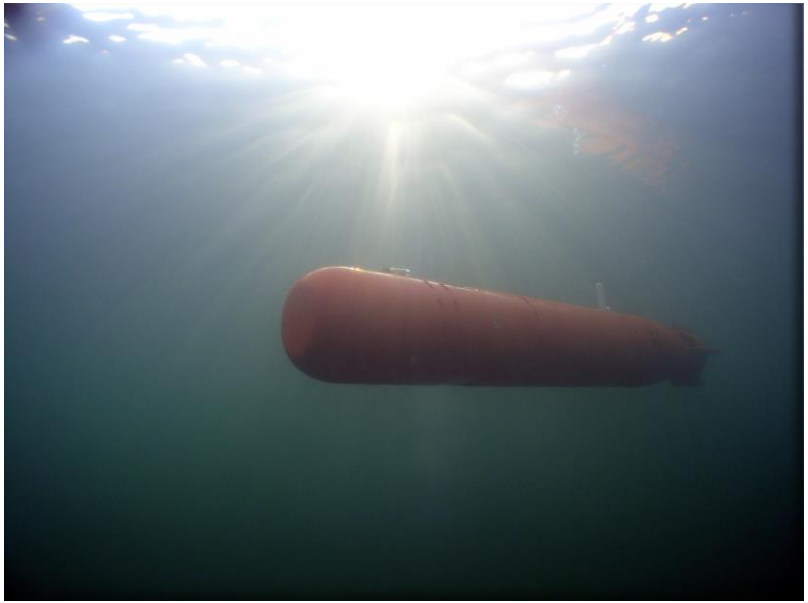
Combined functionality and need for new tactics for optimized use of AUV-systems

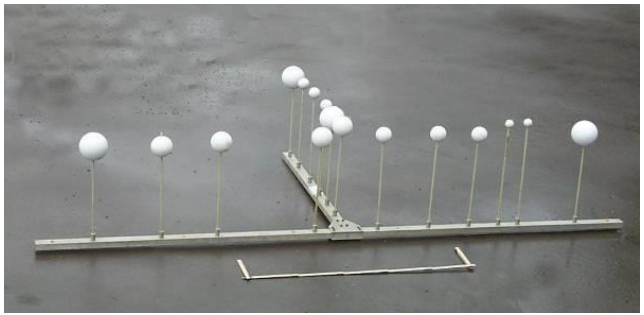


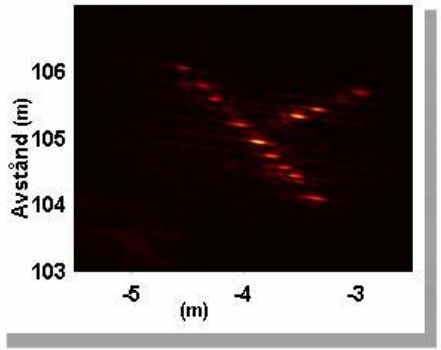
Presentation for UDT 2019

AUV 62 System –20 years of R&D

1996-1999 DAIM - *Digital Acoustic Imaging*.

- FOI and Saab together with LTH and CTH (Universities)
- Results: wide band hi-frequency sonar and algorithms for advanced hi-resolution signal processing methods for synthetic aperture sonar





AUV 62 System –20 years of R&D

1999: AUV62F

- Prototype parts of a torpedo development project become an AUV

AUV 62 System –SAPPHIRES

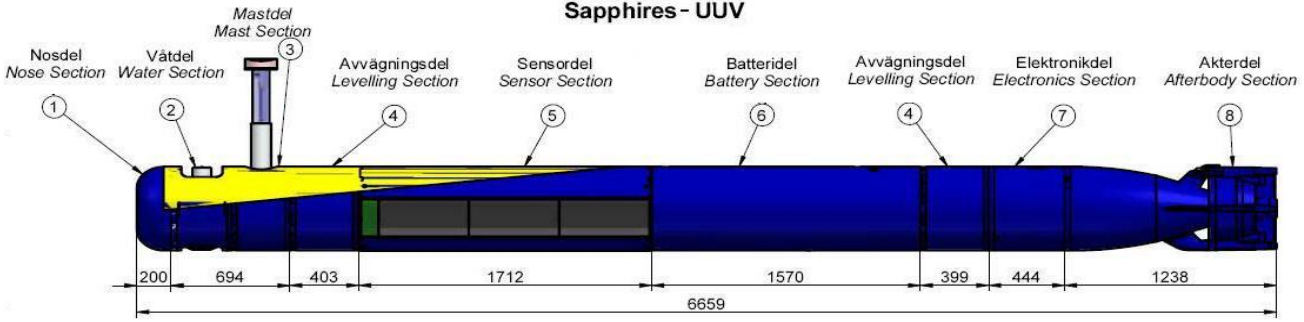
2003 – 2005 a demonstrator project takes form

