

HUGIN 3000 GC

OPERATIONAL CHALLENGES FLEXIBLE SOLUTIONS TO

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Agenda

- ◆ Geo ASA and Geoconsult - a short presentation
- ◆ Hugin – Flexible solutions to operational challenges

Geo ASA – Key Figures

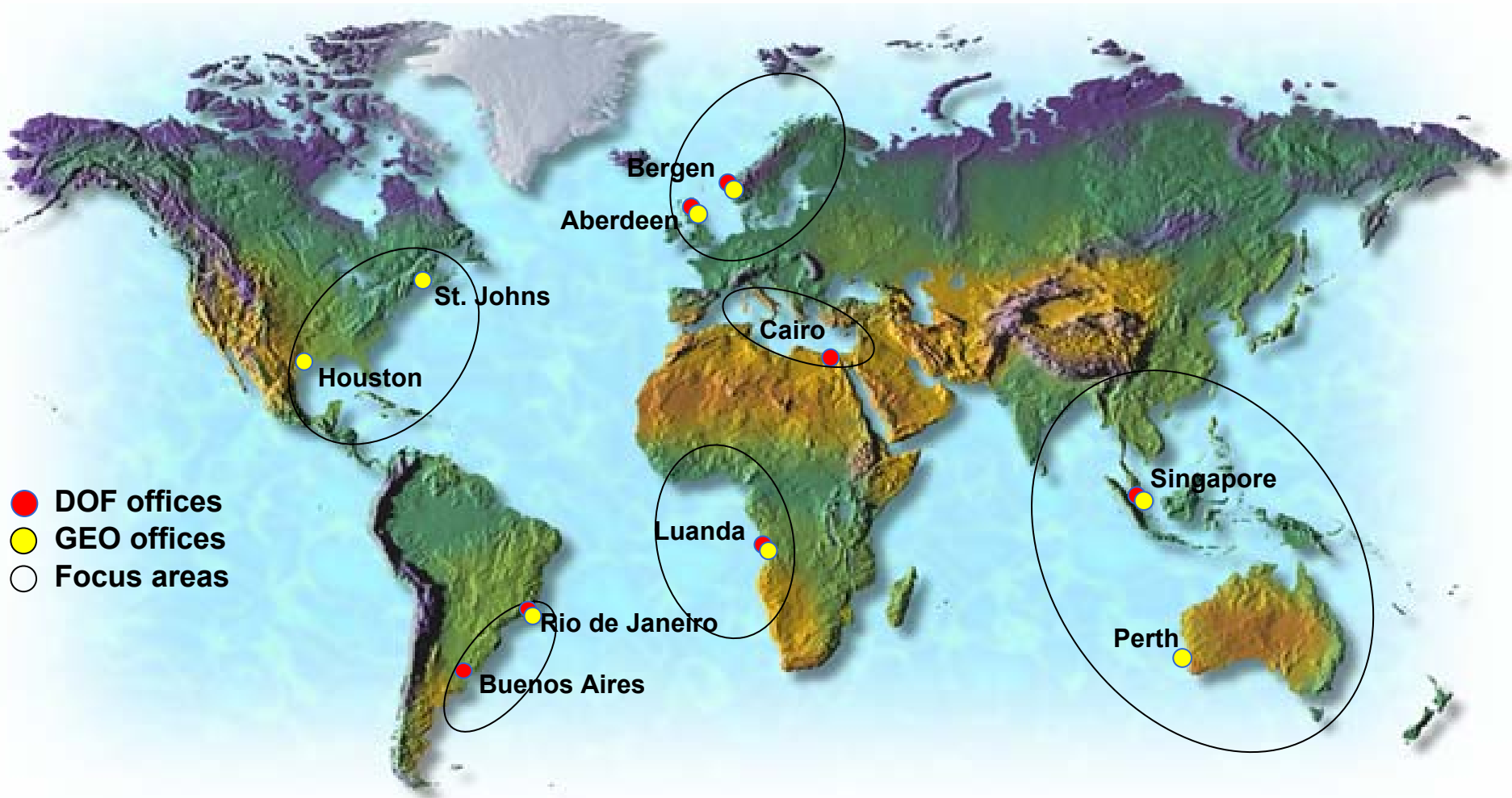
- ◆ Geoconsult established in 1979
- ◆ Acquisition of Geoconsult by DOF ASA , and incorporation of Geo ASA in May 2005
- ◆ Establishment of Geo Subsea in Singapore and Perth, Australia November 2005
- ◆ Aquisition of Century Subsea Ltd. (Aberdeen, Houston and St. John (Canada) in November 2005
- ◆ Total of 478* employees – including freelancers
- ◆ 14 vessels in operation
- ◆ 2 vessels under construction
- ◆ 17 Work - ROVs
- ◆ 3 Observation - ROVs
- ◆ 1 AUV/UUV



