



From Toy to Product The SeaCat Story

Joerg Kalwa
Productmanager UUV

... a sound decision

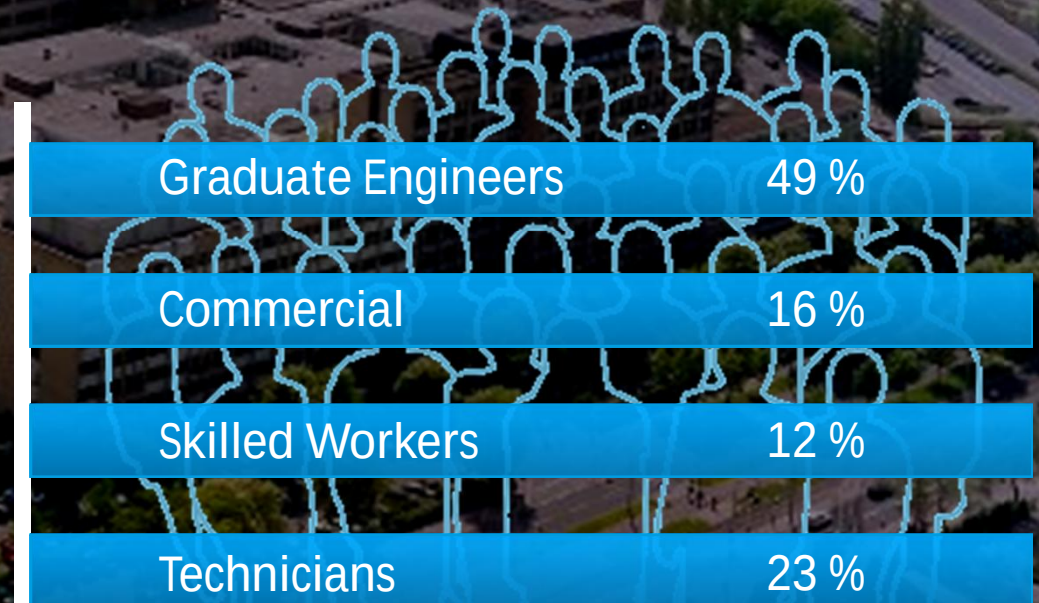
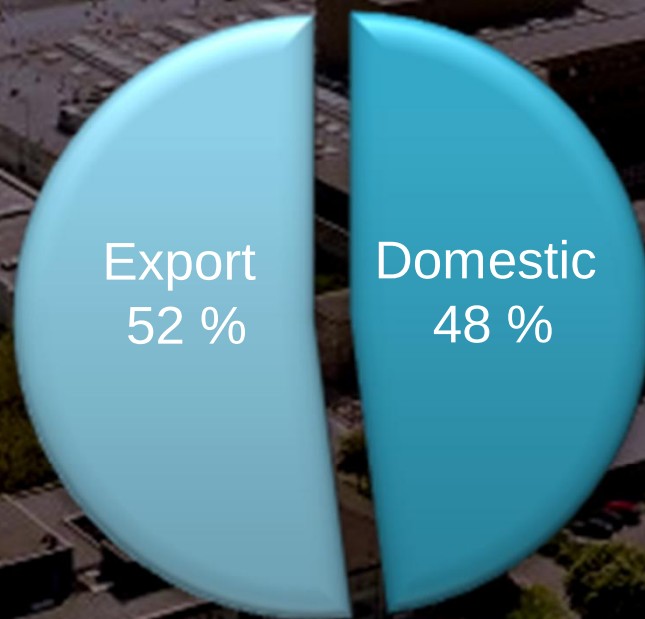