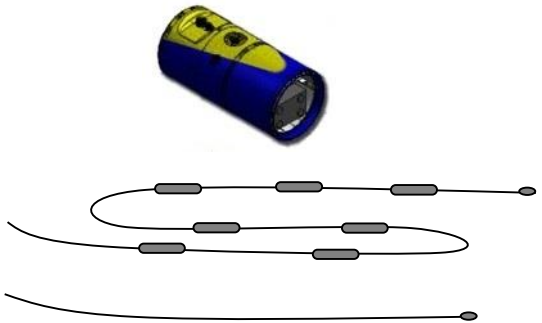
***S**ynthetic **AP**erture **P**rocessing **HI**-**RE**solution **S**ensor*

2005 – 2007 the demonstrator platform is built.

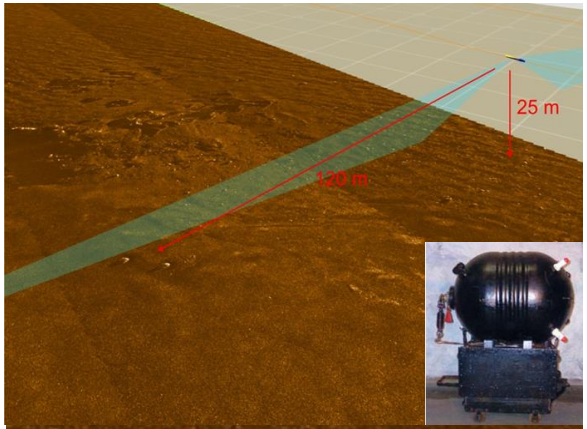
2008 - SAPPHIRES is fully operational

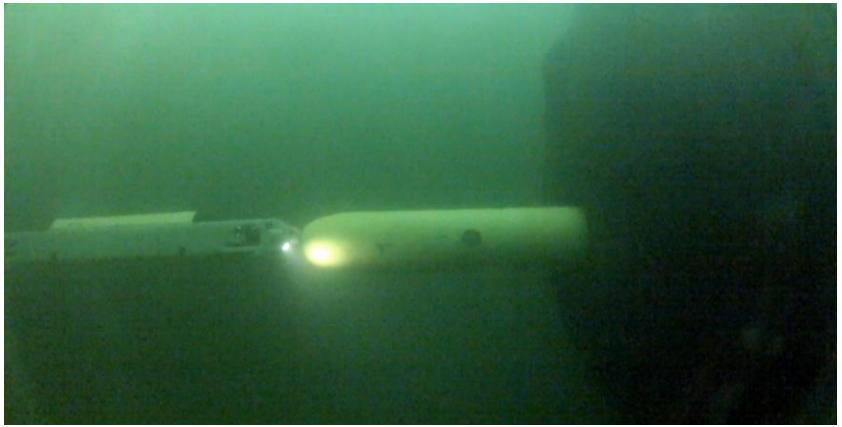
2010 - FMV decided to take the SAPPHIRES Demonstrator one step further - the Acoustic Target (AT) module was designed and constructed

