended hardware warranty
- Firmware and Software update service

ORDERING INFORMATION

MS750 **Part Number 36577-00**

Includes MS750 receiver, Configuration Toolbox software, operating manual, power/data cable, data/1 PPS cable

PHYSICAL CHARACTERISTICS

Size	14.5cmW × 5.1cmH × 23.9cmD (5.7"W × 2.0" H × 9.4"D)
Weight	1.0 kg (2.25 lbs)
Power	12VDC/24VDC, 9 Watts

ENVIRONMENTAL CHARACTERISTICS

Operating temp	-20°C to +60°C
Storage temp	-30°C to +80°C
Humidity	MIL 810 E, Meth. 507.3 Proc III, Aggravated, 100% condensing
Vibration	MIL 810 D, Tailored Random 3gRMS Operating Random 6.2gRMS Survival
Mechanical Shock	MIL 810 D ± 40 g Operating ± 75 g Survival
EMC	
Radiated Emissions	CISPR 12
Conducted Emissions	SAE J1113/41
Radiated Immunity	ISO/DIS 13766, 30V/m
ESD	±15KV
Input Voltage Transients	ISO 7637-2

TECHNICAL SPECIFICATIONS

Tracking	9 channels L1 C/A code, L1/L2 full cycle carrier Fully operational during P-code encryption		
Signal processing	Supertrak Multibit Technology Everest Multipath Suppression		
Positioning mode	**Accuracy[1]**	**Latency[2]**	**Max Rate**
Synchronized RTK	1cm + 2ppm Horizontal 2cm + 2 ppm Vertical	300ms[3]	5 Hz Std
Low Latency	2cm + 2ppm Horizontal[4] 3cm + 2 ppm Vertical	< 20ms	20Hz
DGPS	< 1m	< 20ms	20Hz

[1] 1 sigma level
[2] At maximum output rate
[3] Dependent on data link throughput
[4] Assumes 1 second data link delay

Initialization	Automatic OTF (on-the-fly) while moving
Time required	Typically < 1 minute
Range	Up to 20 km from base for RTK
Start-up	< 90 seconds from power on to positioning < 30 seconds with recent ephemeris
Communications	3 × RS-232 ports. Baud rates up to 115,200 2 × CAN/J1939
Configuration	Via front panel display & keypad, Configuration Toolbox Software or user definable application files
Output Formats	NMEA-0183: GGK, GGA, ZDA, VTG, GST, PJT and PJK Trimble Binary Streamed Output

Trimble

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YOUR LOCAL TRIMBLE OFFICE OR REPRESENTATIVE

Trimble 5700 GPS System

One receiver, many configurations, for greater flexibility and choice

The Trimble® 5700 GPS receiver is an advanced, but easy-to-use, surveying instrument that is rugged and versatile enough for any job.

Combine your 5700 with the antenna and radio that best suit your needs, and then add the Trimble controller and software of your choice for a total surveying solution. The powerful 5700 GPS system will provide all the advanced technological power and unparalleled flexibility you need to increase your efficiency and productivity in any surveying environment.

Advanced GPS receiver technology

The 5700 is a 24-channel dual-frequency RTK GPS receiver featuring the advanced Trimble Maxwell™ technology for superior tracking of GPS satellites, increased measuring speed, longer battery life through less power use, and optimal precision in tough environments. WAAS and EGNOS capability lets you perform real-time differential surveys to GIS grade without a base station.

Modular design for versatility

For topographic, boundary, or engineering surveying, clip the receiver to your belt, carry it in a comfortable backpack, or configure it with all components on a lightweight range pole. With the receiver attached to your site vehicle, you can survey a surface as fast as you can drive! For control applications, attach the receiver to a tripod...it's designed to work the way your job requires.

Full metal jacket...and lightweight

The 5700 GPS receiver boasts the toughest mechanical and waterproofing specs in the business. Its magnesium alloy case is stronger than aluminum,

but also 30% lighter—the 5700 weighs just 1.4 kg (3 lb) with batteries. Whether you're collecting control points on a tripod, or scrambling down a scree slope collecting real-time kinematic data, the receiver is light enough and tough enough to carry on performing.