ATLAS ELEKTRONIK Group Turnover and Employees

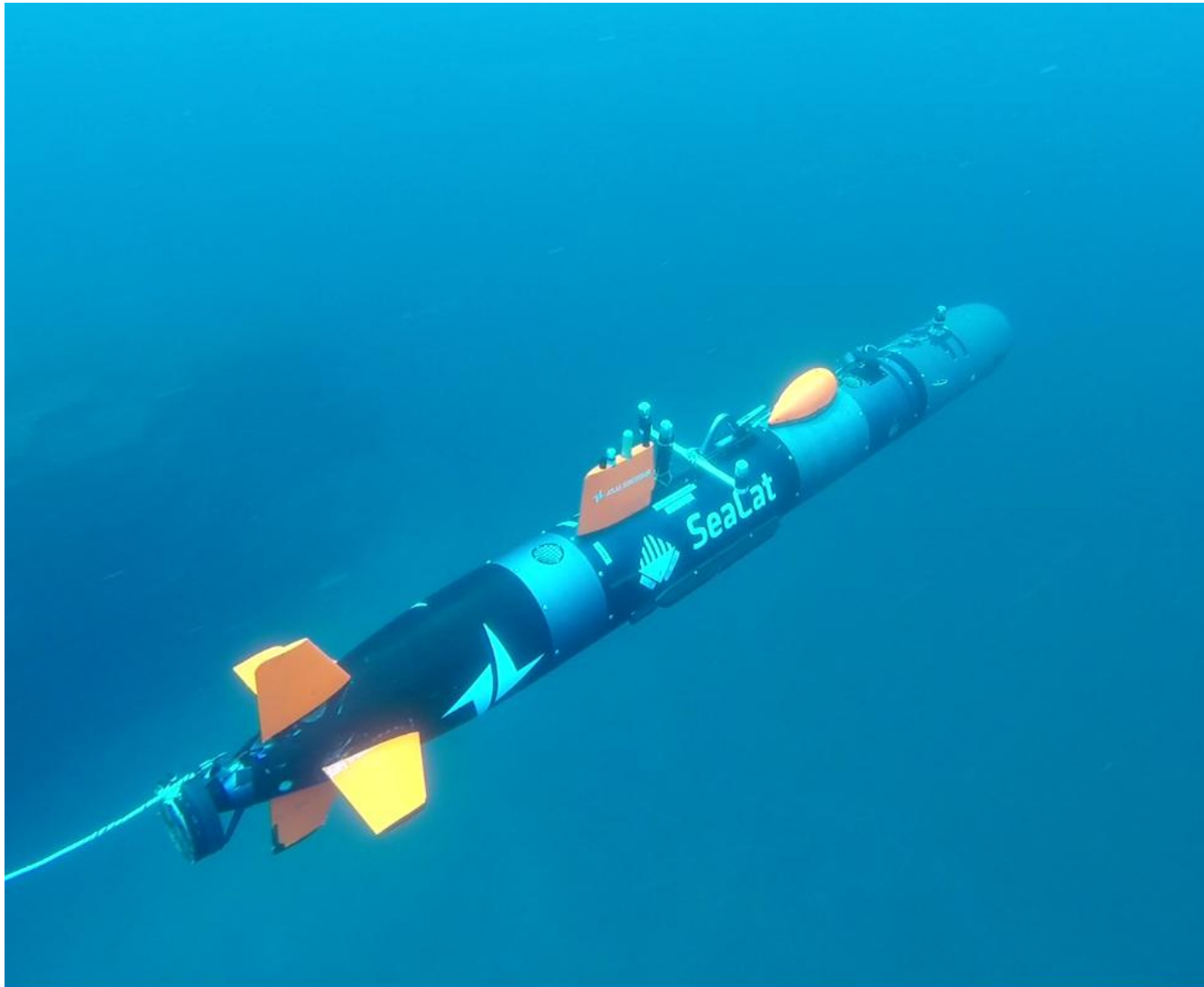
Annual Turnover: 407 Mio. €

2053 employees worldwide

approx. 1300 in Bremen (approx. 1550 in Germany)



ATLAS Hybrid AUV SeaCat

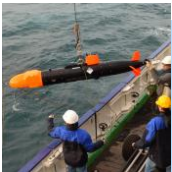


SeaCat

Key Features



Fast Mobilisation
due to low infrastructure requirements



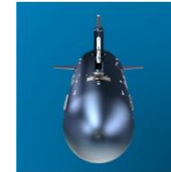
Excellent handling qualities
building on excellent manoeuvrability and
field proven launch and recovery systems



Adaptivity
field-exchangeable sensor technology –
SwapHeads®



Hybrid Operation
allows detailed inspection on objects detected in
a prior wide area mapping mission

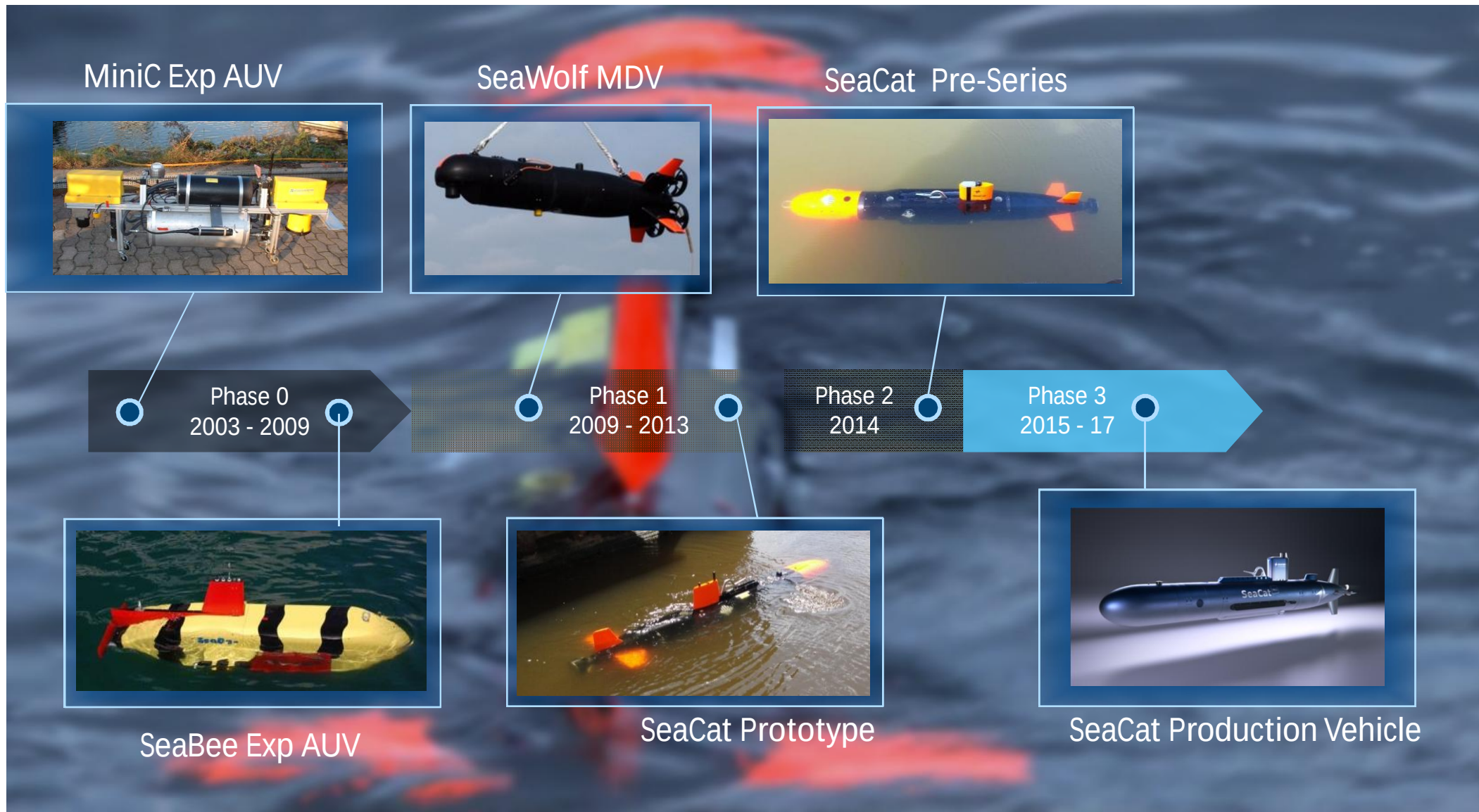


Dimension

*) depending on configuration

Length	> 2.3 m*
Width	~ 0.4 m
Weight	> 260 kg*
Depth rating	600 m
Payload	Up to 35 kg
Speed	- 0.5 ... 6 kts
Endurance	Up to 20 h @ 4 kts

