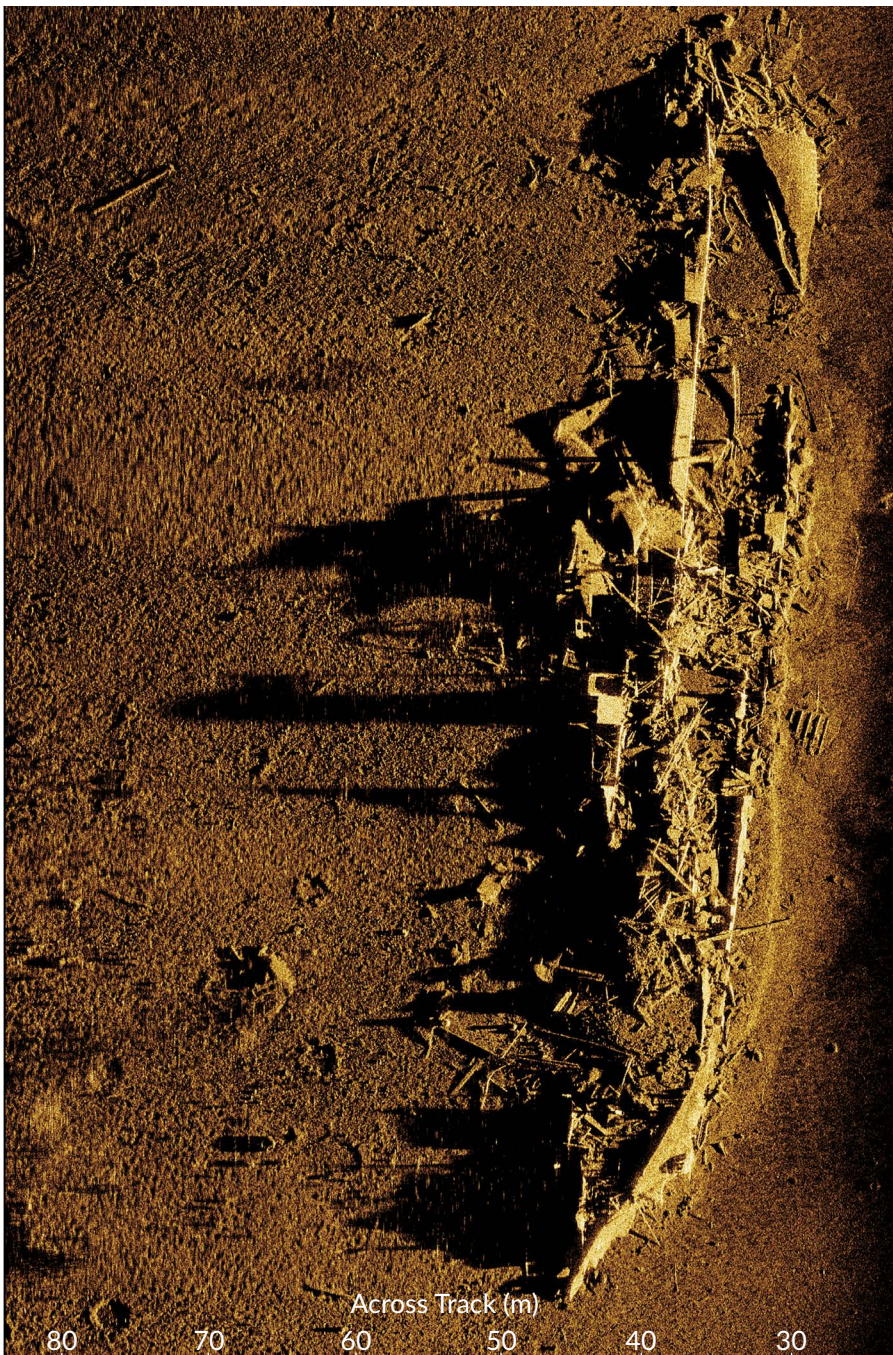


## SEEING WITH SOUND



AquaPix MINSAS image of the SS Ferrando shipwreck provided courtesy of ECA Robotics

**AquaPix® MINSAS** is an off the shelf configurable Interferometric Synthetic Aperture Sonar (SAS) which replaces high end sidescan systems at an affordable price, while delivering significantly higher resolution, range, and area coverage rates (ACR).

MINSAS provides 3 cm x 3 cm constant resolution out to ranges of 220 meters per side, along with simultaneous 6 cm x 6 cm bathymetry.

Innovative and unique features of the MINSAS make it the ideal sonar for a wide range of underwater platforms and UUVs. MINSAS is based around a modular array system which allows for array lengths of 60 cm to 180 cm depending upon platform size and requirements. This modularity along with the industry smallest SAS processing module allow the MINSAS to be integrated to vehicles ranging from Man Portable to Large Diameter.

