



Vessels & Vehicles

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Vessels & Vehicles

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R/V Western Flyer



MBARI's SWATH vessel

The R/V *Western Flyer* is a small water-plane area twin hull (SWATH) oceanographic research vessel measuring 35.66 meters long and 16.15 meters wide. It was designed and constructed for the Monterey Bay Aquarium Research Institute (MBARI) to serve the oceanographic community as a stable platform for deploying, operating, and recovering a tethered remotely operated vehicle (ROV) to a depth of 4,000 meters, conducting hydro-casts (CTD), and other oceanographic activities with state-of-the-art equipment. General ROV operations will, however, be the vessel's primary mission.

Voyage profiles

Vessel operations will typically consist of one-day voyages having a duration of 12 hours or less and near-coastal voyages of an average duration of four days. Extended voyages of two to three weeks' duration will be infrequent, with three extended voyages being planned over an operational year. The R/V *Western Flyer* will on occasion be temporarily redeployed to a new home port which, for example, could result in an open-ocean transit to a port in Hawaii.

The first year after delivery of the R/V *Western Flyer*, MBARI finished



outfitting lab spaces, integrating of the ROV *Tiburon*, which was designed and built by MBARI, and performing operational sea trials in the waters of Monterey Bay. Science missions commenced in March 1997.

Crew continuity, training and role flexibility

The *R/V Western Flyer* has a permanent crew and a shore-based support staff. The crew is trained as a team and all crew members are thoroughly familiar with the arrangement of the vessel, safety systems, operations, and equipment.



Crew pictured from left to right:

Darrell Palmer (Chief Mate/Relief Captain)

Dan Camp (Second Assistant Engineer)

Erik Thunstrom (Relief Deckhand)

Dan Chamberlain (Network & Computer Support Technician)

Tim McLaughlin (First Assistant Engineer)

Ian Young (Master)

Doug Alexander (AB)

Steven Sandstrom-Phillips (Second Mate/Bosun)

Peter Zerr (Chief Engineer)

[More information about the R/V Western Flyer](#)

Last updated: 21 February 2003



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More on the R/V Western Flyer



Photo courtesy of Hilary Brewer

The *R/V Western Flyer* is a 117-foot small waterplane-area twin hull (SWATH) oceanographic research vessel designed and constructed for the Monterey Bay Aquarium Research Institute (MBARI). The *R/V Western Flyer* serves the oceanographic community as a stable platform for deploying, operating, and recovering a tethered remotely operated vehicle (ROV) to a depth of 4,000 meters, conducting hydrocasts (CTD) and other oceanographic activities with state-of-the-art equipment. General ROV operations will, however, be the vessel's primary mission.

Voyage profiles

Vessel operations will typically consist of 3 to 5-day voyages having a maximum duration of 18 hours or less. Extended voyages of two to



three months' duration will be planned once a year. Extended voyages are made up of several legs which vary in length up to a maximum of 12 days per leg. The *R/V Western Flyer* is, on occasion, temporarily redeployed to a new home port for extended voyages.



Photo courtesy of Hilary Brewer

Successful operations have been staged out of Honolulu, Hawaii, Newport, Oregon, and La Paz, Mexico.

The first year after delivery of the *R/V Western Flyer* MBARI finished outfitting lab spaces, integrating of the MBARI-designed and built ROV [Tiburon](#), and performing operational sea trials in the waters of Monterey Bay.

Vessel description

Design Characteristics	
Displacement at DWL	419 LT
Gross Tonnage	499 US, 847 ITC
Net Tonnage	230 US, 254 ITC
Length (LOA)	117'-3 5/8"
Beam Moulded	53'-0"
Draft DWL	12'-0"
Horsepower	2,500 HP
Max. Speed	14.5 knots
Endurance, 8 knots	4000 n.m.
Complement (including Science)	26
Fuel Capacity	22,000 gallons

Potable Water	2400 gallons
Clean L.O. Capacity	700 gallons
Dirty L.O. Capacity	700 gallons
Ballast Capacity	19,530 gallons
Gray Water	300 gallons
Black Water	50 gallons

General arrangement

Accommodations are provided for a combination of 26 crew members and scientists in 14 staterooms located on the upper deck. The crew complement is ten for all voyages and the combination of ROV staff and scientists (16) brings the total vessel complement to 26.



Equipment and control/monitoring systems

The main machinery plant is diesel electric with a common power bus connecting five generators. Any combination of generator operation will provide power for both propulsion and other vessel operations. This design arrangement provides a high level of machinery plant redundancy and operational flexibility. Propulsion power is transmitted through two duplicate drive trains, each consisting of a DC electric motor and fixed pitch propeller. Silicon controlled rectifiers (SCR) are used to convert generated AC power to DC propulsive power. Two electric motor-driven bow thrusters are installed to enhance maneuvering and station-keeping.

Primary equipment and control/monitoring systems

Five generators	Two Caterpillar, Model 3512, 850 kW
	Two Caterpillar, Model 3408, 350 kW
	One Caterpillar, Model 3306, 195 kW

Two propulsion motors	GE, 1250HP ea, 400 RPM
Two bow thrusters	Omnithruster, HCT 600, 300 HPea
Four SCR drives	GE, Model DC2000
Fuel centrifuge	Alfa Laval, Model MAB 103
Marine sanitation device	Orca, Model 11A-36
Air compressor	Quincy, Model QR 25
One water-maker	Sea Recovery model SCR5M3-SW-H
Cathodic protection/monitor	Swath Ocean Systems, Inc.
Uninterruptible power supply	Exide Pwr Wave +18, J1842AU131EE00A
Monitoring system	Intl. Integrated Systems, 300+ inputs
Generator control	Point 8
Propulsion control	Nautronix/GE/Omnithruster
Bow thruster control	Omnithruster B2000
Ballast system control	Swath Ocean Systems, Inc.

Primary navigation and communication equipment	
GPS	Trimble, Model 4000DS, Leica MX420, Furuno GP80
LORAN C	Northstar, Model 9000
Radar	Furuno, Models FR2110 & FR1941
Gyro compass	Anschutz Std. 20 w/one repeater
Dynamic positioning	Nautronix, Model ASK 4001
Autopilot	Maritime Dynamics Inc, Nautronix ASK 4001.
Motion Control	Maritime Dynamics Inc.
Steering system	Swath Ocean Systems, Inc.
GMDSS station	Furuno model RC5000 3T, areas A1-A3
Depth sounder	Knudsen 3208/R
PBX system	Meridian: Phone/intercom/cellular/watch

Weather station	Barometer, wind indicator, Furuno FW-200
Computing station	Chart and Navigation
Dopler	Furuno CI-80 current indicator

Primary fire fighting and safety equipment

Fire detection and alarm system	Cerebus Pyrotronics MXL
SOLAS Rescue Boat	Willard 540
Life rafts	Two 25-Man Viking
Extinguishing systems	Portable & fixed - (7) Fire Hose Stations
EPIRB	Two 9Ghz SARTs, One 406Mhz w/121.5 Mhz beacon

Primary deck machinery

Cranes	One - Model HIAB 290 One - Modified Effer
CTD winch system	Dynacon 12030 Capacity: 6500 m of .322 in. cable Max. continuous line pull: Bare drum - 7000 lbs.@100 fpm Full drum - 4300 lbs.@140 fpm Max. continuous line speed: Bare drum - 240 fpm @ 2500 lbs. Full drum - 415 fpm @ 1450 lbs.
Anchor windlass	Kolstrand Akphaw 223324
Mooring winches	Four - Marco WG023
ROV umbilical handling system	Dynacon TV3615K/SW3616K
Stern "A-Frame"	13,000 lbs. SWL; 14 ft wide, 13 ft clearance through entire range of motion.

