

# Multi-Beam Echo Sounders

For shallow water operations, 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.

In this product survey, we asked the manufacturers of systems that can be used at an operating range <500m for information. We have explicitly made a distinction between operating *depth* and operating *range*. In our opinion, the systems with an operating *range* <500m are the MBES systems for shallow water operation, and small MBES systems that can be used on underwater platforms (and thereby giving information of water depths >500m). MBES systems that can be used at an operating range >500m have been published in previous March/April issue, this product survey can be found on our website.

The manufacturers have given us descriptions of a large number of MBES systems, providing a range of systems from each manufacturer. The complete overview of these systems can be found on our website under the tab 'Product Survey'. For publication in Hydro INTERNATIONAL, we have selected the systems that have been developed most recently.

With the large range of characteristics of MBES systems, we do not expect this product survey to be complete. We appreciate the input of all who contributed to this product survey, and we encourage readers to send us any comments or suggestions they may have to help us improve this product survey.

**Notes**

<sup>1</sup> 500kHz, 250kHz and 125kHz also available  
<sup>2</sup> The EM 2040 is the first true wideband system with operating frequencies from 200 to 400kHz and includes necessary features like dual swath, FM chirp as transmit pulse for long range. All transducers are standard pressure rated to 6000m. The system is the ideal tool for ROV, AUV and any vessel of opportunity. The acoustic beams of EM 2040 are stabilised for yaw, pitch and roll (not just compensated). This gives a much more regular sampling of the bottom and a higher confidence for detection of small objects/features while the vessel is yawing, rolling and pitching. Data from the water volume which is ensonified by the system is available in real time on a display and stored digitally.

No information received  
 N/A Not Applicable



Manufacturer name	Atlas Hydrographic
Product Name	ATLAS FANSWEEP 20-200
Date of first release	1996 (first generation)
<b>2. Mounting and Deployment</b>	
Hull/ Bow/ Side/ ROV/AUV Mounted, towed	Hull/ Bow/ Side/ Portable (via rig)
Retractable Y/N	Y
<b>3. Physical Properties Sonar Head</b>	
Diameter, height (cm)	V-shaped dual-head transducer (dimensions of one transducer array): 26.0 x 33.3 x 5.8 per module
Weight, without cable, per module (kg)	10
Power requirements	1.6kW
<b>4. Used Sonar Methods</b>	
Type of system	Multi-beam echo sounder with side-scan capability
Bottom Detection Method	Hybrid: Based on principles of beamforming and measurements of phase differences
<b>5. System Parameters</b>	
Frequency Range	200kHz
Depth Range, depth resolution	0.5 to 300m
Max. Slant Range	600m max coverage absolute
Max. Swath (function of depth)	12x
Samples per sweep, samples per second	1440, > 20000 (up to 16Hz ping rate)
Beam width (acrossx along track [deg])	1.5° down to <0.2° x 1.3°
<b>6. Bottom Coverage (footprint dimensions at 10/50/150m depth)</b>	
Directly under sensor (m)	0.2 x 0.2 @ 10m depth 1.1 x 0.5 @ 50m depth 3.4 x 0.8 @ 150m depth (along x across)
At max. horizontal range (m)	0.7 x 0.2 @ 10m depth 3.6 x 0.5 @ 50m depth 10.8 x 0.8 @ 150m depth (along x across)
Smallest identifiable cube (m³)	< 0.5 x 0.5 x 0.5
Max swath	600m max coverage absolute
Are footprints equally spaced?	Y
<b>7. Side-scan capabilities</b>	
Does the system have side-scan possibilities?	Y
Number of SSS-points per sweep	4,096 amplitude values per sweep
<b>8. Accuracy</b>	
Calculated statistical system accuracy (cm RMS)	± (0.05m + 0.2% of depth)
System Accuracy in relation to IHO S44-4, meets S44 order	Y, typical IHO special order compliance up to 6-times water depth
Max. allowable survey speed to allow for this accuracy (knots)	16
<b>9. Speed of sound</b>	
System applies ray bending corrections in real-time	Y
System is capable of collecting and integrating the SV-profile in real-time during data collection	Y
If yes, explain the process	Continuously reading of sound velocity at keel and sound velocity profile from available sound velocity sensors
<b>10. Motion Compensation</b>	
Motion sensors compatible to the system	All standard
Dynamic accuracy required from MRU (degrees)	Pitch / Roll: 0.05° or better Heave: 5% of water depth or 5 cm Heading: 0.01° or better
<b>11. Interfaces</b>	
Possible interfaces to the processing unit	via LAN
<b>12. Maintenance criteria</b>	
Mean time before failure (hrs)	10000
Mean time to repair (hrs)	0.5
<b>13. Access to data</b>	
Online access to bathymetric data during collection	Y
If yes, by which means?	Network telegram
<b>14. Other information</b>	
Additional remarks	The ATLAS FANSWEEP 20 is a multi-beam echo sounder that combines the advantages of beamforming and interferometric phase measurement techniques to the benefit of a large coverage together with high accurate depth measurements.
Units sold	> 100

