MARINE TECHNOLOGY REPORTER

March 2013 www.seadiscovery.com

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DSTO First Purchaser of Kraken Sonar Systems Aquapix SAS

By Andrew Safer

Defense Science and Technology Organization (DSTO) of Australia purchased an interferometric synthetic aperture sonar (SAS) system from Kraken Sonar Systems of St. John's, Newfoundland in December 2012. This is Kraken's first commercial sale of the AquaPix SAS system, which follows two sets of sea trials in which the system had been previously tested by Defense Research and Development Canada (DRDC) in Halifax, Nova Scotia and the Naval Undersea Warfare Center (NUWC) in Newport, Rhode Island. Financial terms and contract details regarding the DSTO sale were not disclosed.

"We intend to run AquaPix in as wide a variety of environments as possible to ascertain its full range of capabilities," said David Battle, Head of the Littoral Unmanned Systems Group at DSTO, which is part of Australia's Department of Defense. He added that mine countermeasures and route survey tasks are their top priorities. Asked why DSTO selected the Kraken system, he cited the low cost of Aquapix ownership and several technical features. "We are hoping that the design emphasis on multi-path mitigation pays dividends in shallow water where SAS has been known to struggle," Battle said, adding that the quality and consistency of data are key. Another DSTO priority is a quick and simple integration. "Reliance on correlation-based micro-navigation techniques should reduce the dependence on tight inertial navigation system coupling, thus simplifying the overall integration task." While the contract value was not disclosed, Battle reported that the price paid was significantly less than those quoted by the other manufacturers who had been invited to tender.

A key feature of the Aquapix system that stands out in comparison to conventional sonar, said Kraken Sonar Systems President and CEO Karl Kenny, is the synthetic aperture signal processing software which "tricks the system into thinking the physical transducer array is much longer—20 to 25 times longer," resulting in greatly increased image resolution and range. He adds that the interferomeric SAS produces detailed seabed images with 3 cm resolution to ranges over a 400-meter swath—200 meters x 2 for both sides of the vehicle. Through advanced signal processing, the transducer pings are realigned and made coherent over 1/16 of a wavelength, equivalent to the diameter of a thick human hair. "Interferometric" refers to upper and lower transducers that together enable locating a point on the seabed. In combination with the pressure sensor onboard, this provides the bathymetry. "The high resolution and potential improvements in coverage rate have generated a great deal of interest in SAS technology generally," Battle said. "The ability to source both images and bathymetry through the same sensor seems to be emerging as a must-have feature for AUV sensors."

Kraken Sonar Systems was spun out from Marport Deep Sea Technologies in September 2012 to focus on military and com-

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mercial applications for the SAS technology initially developed by the NATO Underwater Research Center in La Spezia, Italy. Marport acquired the intellectual property from NATO via DRDC in 2010 and further developed the technology between early 2011 and August 2012. Dr. Marc Pinto, who has been involved in the development of SAS since the early 1990s and served as Head of the Mine Countermeasures Department at NATO Underwater Research Center, is currently Chief Technology Officer at Kraken.

After spending 18 months developing the Aquapix system, Kraken's first real-world testing opportunity came in August 2012 when they were awarded a Defense Industrial Research Program contract from DRDC to trial the system in a Repeat-Pass Interferometric SAS program. "The purpose was to collect sonar data to get very high resolution bathymetry," said Vincent Myers, Defense Scientist at DRDC, by conducting multiple runs at varying altitudes over the same area, where mine-like targets had been placed. This also enabled them to look for subtle differences in what Myers refers to as "coherent change detection." He added, "We also wanted the experience of using SAS in Canadian waters using one of our own vehicles." Myers reported that Kraken's integration of the system into the ISE-built hull section of the Arctic Explorer AUV went smoothly and there were no performance issues during the two-week trials. "Looking at the data, some images were pretty spectacular," he recalled. "I've seen a lot of SAS data, and this was right up there, on par with world-leading SAS. I'm impressed they were able to develop this technology in such a short period of time." Kraken is currently processing the data.

Kraken Sonar Systems President and CEO Karl Kenny and Engineering Manager David Shea.