Octans 3000 Fibre Optic Gyro

- Integrated Motion Sensors

- 5 Minute Settling Time

- 3000M Rated



Description

The Octans 3000 is a high specification underwater gyrocompass with integrated motion sensor. The heading sensor consists of a solid state fibre-optic gyroscope (FOG) providing fast settling times and 0.1 degree accuracy in all sea conditions. The motion sensor provides speed and acceleration outputs for roll, pitch, surge and sway. Outputs include 4 analogue ports and one serial port as either RS232 or RS422 in a variety of industry standard string formats. The provided Windows configuration software enables the user to apply bias settings to heading, pitch and roll readings and apply level arms for monitoring of remote points.

Specifications

Heading

Settling Point	+/- 0.1 degrees sec. lat.
Dynamic Accuracy	+/- 0.2 degrees sec. lat.
Resolution	0.01 degrees
Settling Time Static	< 1 minute
Settling Time at Sea	< 3 minutes
Speed Compensation	No limitation
Latitude Range	No limitation

Roll and Pitch

Dynamic Accuracy	0.01 degrees
Range	-180 to + 180 degrees
Follow Up Speed	Up to 500 degrees/s

Heave, Surge and Sway

Accuracy	5 cm or 5% (whichever is greater)
Heave Motion Periods	0.03 to 1000s, tunable

Environment

Vibrations	1g sine (5 to 50Hz)
Shock Operating	30g 6ms
Shock (survival)	50g 11ms
MTBF	30000 hours
Operating Temperature	-40 to +60 degrees C

Electrical

Power Requirements	24V DC at 12W
Inputs	1 x serial
Outputs	1 x serial, RS232 or RS422. 4 x analogue (14bits, +/-10V)
Output Format	880 to 115Kbaud, parity and stop bits programmable
Output String	Selectable from industry standard strings, library can be uploaded from file.
Connector	16 Pin MCBH16M Subcon standard

Physical

Depth Rating	3000m
Weight in Air	25Kg
Weight in Water	17Kg
Housing Dimensions	179 diam x 308 h mm
Base Plate Dimensions	209 diam x 10 h mm

Total Acoustic Positioning Systems

Long and Ultrashort Baseline Acoustic Position Reference System



 **Sonardyne**
SOUND IN DEPTH

Long and Ultra Short Baseline Acoustic Reference System

Sonardyne's LUSBL - The Integrated Positioning Solution

Sonardyne's Long and Ultra-Short Baseline (LUSBL) system is an integrated hydro acoustic system for high accuracy, subsea navigation and positioning applications. The system is readily configurable to support a range of applications including:

- A Position reference sensor for dynamically positioned vessels.
- Survey grade USBL for deep water (3,000 meter) ROV/Towfish tracking
- Accurate positioning of underwater structures.
- Riser angle monitoring and hole positioning for drilling operations.

Key benefits of ownership

The key design benefit of Sonardyne LUSBL is that it minimises the cost of ownership. From initial purchase and commissioning, through to routine maintenance and upgrades, substantial savings over comparable systems can be made. There is no need for an expensive tracking head and the system is easily installed using existing gate valves, ship's cabling and deployment mechanisms.

The performance, technology and flexibility of Sonardyne LUSBL system is derived from the seamless integration of Sonardyne's advanced Ultra-Short Baseline (USBL) and Long Baseline (LBL) systems.

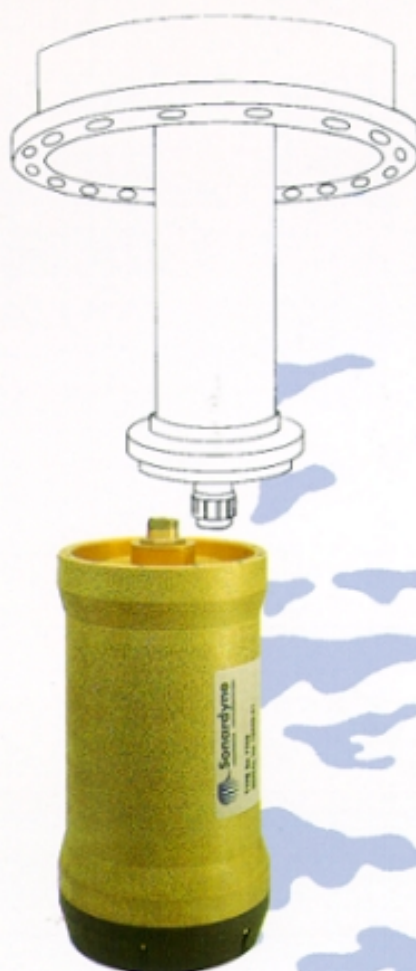
What is Ultrashort and Long Baseline positioning?

An Ultra-Short Baseline position reference system in it's simplest form uses a single seabed transponder and vessel based transceiver and processor. The vessel mounted transceiver positions the transponder with a 'range and bearing' position fix with respect to the vessel. Operators can position a transponder attached to a mobile target without the delay of calibrating a seafloor array of transponders. The overall accuracy of a USBL system depends on the water depth and ship's sensors.

A Long Baseline technique requires an array of transponders, typically four or more, to be deployed on the seabed and calibrated. Vessels and targets equipped with acoustic devices can then be positioned and tracked using 'range-range' observations within the array. Long baseline provides very high positioning accuracy independent of the water depth and ship's sensors.

Combined Benefits

By combining LBL with USBL, Sonardyne's Long and Ultra-Short Baseline system offers the advantages of both techniques in one compact, high performance package. The strong geometry from the transponders in the LBL array coupled with accurate range and bearing data received by the vessel based USBL transceiver gives precise, reliable and stable positioning. By collecting excess range and bearing data not only is there considerable improvement in accuracy, the system can also provide fix quality information in addition to position information on all targets.



Key Features of the Sonardyne LUSBL system

- Multi range fixes allowing very stable positioning with quality control.
- Significantly enhances the performance of DP systems, especially in deep water.
- Accuracy does not degrade with depth.
- Full dual redundancy option available.
- Rapidly calibrates LBL transponder arrays.
- Compatible with existing COMPATT transponder inventories.
- Riser angle monitoring option available.
- Interfaces to (D)GPS for very accurate absolute positioning and system calibration
- Easy installation using existing gate valves and ship's cabling or an "over the side" pole.
- Interfaces to all currently available VRUs, Gyros, and DP sensors.
- Built in spectral analysis capability to see what the in water noise levels are.

System Description

At the core of the LUSBL system is Sonardyne's highly evolved USBL system incorporating a through-hull Transceiver and Navigation Processor. The unique design of the Transceiver head with multiple transmit/receive elements provides near hemispherical coverage, allows position error calculation on even single ranges and eliminates the need for a tracking head. By analysing the local noise spectra and optimising frequency allocations, Sonardyne's USBL system gives outstanding performance in noisy shallow or deep environments.

The system is controlled by the Navigation Processor which commands the transmission of acoustic signals from the Transceiver to the transponders and decodes the data received back. The unit also processes signals from VRUs, north seeking Gyro Compass' and (D)GPS receivers.

