

# Sentinel expeditionary – Intruder detection where it's needed

Client: Naval customers across the globe

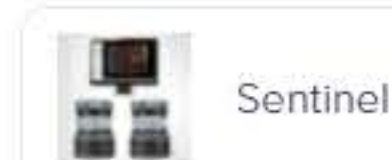
When we initially developed [Sentinel](#) to detect underwater intruders the world was a very different place. At that time, the Cold War was history, and the underwater threat was from rogue state actors and terrorists. Combat divers posed a significant asymmetric challenge: capable of swimming undetected they could cause major damage to our ships and platforms.

Detecting divers effectively was no easy feat. Navy labs had been developing and fielding large, heavy sonars that were seeking to protect naval ports. It was quickly apparent that costly mobilisation and maintenance operations made them unsuitable for permanent deployments. Weighing at approximately 250 kg, they proved difficult to transport and almost impossible to deploy from vessels of opportunity.

A new approach was required. Sentinel was born. Sentinel was the first intruder detection system designed to be portable, only weighing 35 kg. Design parameters were carefully selected to improve the detection and tracking capabilities in comparison to existing systems. Typically deployed in shallow waters and with a requirement to detect threats as far as possible, the design carefully considered the challenges from operating in confined areas, such as complex sound velocity profiles, multipath effects and shadow zones. As a result, Sentinel uses a circular transducer configuration to ensure even coverage. Modern computing and cutting-edge algorithms enable Sentinel to track and analyse a large volume of targets. Improvements were made without compromising performance. Sentinel's range and detection rates were far superior to that of the larger systems. Its size made it truly expeditionary. A system could be mobilised to set up a protective perimeter for your amphibious forces one day or to monitor a sensitive choke point the next.

Fast forward to today, a new cold war is brewing. Peer adversaries are developing new capabilities and are a new addition to the list of threats. Combat-divers remain a significant threat to assets and sailors. The recent attacks on the port of Fujairah are a clear example of what can happen when the guard is let down. Now, unmanned underwater vehicle (UUV) systems have also evolved alongside this threat. UUVs have a smaller signature than divers and can move faster.

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## New threats, no problem

The Sentinel Expeditionary System is perfect for short term operations using Offshore Patrol Vessels (OPVs) and temporary sites onshore. Navies use it as part of naval exercises, provide protection at specific events such as during the Olympics, or protect their expeditionary forces where they are operating.

As new threats emerge, our navy customers want to ensure that their existing Sentinel systems can meet them. After all, the design parameters were carefully selected to improve the detection and tracking of divers. Can they meet the underwater drone challenge? Each sonar head was designed to operate at 70 kHz with a 40 ms pulse to improve the signal-to-noise performance and to increase the effective range of the system. The 20 kHz bandwidth provided an effective 3.75 cm range resolution. Sentinel emits a 360° linear-period-modulated (LPM) pulse and uses 256 receive beams equally spaced along its perimeter to discriminate targets in up to 1500 m range even at high velocity. The results meant Sentinel could detect scuba divers up to 1,000 m range and divers with re-breathers up to 700 m. Sonardyne engineers had the anecdotal experience that the system could detect and track UUVs, but more concrete data was needed to ensure that performance was suitable for the task.

### ANTX 2019

A set of experiments conducted during the [Advanced Naval Technology Exercise](#) (ANTX 2019) in collaboration with the [US Naval Undersea Warfare Center](#) (NUWC) in Newport, RI demonstrated improved performance using Sentinel against combat divers and a one-man portable [Riptide](#) µUUV.

ANTX has become a key naval technology collaboration, development and demonstration event in the US calendar, bringing together more than 1,000 naval, academic and industry attendees at the US Naval Undersea Warfare Center's (NUWC) [Narragansett Bay Test Facility](#) (NBTF) in Newport. The NBTF is a test and evaluation facility designed to support research and development work in advanced underwater weapons and weapons systems, weapon launchers, UUVs and oceanographic equipment.

The Riptide µUUV provided a formidable and very small target. Manufactured by BAE Systems, the Riptide has a diameter of 12.4 cm and weighs under 12kg. The man-portable small, unmanned vehicle is sophisticated yet simple, efficient, and highly flexible platforms.

In the exercise, multiple threat runs using both divers and the µUUV were carried out against Sentinel over two days. In some cases, the runs used highly realistic threat tactics (moving along harbour walls, zig-zagging courses, etc.) designed to make tracking as challenging as possible. The results demonstrated that Sentinel continues to be up to the task.

### Mobilising Sentinel

Our navy customers also want to know how to optimise the system for each new environment. The performance of any sonar system is heavily dependent on the target of interest and the environment the system is being operated. Fortunately, Sonardyne has developed performance prediction tools. That determines the performance of the system in different environments against different types of threats. These tools consider deployment options and provide effective metrics to your team.

With sufficient time a site survey informs the user where to deploy sonars to improve the performance of Sentinel. These surveys can also be conducted remotely. Our training includes how to operate these tools meaning that our customers can conduct those surveys and remain at arm's length from our support teams.

### Most deployed intruder detection system

That is why most navies still trust Sentinel to be the intruder detection of choice. They need a system they can count on and that will stand up to emerging threats. These threats exist now. Equipped with a Sentinel Expeditionary System, a two-person team can rapidly mobilise on-site, use the output from the site survey to deploy the Sentinel and keep a constant vigil. Any threats will raise the alarm. This data can be interfaced with a third-party command-and-control system if required.

That's just what the Slovenian Armed Forces (SAF) [430th Naval Division](#) did in 2019. As part of a broader multinational exercise, their Underwater Special Operations Detachment carried out operations alongside a group of divers from the Montenegrin Navy – a perfect opportunity for putting Sentinel to the test. In Slovenia, the 430th Naval Division often use their Sentinel from vessels in port, while at anchor. For the multinational exercises, they deployed it from a pole mount from the patrol boat stern platform.

Starting with integration drills, involving underwater and surface inspection of the operational area, they moved on to joint inspection of navigable waterways, and then a mine hunting and detection exercise around moorings used by allied vessels.

Throughout, the underwater part of the port's disembarkation area – which is protected by the 430th Naval Division – was monitored using Sentinel. It was then used to steer the force reaction towards the simulated intruders.

The 430th Naval Division's use of Sentinel shows its flexibility – it can be deployed and redeployed from different vessels, quaysides, subsea mount frames or even buoys. In other words, our Expeditionary Sentinel System provides intruder detection where it's needed.

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