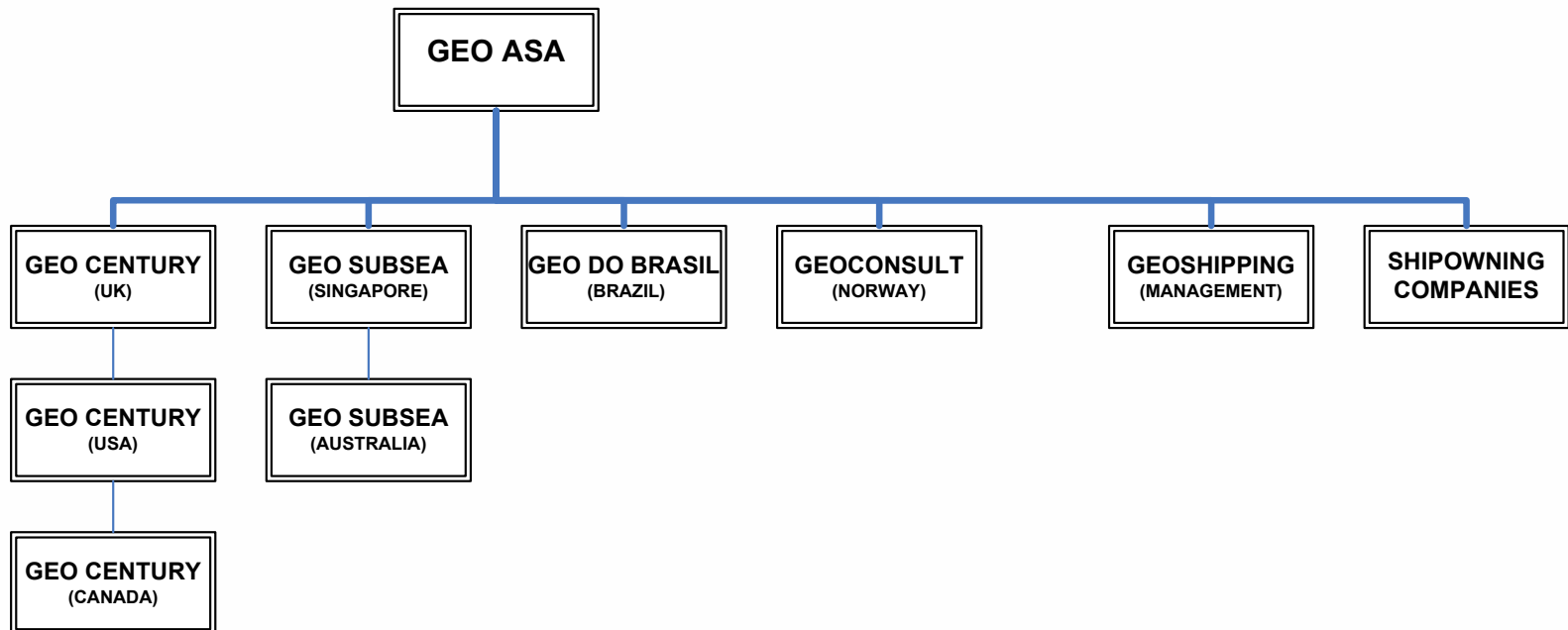
Geo ASA headquarter in Bergen, Norway

* Number of employees not including Geoshipping and vessel crew

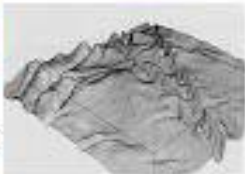
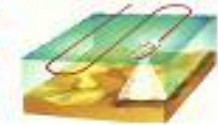
Current Presence and Focus Areas



