

Product Survey

Multi-beam Shallow Water

Multi-beam echo sounders (MBES) have gradually taken over a fair slice of the bathymetric survey cake. MBES is nowadays a common survey tool for offshore surveyors, civil authorities, dredgers and military users. It has proved an efficient alternative to single-beam systems, even in combination with side-scan sonar.

Since its first introduction, the number of beams used in MBES has gradually grown. As a result, the volume of data produced has become a critical issue, not only in data acquisition itself but in processing too. A MBES with 240 beams pinging at a rate of twenty times per second, for example, produces a dataset of over 34 million XYZ points per hour. Nowadays, processing time for these high-density datasets is approximately equal to data-acquisition time. Editing to remove erroneous observations and decrease data volume consumes the major part of total processing time. These procedures are applied off-line, although (more advanced and hence more expensive) new software is available which makes possible real-time processing. This is quite important, for example, in dredging operations where (near) real-time production of DTMs minimises time spent by an expensive vessel in passively waiting before it can start or continue dredging. MBES has quickly proven its superior capabilities over previous systems used to provide complete coverage of a sea bottom. The unique capabilities of the MBES allow it to provide 100% coverage of the bottom, even exceeding IHO specifications. The fact that the MBES transducer is rigidly mounted to the hull enables the user to calculate its position as accurately as the positioning system in use, contrary to the ever-present little errors so well known with towed systems such as side-scan sonar.

MBES may also have caused acceleration in the development of motion-sensing systems and Real Time Kinematic GPS systems and applications. Indeed, no MBES system is complete without accurate positioning, motion sensing and a signal-through-water propagation speed measurement system. Add to this a good data collection/storage and processing system with adequate software and capable, qualified survey staff and you have a perfect package for executing the most challenging survey in very short time. Since one has to start with the hardware, we have asked the manufacturers of MBES systems for a detailed description of MBES systems up to 300m depth; all information may be found in this month's Product Survey. In February 2007, the Product Survey will describe Deep Water MBES systems. ■

Manufacturer name	Kemijoki Aquatic Technology Oy
Product Name	AquaticSonar Swathe Surveyor
Date of first release	2000
Type of Mounting and Deployment	
Hull Mounted	n/a
Retractable	Permanent, Vessel of Opportunity
Bow Mounted	Permanent, Vessel of Opportunity
Over the side	Permanent, Vessel of Opportunity
Towed Body	n/a
ROV/AUV mounted	n/a
Physical Properties Sonar Head	
Diameter	50cm length
Height	50cm
Weight	30kg
Power requirements	12VDC
Used Sonar Methods	
Type of system	Interferometric
Bottom Detection Method	Amplitude detect, phase detect
System Parameters	
Frequency Range	156 kHz
Depth Range	80m
Depth Resolution	□
Max. Slant Range	180deg
Max. Swath (function of depth)	200m (at least 10 times depth)
Nr. of samples per sweep	1300
Max nr. of samples per second	48
Beam width (along*across track [deg])	2*180deg
Bottom Coverage (footprint dimensions at 10/50/150m depth)	
Directly under sensor	n/a
At max. horizontal range	n/a
Smallest identifiable cube	n/a
Max swath	n/a
Are footprints equally spaced?	no
Side scan capabilities	
Does the system have side scan possibilities?	yes
Number of SSS-points per sweep	□
Accuracy	
Calculated statistical system accuracy (cm RMS)	
System Accuracy in relation to IHO S44-4, meets S44 order	I
Max. allowable survey speed to allow for this accuracy (knots)	□
Speed of sound	
System applies ray bending corrections in real time	no
System is capable of collecting and integrating the SV-profile in real time during data collection	no
If yes, explain the process	□
Motion Compensation	
Motion sensors compatible to the system	All motion sensors including TSS DMS range, POSMV
Dynamic accuracy required from MRU (degrees)	□
Interfaces	
Possible interfaces to the processing unit	GPS, Motion sensor, Gyro
Maintenance criteria	
Mean time before failure (hrs)	n/a
Mean time to repair (hrs)	n/a
Access to data	
Online access to bathymetric data during collection	n/a
If yes, by which means?	n/a
Other information	AquaticSonar's main application is in very shallow areas from 0 to 10 m, where multibeam systems cannot give suitable wide area coverage except with very large amount of run lines. It has been proven that the AquaticSonar's coverage is still over 10 times depth below the transducer in such shallow water.