The operator interface consists of a high resolution color monitor with integrated keypad. This allows the system to be set-up, job specific parameters to be entered and live positioning tasks monitored. Operator intervention, can if required, optimise the calibration accuracy of the system which includes an extensive transponder command capability emulating Sonardyne's PAN Long BaseLine surface controller

System Performance

Repeatability is typically 0.5% of slant range although, after completing a comprehensive calibration with a high resolution VRU and gyro the standard error can be as little as 0.2% of slant range. Ultimately, this factor is dependent on transponder array size, water depth, frequency and environmental factors such as vessel noise. With good calibration, a quiet vessel and good array geometry the LUSBL system will provide a position fix within a circle of radius 3 to 5 meters for 96% of the time in 3,000m of water.

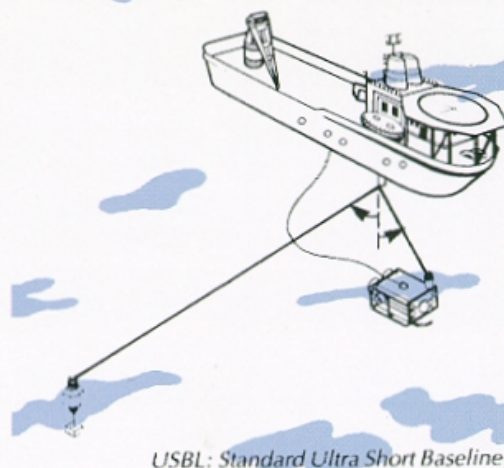
Dual Redundancy

In the dual-redundant configuration, two complete sets of LUSBL equipment (Navigation Processor, Monitor/Keypad and Transceiver) are operated in tandem. The two-sub systems are cross-linked in such a way that, in the event of a failure of any major element, navigation and positioning tasks will continue without the need for operator intervention.

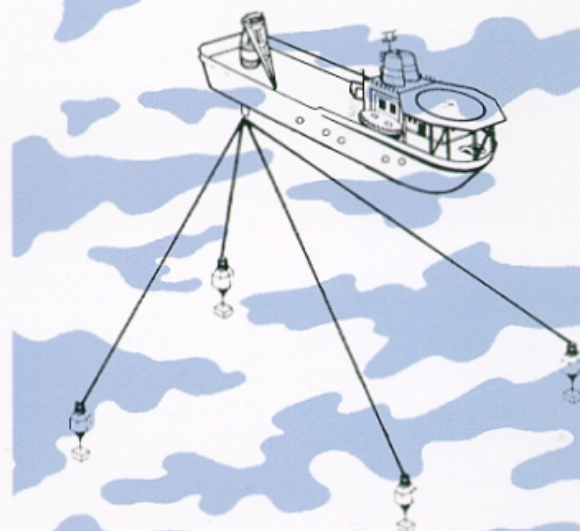
As one sub-system acts as the 'master' and performs all normal system functions the second sub-system, the 'slave', continually monitors the status of the 'master' and if it detects a problem, will assume control and become the new 'master'. From an operators point of view, operation of the dual-redundant version is essentially identical to that of the standard version.

The Right Tool

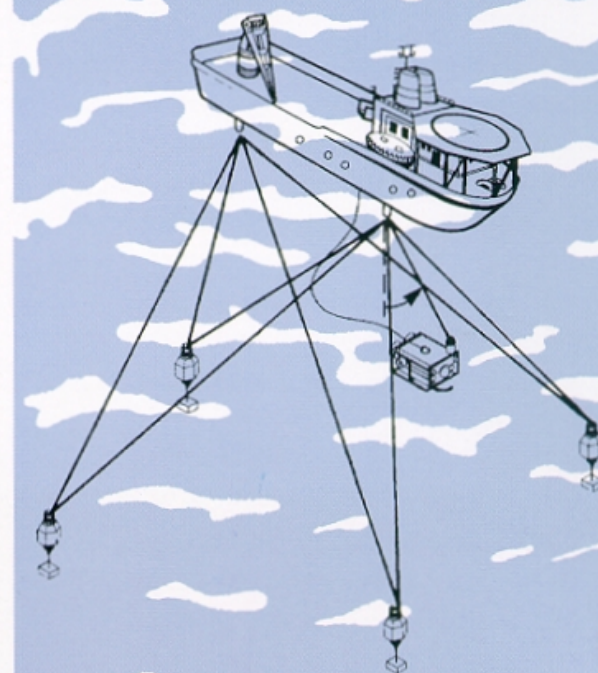
Sonardyne's LUSBL system is a very flexible positioning tool for many demanding offshore applications.



USBL: Standard Ultra Short Baseline

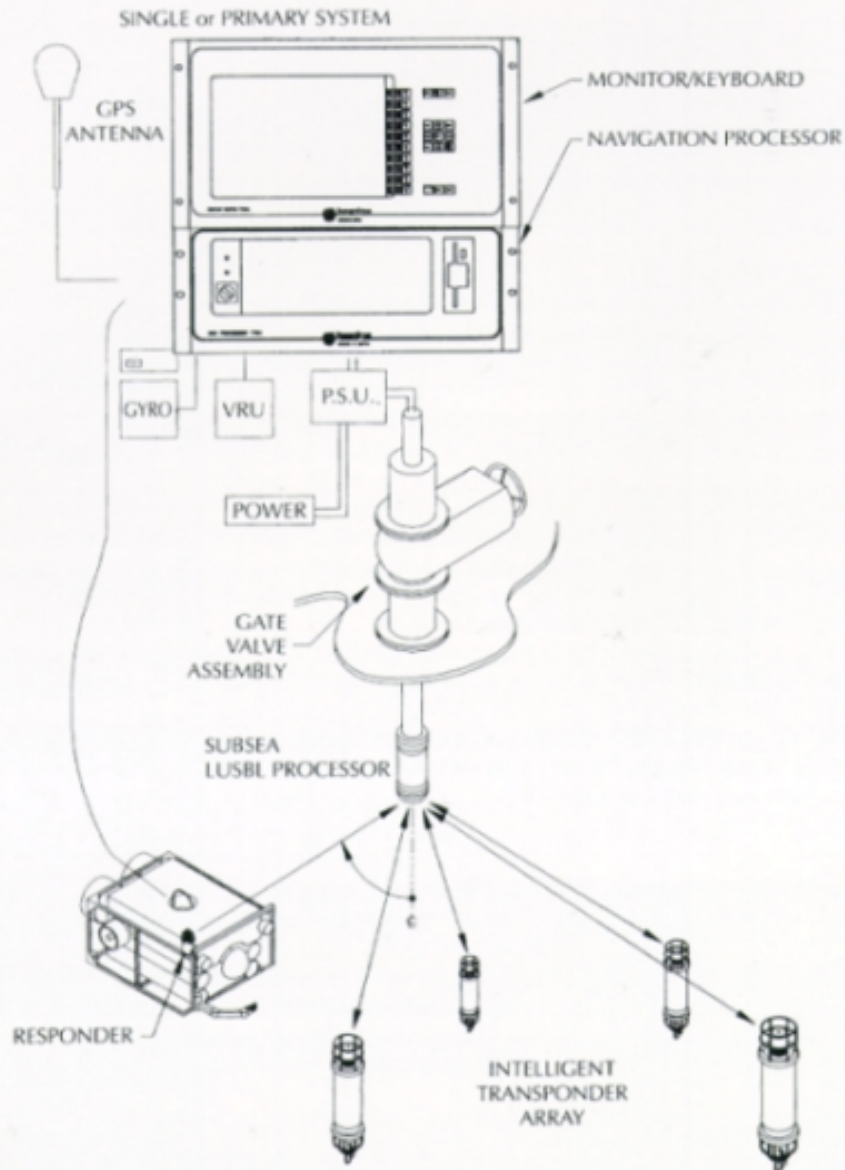


LBL: Standard Long Baseline



LUSBL: Integrated Long and Ultra Short Baseline

LUSBL System Diagram



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XBT
EXPENDABLE BATHYTHERMOGRAPH

XSV
EXPENDABLE SOUND VELOCIMETER

Sippican expendable profiling systems offer antisubmarine warfare (ASW) specialists and oceanographers a fast, accurate, cost effective means of collecting environmental data without restricting ship operation.