Geo ASA – Company Structure

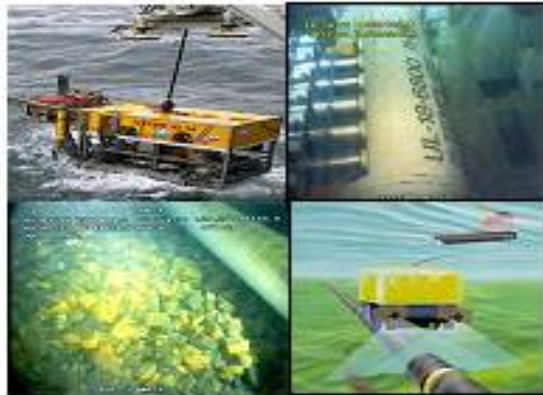


Geo provides a range of subsea services



Survey

- Bathymetric/Geophysical mapping
- Data Processing and Interpretation
- Subsea Positioning/metrology
- 3D Visualisation software
- Geotechnical Services
- Seismic Services
- Environmental Services



IMR

- Pipeline/Structure Inspection
- Module Handling
- ROV Services and Intervention
- Diving Services and Intervention

Construction Support

- Flowline and Umbilical installation
- Subsea Structures
- Tie-in Operations
- Lay Support
- Commissioning Support
- Subsea Cargo Salvage



Subsea Engineering

- Installation engineering
- Subsea Structures
- Intervention Tooling

Special Purpose Vessels – All Prepared for Hugin



Geo has one of the world's most advanced ROV/AUV fleet

Work class ROVs

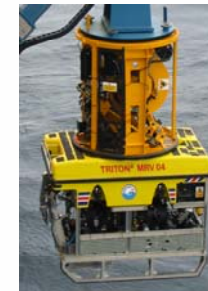
- 17 work class ROVs
- 3 observation class ROVs
- 1 AUV/UUV



Schilling UHD
(4x)



Triton XLS/XL
(7x + 2x)



Triton MRV4
(1x)



Triton / Scorpio
(3x)