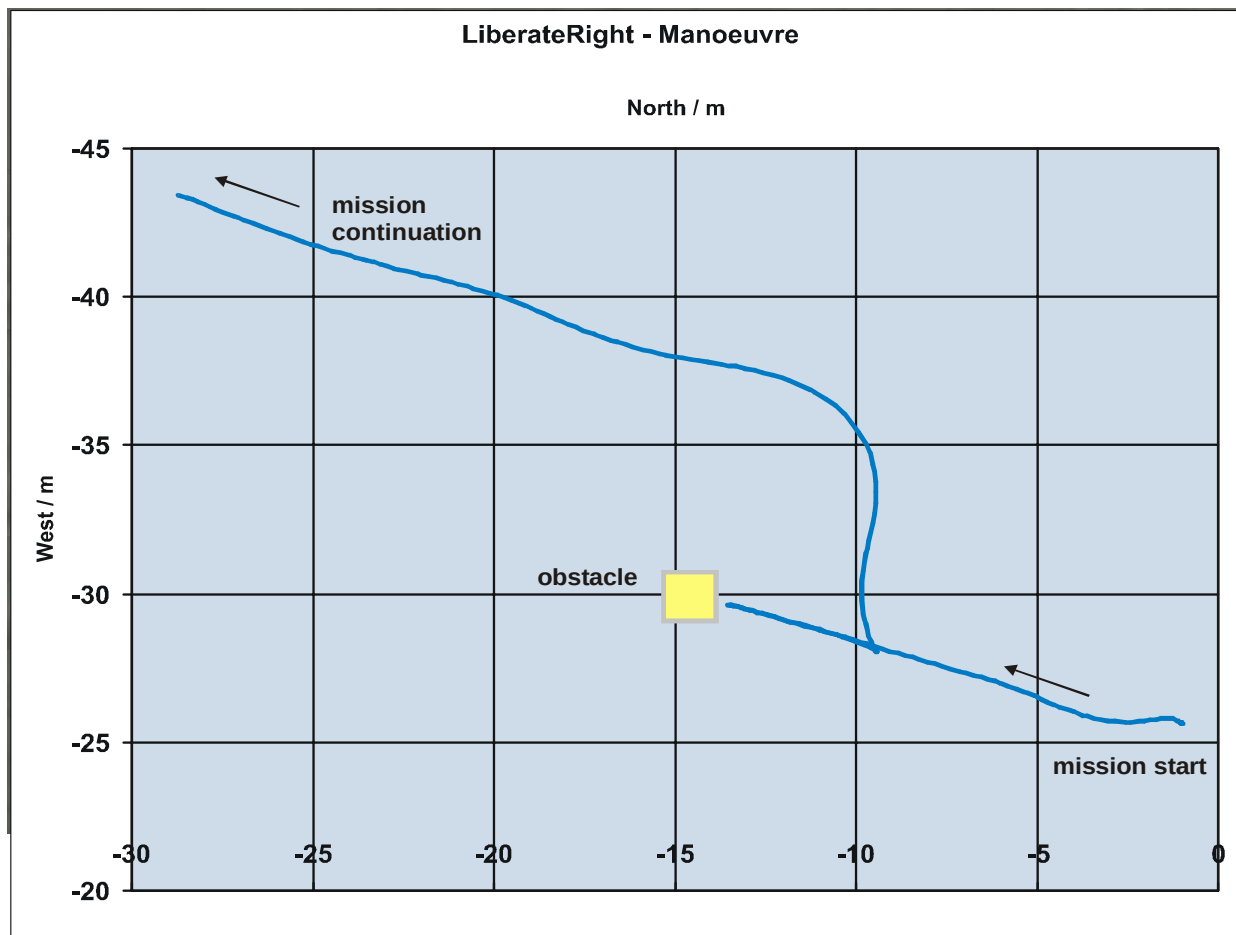
SeaCat History



The Beginning:

2000-2003: ADVOCATE (Advanced Onboard Monitoring...)

- n Open frame test Vehicle „MiniC“ for project ADVOCATE
- n Project goal: advanced onboard diagnosis and recovery using artificial intelligence
- n Use of backup- and recovery mission plans



- n Length ca. 2 m
- n Weight ca. 80 kg
- n max Speed 2 - 3 kn
- n Endurance: ca. 3.0 hrs





Coordination and control of cooperating unmanned systems in uncertain environments

- n First realization of multi AUV control
- n Improvement of External Control and Replanning

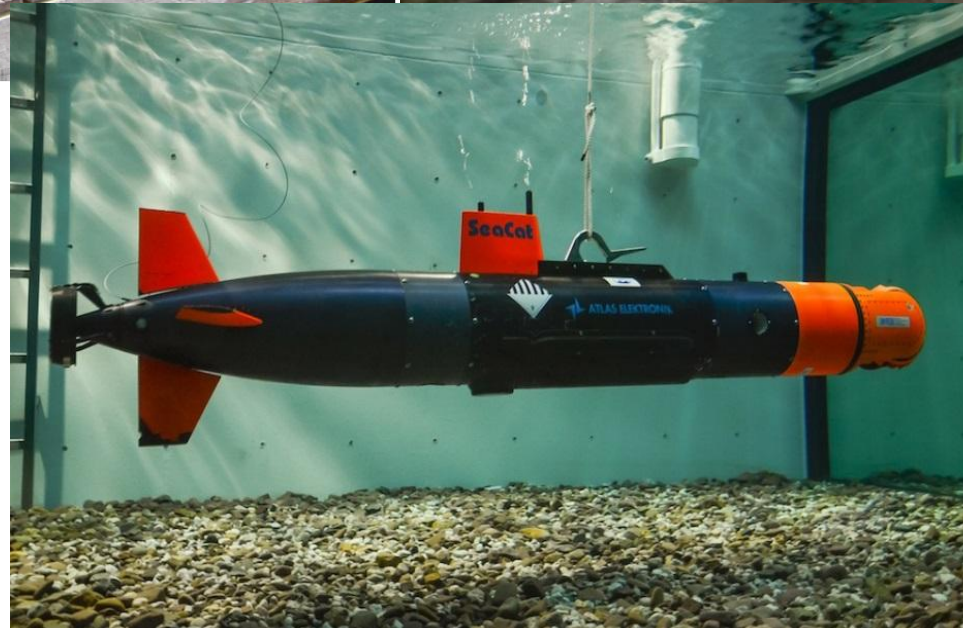


2009-2011: CView - Mapping of Harbour Structures

Beginning of SeaCat



- n Length: about 2.0 m
- n Weight: 112 kg
- n Typ. Speed: 2 - 3 kn (6 kn max)
- n Endurance: 1.5 – 2.5 hrs



- n Length: about 2.8 m
- n Weight: 130 kg
- n Typ. Speed: 3 - 4 kn (6 kn max)
- n Endurance: 6.0 – 8.0 hrs

