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Raytheon's Net-Centric Communications

Building a Foundation for Innovative Solutions



Raytheon

Customer Success Is Our Mission

Deep Siren Tactical Paging

Providing the Submarine Fleet With Communications at Speed and Depth

With the end of the Cold War, the mission of the submarine has changed, with greater emphasis on integrating the subsurface fleet into joint operations. Communications at Speed and Depth (CSD) is one of the U.S. Navy's top undersea priorities and the submarine force's number-one communications priority. CSD provides the submarine fleet with the capability to communicate while operating at tactical speed and depth, providing integration into the Global Information Grid, or GIG, thus extending the FORCEnet below the ocean surface. This enables the submarine commander to share situational awareness, plan collaboratively, and fight synergistically with other forces. These increased operational capabilities allow submarines to remain fully engaged in covert missions while maintaining real-time communications and stealth.

Tactical paging supports this priority by providing the ability for a local tactical unit such as special operations forces or the Submarine Operating Authority (SUB-OPAETH) — ashore or afloat — to reliably transmit tactical messages to a submarine operating below periscope depth. The only radio system that provides this capability works at very long wavelengths and requires the submarine to deploy and trail a towed buoy or buoyant cable antenna, restricting its operational speed and depth. If the submarine is running too fast or too deep, it cannot deploy the antenna and cannot be contacted.

Raytheon recognized the need for this capability in 2005 and put together an industry team to deliver a tactical paging system. During 2005 and 2006, the Raytheon team performed engineering tests at Canadian Forces Maritime Experimental and Test Range near Vancouver Island; conducted an at-sea demonstration with the U.S. Navy at the Pacific Missile Range Facility in Kauai, Hawaii; and participated in Rim of the Pacific Exercise. In August 2007, the Navy awarded Raytheon a \$5.2 million contract to deliver this innovative tactical paging solution for a series of Navy-conducted system tests. These tests will culminate in a Military Utility Assessment, positioning the system for possible fleet operational deployment in 2009.

Acoustic Technology

Deep Siren Tactical Paging (DSTP) provides paging capability via acoustic, expendable buoys that, when contacted via an Iridium communications satellite, can send encoded tactical messages to submerged submarines. Acoustic messages can be sent at any time and received by the submarine without the need to come to periscope depth or deploy a towed antenna, both of which greatly impact the operational posture of the submarine. Figure 1 shows an operational view of the DSTP system.

The Deep Siren acoustic technology uses advanced digital-message processing to ensure submarine message receptions at tactical operating speeds and ranges greater than 50 nautical miles, depending

on local topography. Buoy transducer depth can be optimally chosen to maximize performance as a function of thermal layers and acoustic propagation characteristics. Deep Siren uses digital signaling at low acoustic frequencies to achieve these capabilities.

Figure 2 shows the components of the DSTP system: command station, receive station, and Deep Siren expendable buoy. The portability of the command station enables deployment of Deep Siren in multiple tactical scenarios. In addition to being deployed from shore-based command centers, the command station may be utilized from a surface ship or airborne platform, allowing deployed buoys to be called from anywhere in the world.

Buoy and Submarine Launch Vehicle

The buoy employs an Iridium satellite link for bi-directional worldwide communication over the Iridium satellite system. It can be deployed from a surface ship, airplane or from the submarine itself. The buoy is deployed from a submarine through the trash disposal unit using a submarine launch vehicle (SLV). It is pre-programmed, prior to launch, with a message to be sent back to the base station upon deployment. Once the SLV reaches its pre-programmed depth, a float mechanism is deployed. The buoy separates from the SLV and ascends to the surface.

After the initial communication link is established, the buoy stays in standby mode

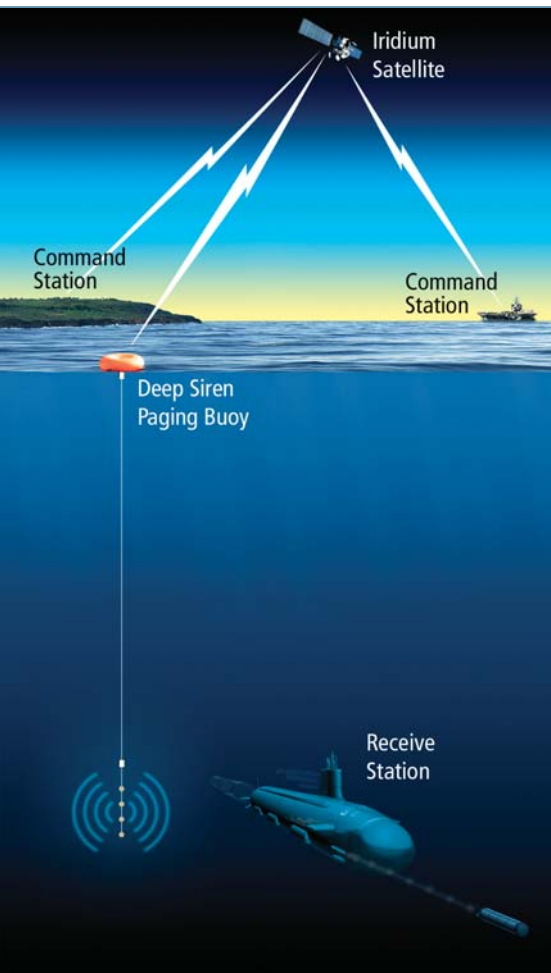


Figure 1. Operational view of Deep Siren Tactical Paging system

for up to three days while waiting for reception of a command via satellite, instructing it to send a message acoustically. It features two hours of Iridium transmission time and one hour of full-power acoustic transmission time. The acoustic transducer depth setting is preconfigured for optimal range. The buoy pays out its lower electronics unit with the acoustic transducers to the preconfigured depth.