The system covered a swath of 220 meters per side, reported Myers, who added that the constant resolution provided by SAS is not found in other data acquisition methods. "The problem (with the other methods)," he said, "is that their resolution degrades with range which limits their usefulness for our purposes, which is to detect naval mines." He said another advantage of the Kraken system is that it does not require an inertial navigation system to produce the imagery. He added that while INS is still required onboard to determine the absolute position, the ability to strap on to the Aquapix system without having to interface it with INS was a plus.

The trials conducted at NUWC in November 2012 and January 2013 were supported by a Cooperative Research and Development Agreement (CRADA) between NUWC and Kraken. The purpose was to integrate and evaluate the AquaPix SAS on one of NUWC's medium-sized AUV's, a 12.75-inch diameter REMUS 600 built by Hydroid Inc. Kraken's Kenny reports that NUWC engineers provided technical input on the payload module requirements and Kraken engineers designed a drop-in wet payload section with minimal integration requirements. Within a five-day period, the conventional sidescan sonar payload section was removed and Kraken's AquaPix SAS module was assembled, tested and installed at NUWC's facility.

Known targets that had been laid were surveyed at varying altitudes and stand-off distances, reports Kenny who adds that there was consistent 3-cm resolution to ranges in excess of 200 meters. 3D bathymetric data was also collected to produce digital terrain models of the seabed in compliance with IHO S44 special order requirements.

Delivery of DSTO's Aquapix system is slated for the end of March. Asked if the availability of SAS at a low price point could be a game changer, Battle replied, "SAS could be a game changer if it proves robust in a wide range of environments.

The problem has been that SAS has remained very expensive, and occasionally finicky, while real array side-scan systems have continued to evolve and improve. If SAS technology becomes more affordable and demonstrates the same kind of robustness that real array systems have become known for, then I think it will be adopted very quickly." Myers said that a reduced-cost option for SAS will make this technology available beyond militaries—to research organizations and universities. Kenny reported that a key focus of Marport and Kraken's R&D efforts has been to develop the technology that would enable them to price their Aquapix SAS system in the $250,000 range.

