AUV System with real-time SAS and ATR demonstrated at CMRE, Italy

The HUGIN AUV with HISAS 1030 synthetic aperture sonar (SAS) has been in operational use by customers including the Royal Norwegian Navy (RNoN) since 2008. The HUGIN AUV and the HISAS 1030 is a result of a joint development at Kongsberg Maritime and the Norwegian Defence Research Establishment (FFI).

In October 2012, FFI with support from the RNoN and Kongsberg Maritime participated in an experiment led by the NATO Centre for Maritime Research and Experimentation (CMRE) near Elba, Italy. A prototype of the next generation HISAS system, installed on FFI's HUGIN HUS AUV, was operated from CMRE's research vessel R/V Alliance during the Autonomous Reactive Intelligence Sea Experiment (ARISE) 2012.

CMRE, previously NURC and SACLANTCEN, is a research institute focusing on developing and evaluating technologies for use by NATO nations in the marine environment. The ARISE 12 experiment was aimed at verifying and evaluating advanced autonomy concepts for AUVs under realistic mine-hunting conditions and included a number of tests where AUVs needed to dynamically re-plan missions and adapt to the local environment.

In order to allow in-mission adaptation, the new HUGIN system includes hardware and software for real-time SAS processing, real-time automated target recognition (ATR) based on the SAS data, and in-mission re-planning for identification of automatically classified mine-like targets using an optical camera and/or other sensors.

The upgraded HISAS system also computes a performance measure in real time, which can be used to automatically change line spacing in lawnmower patterns to ensure maximum coverage without gaps.

In a single mission, a pre-defined search pattern was executed by the AUV in an area where various exercise targets had been placed. The recorded HISAS data was processed during the mission and the output fed to the SITAR ATR system. From the automatically detected and classified targets, an extended mission plan for electro-optical identification (EOID) was computed. The vehicle then surfaced and sent the list of targets and the new mission plan to the operator, allowing the operator to adjust the EOID plan. After the plan was accepted by the operator, the vehicle dove, turned on the camera system and recorded a series of still images of the targets. When the mission was completed, all the data including SAS imagery and camera images were instantly available for download from the AUV. The data was then played back in Kongsberg's Reflection PMA software package.

With the above functions in the vehicle, HUGIN can perform detection, classification and identification during a single mission. This functionality provides substantial time savings in mine countermeasure (MCM) missions and facilitates in-stride AUV based MCM operations.

HUGIN performed well under 9 missions during the ARISE 2012 experiment, successfully demonstrating in-mission SAS processing, ATR and camera ID components under realistic mine-hunting conditions.
The HUGIN HUS AUV with the HISAS interferometric SAS launched from R/V Alliance.

SAS mosaic of the search survey with optical image of one of the detected targets.