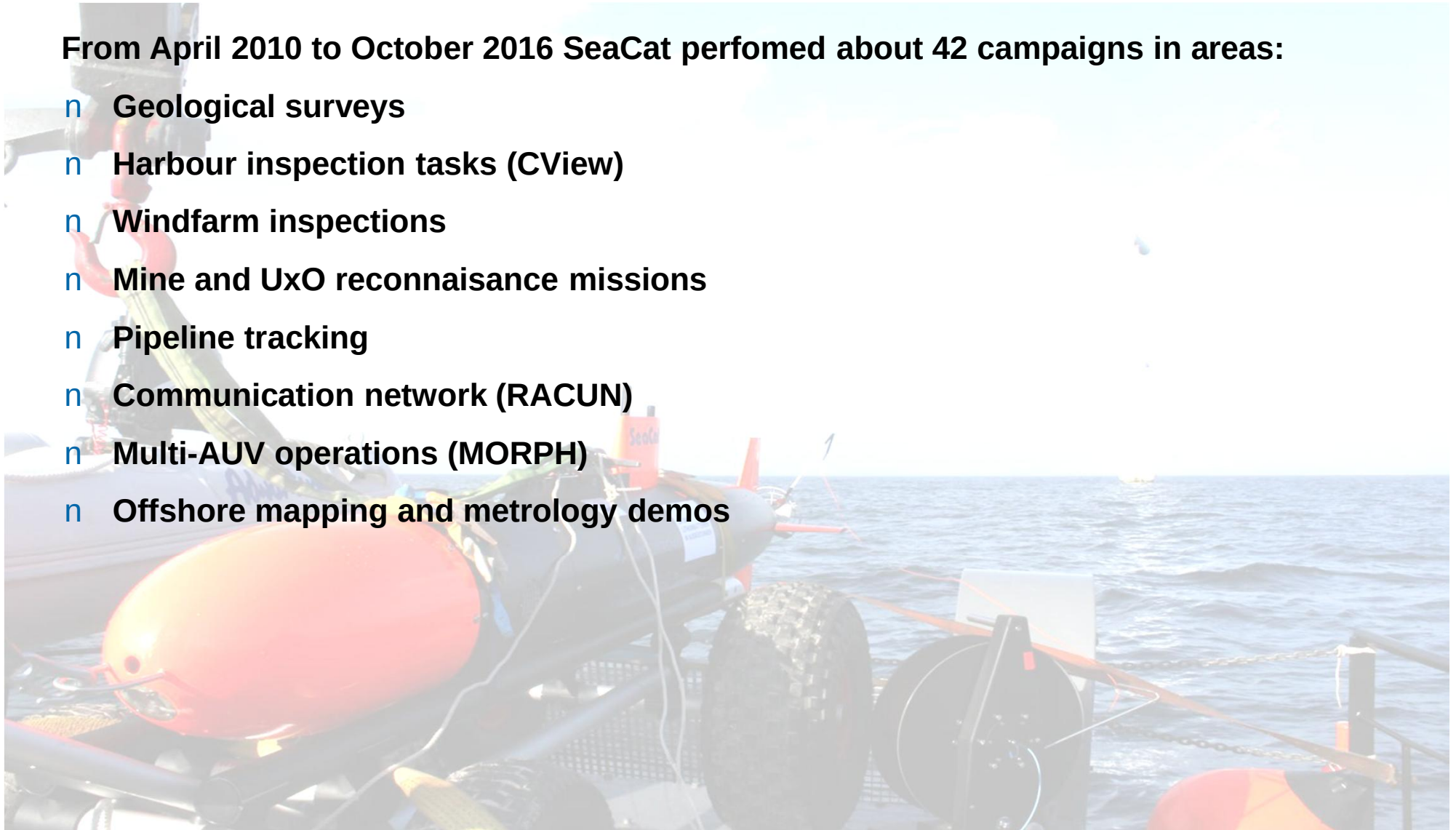
Hybrid AUV SeaCat – key feature: modularity and adaptivity



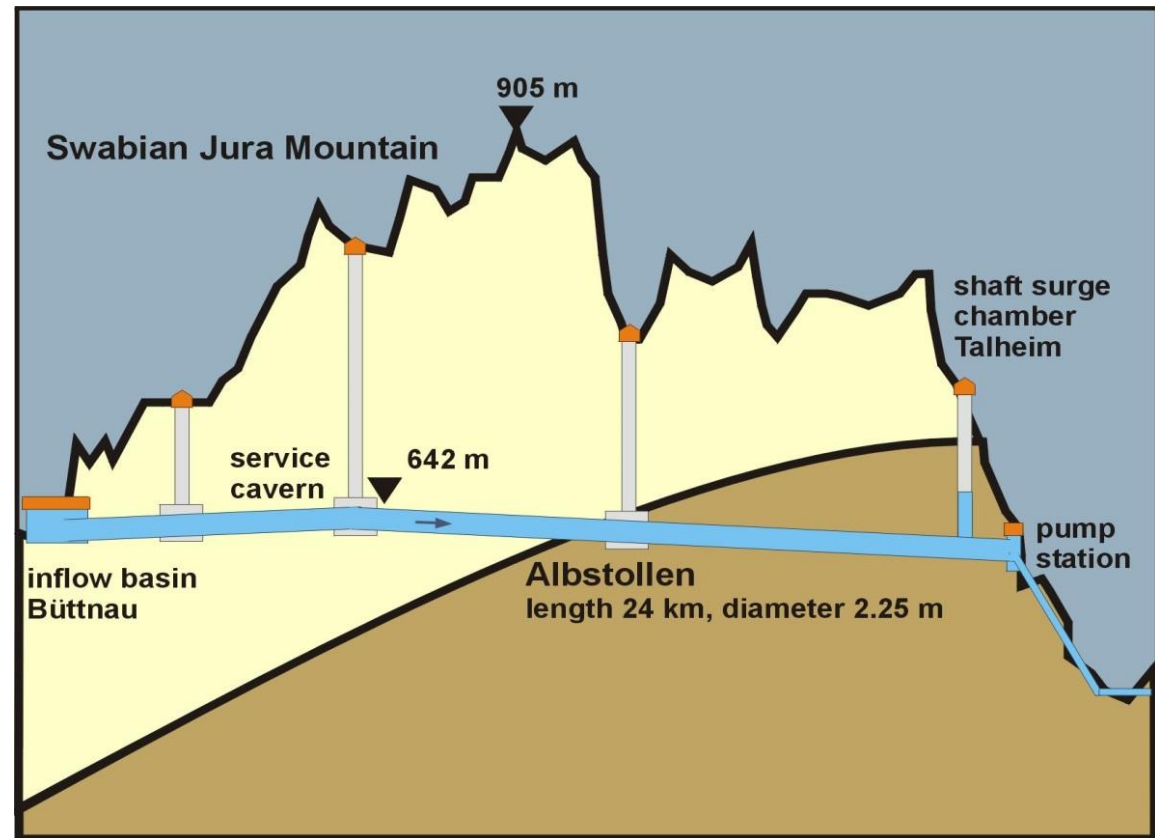
Track Record of the SeaCat Prototype

From April 2010 to October 2016 SeaCat performed about 42 campaigns in areas:

- n Geological surveys**
- n Harbour inspection tasks (CView)**
- n Windfarm inspections**
- n Mine and UxO reconnaissance missions**
- n Pipeline tracking**
- n Communication network (RACUN)**
- n Multi-AUV operations (MORPH)**
- n Offshore mapping and metrology demos**



March 2012: Inspection of 24 km Water Supply Pipe



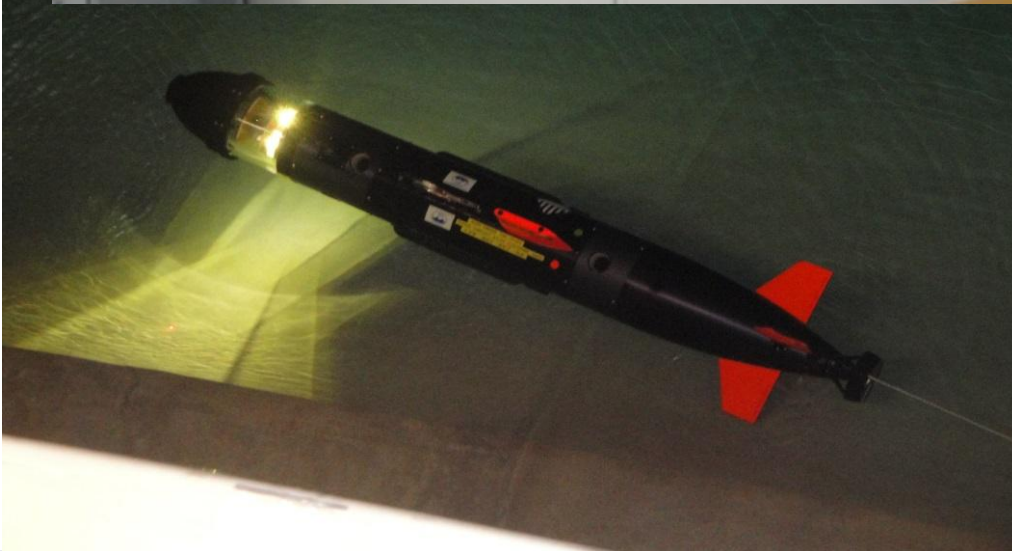
The challenge:

- n 24 km concrete tube
- n 2.3 m diameter
- n no intermediate access
- n mission to be terminated at right position

March 2012: Inspection of 24 km Water Supply Pipe



**The inspection head,
featuring 5 cameras and lighting**

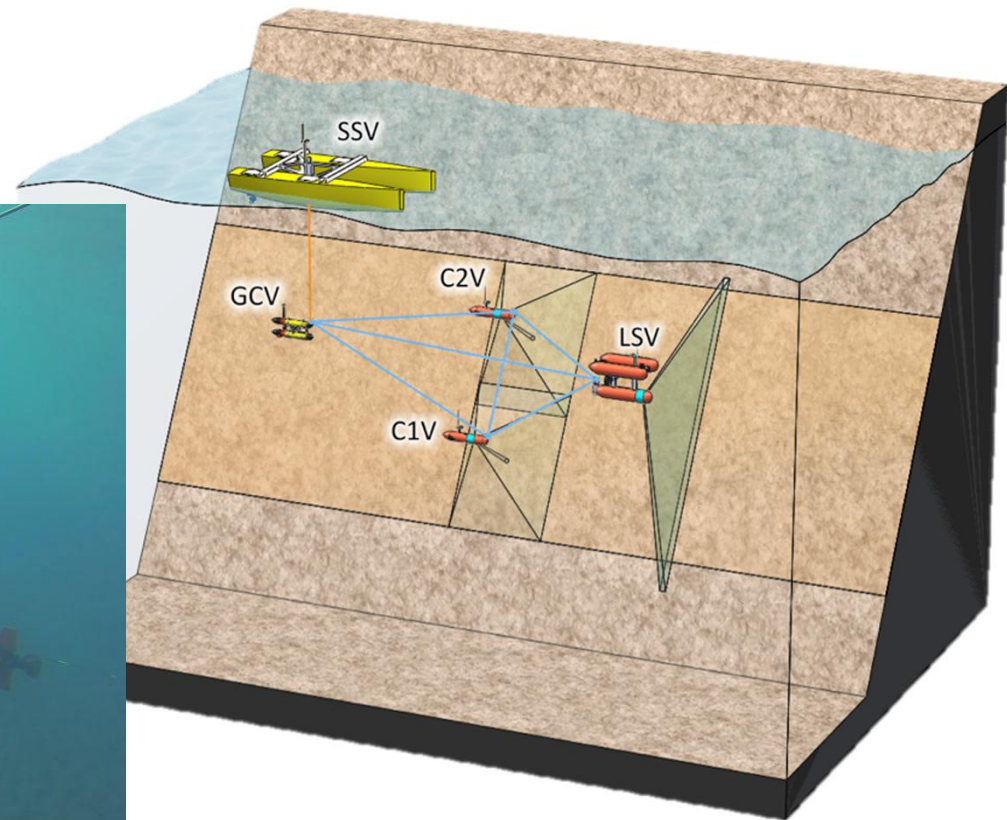
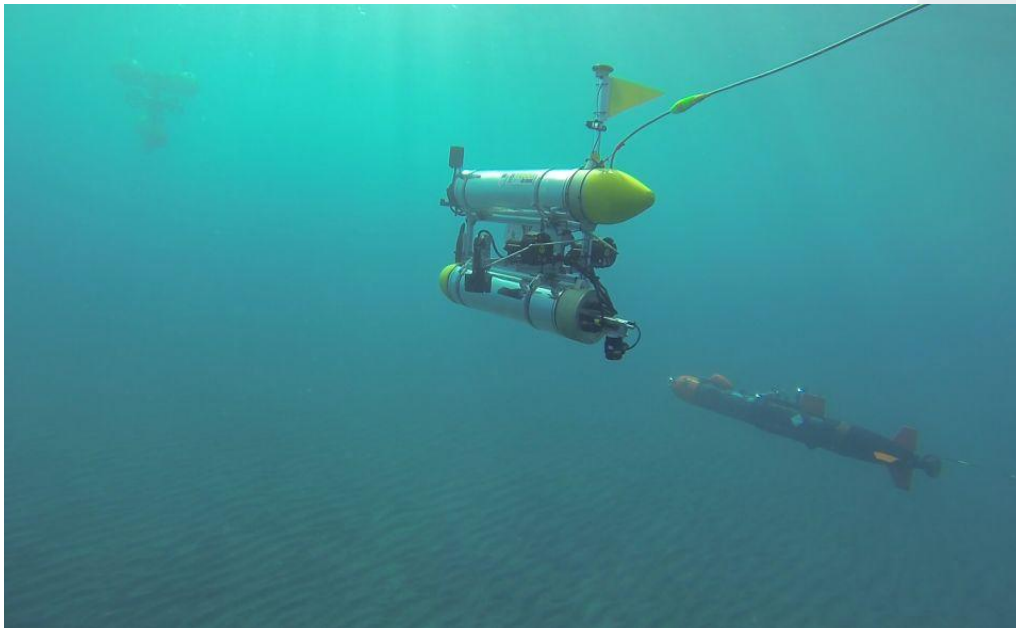
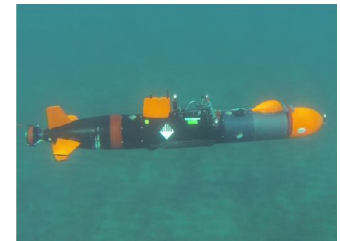
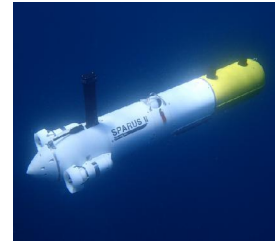