Another unique feature of Kraken's AquaPix® sonars is our Real Time SAS (RTSAS) processing module. This industry first capability processes raw sonar data into SAS tiles, in real time during the mission, to the internal storage hard drive or optional removable data pod. RTSAS allows for ATR and Data Exfiltration capabilities of processed SAS data, along with greatly reduced PMA.

With SAS once relegated to only expensive military platforms, Kraken's AquaPix® now makes it available to commercial and research customers looking to increase their capability while reducing survey costs.

# Aquapix® MINSAS

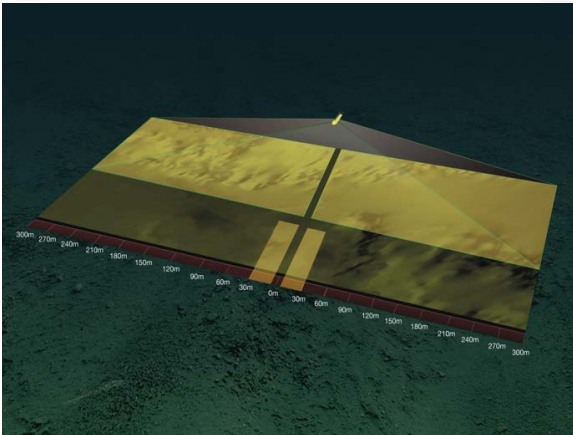


AquaPix MINSAS 120 system components shown with RTSAS Processing and deep water oil compensators

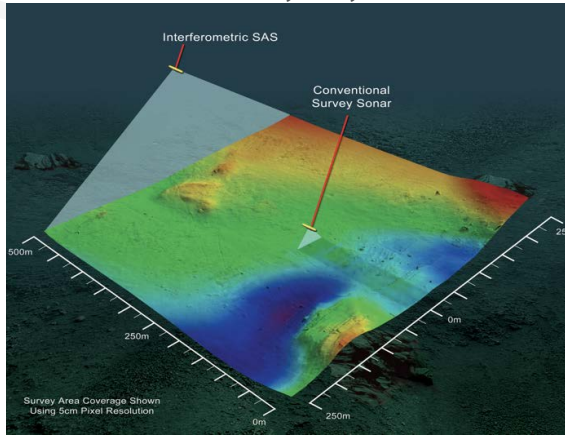
System Specifications	MINSAS 60	MINSAS 120
Platform speed	2-5 kts	2-6 kts
Receiver array dimensions - L/W/H	53.0 / 3.0 / 7.0 cm	109.0 / 3.0 / 7.0 cm
Receive array weight - air / water	6.4 kg / 3.2 kg	12.8 kg / 6.4 kg
Transmit array weight - air / water	0.5 kg / 0.19 kg	
Electronics module dimensions	47 cm x 17 cm dia.	
Electronics module weight - air / water	12.4 kg / 1.4 kg (1000 m)	
Total system weight - air / water	26.2 kg / 8.18 kg	39.0 kg / 14.58 kg
Depth rating	1000, 3000, 6000 m	
System power, no SAS processing	58 W	70 W
RTSAS processing power	75 W	
Power supply	24 VDC / 48 VDC, 250 W peak power	
Along track SAS image resolution	2.5 cm unshaded, 3 cm shaded	
Across track SAS image resolution	1.5 cm (downsampled to 3 cm)	
SAS bathymetry resolution - Real Time	25 cm x 25 cm	
SAS bathymetry resolution - Post Proc.	6 cm x 6 cm	
SAS bathymetry vert. accuracy @ 100m	10 cm	
Source level	210 dB re 1µPa @ 1 m	
PRF	8 Hz	4 Hz
Center frequency	337 kHz	
Pulse length	10 ms (configurable 1 ms -> 1-10 ms)	
Pulse bandwidth	40 kHz	
Pulse type	Linear FM	
SAS robustness against yaw	±4° over 20 m track length	
SAS robustness against sway	±10 m	
Max crab angle	20°	

Physical Specifications and Performance Characteristics of the MINSAS 60 and 120

SAS swath vs SSS swath



Interferometric Bathymetry vs Multibeam



Kraken Aquapix SAS swath width at 3 cm constant resolution compared to typical Side Scan Sonar swath width at 5 cm resolution - Left

Kraken Interferometric SAS Bathymetry coverage area compared to Multibeam coverage area - Right

MINSAS swath width is 20X altitude

Speed		MINSAS 60		MINSAS 120	
Knots	m/s	Range meters	ACR km <sup>2</sup> / hr	Range meters	ACR km <sup>2</sup> / hr
3.00	1.54	118	0.92	220	1.71
3.50	1.80	100	0.91	208	1.88
4.00	2.06	87	0.91	181	1.88
4.50	2.32	77	0.90	160	1.87
5.00	2.57	69	0.90	143	1.86
8.00	4.12	-	-	87	1.80
10.00	5.14	-	-	68	1.76

Typical Area Coverage Rates (ACR) of AquaPix MINSAS at 3 cm resolution based on speed and array length