SM-30 SONAR MAPPING SYSTEM

- Cable & Pipeline Route Surveys
- Geohazard Surveys
- Geological Investigations
- Seafloor Searches
- Hydrographic Surveys
- Marine Mining Exploration

The SM-30 is a deep seafloor mapping system capable of generating seafloor imagery across a swath of up to 6,000 meters (3.25 nautical miles). It's the ideal large area survey or search tool, allowing both wide swath mapping and high-resolution target imaging.

The SM-30 is designed provide cost-effective search and survey coverage over large areas of the seafloor. The 30 kHz sidescan transmit frequency permits operation on swath-widths up to 6,000 meters and detection of a range of acoustic targets – from shipwrecks to objects only a few meters in size. The low frequency sonar provides for greater penetration of the seafloor allowing mapping of buried cables and pipelines.

FEATURES

- Sub-Bottom Profiler – 4.5 kHz SBP for simultaneous acquisition of near-seafloor geological information
- Integrated Navigation – Data telemetry and control channels for an acoustic interrogator/ receiver/ processor
- Wide System Bandwidth – Low Q transducers, combined with short, high power transmit pulses and wide receiver bandwidths provide the resolution of higher frequency systems with the range advantage of a lower frequency system
- High Dynamic Range Signal Processing – Very low noise receivers with TVG applied in the towfish provide wide dynamic range needed for optimal signal quality
- Excellent Towfish Stability – the two-body tow system uses a depressor weight and a neutrally buoyant umbilical to de-couple the towfish from ship heave which provides the stability needed for high quality imagery
- Extensive Sensor Package – High precision depth, pitch, roll and heading sensors are sampled 5 times a second and transmitted to the surface to allow for correction for vehicle attitude changes

GENERAL
Size – 4.2m long x 1.2m wide x 1.3m high
Weight – 700kg, neutrally buoyant in water
Depth Rating – 6000 meters
Tow Cable – double armored coaxial cable
Depressor – 900kg deadweight
Umbilical – 50m or 100m neutrally buoyant
Power Requirement – 115 VAC, 60 Hz, 1ϕ, 20A

SONAR
Frequency – 27 kHz Port and 30 kHz Starboard
Beamwidth – 1.4° horizontal, 50°vertical
Transmit Power – low 100/ high 1000 watts
Pulse Length – 1 to 80 cycles, 17 - 1400μsec
Gain Adjustment – twenty 3dB steps
Swath Widths – 750m,1500m, 3000m & 6000m
Range Resolution – *Range*/2048
System Dynamic Range – 72 dB

SUB-BOTTOM PROFILER
Frequency – 4.5 kHz
Beamwidth - 70° toroidal
Transmit Power – 700 or 2000 watts RMS
Pulse Length – 1 to 15 cycles, 0.3 to 3.2 msec
Gain Adjustment – 42 dB in twenty 3 dB steps

SENSORS
Depth – Paroscientific 410 KT, 0.5 m acc.
Attitude – pitch and roll, 0.1°
Heading – gimballed fluxgate compass, 0.3°
Navigation – RS232 @9600 baud

SM-30 REPRESENTATIVE PROJECTS & SURVEYS

CHEVRON	Katrina/ Rita Damage Assessment Survey, Gulf of Mexico 2005
SUBSEA RESOURCES	Search for CargoVessel, Project ELLA, 2005
SHELL	Pre-Drilling Ordnance Survey 2000
LOCKHEED	Search for Trident Missile Parts, Cape Canaveral 1988-1989
COLUMBUS AMERICA	Search for the S.S. Central America, W. Atlantic 1986-1987

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Williamson & Associates AMS-60 Sonar Mapping System

The AMS-60 is a deep-towed side scan bathymetric sonar system built by Acoustic Marine Systems, Inc. of Redmond, Washington. Information gathered with the AMS-60 is digitized, processed, and logged with an image processing system such as GeoMAP or ISIS. The AMS-60 is a deep ocean (6,000 meter operating depth) bottom mapping instrument which combines high resolution side scan sonar imagery with accurate swath bathymetric measurements. In addition, a 4.5 kHz sub-bottom profiler gathers detailed geological data from beneath the towfish. The AMS-60 has a side scan sonar frequency of 57.6 kHz and variable swath widths from 250 to 2500 meters.