Fast and efficient data storage and communications

Use the receiver's CompactFlash memory to store more than 3,400 hours of continuous L1/L2 data collection at an average of 15-second intervals. Transfer data to a PC at speeds of more than 1 megabit per second through the super-fast USB port. Your choice of UHF radio modem is built in to the receiver to provide RTK communications receiving without the need for cables or extra power!

Your choice of Trimble antenna

Choose the high-accuracy Trimble GPS antenna that best suits your needs: the lightweight and portable Zephyr™ antenna for RTK roving, or the Zephyr Geodetic™ antenna for geodetic surveying.

The Zephyr Geodetic antenna offers submillimeter phase center repeatability and excellent low-elevation tracking, while the innovative design of its Trimble Stealth™ ground plane literally burns up multipath energy using technology similar to that used by stealth aircraft to hide from radar. The Zephyr Geodetic antenna thus provides unsurpassed accuracy from a portable antenna.

Key Benefits

- Industry-leading technology provides superior performance
- Flexible configurations put you in total control
- Rugged, high-performance hardware is built to last
- With the Trimble controller and software of your choice, enjoy seamless integrated surveying

Trimble.

Trimble 5700 GPS System

General

- Front panel for on/off, one-button-push data logging, CompactFlash card formatting, ephemeris and application file deletion, and restoring default controls
- LED indicators for satellite tracking, radio-link, data logging, and power monitoring
- Tripod clip or integrated base case

Performance specifications

Measurements

- Advanced Trimble Maxwell technology
- High-precision multiple correlator L1 and L2 pseudorange measurements
- Unfiltered, unsmoothed pseudorange measurement data for low noise, low multipath error, low time domain correlation, and high dynamic response
- Very low noise L1 and L2 carrier phase measurements with <1 mm precision in a 1 Hz bandwidth
- L1 and L2 Signal-to-Noise ratios reported in dB-Hz
- Proven Trimble low-elevation tracking technology
- 24 Channels L1 C/A Code, L1/L2 Full Cycle Carrier, WAAS/EGNOS.

Code differential GPS positioning[1]

Horizontal . . . . . ±(0.25 m + 1 ppm) RMS
Vertical . . . . . ±(0.5 m + 1 ppm) RMS
WAAS differential positioning accuracy typically <5 m 3DRMS[2]

Static and FastStatic GPS surveying[1]

Horizontal . . . . . ±5 mm + 0.5 ppm RMS
Vertical . . . . . ±5 mm + 1 ppm (× baseline length) RMS

Kinematic surveying[1]

Real-time and postprocessed kinematic surveys
Horizontal . . . . . ±(10 mm + 1 ppm) (× baseline length) RMS
Vertical . . . . . ±(20 mm + 1 ppm) RMS
Initialization time . . . . . Single/Multi-base minimum 10 sec + 0.5 times baseline length in km, up to 30 km
Scalable GPS infrastructure initialization time . . . . . <30 seconds typical anywhere within coverage area
Initialization reliability[3] . . . . . Typically >99.9%

Hardware

5700 GPS receiver

Physical:
Casing . . . . . Tough, lightweight, fully sealed magnesium alloy
Waterproof . . . . . Tested to IPX7 standards
Shock and vibration . . . . . Tested and meets the following environmental standards:
Shock . . . . . MIL-STD-810F to survive a 1 m (3.28 ft) drop onto concrete
Vibration . . . . . MIL-STD-810-F on each axis
Weight . . . . . With internal batteries, internal radio, internal battery charger, standard UHF antenna: 1.4 kg (3 lb)
As entire RTK rover with batteries for greater than 7 hours, less than 4 kg (8.8 lb)
Dimensions (W×H×L) . . . . . 13.5 cm × 8.5 cm × 24 cm (5.3 in × 3.4 in × 9.5 in)

Electrical:
Power . . . . . DC input 11 to 28 V DC with over voltage protection
Power consumption . . . . . 2.5 W receiver only, 3.75 W including internal radio
Battery . . . . . Greater than 10 hours data logging, or greater than 7 hours of RTK operation on two internal 2.0 Ah lithium-ion batteries
Battery weight . . . . . 0.1 kg (3.5 oz)
Battery charger . . . . . Internal with external AC power adapter; no requirement for external charger
Power output . . . . . 11.5 to 20 V DC (Port 1), 11.5 to 27.5 V DC (Port 3) on external power input
Certification . . . . . Class B Part 15 FCC certification, CE Mark approved, C-Tick approved, Canadian FCC