March 2012: Inspection of 24 km Water Supply Pipe



The Project MORPH (2012-2016)

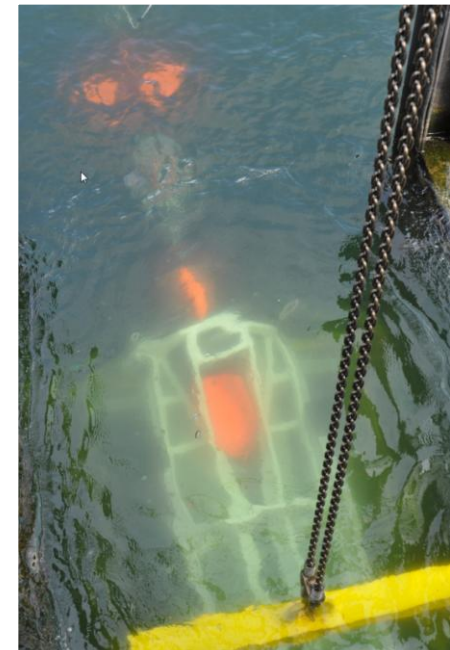
Cooperative Missions for mapping of underwater structures



Marine Robotic System of Self-Organizing, Logically Linked Physical Nodes

2015: Docking Trials

Using USBL Docking Trials



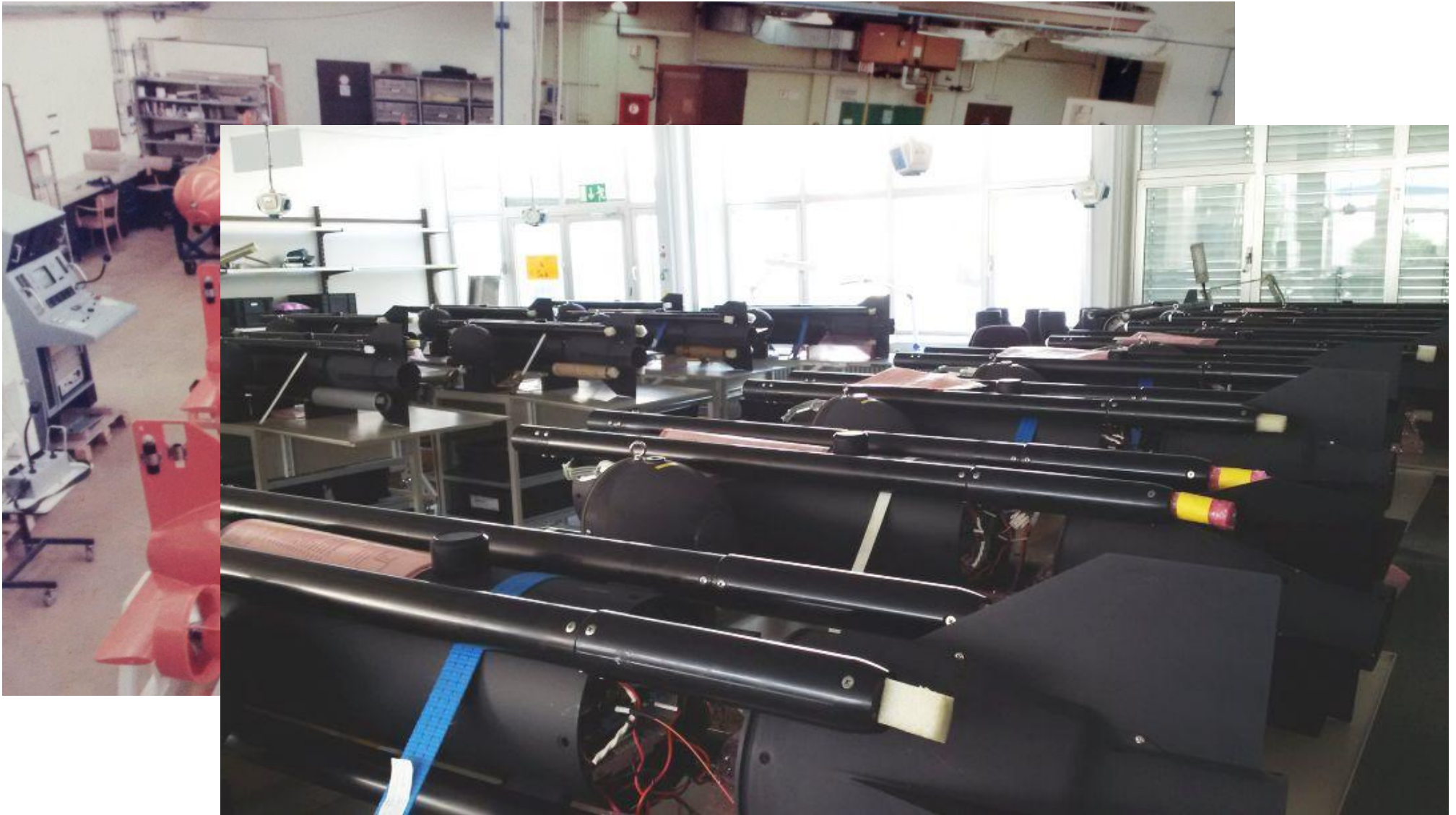
SeaCat becomes StrayCat



- n The StrayCat was (and is) a very valuable tool for exploring new concepts**
- n Prooved to be robust, versatile and of high usability**
- n What now?**

Industrial serial production at Atlas

Penguin B3 + SeaFox Mine Disposal Vehicles



SeaCat Hybrid AUV

Standards – because quality matters

Standards and Qualification

- BV 0430 (shock)
- BV 0240 (vibration)
- Mil Std 810 G (environmental tests)
