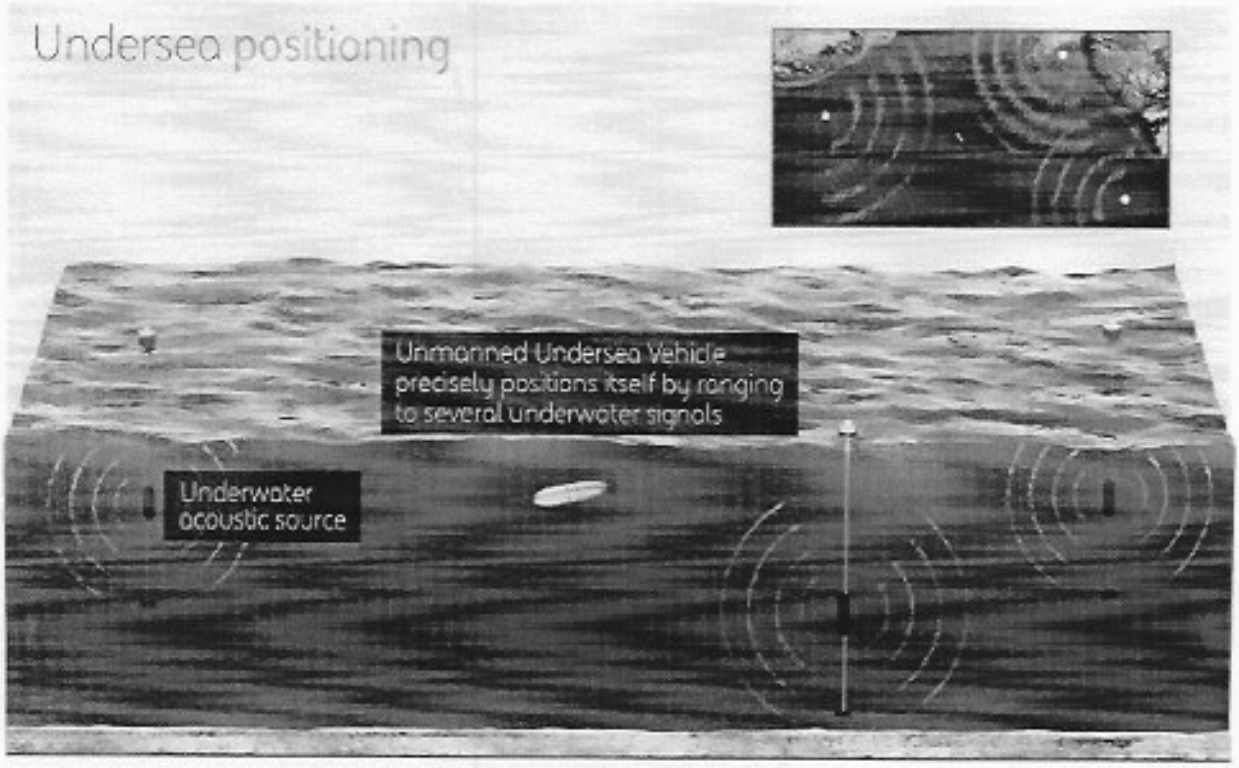
DARPA program seeks to give subs and undersea drones an acoustic GPS

BAE's POSYDON team aims to use acoustic beacons to provide location fix.

by Sean Gallagher - Jun 15, 2016 8:20pm EEST



A conceptual illustration of how POSYDON will work.

BAE Systems

A technology being developed under a Defense Advanced Research Projects Agency (DARPA) program could soon bring GPS-like navigation below the waves. The POSYDON program seeks to create a network of acoustic underwater beacons that act like GPS satellites—broadcasting a burst of data encoded into sound waves that underwater craft can use to get a fix on their location.

GPS uses radio signals from satellites carrying time and position data, allowing a receiver to passively pick up that data and calculate its position. But while GPS works well for ships, ground vehicles, and aircraft, the radio signal from GPS satellites doesn't penetrate very far below the ocean's surface. It's a technical problem that submarines have dealt with since long before GPS was available. It has forced subs to come close to the surface and raise an antenna mast if crews want to figure out where they are.

During the Cold War, the US developed an incredibly accurate—and expensive—technology for helping submarines navigate the seas without surfacing. The solution was based on inertial sensors: gyroscopes measured acceleration and movement relative to the Earth in a fashion similar to the guidance systems used for ballistic missiles. Gyroscopes have since gotten a lot smaller, and the fundamental parts of inertial navigation are now part of most smartphones. But precise inertial systems are still very expensive and not easy to miniaturize. Really accurate inertial navigation has continued to be a problem for undersea drones.

A lot of things can throw off the estimated positions given by inertial systems, requiring them to be periodically recalibrated with a GPS fix. That's not a problem if your undersea vehicle is in friendly waters, but it's a risky proposition if it happens to be in a rougher patch of ocean. Getting a GPS fix requires a submarine or underwater drone to get close to the surface, and during wartime it's possible that an adversary would try to deny GPS navigation in some areas by jamming or spoofing GPS signals.

That's where POSYDON (which is nominally an acronym for "Positioning System for Deep Ocean Navigation") comes in. BAE Systems and researchers from the University of Washington, the Massachusetts Institute of Technology, and the University of Texas at Austin are creating a system that takes advantage of the propagation of sound underwater to mimic what GPS does. POSYDON will allow undersea vehicles to pick up timing and position data from acoustic beacons anchored to the sea floor from great distances and use those signals to triangulate their location.

Joshua Niedzwiecki, director of sensor processing and exploitation at BAE Systems, said that the POSYDON team would be "selecting and demonstrating acoustic underwater GPS sources and corresponding small-form factor receivers." The team will also develop prototypes for vehicle hardware required to translate received signals into a position fix.

While it may sound relatively straightforward, this isn't a simple task. Sound doesn't always move in a straight line underwater—it can echo off obstructions and have its direction distorted by differences in temperature and other factors. As such, the POSYDON team will also have to find ways to overcome constructive and destructive interference of sound waves caused by these factors. They'll also have to find ways to prevent jamming and spoofing of the signals.