GENERAL SYSTEM DESCRIPTION

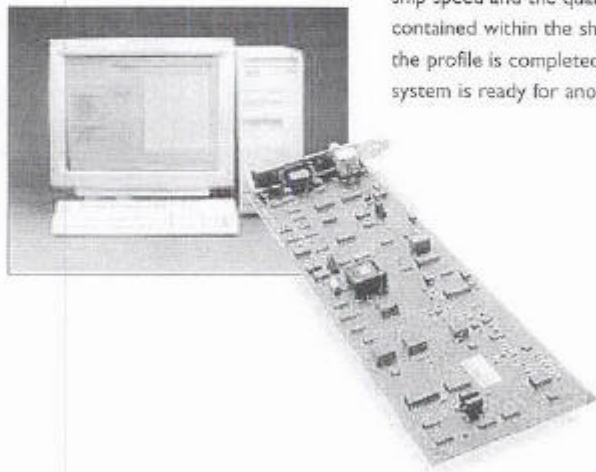
A standard XBT/XSV system consists of an expendable probe, a data processing/recording system, and a launcher. An electrical connection between the probe and the processor/recorder is made when the canister containing the probe is placed

within the launcher and the launcher breech door is closed. Following launch, wire dereels from the probe as it descends vertically through the water. Simultaneously, wire dereels from a spool within the probe canister, compensating for any movement of the ship and allowing the probe to freefall from the sea

surface unaffected by ship motion or sea state.

The XBT/XSV system uses a sea water ground. As soon as an electrode within the nose of the expendable probe makes contact with the water, the circuit is complete and temperature or sound velocity data can be telemetered to the ship-board data processing equipment. Data are recorded and displayed in real time as the probe falls.

The nose of each expendable probe is precision-weighted and the unit spin-stabilized to assure a predictable rate of descent. From this rate of descent, probe depth is determined to an accuracy of $\pm 2\%$. When the probe reaches its rated depth (a function of ship speed and the quantity of wire contained within the shipboard spool) the profile is completed and the system is ready for another launch.



Sippican, Inc.

EXPENDABLE BATHYTHERMOGRAPH (XBT)

Temperature profiles and computed sound velocity data obtained by the Expendable Bathymograph (XBT) are used by ASW operators to identify the impact of temperature on sonar propagation and acoustic range prediction. The XBT also provides a quick and inexpensive means of collecting temperature data for oceanographic and geophysical studies.

The XBT contains a precision thermistor located in the nose of the probe. Changes in water temperature are recorded by changes in the resistance of the thermistor as the

XBT falls through the water. The XBT is capable of temperature accuracies of $\pm 0.1^{\circ}\text{C}$.

The XBT has proved to be reliable in over 30 years of use. During this time, Sippican has developed several variations of the standard probe to meet the requirements of a wide range of applications.

EXPENDABLE SOUND VELOCIMETER (XSV)

Sippican also offers an Expendable Sound Velocimeter (XSV) for the direct measurement of sound velocity. The XSV obtains accurate sound velocity profiles for the support of ASW operations, mine counter-measure operations and oceanographic research.

The XSV measures the speed of sound in water using a ring around

sound velocity sensor. The XSV obtains real time sound velocity data accurate to ± 0.25 meters/second at depths up to 2000 meters.

The XSV can significantly increase the accuracy of sonar propagation and acoustic range predictions, improve the accuracy of acoustic positioning systems and provide data for the study of acoustic propagation in the world's oceans. The XSV is most useful in such areas as Arctic, Mediterranean and coastal waters where high salinity variability may cause computed sound velocity data, based upon temperature profiles and assumed salinity data, to be inaccurate.

Both the XBT and XSV are available in air-launched and sub-launched configurations.

EXPENDABLE BATHYTHERMOGRAPH (XBT)

	APPLICATIONS	MAXIMUM DEPTH	RATED SHIP SPEED*	VERTICAL RESOLUTION
T-4	Standard probe used by the US Navy for ASW operations	460 m 1500 ft	30 knots	65 cm
T-5	Deep ocean scientific and military applications	1830 m 6000 ft	6 knots	65 cm
Fast Deep™	Provides maximum depth capabilities at the highest possible ship speed of any XBT	1050 m 3280 ft	20 knots	65 cm
T-6	Oceanographic applications	460 m 1500 ft	15 knots	65 cm
T-7	Increased depth for improved sonar prediction in ASW and other military applications	760 m 2500 ft	15 knots	65 cm
Deep Blue	Increased launch speed for oceanographic and naval applications	760 m 2500 ft	20 knots	65 cm
T-10	Commercial fisheries applications	200 m 660 ft	10 knots	65 cm
T-11 (Fine Structure)	High resolution for US Navy mine countermeasures and physical oceanographic applications	460 m 1500 ft	6 knots	18 cm

EXPENDABLE SOUND VELOCIMETER (XSV)

	APPLICATIONS	MAXIMUM DEPTH	RATED SHIP SPEED*	VERTICAL RESOLUTION
XSV-01	ASW application where salinity varies; Naval and civilian oceanographic and acoustic applications	850 m 2790 ft	15 knots	32 cm
XSV-02	Increased depth for improved ASW operation where salinity varies; Naval and civilian oceanographic and acoustic applications	2100 m 6560 ft	8 knots	32 cm
XSV-03	High resolution data for improved mine counter-measures and ASW operations in shallow water; geophysical survey work; commercial oil industry support	850 m 2790 ft	5 knots	10 cm

*System depth accuracy: 8.0 meters or 2% of depth, whichever is larger (for XSV)

*All probes may be used to speeds above rated maximum, however there will be a proportional reduction in depth capability.

All probes are shipped 12 to a case which is constructed of weather-resistant, biodegradable material. Shipping weight varies from 25 lbs. to 45 lbs. depending on probe type. Dimensions of the case vary from 17" X 14" X 18" (2.3 cu ft) to 17" X 14" X 19" (2.6 cu ft).

LAUNCHERS

Sippican launchers are available in three models. Each is compatible with all XBTs, XSVs and shipboard data processing systems.



LM-2A DECK MOUNTED
The LM-2A is easily installed on the deck of any vessel.



LM-3A HAND-HELD
Provides portability, allows more flexibility in selecting launcher position and reduces interference with other equipment.



LM-4A THRU-HULL
The standard launcher for all military vessels. Employs the same basic assembly as the LM-2A, however, the LM-4A is installed below deck for

improved safety and increased convenience under heavy weather conditions.

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Sippican is an ISO-9001 Certified Company

Starfix.Seis is an advanced vessel positioning software system developed from the proven PCNav and PCSeis products. It has been developed to address the specific requirements of Fugro's seismic acquisition vessels, general hydrographic, and construction survey needs.

Starfix.Seis can be integrated with any of the other modules in the Starfix Navigation Suite including **Starfix.Anchors** and **PCTug** for remote barge, anchor handling operations and **Starfix.USBL** for USBL operations and Calibration.