Observation class ROVs



Comanche

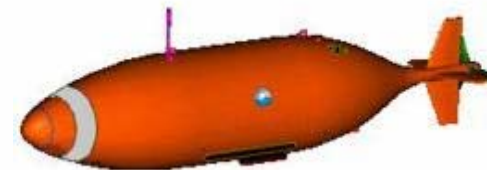


Mohican



Seaeye Tiger 845

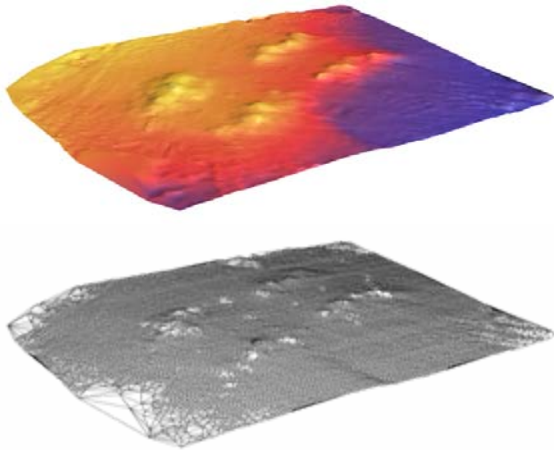
AUV



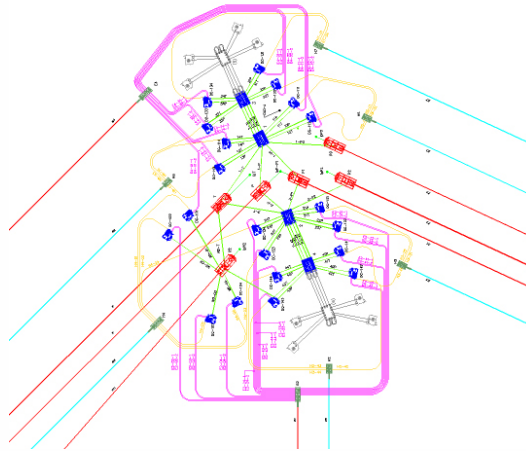
AUV/UUV - Hugin 3000-GC

Century ^{3D}

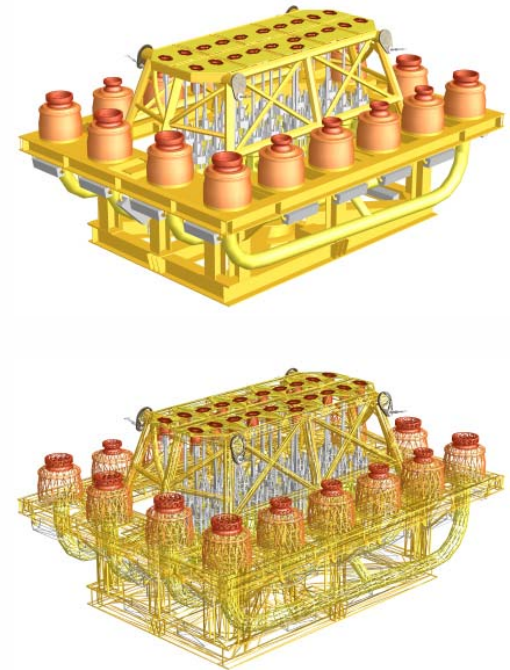
Core Data for 3D Visualisation



Digital Terrain Model



Field Layout Drawing



3D Models

Animation, Simulation and Real Time 3D Visualisation System for the Oil and Gas Industry

Hugin 3000-GC



General specifications

- ◆ Max depth 3000m
- ◆ 60+ hours endurance
- ◆ Speed ~4 knots
- ◆ Length 5.2m
- ◆ Diameter 1.0m
- ◆ 1500kg (dry) / 2500kg (wet)

Positioning

- ◆ INS (Inertial Navigation System)
- ◆ High accuracy pressure sensor
- ◆ Doppler log
- ◆ CTD sensor

Payload

- ◆ Simrad EM3000 - 120 dgrs - or
Simrad EM2000 - 150 dgrs
- ◆ Edgetech SSS (120/410kHz)
- ◆ Edgetech SBP (2-12kHz)
- ◆ Other sensors (optional)

Hugin - Flexible solutions to operational challenges

Challenges

- ◆ Multitasking
- ◆ Depth
- ◆ Temperature
- ◆ Route Complexity
- ◆ Survey Resolution

HUGIN has proved itself highly flexible both in terms of itself and as part of a wider equipment spread onboard several of Geoconsults vessels.

Multitasking

- ◆ **Data download and battery maintenance**
Whilst the UUV is on deck for data downloading and battery maintenance the vessel continues to work on other tasks.
 - ◆ **Waiting On Weather**
Similarly, some ROV operations are possible during periods of poor weather when the UUV can not be operated.
-
- ◆ This has been a scenario repeated on several projects, ROV inspection, video and “target and soil verification” to aid side scan sonar interpretation has been conducted whilst the UUV has been on deck.
 - ◆ With the UUV on deck, it is possible to perform e.g. reconnaissance surveys using hull mounted equipment before performing high resolution work with HUGIN.

In the Barents Sea with Hugin on Geobay

- ◆ **AUV/UUV (high res. MBE/SSS/SBP)**
- ◆ **ROV (Video and low fly SSS for target detection and soil verification)**
- ◆ **Geotechnical Sampling**

With such a spread mobilised the ability of the vessel to change from task to task, depending on weather or other factors resulted in almost zero downtime due to equipment failure or weather.