Geoacoustics a Kongsberg company	Kemijoki Aquatic Technology oy (kat)	Kongsberg Maritime	L-3 Elac Nautik
GeoSwath Plus Compact <sup>1</sup>	AquaticSonar Swathe Surveyor	EM 2040D	SeaBeam 1185
2010	2001	2009	2003
<b>Hull / Bow / Side</b>			
Y	Y	Y	Permanent; vessel of opportunity, (ROV: N/A)
<b>Transducer (dual) 33 x 11 x 8</b>			
V-shaped array, height 50	TX: 72x14x15 (0.5 deg) RX: 2x (41x14x14) (1 deg)	39 x 28 (2 transducers required), 8	
<b>Transducer (dual) 1.9</b>			
19	52 in air	17	
<b>24VDC, 40W</b>			
12-30V	<100W	N/A	
<b>Phase Measuring Bathymetric Sonar</b>			
Interferometric	Multi-beam	Multi-beam	
<b>Vernier Phase Detection</b>			
Automatic/manual	Amplitude detect, phase detect	Combination (amplitude and phase detection)	
<b>500kHz (125kHz and 250kHz available)</b>			
100/155kHz	200 to 400kHz	180kHz	
<b>0-50m, 1.5mm</b>			
100m, 50mm	1-500m	300m, min. 10mm	
<b>97.5m</b>			
150m	550m	500m	
<b>12x</b>			
10x (depths of 2-10m)	10x	9x	
<b>max 13000 per sweep</b>			
3000 /swath (theoretical), pulse repetition up to 48Hz	1600 /ping	126, 21	
<b>240°x 0.5°</b>			
180° x 2°	1°x 0.5°, 1°x1°, 2°x1°	1.5°x 1.5°	
<b>9x69 / 44x155/ N/A</b>			
<input type="checkbox"/>	7*13cm/ 35*65cm/ 105*196cm	26x26 / 131x131 / 393x393	
<b>52x2/ 73x3/ N/A</b>			
<input type="checkbox"/>	12*14cm/ 61*71cm/ 183*214cm	465x110 / 2320x550 / 2200x920	
<b>Better than IHO-SP44 Special Order or Order 1 depending on depth</b>			
<input type="checkbox"/>	15*15*15cm/ 75*75*40cm/ 200*200*120cm	26x26x26cm / 1,3x1,3x1,3 m / N/A	
<b>120m / 167m / N/A</b>			
120m/10m depth	800m	153,5°/83m / 153,5°/415m / 108°/410m	
<b>Y</b>			
N/A	Y	N	
<b>Y</b>			
Y	Y	Y	
<b>133 per m, 13000 max per side</b>			
<input type="checkbox"/>	>100,000	2048	
<b>3</b>			
Special Order	Order1	Special	Better than 0.2% of water depth Special
<b>Depth dependent</b>			
4-5knots	>12	Depth dependent	
<b>Y</b>			
<input type="checkbox"/>	Y	Y	
<b>Y</b>			
<input type="checkbox"/>	Y	Y	
<b>SVP can be imported as file and applied in real time to data</b>			
<input type="checkbox"/>	Calculation of each sounding is according to Schnells law of refraction, in real-time	<ul style="list-style-type: none"> <li>SSV and SVP are time stamped, merged and taken into account for ray bending processing</li> <li>SSV is taken into account for beamforming processing</li> <li>The time stamped profile is stored as ACII-file</li> </ul>	
<b>All standard</b>			
SMC, TSS DMS etc.	Seatex MRU5, Seapath 300, Applinix POS/MV, and other sensors with comparable accuracy	All motion sensors with TSS1 protocol	
<b>0.05° or better</b>			
at least 0.01 degrees	Pitch/Roll 0.02 deg Heave 5cm	Pitch/Roll 0.05°, Heave 5cm	
<b>All standard processing packages including QPS Qinsy and Hypack (real-time) and Caris HIPS and SIPS, IVS3D Fledermaus</b>			
SVP, heading, DGPS etc	Sound velocity at transducer, Sound Velocity profile, Position, Heading, 1PPS, Single-beam echo sounder (optional)	All external sensors to fulfill SP 44 special order requirements; LAN to external processing unit	
<b>On request</b>			
<input type="checkbox"/>	>2000	>6.000	
<b>On request</b>			
<input type="checkbox"/>	< 1	1	
<b>Y</b>			
Y	Y	Y	
<b>Data broadcast via Ethernet or file export</b>			
Basic raw bottom with raw coverage	Real-time visualisation of bathymetric data, both raw data and gridded data in 2D and 3D, swath, quality of each beam, water column, seabed image, attitude data, 3D waterfall	LAN based server, XSE data-format	
<b>The compact and lightweight system can be pre-calibrated and is a truly portable solution for very small crafts.</b>			
System, designed for economical shallow water surveying, even 1-2m. Ideal for coastal surveying and harbours or inland waterways.			
<b>On request</b>			
<input type="checkbox"/>	2	34	<ul style="list-style-type: none"> <li>Superior Signal-to-Noise-Ratio (-36dB)</li> <li>Tilt mode for side inspections up to 85°</li> <li>Easy maintenance routine with external testing unit</li> <li>System can be easily upgraded to SeaBeam 1180 resp. Dual Frequency 50kHz/ 180kHz system</li> <li>Water Column Imaging (WCI) Capability</li> <li>Amplitude recording for Backscatter analysis and seafloor classification</li> </ul>