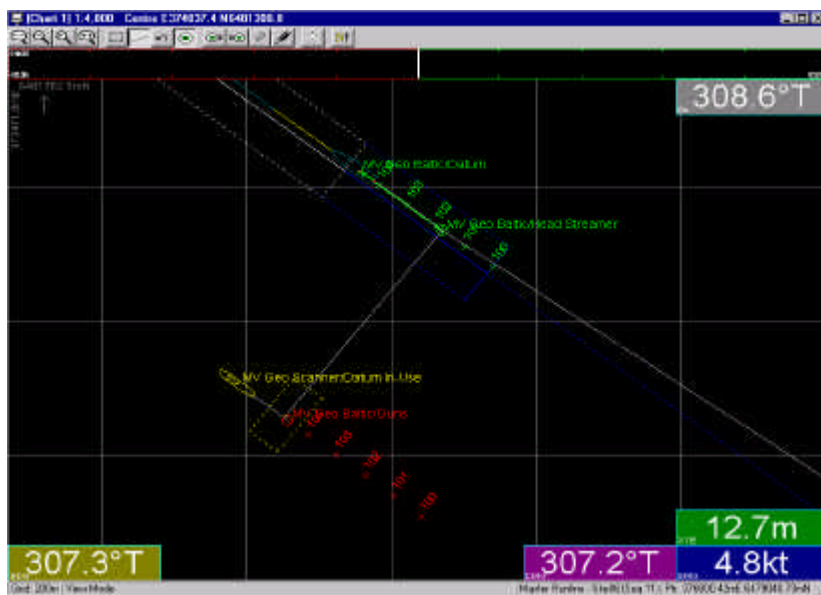
The **Starfix.Seis** application enables the navigation system to be configured and modified in realtime. All other applications operating over the LAN are notified of any changes in configuration and update accordingly. The calculation engine computes and corrects in 3 dimensions. The new Starfix Project File formats have been designed to fully utilise this capability.

Sensor input and output data strings to devices, such as autopilots, are handled via IOWIN drivers and are user selectable.

Starfix.Seis makes use of high accuracy external time sources, such as GPS timer cards, or timerboards connected to GPS (1PPS), to provide microsecond precision and synchronisation of all data.

Features

- Configuration for:
 - Project Information.
 - Geodesy with 8 projections.
 - Selection of calculations mode from Grid, Spheroidal, or Rhumbline.
- System inputs per vessel (10 vessels):
 - Vessel file containing name, colours, fixed offsets, and fairlead information.
 - 7 positioning systems + 1 dead reckoning system.
 - 5 heading sensors.
 - 5 motion sensors.
 - 3 speed sensors.
 - 2 range/bearing systems.



Display showing slave seismic vessel trying to keep its gun array on station

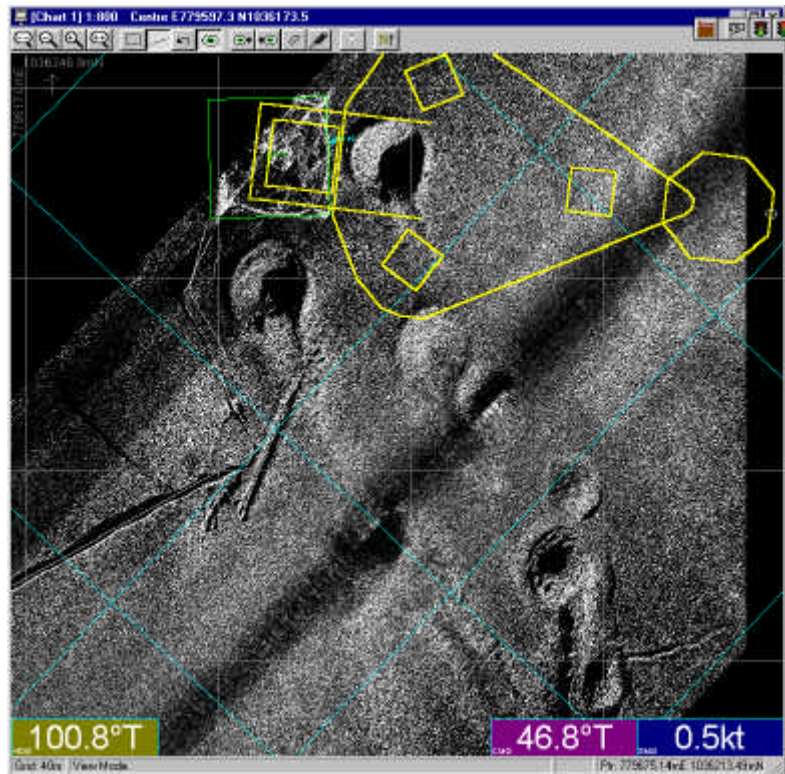
- 5 echosounder channels.
- 5 heave channels
- 5 pitch / roll channels
- Input for 30 targets, such as USBL transponders.
- Provision for 10 variable offsets
- Provision for 30 O/Ts (positions to be worked with), which can be:
 - Logged and printed.
 - Information relative to line or target calculated.
 - Selected as steer point or shot firing point, or offset fix point.
 - Set it's own Kalman filter.
 - Each O/T publishes its own position offset message data to MM.
 - Create O/T as mean of a selection of O/Ts.
- Navigation can be to runline, waypoint (target), or pipeline.
- Separate files are maintained for runlines, waypoints, pipelines, anchor patterns, and database features (items that need to be displayed but not navigated to). Multiple pipelines can be contained in a single file, and pipelines with zero radius curves become dogleg lines.
- PCNav and PCSeis project files are supported.
- Line running features include:
 - Provision for line extensions.
 - Input of automatic start and end fixing distances.
 - Line corridor width.
 - Turning circle at start of line runin.
 - Reverse line heading.
 - Ghost lines.
- Shot firing features include:
 - Fixing by time, distance, or KP.
 - External fixing for VSP surveys.
 - Fix increment or decrement by user selectable number.
 - Provision of Fiducial Fix Identification number (FFID) counter.
 - Manual fix counter is independent of shot counter.
 - Offset and Man OverBoard fixing.
 - Issuing of line Prestart message for annotation purposes.
- Online geodetic conversions and position to line calculator.
- Precise (within microseconds of GPS time) multi vessel shooting via GPS timer cards and MMRadio data link.
- Sound card support.

DISPLAY

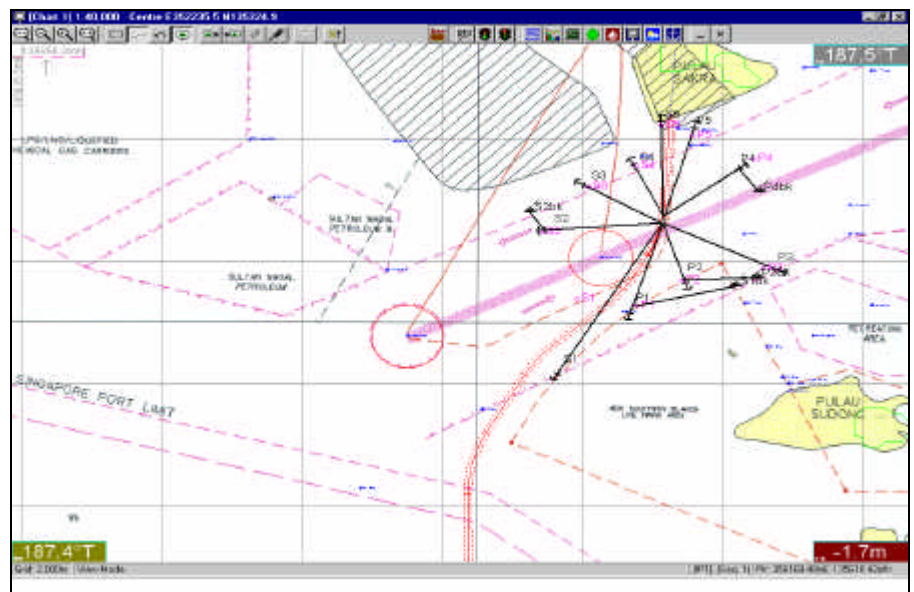
Display provides a graphical presentation of the vessels and O/Ts against a database and navigation information in relation to centrelines, runlines, and waypoints. Full control of the graphical display is available and any number of graphical display and text displays can be shown simultaneously.