- DIN EN 60529 (VDE 0470-1) (electrical safety)
- CE Conformity
- MIL STD 461 F (EMC)
- DNVGL I-5-3 (Unmanned Submersibles)
- BV 0420 (magnetic safety on board naval ships)
- UN38.3 (safety regulations for dangerous goods)



From Toy to Product

Major changes:

- n Hardware redesign:**

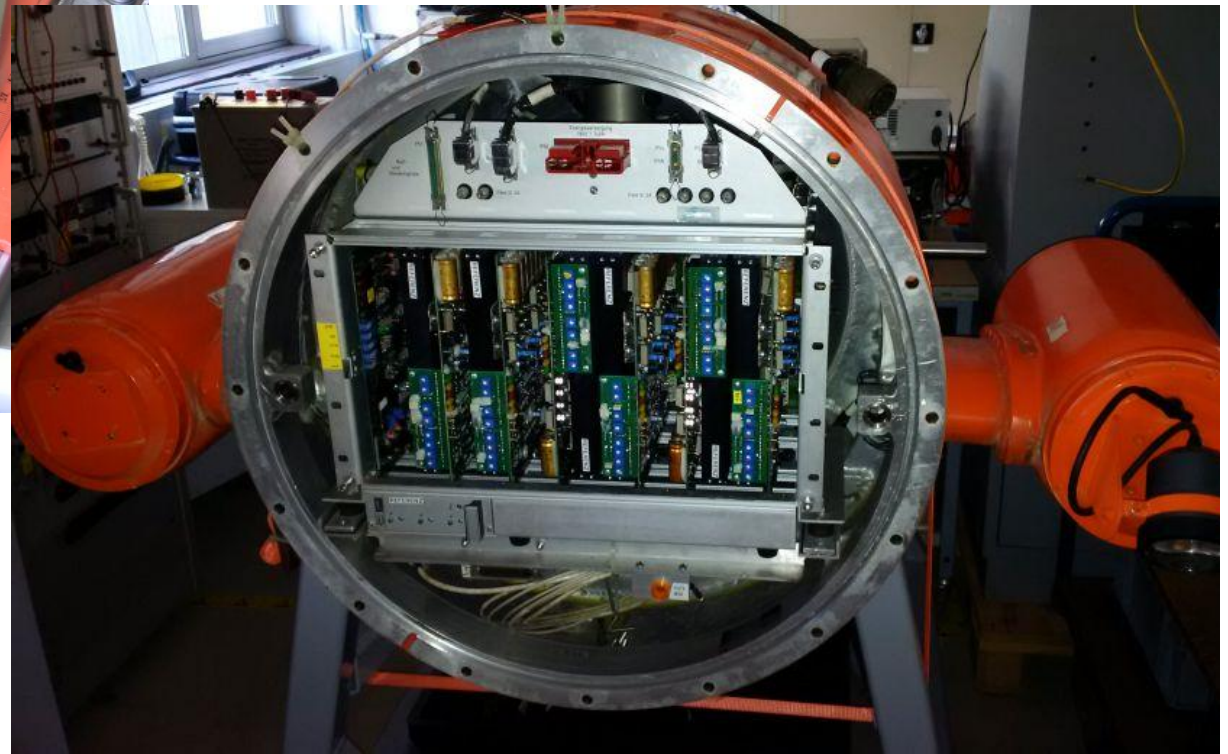
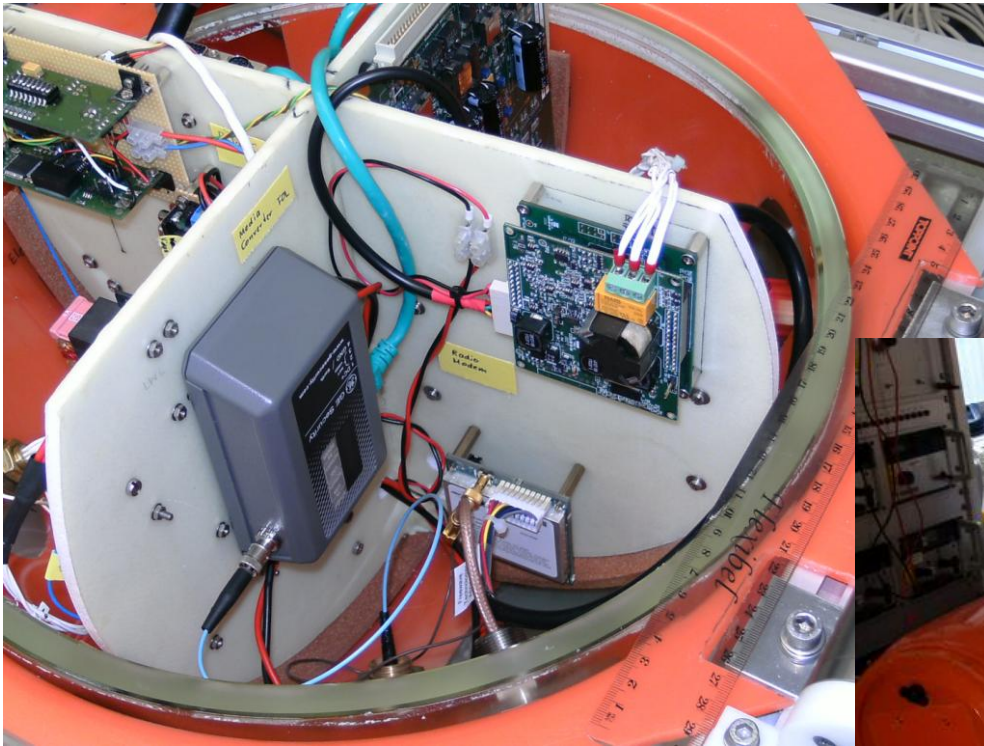
- n Hull redesign: 600 m design depth (720 m tested, 900 m calculated)**
- n Junction of sections modified (based on torpedo design)**
- n Commercial consumer electronics replaced by components of industrial standards**
- n Electronics design to EMC Standards (cabling, connectors)**
- n Underwater communication, USBL transponder, and ELP.**
- n New lithium ion batteries, UN 38.2 certified, 1,6 kWh per module**