# THE ULTIMATE TOOLS FOR HIGH RESOLUTION IMAGERY AND BATHYMETRY



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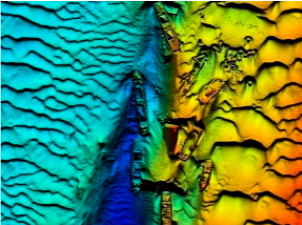


## EM 2040 - Multibeam echo sounder

- Frequency range: 200 to 400 kHz
- Swath coverage: 140 degree single / 200 degree dual system
- Multiple swaths in the water at one time for higher along track density and higher survey speeds
- FM chirp allowing much longer range capability
- Active roll, pitch and yaw stabilization
- Nearfield focusing on both transmit and receive
- Designed for ROV, AUV and Surface deployment
- Depth rated to 6000m

## HISAS 1030 - High resolution interferometric synthetic aperture sonar

- Easy to use
- High resolution imagery and bathymetry
- Capable of resolving 2-5 cm objects at ranges of up to 200 meters to either side
- Adjustable transmit beam pattern

[www.km.kongsberg.com](http://www.km.kongsberg.com)

			
Manufacturer name	<b>R2Sonic LLC</b>	<b>Reson</b>	<b>Teledyne Odom Hydrographic</b>
Product Name	Sonic 2024	SeaBat 8125-H	ES3/ES3M-XX
Date of first release	2009	2010	2008
<b>2. Mounting and Deployment</b>			
Hull/ Bow/ Side/ ROV/AUV Mounted, towed	All	Hull, ROV, AUV, Bow, Side	Hull/Bow/Side/Towed
Retractable Y/N	Y	N	Y
<b>3. Physical Properties Sonar Head</b>			
Diameter, height (cm)	480 x 273mm	38.3 x 49.9	162mm L x 117mm H x 92mm W
Weight, without cable, per module (kg)	16.2kg (in air)	□	Stainless Steel Model 8kg Delrin Model 2kg
Power requirements	48VDC. Total system power consumption: 50W	24VDC Supplied by topside	24VDC less than 25W
<b>4. Used Sonar Methods</b>			
Type of system	Wideband Multi-beam Echo sounder	Time delay beamforming	Beam Steered
Bottom Detection Method	Amplitude/Phase/Blend	Amplitude, phase or blend	Amplitude
<b>5. System Parameters</b>			
Frequency Range	Wideband 200kHz to 400kHz. Over 20x Frequencies in 10kHz steps, selectable in real-time	455kHz	240kHz
Depth Range, depth resolution	400m, 1.25cm	0.5-120m	60m max depth range, resolution 0.02% of range
Max. Slant Range	500m	120m	100m
Max. Swath (function of depth)	5.6x	3.4x	210m
Samples per sweep, samples per second	256, 15.36	256 or 512 soundings per ping, up to 50Hz ping rate, 15kHz sample rate	14Hz range dependent
Beam width (acrossx along track [deg])	0.5°x 1°	0.5°x 1°	3° x 120°
<b>6. Bottom Coverage (footprint dimensions at 10/50/150m depth)</b>			