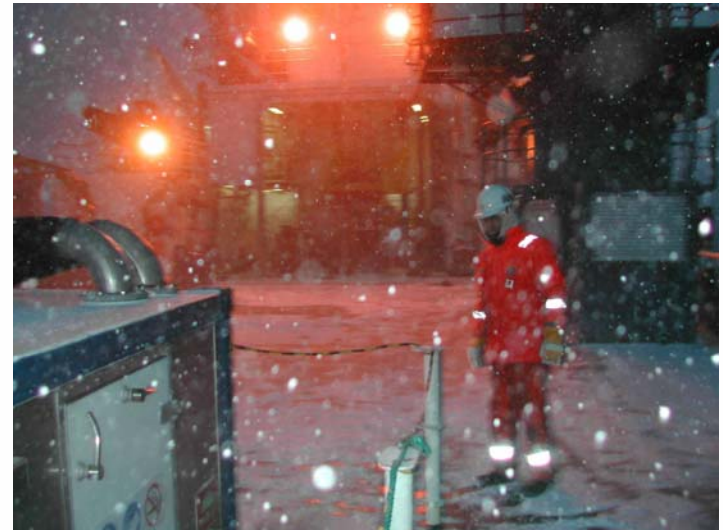
Mission preparation



ROV ready for launch in icy conditions



Killerwhale playing near Hugin



Rough conditions in Barents Sea

- Or on its own

Alternatively HUGIN can be run from a smaller vessel without other spreads mobilised. This has been done on a number of occasions in the Norwegian Sector.

Shallow or Deep?

The UUV can operate down to 3000 meters water depth

EM3000 -> 1500 meters of water

EM2000 1500 – 3000 meters of water

- ◆ Down to 2900 meters water depth (Deepest dive 2990)
- ◆ 120 meters to 2100 meters (Spain – Algerie)

This wide range of operational depths presents very different challenges for the vehicle and its operators, but has been proven on a number of occasions

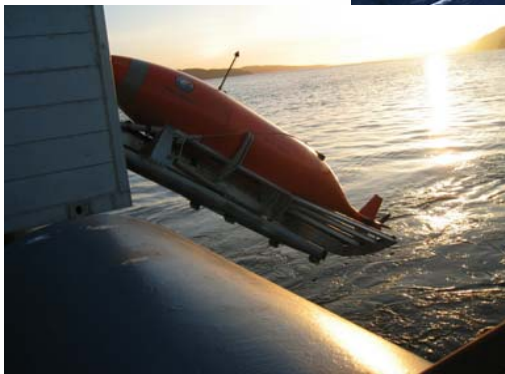
Vessel Flexibility

- ◆ Due to its modular make, HUGIN can be run from most of the vessels owned by the GEO Group and is therefore not dependent on vessel availability
- ◆ Given enough deck space the only other requirements are a pole for mounting the control and data modems and a minor modification to the APOS hardware and software.

HUGIN has been operated from the following vessels:

- ◆ **SV Geograph (59.5m long, 1035 Gross)**
- ◆ **SV Geobay (87.0m long, 3502 Gross)**
- ◆ **SV Geofjord (92.9m long, 3746 Gross)**
- ◆ **SV Geosea (84.8m long, 3206 Gross)**