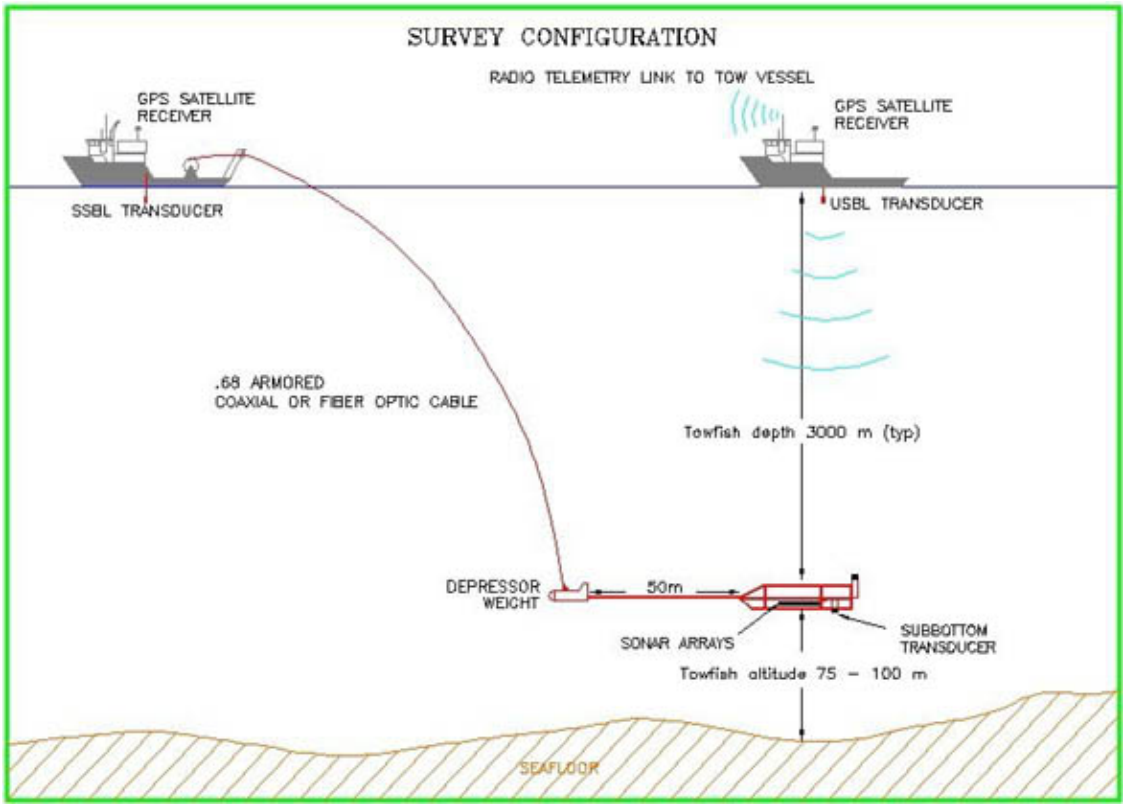

Figure 1 – Survey Configuration

The AMS system is deployed in a two-body tow configuration as shown in Figure 1, which effectively decouples the survey sled from ship heave and surface wave action. This stable towing arrangement permits the high resolution acoustic imaging and precision depth measurement required for detailed bottom mapping. The towfish, depressor, umbilical between towfish and depressor and the overboarding sheave are shown in Figure 2. Towfish attitude is monitored for pitch, roll heading, altitude, and depth on a ping by ping basis. All telemetry, navigation channel, and sonar data are transmitted from the towfish via a standard 0.45 or 0.68 inch diameter marine coaxial cable to the surface electronics rack, and the digitizing, image processing, and data logging unit. Digitized data from the side scan sonar, sub-bottom profiler, and telemetry string are combined by image processing system with positioning information provided by the integrated navigation computer and stored on 1.2GB optical disks. At long ranges during wreck searches, a layback positioning procedure can be used instead of an acoustic technique.

Precision bathymetry is collected with an interferometer constructed by positioning two identical 60 kHz transducers mounted in parallel on either side of the AMS towfish. The transducers are mounted in the same plane, at a spacing of 10 wavelengths between centers, and directed downward at an angle of about 30 degrees. Only one array on each side transmits a sonar pulse, but both arrays receive the returning signals. Received signals are sent to the surface rack where signals from one are processed in the conventional manner for side scan imagery.

In the bathymetric data stream, the signals from both arrays are summed, forming a fringe-like interference pattern. The alternating pattern of fringes represents the phase correlation between the signals received at each array. The strongest returns represent the point at which the signals interact constructively, and nulls are formed where the signals are 180 degrees out of phase. Since the frequency, sound velocity, array separation, and mounting angle are all known, the theoretical geometry of the interference pattern can be calculated, with spot elevations relative to the towfish assigned to the seafloor at the center of each fringe maxima, minima and other locations between the maxima and minima. Since the towfish depth in the water column is accurately known (the Paroscientific DigiQuartz pressure sensor used in the AMS sonar has an instrumental precision of $\pm$ 2.2 cm), very accurate bottom elevations can be assigned, even in extreme water depths. In the processor the fringe data are digitized and recorded. The positions along each fringe are tracked and this information is combined with the navigation and towfish telemetry data to assign about 40 x, y and z values to each side of the swath. These sounding files are gridded and contoured using QUICKSURF software running under AutoCAD on a 200 MHz PENTIUM computer to produce preliminary field charts. All of the ancillary functions available under AutoCAD are available to the user to enhance the output of bathymetric information.