Environmental:
Operating temperature[4] . . . . . –40 °C to 65 °C (–40 °F to 149 °F)
Storage temperature . . . . . –40 °C to 80 °C (–40 °F to 176 °F)
Humidity . . . . . 100%, condensing

Communications and data storage:

- 2 external power ports, 2 internal battery ports, 3 RS232 serial ports
- Integrated USB for data download speeds in excess of 1 Mb per second
- External GPS antenna connector
- CompactFlash advanced lightweight and compact removable data storage. Options of 64 MB or 128 MB from Trimble
- More than 3,400 hours continuous L1+L2 logging at 15 seconds with 6 satellites typical with 128 MB card
- Fully integrated, fully sealed internal UHF radio modem option
- GSM, cellphone, and CDPD modem support
- Dual event marker input capability
- 1 Hz, 2 Hz, 5 Hz, and 10 Hz positioning and data logging
- 1 pulse per second output capability
- CMRII, CMR+, RTCM 2.*x* and 3.*x* input and output standard
- 14 NMEA outputs

Zephyr antenna

Dimensions . . . . . 16.2 cm (6.38 in) diameter × 6.2 cm (2.44 in) height
Weight . . . . . 0.55 kg (1.20 lb)
Operating temperature . . . . . –40 °C to 70 °C (–40 °F to 158 °F)
Humidity . . . . . 100% humidity proof, fully sealed
Shock and vibration . . . . . Tested and meets the following environmental standards:
Shock . . . . . MIL-STD-810-F to survive a 2 m (6.56 ft) drop onto concrete
Vibration . . . . . MIL-STD-810-F on each axis

- 4-point antenna feed for submillimeter phase center repeatability
- Integral low noise amplifier
- 50 dB antenna gain

Zephyr Geodetic antenna

Dimensions . . . . . 34.3 cm (13.5 in) diameter × 7.6 cm (3 in) height
Weight . . . . . 1.31 kg (2.88 lb)
Operating temperature . . . . . –40 °C to 70 °C (–40 °F to 158 °F)
Humidity . . . . . 100% humidity proof, fully sealed
Shock and vibration . . . . . Tested and meets the following environmental standards:
Shock . . . . . MIL-STD-810-F to survive a 2 m (6.56 ft) drop onto concrete
Vibration . . . . . MIL-STD-810-F on each axis

- 4-point antenna feed for submillimeter phase center repeatability
- Integral low noise amplifier
- 50 dB antenna gain
- Trimble Stealth ground plane for reduced multipath

1 Accuracy may be subject to conditions such as multipath, obstructions, satellite geometry, and atmospheric parameters. Always follow recommended survey practices.
2 Depends on WAAS/EGNOS system performance.
3 May be affected by atmospheric conditions, signal multipath, and satellite geometry. Initialization reliability is continuously monitored to ensure highest quality.
4 Receiver operates normally to –40 °C (–40 °F) but some office-based functions such as USB download or internal battery charging are not recommended at temperatures below freezing.

Specifications subject to change without notice.

YOUR LOCAL TRIMBLE OFFICE OR REPRESENTATIVE

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Trimble.

MODEL 455

DESCRIPTION

The Innerspace Technology Model 455 Survey Depth Sounder provides analog and digital depth on high resolution LCD display screens. The small, lightweight unit is ideal for use on small boats for hydrographic and GIS surveys, and also has applications on general purpose workboats and Corps of Engineers reconnaissance vessels. The 455 has most of the capabilities of Innerspace's legendary thermal printing depth sounder recorders, except for the thermal chart recording, plus it has many new features. Designed with the operator in mind, the easy-to-use menu is controlled via up / down, left / right arrows; no numerical entries are required and, when power is turned off, all entries are saved for next power on. In the operation mode, operator entries are always in view on the LCD display screen, along with the large numeral, digitized depth. The 455's analog display provides a continuous, high resolution bottom profile with alphanumerical annotation of pertinent information including: Speed-of-Sound, Tide, Draft, Time and Fix Number. For a hard copy, a screen print of the analog data may be sent to a standard computer printer or it can be stored internally on a 24 or 48 mb integrated circuit for later recall.