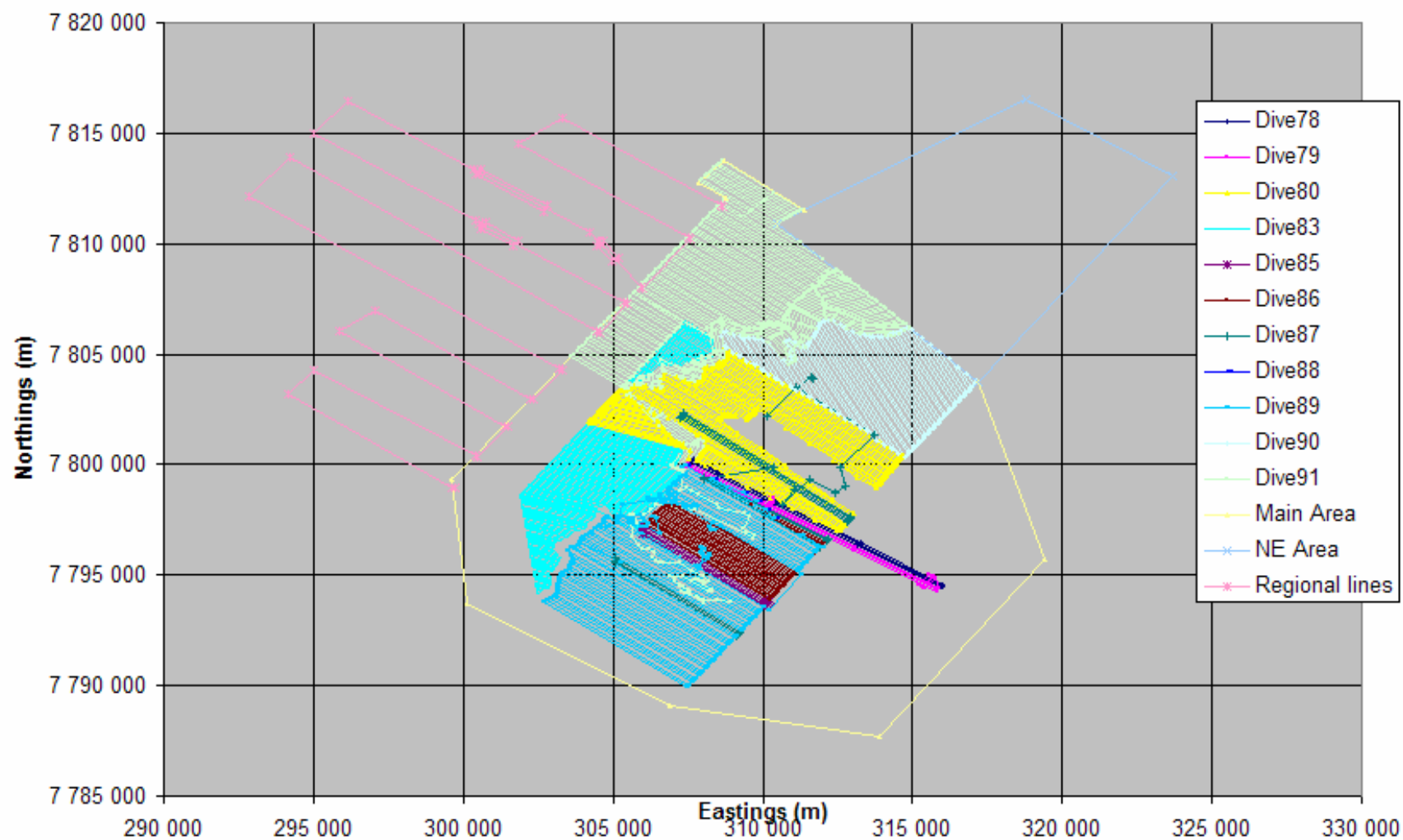
Different Vessel Configurations



It is Never too Late

Mission plans can be changed on the fly

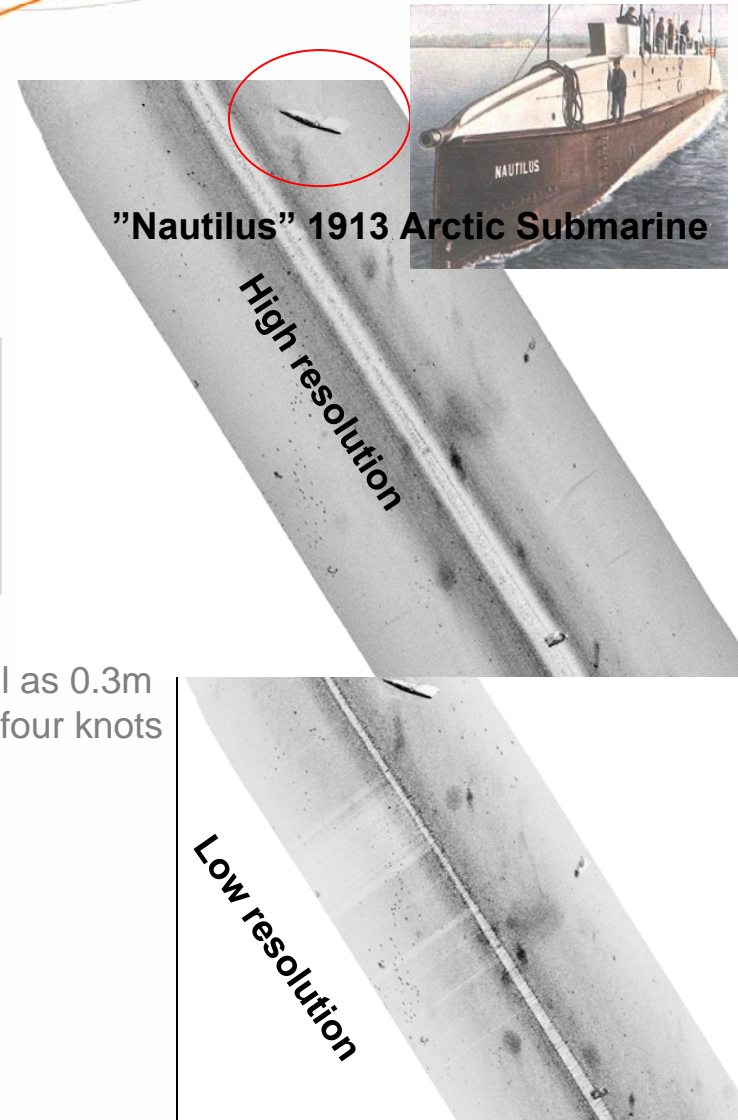
- ◆ **Line plan**
- ◆ **Flying height**