The 4.5 kHz sub-bottom profiler on each towfish provides an analog signal representing acoustic intensity levels associated with the various sub-seabed sediment layers which are digitized with the image processor and displayed on both the video monitor and on a gray-scale recorder with corrected side scan imagery. In post processing, corrected sub-bottom records are produced which indicate actual water depth (rather than the varying towfish altitude).

The sidescan imagery is recorded in analog format on a digital gray-scale recorder and in corrected (water column removed), digitized format on the image processor monitor. During the post-processing this side scan imagery is integrated into a photographic mosaic of the surveyed area.

AMS-60 SYSTEM KEY FEATURES

Sub-Bottom Profiler - 4.5 kHz SBP for simultaneous acquisition of near-seafloor geological information

Integrated Navigation - data telemetry and control channels for an acoustic interrogator/receiver/processor such as the Sonardyne ROVNAV

Wide System Bandwidth - low Q transducers, combined with short, high power transmit pulses and wide receiver bandwidths provide the resolution of higher frequency systems with the range advantage of a lower frequency system

High Dynamic Range Signal Processing - very low noise receivers with TVG applied in the towfish provide the wide dynamic range needed for optimal signal quality

Excellent Towfish Stability - the two-body tow system uses a depressor weight and a neutrally buoyant umbilical to de-couple the towfish from ship heave which provides the stability needed for high quality imagery and bathymetry

Extensive sensor package - high precision depth, pitch, roll and heading sensors are sampled 5 times a second and transmitted to the surface to allow for correction for vehicle attitude changes.

SPECIFICATIONS

General

- Size - 3 m long x 1 m wide x 1.3 m high
- Weight - 680 kg, neutrally buoyant in water
- Depth Rating - 6,000 meters
- Tow Cable - single armored coaxial cable
- Depressor - 680 kg deadweight
- Umbilical - 50 or 100 meters neutrally buoyant
- Power Requirements - 115 VAC, 60 Hz, 1f, 15A

SPECIFICATIONS (CONTINUED)

Sensors

- Depth - Paroscientific 410 KT, 0.5 m acc.
- Attitude - pitch and roll, 0.1 deg
- Heading - gimballed fluxgate compass, 0.3 deg
- Magnetometer (opt) - 3 axis fluxgate, 1 gamma

Sonar

- Frequency - 57.6 kHz port and starboard
- Beamwidth - 1.4 deg horizontal, 60 deg vertical
- Source Level - Typ. 227 dB re 1 uPa @ 1 meter
- OCV Response - Typ. -179 dbV/uPa
- Transmit Power - 2000 or 125 watts
- Pulse Length - 1 to 80 cycles, 17 to 1400 usec
- Gain Adjustment - 42 dB range in 3dB steps
- Sensitivity - -175 dbV/%Hz
- Swath Widths - 250 m to 2500
- Range Resolution - 1/2048 of swath width
- Image Dynamic Range - 72 dB (12 bit pixels)
- Swath Bathymetry - Isophase Interferometry

Sub-Bottom Profiler

- Frequency - 4.5 kHz
- Beamwidth - 70 deg cone
- Transmit Power - 550 or 20 watts RMS
- Pulse Length - 1 to 16 cycles, 0.3 to 3.2 msec
- Gain Adjustment - 42 dB in 10 3dB steps

AMS-60 Side scan sonar towfish on the deck of the SV *Geosounder*

Dynacon Winch and HPU

Dynacon 421 Oceanographic Winch

Line pull, bare drum - 10,000 lbs
Drum width - 46"
Flange inside dia – 86"
Currently set up for 0.68" cable dia, capacity - 10,000m
Speed - 150 fpm bare drum,
Weight, winch alone - 18,000 lbs
Weight, Winch & 3400m 0.68 cable - 26,000 lbs
Dimensions, winch –11'L x 8.5'W x 9'H

HPU

Weight, 5600 lbs
Dimensions, 6'H x 7.8'W x 4.5'L
460V 3phase, 75hp

Dynacon Winch on board the SV *Geosounder*

B1 Winch

Brake capacity – 75,000 lbs
Line pull, bare drum – 40,000 lbs
Drum width – 36"
Flange inside dia – 49.3"
Currently set up for 0.68" cable dia, capacity - 10,000 m Speed – 100 fpm bare drum, 375 fpm full
Weight, winch alone – 25,000 lbs (includes integral HPU)
Winch & cable – 44,000 lbs
Dimensions – 9'H X 8'W X 11'L
HPU – 460V 3phase, 75hp

B1 Winch in W&A yard prior to mobilization.