Features:

- One instance of Display per machine but multiple instances across a LAN.
- All displays are individually configurable.
- Text displays are available for:
 - Display of information between O/Ts.
 - Differences in O/T positions.
 - Configurable general information.
 - Line running information including selection of alternate line.
 - Running to target information including selection of alternate target.
- Graphical screen features are:
 - Fully configurable for colours, project file information, O/T information, O/T symbols.
 - Selection of 4 automatic and multiple user defined configurations.
 - Can be centred to an O/T or a selected point.
 - Tiling of graphics image backdrops.
 - Full pan/zoom capabilities.
 - Return to previous views.
 - Range/bearing calculator and position export to other applications.
 - Plot range rings about selected O/Ts.
 - Definition of rubberband lines drawn between selected O/Ts.
 - Enable/disable of scalable left/right indicator.
 - Enable/disable of overlay of speed and heading text in large font.
 - Enable/disable of coverage plot.
 - Enable/disable of swath plots.
- Ghost vessel shapes.
- Displays plan view of catenary module.
- Displays streamer model from MiniStreamer module.



Navigation display with Sonar bitmap backdrop

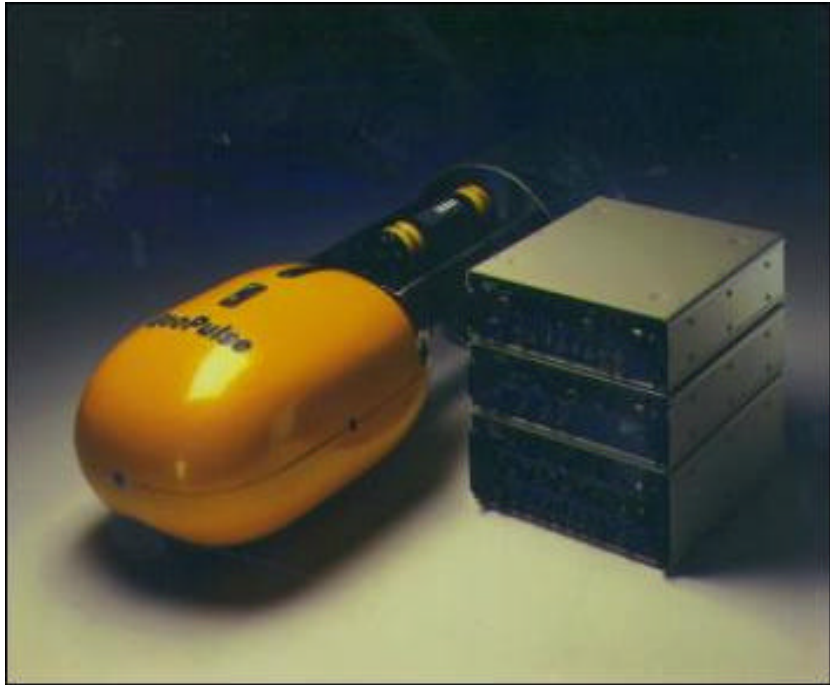


Display showing barge move with piggybacked bouys

Geoacoustics Combined Sidescan Sonar/Subbottom Profiler

Data from the GeoPulse Receiver (Model 5210A) can be displayed directly onto a wide range of industry standard graphic recorders. The GeoPulse Profiler is often used in combination with our Dual Frequency Side Scan sonar.

GeoAcoustics has a long and successful tradition of manufacturing all types of seabed survey instruments. For many years these have been available as stand-alone systems or in combination on a single towfish, allowing simultaneous surveys to be carried out with the minimum of fuss in the most cost effective way possible. This field proven technology is extensively used world-wide by both commercial and research organisations.



Popular combinations include:

- The GeoChirp Profiler and Dual Frequency Side Scan Sonar
- The GeoPulse Profiler and Dual Frequency Side Scan Sonar
- GeoPro Sonar Processor together with the Dual Frequency Side Scan Sonar
- GeoPro Sonar Processor with any of the profiling systems

Dual Frequency Side Scan Sonar

These systems can be assembled at our factory ready for use, but many of our customers mix and match the systems according to their varying survey requirements. The GeoAcoustics Dual Frequency Side Scan Sonar system is the ideal tool for seabed feature mapping, offering flexibility and high quality results in a simple and reliable package. The system offers high resolution, switch selectable, dual frequency operation (100/410 kHz), which when combined with multiplexed data transmission enables a low drag co-axial tow cable to be used. This also facilitates simple installation onto remotely operated vehicles (ROV's) and combined systems towfish.

The standard system employs a lightweight towfish, which is easily deployed by one person and can operate to a depth of 1000 metres. There are separate controls for each channel, which makes the system very easy to operate. Optional extras include a deeper rated towfish, a towfish instrumentation package and a stainless steel towbody.

The basic system includes the following:

- Transceiver (model SS941)
- Towfish (model 159D), which houses the Multiplexer (model SS942) and Two Dual Frequency Transducers (model 196D/Port and Starboard).

The multiplexed data transmission technique employed allows the system to be used with a wide selection of towcables, including twisted pair and co-axial cables. Data from the Dual Frequency Side Scan Sonar can be input to many sonar processing systems, including a GeoPro Sonar Processor, or it can be displayed on a wide variety of industry standard graphic recorders.

The versatility, ease of operation and cost effectiveness of the system has made it a popular choice with commercial survey companies.

GeoPulse Sub-bottom profiler

The GeoPulse Sub-bottom Profiler is a tried and tested, industry standard sub-bottom profiling system for shallow geophysics. It is highly flexible allowing operation as either a hull mounted deep water system, an "over-the side mount" system for small boat operations or as a towed system.

The basic system includes the following:

- GeoPulse Transmitter (Model 5430A)
- GeoPulse Receiver (Model 5210A)
- Towfish (Model 136) containing
- Profiling Transducers (Model 137D)