Directly under sensor (m)	Variable based on swath angle selection from 10 to 160 degrees.	0.09m, 0.44m, 1.3m	□
At max. horizontal range (m)	Variable based on swath angle selection from 10 to 160 degrees.	0.35m, 1.8m, 5.3m	0.2x0.5/ 0.9x2.6
Smallest identifiable cube (m³)	1cm buoy rope running on bottom @6m depth, 20cm diameter anchor chain @23m depth, hydrocarbon seep @60m depth, 2.5m outfall pipeline @180m depth (below sonar).	IHO compliant	0.7x1.0/ 3.4x5.2
Max swath	160 degrees, single head	□	0.5m/4m
Are footprints equally spaced?	Y, equidistant or equiangular	Selectable	30/100
<b>7. Side-scan capabilities</b>			
Does the system have side-scan possibilities?	Y	Y	□
Number of SSS-points per sweep	Up to 32000	Full sample rate	Y
<b>8. Accuracy</b>			
Calculated statistical system accuracy (cm RMS)	5mm	0,6	□
System Accuracy in relation to IHO S44-4, meets S44 order	Exceeds IHO S44	Special order	0.2
Max. allowable survey speed to allow for this accuracy (knots)	12	8	Meets IHO Special Order*
<b>9. Speed of sound</b>			
System applies ray bending corrections in real-time	Y	Y	□
System is capable of collecting and integrating the SV-profile in real-time during data collection	Y	Y	N
If yes, explain the process	Through acquisition software	Manual dip or MVP interface available	N
<b>10. Motion Compensation</b>			
Motion sensors compatible to the system	All motion sensors with TSS1 protocol	TSS, IXSEA, Applanix, Kongsberg, CODA-Octopus	All capable of outputting TSS1 string
Dynamic accuracy required from MRU (degrees)	Pitch/Roll: 0.10 degrees or better, Heave 5cm	0.05	0.25° roll and pitch
<b>11. Interfaces</b>			
Possible interfaces to the processing unit	Motion, Heading, SVP, GPS	All standard serial/Ethernet sensors.	Ethernet
<b>12. Maintenance criteria</b>			
Mean time before failure (hrs)	>10,000	10000	No statistical data available
Mean time to repair (hrs)	0.5	1	<1hr
<b>13. Access to data</b>			
Online access to bathymetric data during collection	Y	Y	Y
If yes, by which means?	Online Software, Gigabit Ethernet	Streaming Ethernet	Raw point files are exported in real-time
<b>14. Other information</b>			
Additional remarks	Swath Sector Rotation (SSR) capability Switchable Forward looking sonar capability Depth rating to 3000m 3 years warranty standard	Real-time water column display, autopilot, roll stabilization	IHO Special Order requires 3 data points per cell.
Units sold	□	25	100