- ◆ **Switch payload on and off and change gain, pingrate, TVG etc.**



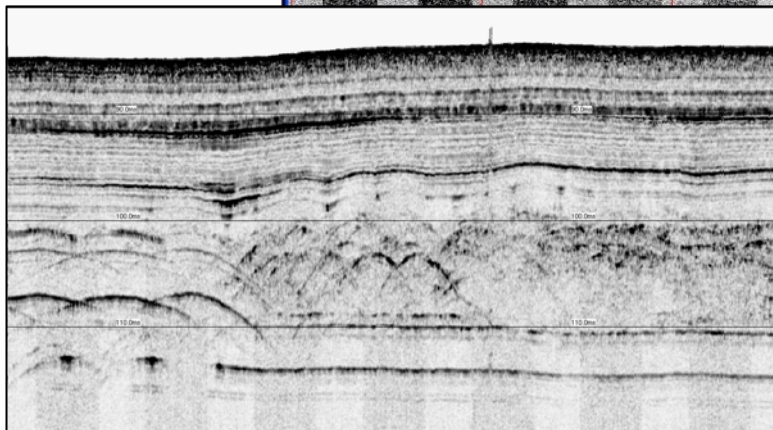
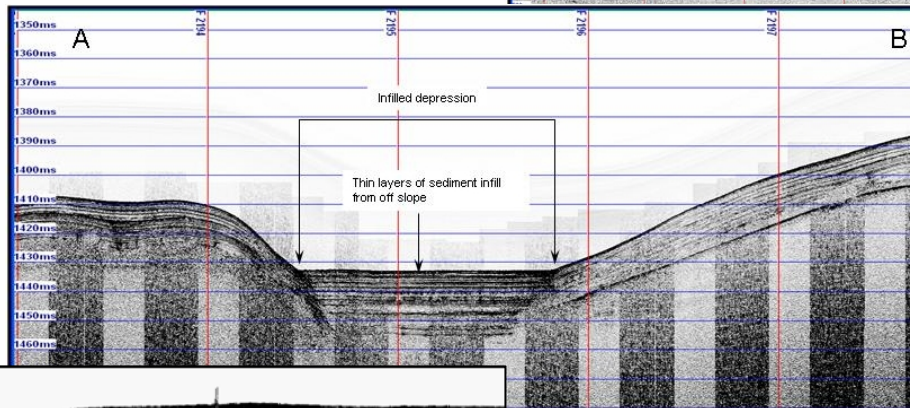
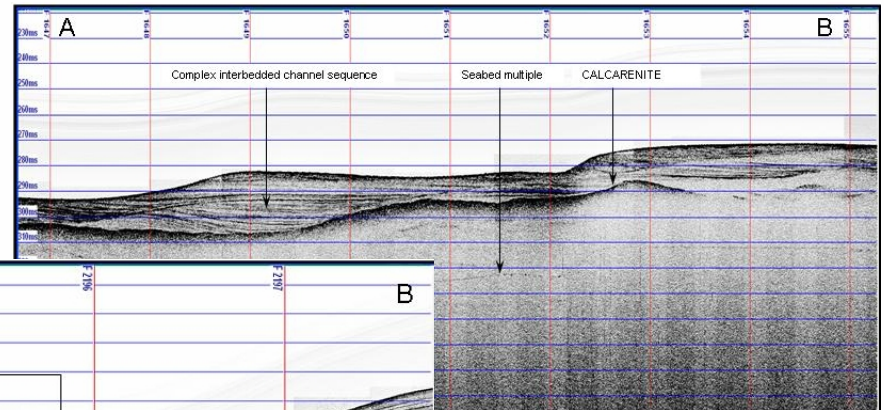
Coverage and Resolution

