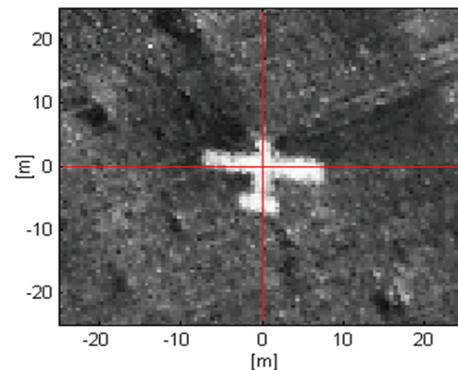
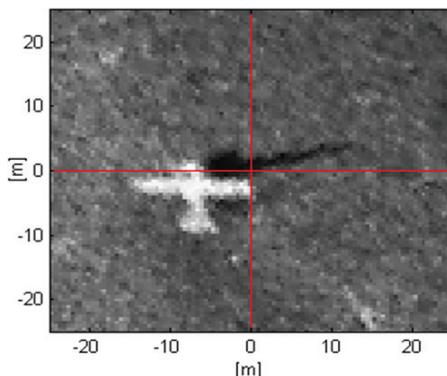
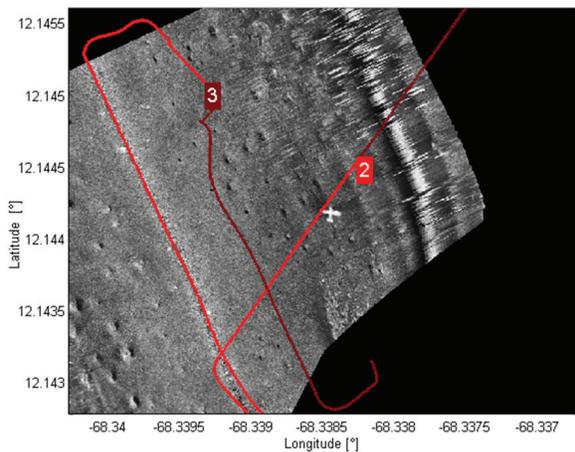




NAVAL RESEARCH LABORATORY

The Corporate Laboratory for the Navy and Marine Corps

Automated Bottom Feature Navigator (ABFN)



Bottom fix example using sidescan imagery detection of an airplane. The position offset from center in the image on the right can be used to reduce the UUV's position error.

These inventions provide essential technology components that enable an Autonomous Underwater Vehicle (AUV) to conduct long endurance submerged missions using 'landmarks' on the seafloor to constrain the vehicle's position error. Multiple sightings of the same seafloor object using the AUV's swath sensors (multibeam bathymetry, sidescan, LIDAR, etc.) are used to create position fixes that can be used by the vessel's navigation system to reduce the vehicle's position error in real-time and in post-processing of the navigation data.

Long term submerged AUV missions are a challenge because of the inability of the vehicle to accurately know its position. GPS cannot be used underwater, and surfacing of an AUV for a GPS fix is usually problematic. Dead reckoning systems, typically using a coupled inertial motion unit and Doppler Velocity Log, have unconstrained position error growth. Options to constrain position error growth during a submerged AUV mission are to use 1) a ship placed marker, which limits the range of travel for the AUV, or 2) stationary bottom features that are discovered by the AUV sensors during a mission and used as landmarks. While a landmark does not provide a geodetic referenced position (unless it has been previously surveyed), it provides a way to constrain position error growth with repeated sightings of the same landmark. Researchers at the Naval Research Laboratory have developed several technologies which contribute to the ability to utilize landmarks for reducing UUV position uncertainty. Automated identification of objects in sidescan imagery is addressed. Additionally, an approach was developed for the automated identification of geographic areas whereby data overlap occurs to reduce the search area for targets suitable to use as landmarks. Lastly, a technique for given seafloor objects being spotted multiple times during a mission provides the capability to create position fixes used by the vessel's navigation system to reduce position error.

Advantages

- Constrains vehicle position error growth for long endurance submerged AUV missions.
- Takes advantage of existing seafloor objects detected by AUV sensors that can be used as 'landmarks' to reduce position error

Opportunities

- Autonomous Underwater Vehicle (AUV) position error reduction
- Long endurance submerged AUV operations

U.S. Filed Patents 7,567,714; 7,764,840; 7,990,804; 8,1549,52; 8,243,551 and 9,030,915 and U.S. Patent Publication US 2014/0320653 are available for License to companies with commercial interest. Collaborative research and development is available under a Cooperative Research and Development Agreement (CRADA).