

Paper to UDT 2019 (Extended abstract)

Combined functionality and need for new tactics for optimized use of AUV systems

Experience and lessons learned from a Swedish perspective based on the long experience of using modular AUV systems with interchangeable payload modules.

1 Introduction

The Swedish experience from the development and use of the AUV62-systems with combined functionality is that close cooperation with all involved parts, strategic research and new tactics are vital for optimized use of AUV-systems.

The AUV-program leading up to the AUV62-system started in 1996 in cooperation between the Swedish Defence Materiel Administration (FMV), the Swedish Defence Research Agency (FOI) and Saab. The first task was a research and development program for a synthetic aperture sonar that could produce high-resolution images efficiently also in shallow waters. A lot of effort was put in optimizing lobe forming which is crucial when operating in shallow waters. The result was the demonstrator SAPPHIRES (Synthetic Aperture Processing High Resolution Sensor)

In a parallel research and development program initiated in 1999 a prototype AUV called AUV62F was built using prototype parts from Saab's torpedo development project. These two concepts were then combined in the first AUV62-MR (Mine Reconnaissance) vehicle in 2008. The tests performed with the AUV62-MR were successful and even led to the vehicle being used by other government agencies. For example, it was used to search for objects in muddy and shallow waters – sometimes just a couple of meters depth.



Fig. 1. AUV62-MR

Starting as a spin-off of this new AUV concept, an acoustic module for ASW training was developed during 2010-2013. The module for ASW training could replace

the sonar module in the vehicle. This configuration was developed into the AUV62-AT acoustic target system.

The Swedish armed forces (SwAF) has since 2017 incorporated the use of the highly advanced AUV62-AT acoustic target as a very cost efficient, reliable and flexible resource for bulk training in ASW.

2 Operational use

The AUV62-AT system is used for all key components of an ASW training mission, locate/track/attack, including multiple units and sensor systems and firing torpedoes at the target. After an ASW training mission recorded data can be extracted from the AUV and used for advanced mission evaluation. The system registers and store all navigational and sensor data including direction of incoming sonar pulses and acoustic response sent from the AUV. Recorded data can also be retrieved between missions during an exercise to provide rapid feedback.

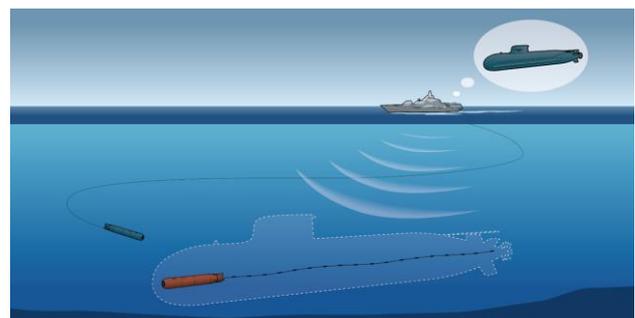


Fig. 2. Synthetic representation of a submarine

The AUV62AT-systems are currently operated under a Government Owned, Company Operated (GOCO) contract between the SwAF, the Swedish Defence Materiel Administration and Saab. The SwAF owns the AUV-systems and Saab operates, stores and maintains the vehicles and all related equipment. This concept eliminates the need for SwAF to provide personnel and infrastructure for the AUV system. FMV coordinates all sustaining activities, initiates development activities to improve operational output and evaluates the service provided by Saab.

The GOCO concept enables a flexible and cost efficient introduction of a new system consisting of a few items. It also enables a seamless transition of operation from the

contractor to SwAF during expansion of the system. The level of services provided by the contractor can also be flexible and alter depending on, for example, season or location. In addition Saab can operate the AUV:s from their own or from a SwAF platform.

The GOCO concept includes working in an Integrated Project Team (IPT) between FMV, Saab and SwAF. The IPT is a stable platform to coordinate exercise planning, continuous improvements, vehicle maintenance/development and cooperation with other projects and activities using the AUV62-systems. Among others both FMV and FOI also use the AUV62 for testing and evaluation of different systems such as sensor- and weapon systems.

The modular concept of this AUV-system enables a cost efficient operational life. The same vehicle can perform a number of different missions by using different payload modules reducing the number of vehicles needed for fulfilling operational requirements. Evolutionary development of the AUV-system is easier when an improved or new module can be developed and incorporated seamlessly with limited risk and minimum system down time.

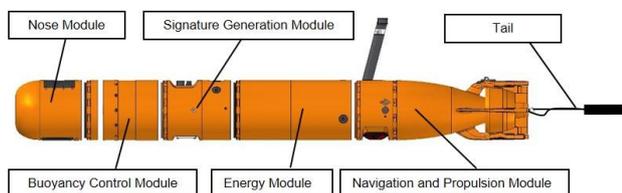


Fig. 3. AUV62-AT modular design

3 Transition to unmanned systems

AUV-systems require different tactics to be applied to make full use of their capability, thereby adding capacity to the SwAF. Using autonomous systems for tasks previously performed by manned systems leads to a wide range of necessary adaptations in terms of asset use and mission tactics as well as logistics.

A successful introduction of unmanned systems requires a thorough review of the intended capabilities including evolutionary development of new or enhanced capabilities. Conceptual thinking is vital the development of tactics, integration of the systems and their chain of logistics.

4 Research and development

Research, development and continuous improvement activities is performed and include participation by Saab,

FMV, SwAF and FOI. Possible future capabilities include decoy, long-range surveillance, harbor protection and sea floor mapping/classification

The research collaboration extends even to the academic arena particularly in the Swedish Maritime Robotics Center (SMaRC) project funded by the Swedish Foundation of Strategic Research. SMaRC is a triple helix national industrial research center with focus on maritime robotics. The research areas include autonomy, communication, endurance and perception.

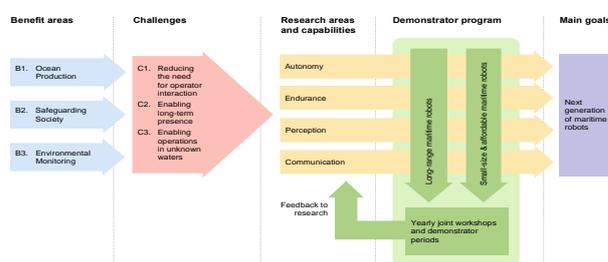


Fig. 4. SMaRC activities and work packages

References

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Author/Speaker Biographies

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Johan Wahren is Project Manager for underwater warfare weapon systems at the Swedish Defence Materiel Administration and has the AUV62-AT/MR systems in his portfolio.

He is also involved in R&D activities in co-operation with other government agencies and universities in Sweden, such as SMaRC (Swedish Maritime Robotics Center).

Johan has a MSc. degree in Materials Technology from the Royal Institute of Technology in Stockholm, Sweden and has a background in the Medtech industry and the Swedish Standards Institute.