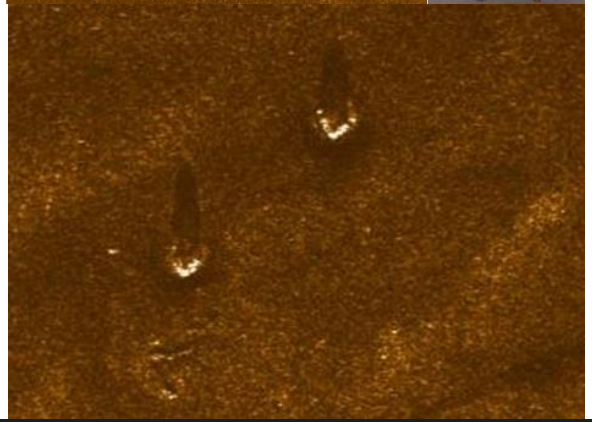


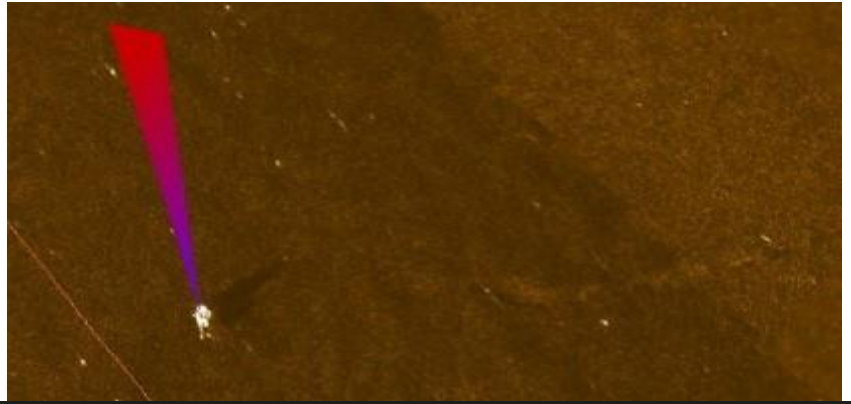


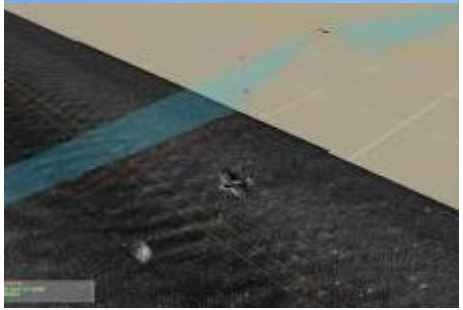
AUV 62 System –SAPPHIRES







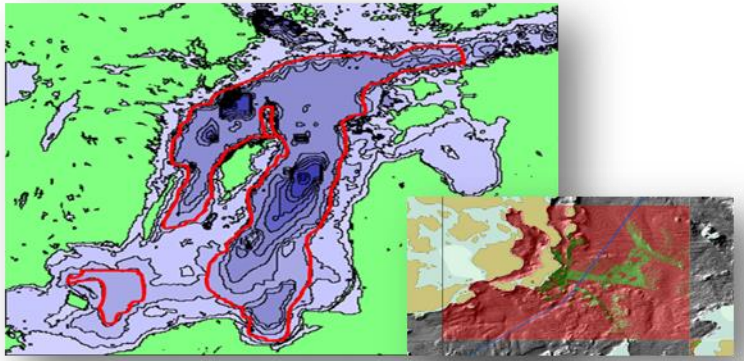




Background for implementing AUV62-AT Acoustic Target

Environmental conditions in the Baltic Sea

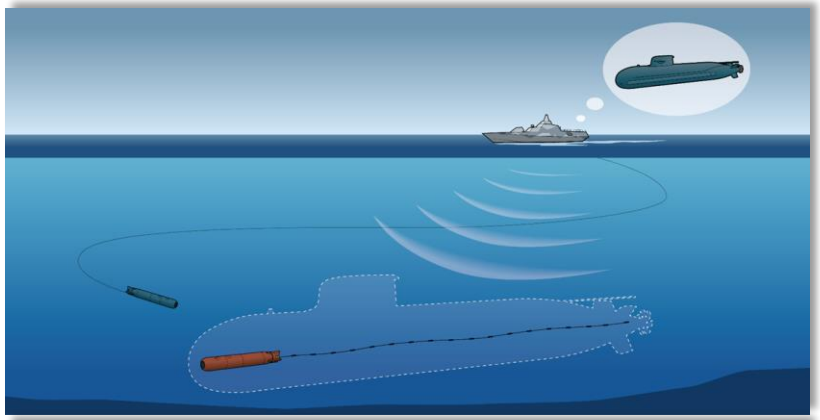
- Shallow waters
- Sea floor topography
- Sea floor material
- Brackish water
- Thermoclines
- Sea traffic intensity

