# Beating Sea Mines at Their Own Game

BY JAMES CARELESS

When it comes to envisioning sea mines, it is time to forget the spike-covered balls that are commonly portrayed in movies. Many modern sea mines are stealthy with form factors that resemble undersea rocks. Some are even disguised with artificial turf that looks like seaweed, to help them fool conventional sonar detection systems.

If this isn't enough, some advanced sea mines can detect the audio differences between carriers and escort ships transiting overhead – and only detonate when they hear carriers above them.

It is this kind of sophisticated threat (along with other undersea visualization/detection missions) that Kraken Robotics' Synthetic Aperture Sonar (SAS) undersea vehicles are designed to detect. SAS is a proven underwater imaging technology that dramatically improves seabed surveys by delivering ultra-high resolution imagery at superior coverage rates. (It is commonly used on TV programs that look for shipwrecks.)

Kraken Robotics has harnessed SAS to work on both towed and autonomous underwater vehicles; some of which have recently been purchased by the Royal Danish Navy for its upgraded mine hunting program (contract value $40 million CAD). Based in St.

John's Newfoundland with offices in Canada, the US and Germany, Kraken Robotics is an R&D-driven pioneer in the design, development and marketing of advanced sensors for Unmanned Underwater Vehicles (UUVs). The company also builds pressure tolerant battery systems and autonomous launch/recovery systems to handle UUVs at sea without damaging them.
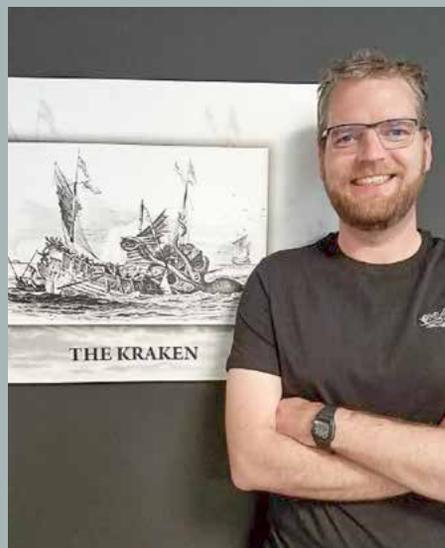
David Shea, Kraken's SVP of Engineering, foresees a busy future for Kraken Robotics

"Using SAS, we're offering very high resolution and great performance, and we're doing so at a fantastic price," said David Shea, Kraken's SVP of Engineering. "We are able to harness commercial-off-the-shelf technology to deliver this performance without the high costs associated with dedicated military equipment. This is why Kraken Robotics has a cadre of military and civilian customers around the world who are using our undersea solutions today in real-life situations; gathering extremely high-resolution undersea images affordably and effectively."

KATFISH

Kraken Robotics' KATFISH is to conventional towed sonar arrays, as a Tesla Model S electric car is to a 1950s Pontiac coupe. They both do the same jobs, but the KATFISH (and Tesla) do it so much better.

In the case of the KATFISH, this towed array acquires over 3 billion pixels per 3 square km/hour of area coverage rate. This translates into 30 times more image detail than a conventional side scan sonar array

PHOTO: The KATFISH has been deployed in over 10 countries by military and commercial operators

covering the same terrain. Moreover, the KATFISH's advanced algorithms perform thousands of adjustments per second, to ensure every image pixel displays data with incredible clarity.

The reason the KATFISH can do so much more is that it is built as an autonomous underwater vehicle (UUV), capable of adjusting its own trim to compensate for stability-disturbing waves and other environmental issues. "It's got the intelligence of an AUV but doesn't have any internal batteries or propulsion system, which is why the KATFISH is towed from a surface vessel with a power and fiber optic cable connected to it," said Shea. "Using the KATFISH's autonomously-stabilized SAS, operators can view the sea floor in astoundingly fine detail. The images it captures can tell them if an object is a rock, a piece of manmade debris, or a mine; long before a diver has to check it out in person."

