From Toy to Product
The SeaCat Story

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... a sound decision
ATLAS ELEKTRONIK Group

Turnover and Employees

Annual Turnover: 407 Mio. €

2053 employees worldwide
approx. 1300 in Bremen (approx. 1550 in Germany)

Export
Domestic
52 %
48 %

Graduate Engineers
Commercial
Skilled Workers
Technicians
49 %
16 %
12 %
23 %
ATLAS Hybrid AUV SeaCat
SeaCat

Key Features

**Fast Mobilisation**
due to low infrastructure requirements

**Excellent handling qualities**
built 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

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**Dimension**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>&gt; 2.3 m*</td>
</tr>
<tr>
<td>Width</td>
<td>~ 0.4 m</td>
</tr>
<tr>
<td>Weight</td>
<td>&gt; 260 kg*</td>
</tr>
<tr>
<td>Depth rating</td>
<td>600 m</td>
</tr>
<tr>
<td>Payload</td>
<td>Up to 35 kg</td>
</tr>
<tr>
<td>Speed</td>
<td>0.5 ... 6 kts</td>
</tr>
<tr>
<td>Endurance</td>
<td>Up to 20 h @ 4 kts</td>
</tr>
</tbody>
</table>

*) depending on configuration
SeaCat History

Phase 0
2003 - 2009

Phase 1
2009 - 2013

Phase 2
2014

Phase 3
2015 - 17

MiniC Exp AUV
SeaWolf MDV
SeaCat Pre-Series

SeaBee Exp AUV
SeaCat Prototype
SeaCat Production Vehicle
The Beginning:
2000-2003: ADVOCATE (Advanced Onboard Monitoring...)

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

- Length ca. 2 m
- Weight ca. 80 kg
- max Speed 2 - 3 kn
- Endurance: ca. 3.0 hrs
2006-2009 SeaBee Research AUV used in GREX

Coordination and control of cooperating unmanned systems in uncertain environments

- First realization of multi AUV control
- Improvement of External Control and Replanning
2009-2011: CView - Mapping of Harbour Structures
Beginning of SeaCat

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

- Length: about 2.8 m
- Weight: 130 kg
- Typ. Speed: 3 - 4 kn (6 kn max)
- 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:

- Geological surveys
- Harbour inspection tasks (CView)
- Windfarm inspections
- Mine and UxO reconnaissance missions
- Pipeline tracking
- Communication network (RACUN)
- Multi-AUV operations (MORPH)
- Offshore mapping and metrology demos
March 2012: Inspection of 24 km Water Supply Pipe

The challenge:
- 24 km concrete tube
- 2.3 m diameter
- no intermediate access
- 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
The StrayCat was (and is) a very valuable tool for exploring new concepts
Prooved to be robust, versatile and of high usability
What now?
Industrial serial production at Atlas
Pinguin 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:

- **Hardware redesign:**
  - Hull redesign: 600 m design depth (720 m tested, 900 m calculated)
  - Junction of sections modified (based on torpedo design)
  - Commercial consumer electronics replaced by components of industrial standards
  - Electronics design to EMC Standards (cabling, connectors)
  - Underwater communication, USBL transponder, and ELP.
  - New lithium ion batteries, UN 38.2 certified, 1.6 kWh per module

- **Software redesign:**
  - Strict agile process: requirements, design, coding, test
  - Unit-, Integration-, System-, and Acceptance testing
  - Hardware in the loop testing
From Toy to Product
SeaBee vs Pinguin 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

in the field within minutes without affecting the AUV
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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