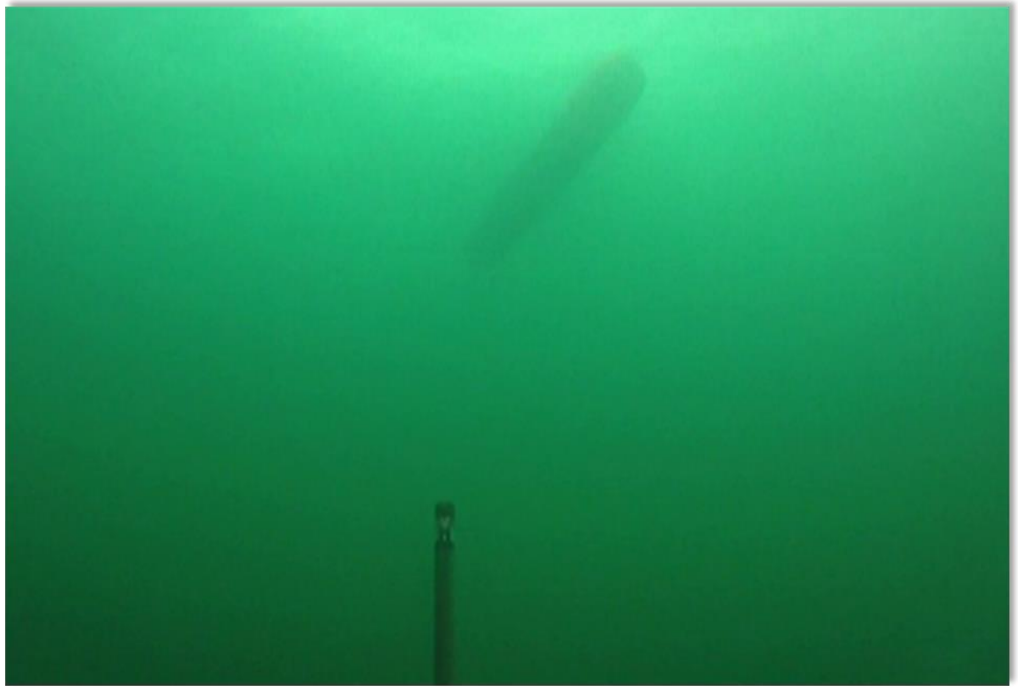


Submarines are a limited and expensive ASW training resource

AUV-systems can provide cost efficient ASW bulk training

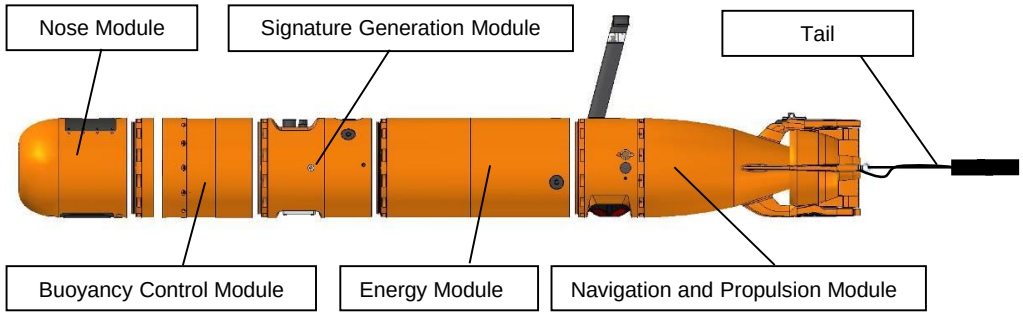
Vision for implementing AUV62-AT





Development and use of the AUV62-AT

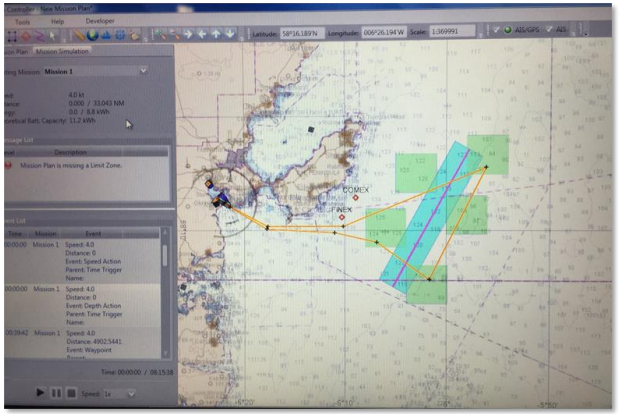
- Modular design
- Multiple comlinks
- Pumpjet propulsion
- Different tail configurations (length/active/passive)
- Rugged design