At present, the KATFISH has been deployed in over 10 countries by military and commercial operators.

Kraken's ThunderFish is the truly autonomous evolution of the KATFISH. This self-sufficient advanced platform is depth-rated to 6000 metres and is capable of staying on target as needed, which is why the ThunderFish is known as a Hovering Autonomous Underwater Vehicle (H-AUV). "We refer to the ThunderFish's shape as being a 'Kit Kat bar', because it is rectangular rather than torpedo shaped," Shea said. There's a reason for this: The ThunderFish's shape aids it in hovering over targets, in addition to 'mowing the lawn' in a British grid pattern during searches."

Besides its autonomous capabilities, the ThunderFish offers versatile payload options and a modular battery system. This enables the platform to adapt to many different AUV missions of varying depths, duration, and applications.

OTHER UNDERWATER PRODUCTS

For those operators who already own/operate AUVs, Remotely Operated Tow Vehicles (ROTVs), Remotely Operated Vehicles (ROVs) or Tow Bodies and want to upgrade to SAS, Kraken offers AquaPix Interferometric Synthetic Aperture Sonar (InSAS/MINSAS) packages. Available in a range of array configurations, InSAS/MINSAS replaces high end sidescan systems at an affordable price, while delivering significantly higher resolution, range, and area coverage rates (ACR).

Launching and recovering UUVs at sea can be a dangerous and potentially damaging exercise. This why Kraken Robotics has created their Autonomous Launch and Recovery System to easily recover UUVs without direct human intervention. When combined with the company's Kraken Tentacle Winch, the system can manage the KATFISH's deployment, operations, and recovery in a safe, consistent manner.

Kraken Robotics has created the Autonomous Launch and Recovery System to easily recover UUVs

On the power side of the equation, Kraken's Pressure Tolerant Battery Systems use Lithium-Polymer cells encapsulated in a flexible silicone polymer to provide reliable, consistent power at depth. The same polymer system can be used to protect electronics as well.

"We can provide power at depths up to 6,000 metres without needing the hoses and other equipment required by a conventional pressure tolerant oil compensated system," said Shea. "There's also no risk of leaking and oil spills. The silicone polymer is self-healing even if punctured and very environmentally friendly."

Other Kraken Robotics' underwater products include their SeaVision system (using a trio of differently-coloured lasers to capture 3D imagery) and their DataPods (each capable of recording up to 2.5TB of data in a 1000m depth-rated pressure module).

CUSTOMERS AND CONTRACTS

At press time, Kraken Robotics was celebrating the successful conclusion of a complaint filed by a competitor against Kraken's $40 million Royal Danish Navy contract. "The Board of Complaints which oversaw the complaint process has ruled in favor of the Royal Danish Navy's position on all points," Shea told CDR. "We can now proceed with upgrading this client's underwater detection process, which has been based on older remotely-controlled UUVs for the past 20 years." (He hopes this deal will lead to similar sales to other NATO navies.)

Meanwhile, the COVID-19 slowdown has not prevented Kraken from finding new business. In July 2020 it announced three defence customer orders worth a total of approximately $1 million. They comprise an order of MINSAS 60 LW sensors for man-portable vehicles, the sale of a SeaVision laser scanner to a large US defence contractor, and a first purchase order issued to the company's Acoustic Signal Processing Group (APSG) under an 8-year framework agreement with a leading international defence contractor.

Looking ahead, David Shea foresees an equally-busy future for Kraken Robotics.

"We're continuing to innovate," he said. "For instance, we are working on a low-frequency ultra-wideband SAS that will address the high false alarm rates experienced by high-frequency SAS when searching for stealthy underwater targets and mines with acoustical cloaking. This project is partially funded by the RCN, and we hope to start testing it later this year or early in 2021. It is just one of the many ways that Kraken is working on innovative yet affordable solutions for our clients, COVID-19 notwithstanding." ∎

James Careless is CDR's Ottawa Correspondent