SPECIFICATIONS

GRAPHIC DISPLAY

- 640 x 480 Pixel Monochrome Transflective LCD with Backlight and Contrast Control
- 5 ¾ in. x 4 ¾ in. viewing area
- Emulates paper chart recorder

NUMERIC DISPLAY

- 4 lines x 40 characters with large 1 in. high numerics and Backlight

OPERATION

- Menu driven parameter selection on alphanumeric display

PARAMETER SELECTION

- Speed-of-Sound, Tide, Draft, Gate Width, Scale, Backlight, Com Ports and many more

RESOLUTION

- .1 Unit graphic and numeric

DEPTH RANGES

- 0-45, 40-85, 80-125, 120-165, 160-205 Feet or Meters (dm and cm selection)
- Multipliers: 1, 2, 10
- Auto Ranging

ANNOTATION

- LCD graphic display numerically displays Speed-of-Sound, Tide, Draft, Date, Time, Depth, Fix number and GPS Data

TRANSMITTER

- Front panel switch selectable power levels: 250 watts to 10 watts in 4 levels

RECEIVER

- Time varied automatic gain adjustment under microprocessor control 20 or 30 Log
- Front panel manual gain control 20db
- Adjustable Blanking

DIGITIZER

- Range Gated (selectable widths)
- Initial Depth Entry
- 4 Modes of Operation
- Gate Mark on Graphic Display

UTILITIES

- Depth Simulator
- Chart Speed
- Screen capture to memory

INPUTS/OUTPUTS

- RS232 Port A
- RS232 Port B
- RS232 Port C
- Parallel Port
- Keyboard and VGA Port
- GPS Antenna with GPS option
- Floppy Port

TRANSDUCER

- 200kHz 8°
- Optional: 200kHz 3°

POWER

- 12VDC, 2½ Amp

ENCLOSURE

- Drawn aluminum case
- Aluminum panel painted to resist corrosion.
- Removable handle and soft carry bag included.

OVERALL SIZE

- 13 in. Wide x 9 in. High x 9 in. Deep
- 38.1 cm Wide x 22.86 High x 22.86 Deep

WEIGHT

- 15 lb.
- 6.8 kg

OPTIONS:

- Heave sensor
- Remote VGA display
- Tabletop / overhead mounting bracket
- Custom annotation (1 Line 40 Characters)
- Remote readout (large numeric)
- Continuous analog storage, 48mb
- AC power supply
- Portable transducer mounts
- Floppy Disk Drive in travel case
- Mini keyboard (89 key) and adapter cable
- 125 kHz transceiver and transducer 125kHz 7º
- Laplink software
- Color graphic display

EdgeTech

4200-FS
SIDE SCAN SONAR SYSTEM

Technologically advanced digital "chirp" high-resolution side scan sonar system.

The ***NEW EdgeTech 4200-FS Side Scan System*** provides a unique advantage over conventional dual frequency 100/500 kHz side scan systems by combining EdgeTech's Full Spectrum and MulitPulse technologies into one unit. The new 4200-FS offers two software selectable modes of operation:

- **High Definition Mode (HDM)** - conventional mode operation with extra long array (90 cm) for superior resolution; excellent tool for Mine Countermeasures (MCM's).
- **High Speed Mode (HSM)** - dual pulse operation for speeds up to 10 knots, while meeting NOAA and IHO requirements for "hits on target" compared to conventional systems at 4 knots. This is an additional feature for high-speed navy patrol vessels.

The 90cm array configuration for these two modes of operation is dynamically reconfigured by the system to suit the user's immediate application. Real time selection of the 2 modes allows the user to choose the mode best suited to his task at hand.

The 4200-FS uses EdgeTech's Full-Spectrum chirp technology to deliver wide band, high energy transmit pulses, coupled with high-resolution and superb signal to noise ratio echo data. The system employs wide band, low noise front end electronics which reduce system induced phase errors and drift to negligible levels. The sonar data is also available as a complex, fully coherent data set suitable for advanced user applied post processing.