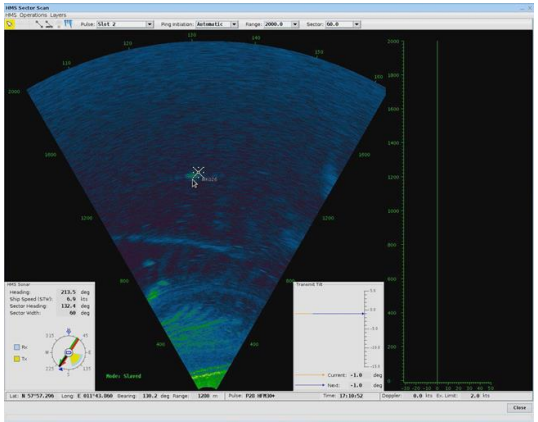


Development and use of the AUV62-AT

Key funtions:

- AUV62-AT can handle multiple units simultaneously
- Entire chain locate/track/attack can be trained
- Joint actions can be trained, such as ship/ship or ship/helicopter cooperation.
- AUV62-AT can also be used as torpedo target during exercises





Development and use of the AUV62-AT

Mission planning and evaluation:

- Flexible planning – adapt on the go
- Preparation of routes and active/passive signals
- Real time position prediction in mission planning system with overlay functions such as charts and AIS data.
- A single crew can operate more than one vehicle simultaneously
- On board evaluation possible for rapid feedback during excersice
- Advanced evaluation possible through combined data processing

AUV62-AT – Business model for SwAF

GOCO business model for KUT (Advanced ASW-target Service):

- Flexible and cost efficient introduction of new system
- Cost efficient solution for a system consisting of a few items
- Seamless transition of operation from contractor to SwAF during expansion of system size
- Flexible system operation - level of service provided by contractor can alter.

AUV62-AT – Business model for SwAF

Benefits:

- Eliminates need for SwAF personell to operate and maintain the systems
- Skilled personell for efficient service, repairs and modifications
- No need for storage and handling facilities or transportation for SwAF
- Less administration
- Integrated Project Team (IPT)
- Saab can operate the AUV:s from own or SwAF platforms

AUV62-system – Research and development

Use of collected data and combined experience

- Continous improvment, development, research
- Cooperation between SwAF, Swedish Defence Materiel Administration, Swedish Defence Research Agency and SAAB.
- The modular design allows for easy upgrades/maintenance and implementation of new payload modules for new capabilities

AUV-62 is also used as an important V&V asset for other projects by Swedish Defence Materiel Administration, Swedish Defence Research Agency and SAAB.

AUV62-system – Research and development

Examples of future applications:

- Decoy
- Reconnaissance
- Harbour protection
- MCM (Sea floor mapping/classification and object identification)
- Mobile communication node for sensor node network

SMaRC – Swedish Maritime Research Center

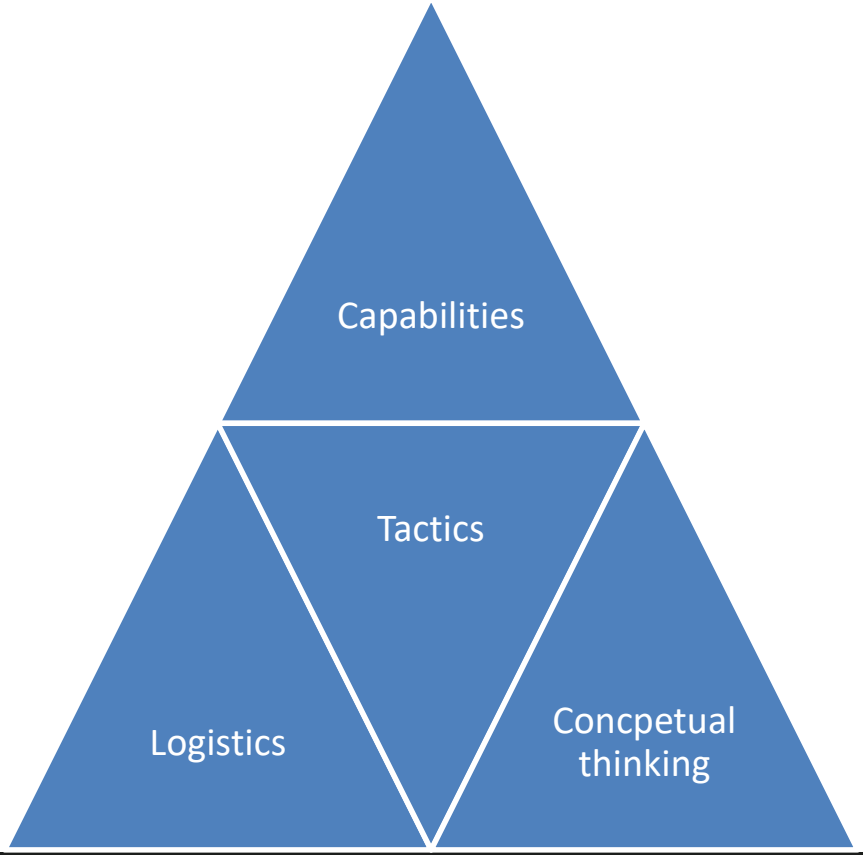
- Triple-Helix national industrial research center funded by the Swedish Foundation for Strategic research
- 7 years with a total project budget of >200MSEK
- Focus on Maritime Robotics
- Research areas:
  - Autonomy
  - Communication
  - Endurance
  - Perception
- Working groups now at full speed with effective collaboration between all participants