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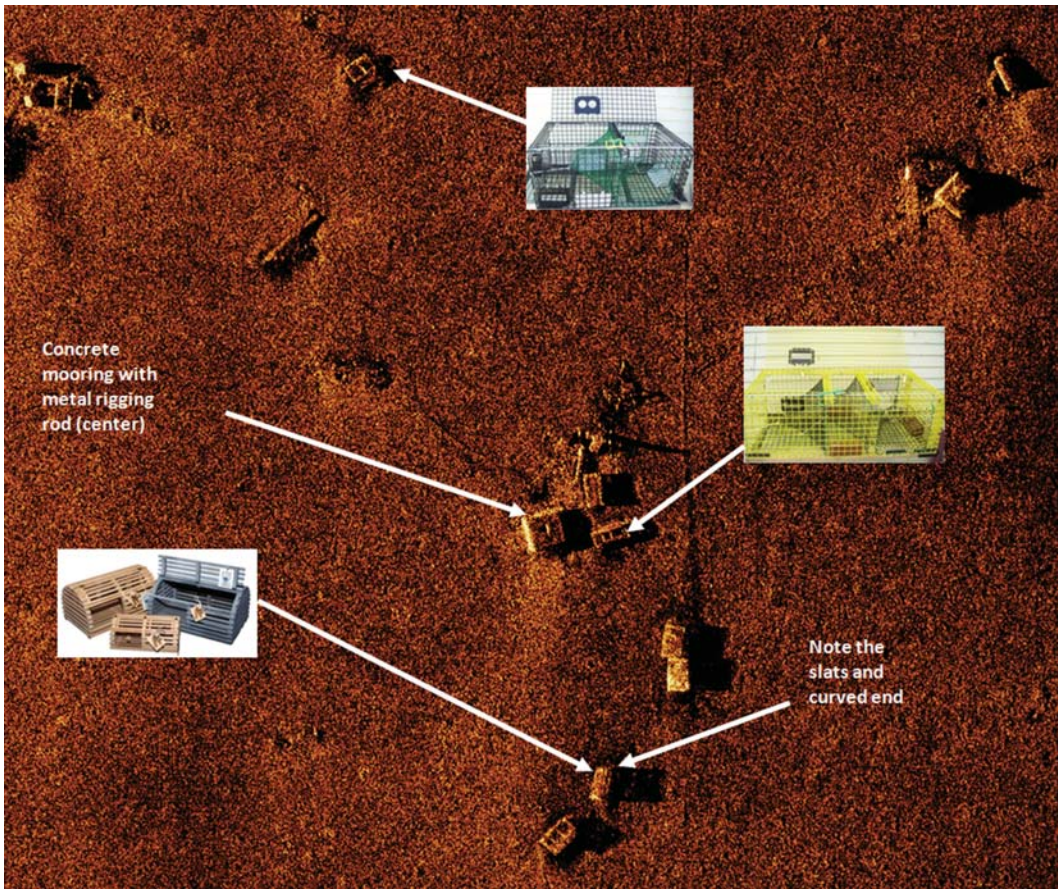
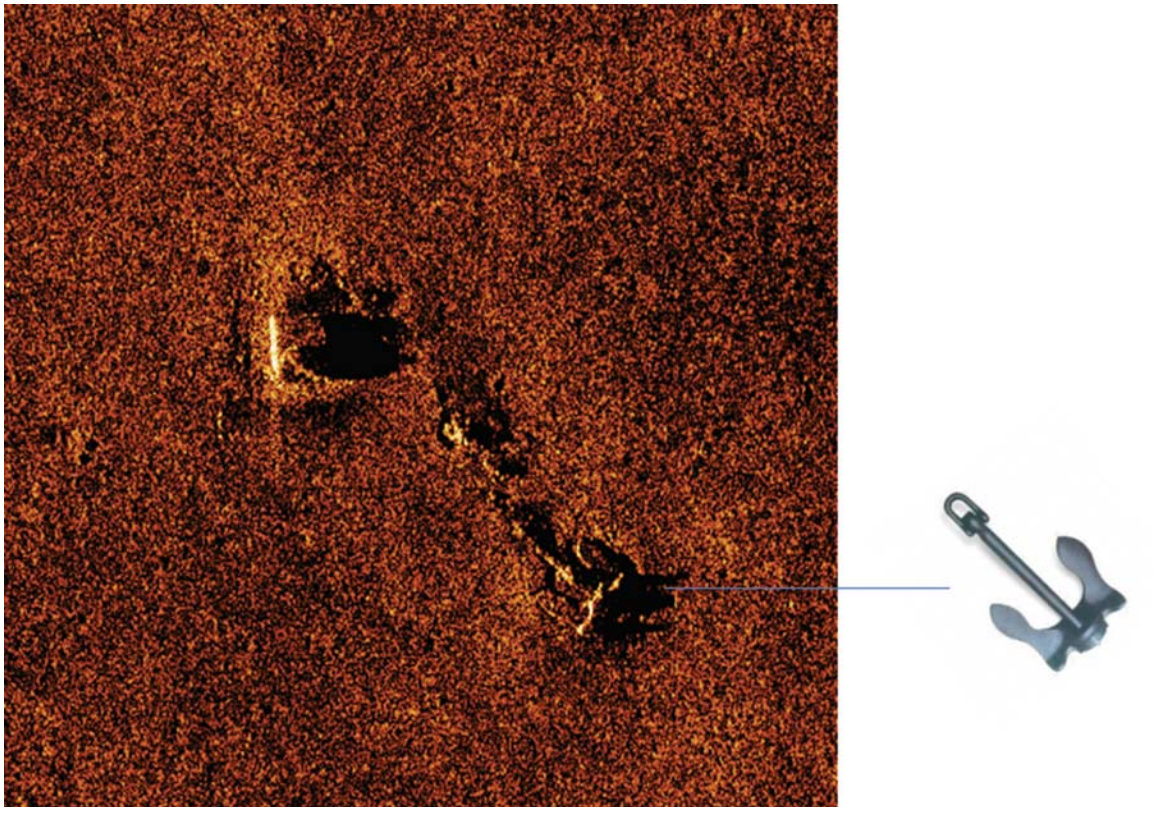


Debris Field Imagery Generated by AquaPix SAS.



Anchor Image Generated by AquaPix SAS.

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