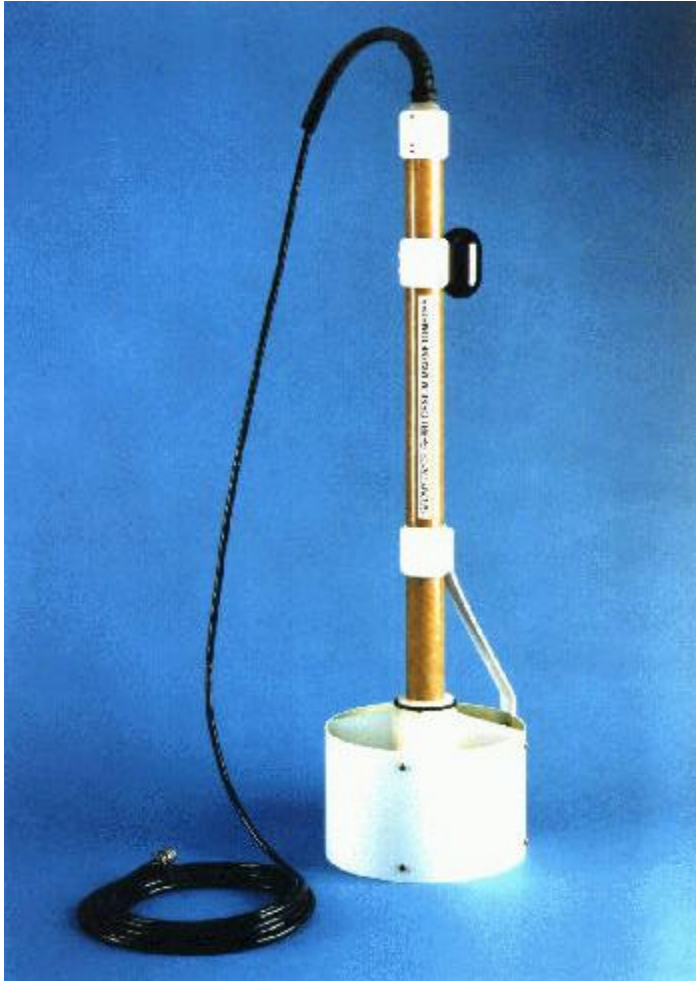
The four transducer Model 136 Towfish provides a stable sub-tow survey platform, which may be towed down to 600 metres using a standard 2000 metre armoured tow cable. Alternative deployment options for the profiling transducers are:

The Hull Mounted option can be configured with up to 16 transducers providing a narrow beam pattern for deep water operation, whilst still achieving good penetration.

With the Over-the side Transducer Mount (Model 132) it is possible to use the system in very small boats for river, harbour or shallow lake surveys and also bridge scour investigations.

Data from the GeoPulse Receiver (Model 5210A) can be displayed directly onto a wide range of industry standard graphic recorders. The GeoPulse Profiler is often used in combination with our Dual Frequency Side Scan sonar.

Mini-Marine Cesium Magnetometer



Extremely high resolution Cesium Vapor performance has been incorporated into a low cost, small size, system for professional surveys in shallow water. The G-881 is focused for operation in small boat, shallow water surveys. Being small and light weight (44 lbs net) it is easily deployed and operated by one man. The well proven Cesium sensor is combined with the unique CM-200 L armor counter and ruggedly packaged for small boat operation.

The Cesium magnetometer provides the same operating sensitivity and sample rates as the larger model G-880. A rugged fiber-wound fiberglass housing incorporates selective orientation of the sensor and therefore maintains operations throughout the world with small limitations as to the direction of the survey in Equatorial regions.

The G-881 system is particularly well suited for the detection and mapping of all sizes of ferrous objects. It is the lowest priced – highest performance fully operational marine magnetometer system ever offered. Utility software is supplied with each magnetometer and allows display of data and recording to hard disk.

SEASCOUT

Introduction

The SEASCOUT is a lightweight Cone Penetration Test (CPT) system that operates from an underwater ground surface such as the seabed. Its purpose is the rapid and accurate determination of subsurface soil conditions to a penetration of about 6 m. Further developments will extend this to 10 m. The basis of the lightweight design is a miniature cone penetrometer with a 100 mm² cone base area, rather than the conventional 1000 MM². This results in a substantial reduction of the thrust and the reaction equipment requirements.

Cone Penetration Tests involve the measurement of the resistance of the ground to the controlled penetration of push rods that have an instrumented "Cone" at their tip. The instrumentation measures vertical penetration, cone resistance and, as options sleeve friction and porewater pressure. These measurements permit high quality interpretation of the ground conditions encountered.

SEASCOUT Apparatus

The SEASCOUT apparatus incorporates various components including a reaction frame, a thrust machine, a coiled push rod, a cone penetrometer and data acquisition system.

Thrust machine and push rod

An underwater hydraulic power pack drives the patented thrust machine. Push rod handling is by a mechanical coiling/straightening device. This permits a very low apparatus height while maintaining continuous, rather than stroke-based, penetration and retraction of the cone penetrometer.

Reaction Frame

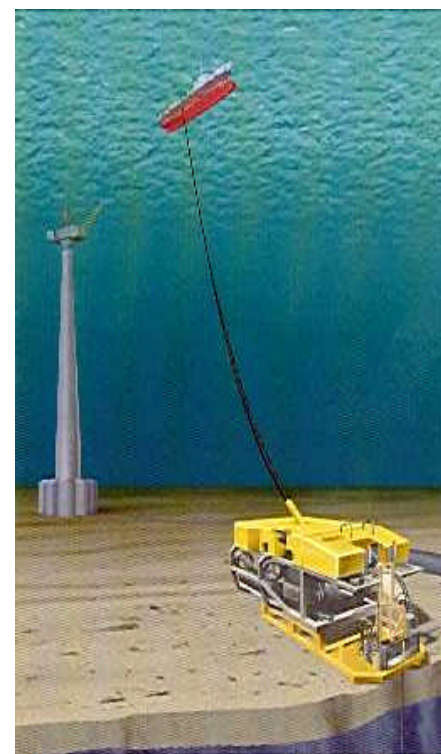
Reaction equipment usually comprises a ballasted underwater frame (such as that shown in Fig.1), which can be deployed from small vessels equipped with a suitable crane or 'A' frame. Alternative operational modes include an underwater sledge, which can be winched from shore or from a vessel, and Remotely Operated Vehicles (ROVs). Downward thrusters, water ballasting and suction anchors can be used to provide additional ROV reaction. The system can also be modified for installation on pipeline ploughs and other trenching machines.



Cone Penetrometer and data Acquisition system

Typical features of the SEASCOUT measuring system include:

- a cone base area of 100 mm² and an optional friction sleeve area that is dimensionally proportioned to 1500 mm²
- 10 kN cone penetrometer load sensor(s)
- optional pore pressure measurement at the face of the cone (face filter) or immediately above the base of the cone (base filter) for maximum 2.5 MPa pressure
- an inclinometer within the cone penetrometer
- data transmission by communication cable to surface-based recording and read-out apparatus
- storage of the signals from the internal sensors of the cone penetrometer in digital form for subsequent computer-based processing and presentation.