SMaRC – Swedish Maritime Research Center

Benefit Areas:

- Ocean production
- Safeguarding Society
- Environmental Monitoring
- Main challenges
- Reduced human interaction
- Long-term presence
- Operations in Unknown Waters

Transition from manned- to unmanned systems



Transition from manned- to unmanned systems

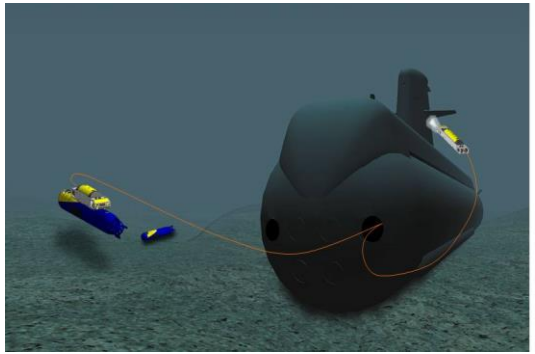
Capabilities

- What is the purpose of using the system?
- What advantages does it have compared to existing systems
- Set up a system to maintain and evolve capabilities
- Set up a system to develop new capabilities

Transition from manned- to unmanned systems

Mission tactics

- Adaptations and development based on the capabilities of the system and the tasks it has to perform.
- System perspective
- Involve and prepare system users in the process of creating and integrating new or modified tactics
- Continous reevaluation of mission tactics to ensure continous improvements



Transition from manned- to unmanned systems

Logistics

- Adaptations and development to support platform capabilities and mission tactics.
- Consider where and how the AUV-system is used.
- Consider aspects such as:
  - Reliability and mean time between failure
  - Transportation
  - Demand for field repairs and infrastructure to support it
  - Security

Transition from manned- to unmanned systems

Conceptual thinking

- Optimize integration of unmanned systems and their chain of logistics on existing platforms to maximize system performance
- Consider existing and future use and handling of unmanned systems and their chain of logistics during platform design.
- Consider use and handling of unmanned systems and their chain of logistics from a user perspective on different levels (operators/units/flottillas) and adapt accordingly

Transition from manned- to unmanned systems

Swedish conclusions – some examples for optimizing use of AUV:s

- Delegate decision making of lower tasks to lower level (man/machine)
- Consider transport to operating area and launch- and recovery sites – from land or from platform at sea?
- Consider mission duration and task (example: is ROV or AUV best choice?)
- Minimize AUV idle time
- Size versus capabilities and numbers
- Use AUV:s for V&V activities and platform health checks

Overall summary

- Sweden has 20+ years of experience of development and use of AUV systems for MR and ASW training.
- The AUV62-system is a reliable and versatile modular platform enabling evolutionary development and seamless incorporation of new capabilities.
- The AUV62 is frequently used for V&V- and R&D activities by the Swedish Defence Materiel Administration, Swedish Defence Research Agency and SwAF.
- Continous R&D acitivities are ongoing both for existing and new capabilities.
- SMaRC is an important piece of building strategic national competence in autonomous underwater systems and their applications
- Transition to unmanned systems require a new operative perspective and new methods to be successful.

Questions?