Command and Receive Stations

The command station supports multiple types of acoustic messages and also a locator ping capability. Messages are encoded with a proprietary acoustic waveform providing high probability of receipt. A locator ping is a single-frequency tone with duration, repetition, pause and frequency defined by the command station operator. A user can select which buoy to communicate with and which message to send from this station and can monitor buoy status.

The command station also provides buoy management. It maintains a list of available buoys and can request buoy data, such as GPS position, life information and status. It is also used to remotely scuttle the buoy if necessary.

A receive station is deployed on the submarine to receive and decode acoustic messages transmitted by the buoy. The messages are decoded and displayed in real time without operator intervention. This station connects to the output of a SONAR array onboard the submarine and processes the acoustic signal. The receive station indicates to the operator on board the submarine that a message has been received, along with the content of the message.

Mission Systems Integration

With a history of providing the submarine fleet with communications capabilities, Raytheon leads the multinational DSTP industry team and provides mission systems integration. RRK Technologies, Ltd (United Kingdom) supplies the Deep Siren long-range acoustic transmit-and-receive algorithms, and Ultra Electronics Maritime Systems (Canada) builds the expendable buoy and launch vehicle, permitting submarine deployment.

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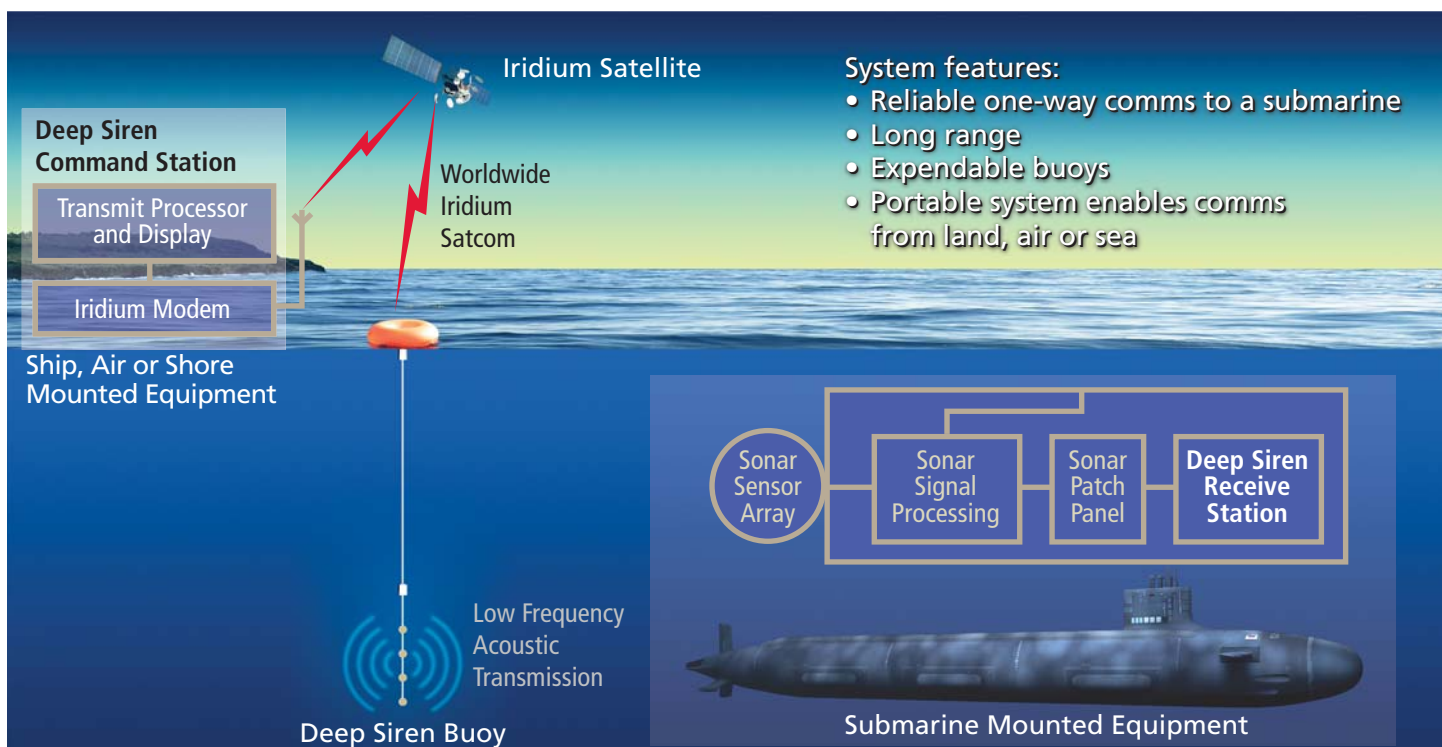


Figure 2. DSTP system components

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