SEASCOUT

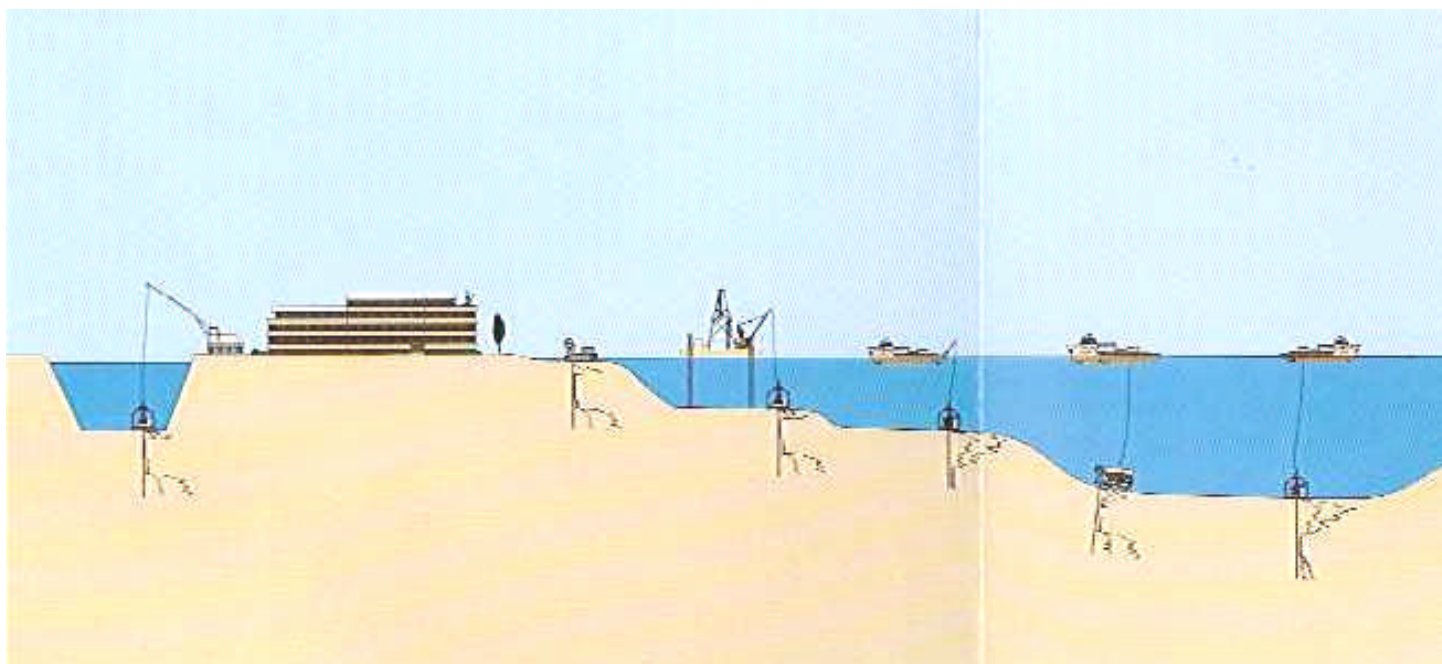


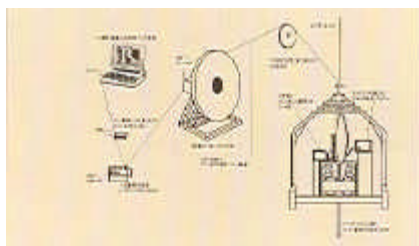
Figure 1: Typical applications of the SEASCOUT system

SEASCOUT

Test Procedure

The SEASCOUT test procedure includes the following steps:

- positioning of the SEASCOUT at the required test location, for example by lowering the frame to the seabed
- penetration of the cone penetrometer to the required test depth, while monitoring data acquisition
- retraction of the push rods and cone penetrometer from the ground
- lifting the SEASCOUT and moving to the next test location
- data processing.



System Advantages

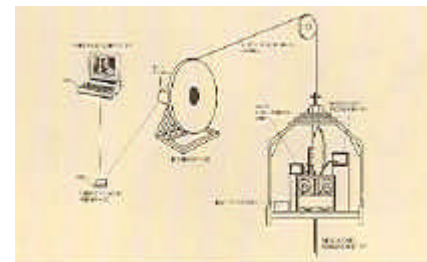
The SEASCOUT system provides numerous advantages over conventional systems, with typical benefits including:

- Lightweight unit with minimal deck equipment that can be deployed from smaller, less expensive vessels
- Small operational team
- Very quick mobilisation and demobilisation operations
- Rapid testing, real time display of results and on site evaluation of ground conditions
- System flexibility which permits installation on other seabed machines and ROVS.
- Facility for soil testing on sites with difficult or restricted access such as beneath oil production platforms and within pipeline trenches

Operational Specifications

Equipment specifications for the frame mounted SEASCOUT are as follows:

- Mass of SEASCOUT and unballasted frame: 1 ton
- Frame base area: equal-sided triangle with 2 m sides
- Frame height: 2.4 m
- Minimum vessel crane or A-frame: 25 kN SWL
- Required vessel power supply: 380/440V, 50/60 Hz, 5 kVA
- Minimum vessel deck space: 2.5m by 2.5 m plus a sheltered area for the operator.
- Winch lift capacity 1400 kg



SEASCOUT

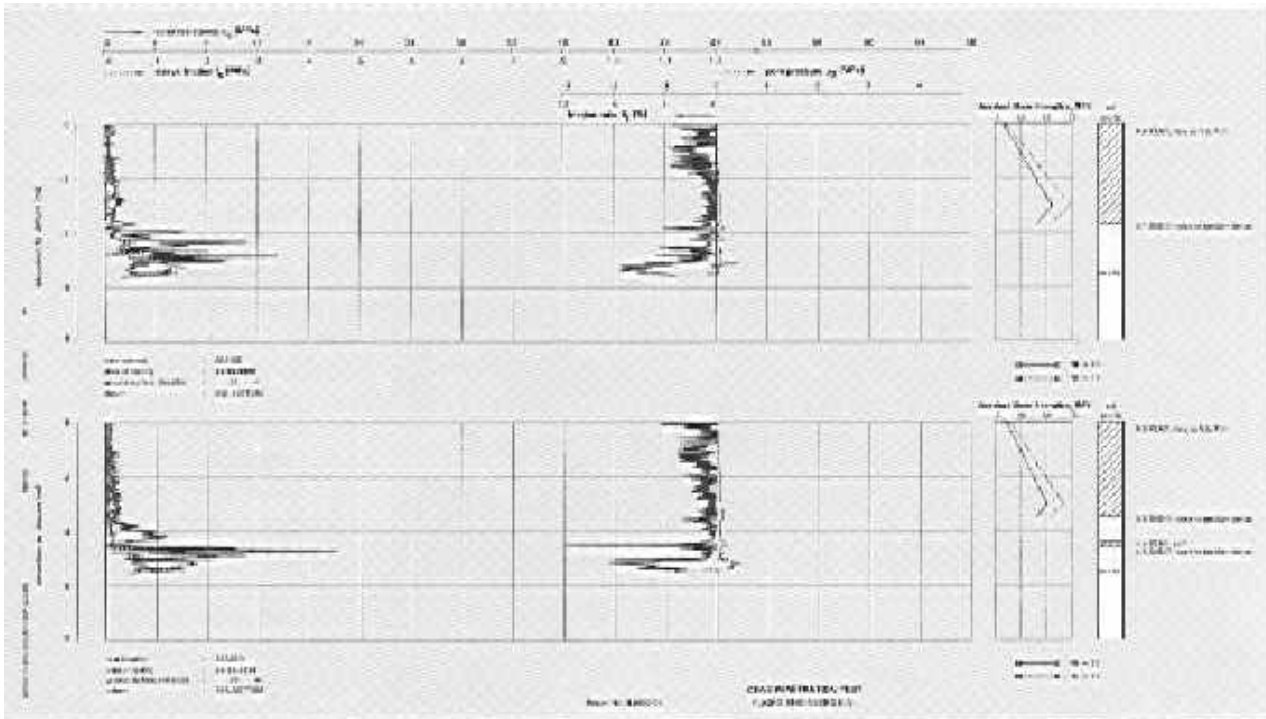


Figure 4: Example of data obtained with SEASCOUT and interpreted soil profile from CPT data

SEASCOUT System Specification

3 channel Piezo-cone penetrometer: 100mm² cross
sectional area 1 tonne capacity

Approximate Dimensions (m)

2.0 * 2.0 * 2.4
1.8 * 1.8 * 2.0
0.3 * 0.3 * 0.1
1.0 * 2.0 * 0.6

Seascout Cone Penetrometer Selection

2 channel Friction-cone penetrometer: 100mm² cross
sectional area 1 tonne capacity

Gross Weight (Kg)

1000
1200 (water depth >50m)
5
150

Typical Equipment set

Item no.

SEASCOUT Unit
Spare parts
Umbilical Reel with cable
Portable computer