- n Software redesign:**

- n strict agile process: requirements, design, coding, test**
- n Unit-, Integration-, System-, and Acceptance testing**
- n Hardware in the loop testing**

From Toy to Product

SeaBee vs Penguin B3 and SeaCat



SeaCat Hybrid AUV Product Family



SeaCat Prototype



SeaCat



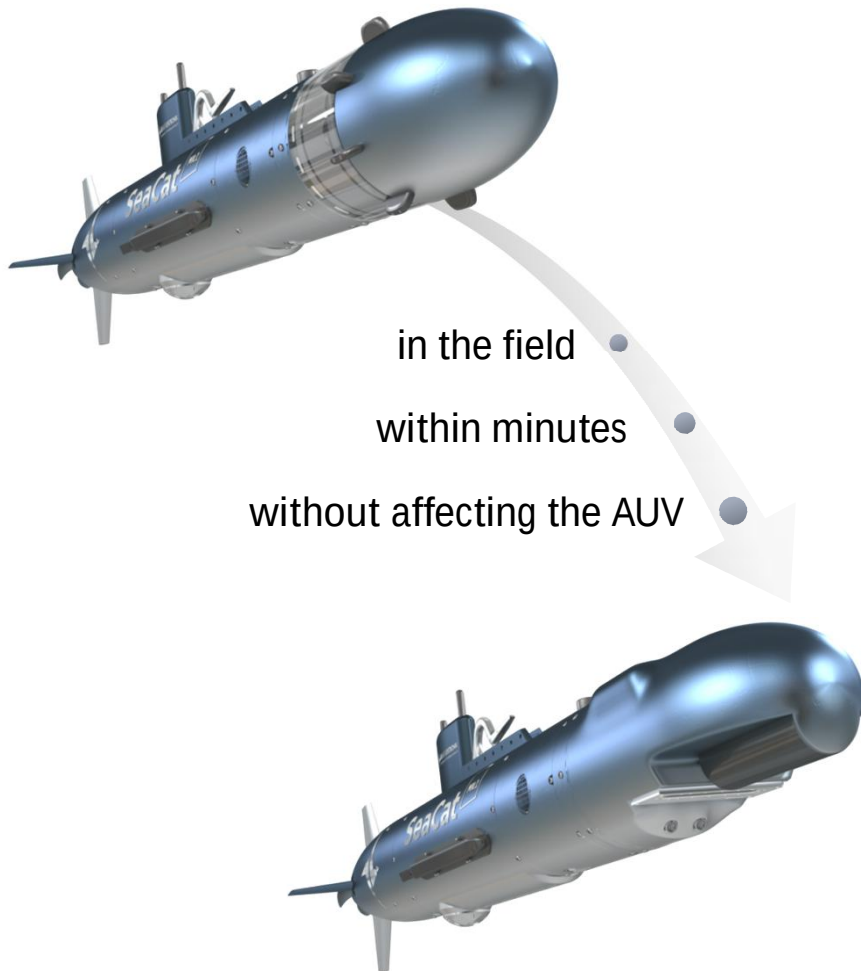
SeaCat ER



SeaCat SAS

SeaCat Hybrid AUV

Adaptivity: Expand capabilities by plug & play SwapHeads



Survey Heads



Inspection Head



Water Quality Head



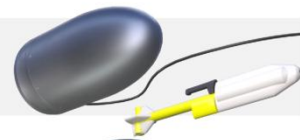
Tunnel Inspection Head



Harbour Inspection Head



Geo Magnetics Head



Subbottom Head



Customised Applications Head

SeaCat Hybrid AUV

Documentation

External technical documentation

- Description
- Manual
- Maintenance Description
- Illustrated Spare Parts Catalogue

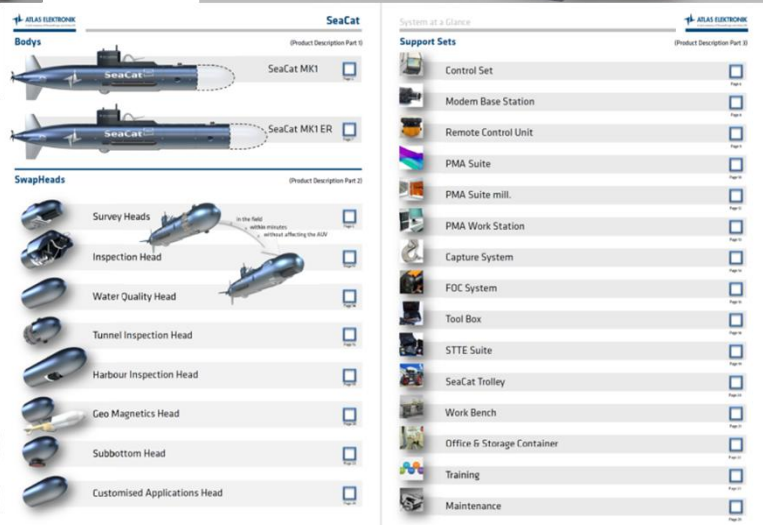
Interactive Electronic Technical Manual

- IETM Level 2 searchable .pdf-files with hyperlinks and jump marks



SeaCat Hybrid AUV

Supply



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... a sound decision