N/A Not Applicable
 □ No information received



Kongsberg Maritime	Kongsberg Maritime	L-3 Communications ELAC Nautik GmbH	RESON Inc.
EM 3002	EM 3002D	SEA BEAM 1185	SeaBat 8125
2003	2003	2003	1999
Permanent	Permanent	Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity
Permanent	Permanent	Permanent, Vessel of Opportunity	<input type="checkbox"/>
Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity
Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity
Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity
Permanent, Vessel of Opportunity	Permanent, Vessel of Opportunity	n/a/ n/a	Permanent, Vessel of Opportunity
332mm	332mm	390x280mm 2 transducer required	<input type="checkbox"/>
119mm	119mm	80mm	<input type="checkbox"/>
25kg in air, 15kg in water	25kg in air, 15kg in water	17kg	<input type="checkbox"/>
80W	80W	n/a	24VDC, 5.6A Peak, 2A Average (May be supplied from sonar processor)
Multibeam, Combination	Multibeam, Combination	Multibeam	Multibeam
Amplitude detect, phase detect	Amplitude detect, phase detect	Combination	Combination
300kHz	300kHz	180kHz	455kHz
1-200m	1-200m	300m	1m-120m
1cm	1cm	Min. 1cm (depth dependent)	6mm
300m	300m	320m	120m
<input type="checkbox"/>	<input type="checkbox"/>	153.5	120
254	512	126	Range dependent
40	41	21	40Hz
1.5*1.5 deg	1.5*1.5 deg	1.5*1.5	1*0.5 (at nadir)
17*17cm/ 80*80cm/ 263*263cm	17*17cm/ 80*80cm/ 263*263cm	26*26/ 131*131/ 393*394	8*16/ 45*90/ n/a
35*13cm/ 177*131cm/ 300*300cm	35*13cm/ 177*131cm/ 300*300cm	465*110/ 2320*550/ 2200*921	68*16/ 340*90/ n/a
20*20*20cm/ 120*120*40cm/ 300*300*120cm	20*20*20cm/ 120*120*40cm/ 300*300*120cm	26*26*26cm/ 1.3*1.3*1.3m/ n/a	
38m/ 210m/ 170m	73m/ 250m/ 180m	153.5/83m, 153.5*415m, 131/600m	35m/ 175m/ n/a
yes	yes	no	no
yes	yes	yes	yes
up to 600l	up to 6002	2048	One per sample
5cm	5cm	Better than 0,2% of water depth	IHO Special Order & US Army
Special	Special	Special	Special
12	12	Depth dependent	up to 12
yes	yes	yes	no
yes	yes	yes	no
Calculation of each sounding is according to Schnells law of refraction, in real time	Calculation of each sounding is according to Schnells law of refraction, in real time	SSV and SVP are time stamped, merged and taken into account for ray bending processing; SSV is taken into account for beamforming processing; The time stamped profile is stored as ASCII-file	SU Profile & ray bending performed in data acquisition system
Seatech MRU5, Seapath 200, Applanix POS/ MV, and other sensors with comparable accuracy	Seatech MRU5, Seapath 200, Applanix POS/ MV, and other sensors with comparable accuracy	All motion sensors with TSS1 protocol	3 x sea range, TSS range, Seatech range
Pitch/Roll 0.02 deg Heave 5cm	Pitch/Roll 0.02 deg Heave 5cm	Pitch/Roll 0.05deg, heave 5cm	Pitch/Roll 0.25° Heave 5%
Sound velocity at transducer, Sound Velocity profile, Position, Heading, IPPS, Single beam echo sounder (optional)	Sound velocity at transducer, Sound Velocity profile, Position, Heading, IPPS, Single beam echo sounder (optional)	All external sensors to fulfill SP 44 Special Order requirements; LAN to external processing unit.	10Mb Ethernet, RS232 Serial
>2000hrs	>2000hrs	>6.000	<input type="checkbox"/>
< 1hr	< 1hr	< 1hr	<input type="checkbox"/>
yes	yes	yes	yes
Std realtime sw is the KM SIS sw, other softwares which can be used: QINSy, HYPACK Max, Triton imaging	Std realtime sw is the KM SIS sw, other softwares which can be used: QINSy, HYPACK Max, Triton imaging	LAN based server, XSE data-format	10MB ethernet export in real-time
EM 3002 signal processing includes high density mode, which gives reduced acoustic footprint by calculating several independent soundings from each slant beam. EM 3002 can be used for 3D inspection of underwater structures by scanning the transmit beam electronically over a +/-30 degree sector. The EM 3002 sonar head is produced from titanium, thus avoiding all corrosion problems. More than 100 systems have been sold (EM 3002 and EM 3002D)	EM 3002 signal processing includes high density mode, which gives reduced acoustic footprint by calculating several independent soundings from each slant beam. EM 3002 can be used for 3D inspection of underwater structures by scanning the transmit beam electronically over a +/-30 degree sector. The EM 3002 sonar head is produced from titanium, thus avoiding all corrosion problems. More than 100 systems have been sold (EM 3002 and EM 3002D)	Superior Signal-to-Noise-Ratio (-36 dB); Tilt mode for side inspections up to 85°; Easy maintenance routine with external testing unit; System can be easily upgraded to SEA BEAM 1180 resp. Dual Frequency 50kHz/ 180kHz system; Water Column Imaging Capability; Amplitude recording for Backscatter analysis and seafloor classification	Ship Wreck, 8125 SeaBat System