The 4200-FS Side Scan System offers simultaneous dual frequency operation in high definition mode and is designed to allow efficient integration of other optional sensors. The EdgeTech telemetry link allows the sonar signals that are digitized in the tow fish to be transmitted over long coaxial cable lengths (6000m) with no loss of signal quality.

Features:

- Selectable dual mode of operation: High Definition Mode (HDM) or High Speed Mode (HSM)
- HDM- Conventional simultaneous dual frequency operation
- HSM- Multi pulse mode on either selected frequency
- Extra long array (90 cm) for superior resolution (HDM)
- Multi pulse mode (HSM)
- 120 & 410 kHz dual frequency
- 2000 meter depth rating
- Single coax tow cable over 6000 m
- Integrated with other sensors
- Full Spectrum chirp processing
- Able to interface with customer supplied PC and 3rd party software

Applications:

- Mine Countermeasures (MCM's)
- Geo-hazard surveys
- Geological/geophysical surveys
- Route surveys
- Archeological surveys
- Search and recovery

The 4200-FS sets new standards in the industry for seafloor mapping by integrating key performance and safety features, the dual mode feature along with EdgeTech's Secondary Recovery System, Standard Heading, Pitch & Roll, optional Depth and Acoustic responder for accurate towing positioning at a price which is commercially sensitive.

4200-FS SIDE SCAN SONAR

Key Specifications

4200-FS Tow Fish

Frequency	120 / 410 kHz dual
Modulation	Full Spectrum chirp frequency modulated pulse with amplitude and phase weighting
Operating Range (max)	120 kHz 500 meters p/side; 410 kHz 150 meters p/side
Towing Speed (max safe)	12 knots
Towing Speed *	4.8 knots in HDM, 9.6 knots in HSM
Output Power	120 kHz 4 joules, 410 kHz 2 joules
Pulse Length	120 kHz up to 20 ms, 410 kHz up to 10 ms
Resolution Across Track	120 kHz 8 cm, 410 kHz 2 cm
Resolution Along Track	120 kHz: 2,5m @ 200 meters range, 410 kHz: 0,5m @ 100 meters range
Horizontal Beam Width (HDM)	120 kHz - 0.64°, 410 kHz - 0.3°
Horizontal Beam Width (HSM)	120 kHz - 1.26°, 410 kHz - 0.4°
Optional CW Pulse Short Range	120 kHz, 410 kHz
Digital Link	4 MBits/sec (typical), 4 channels of side scan data + sensor data
Dynamic Range	24 Bits
Depression Angle	Tilted down 20°
Vertical Beam Width	50°
Operating Depth (meters)	2000
Operating Temperature	0°C to 45°C
Optional Sensor Port	(1) Serial - RS 232C, 9600 Baud, Bi-directional
Heading/Pitch/Roll	Heading Accuracy: < 1.5° RMS Heading Resolution: 0.1° Roll, Pitch Angle Accuracy: ± 0.4° Roll, Pitch Angle Repeatability: 0.2° Roll, Pitch Angle Resolution: 0.1°
Options	Pressure, Temperature, Magnetometer, USBL Acoustic Tracking System, Acoustic Responder, Depressor and Custom Sensors
Diameter	11.4 cm (4.5 inches)
Length	125.6 cm (49.5 inches)
Tow Fish Material	Stainless Steel
Weight in Air/Saltwater	48 / 36 kg (105 / 80 pounds)
Tow Cable Length	6,000 meters
Tow Cable Type	Co-axial

System Options

	4200P portable topside processor (see EdgeTech website for specs)

* Meets NOAA Shallow Water Survey Specification- Min 3 pings on a 1-meter target at 100 meters range.

Specifications subject to change without notice.

Other EdgeTech Products

✓ Side Scan, Sub-bottom, Integrated and Modular Imaging Systems for Deep Towed, AUV, ROV and Other Applications utilizing Full Spectrum, MultiPing or Synthetic Aperture Acquisition and Processing Techniques.

EdgeTech

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