- ◆ 100 and 500 kHz sidescan simultaneously
- ◆ - or on the same mission (switch on the fly)

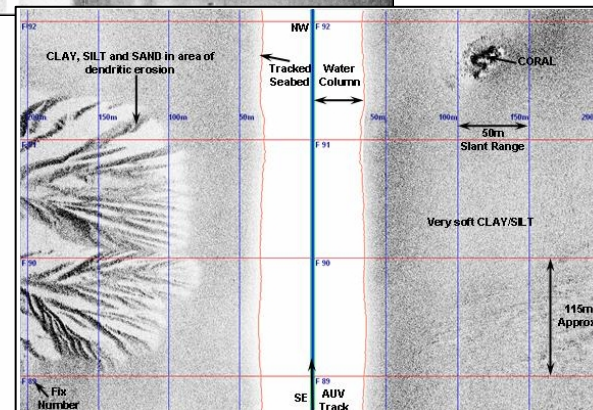
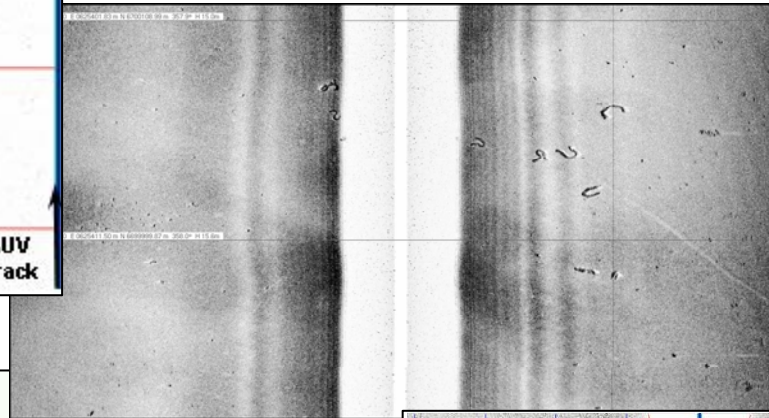
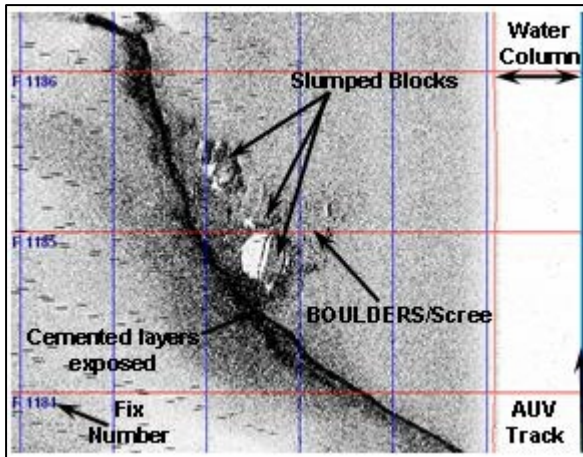
Tests have been performed which indicate that objects as small as 0.3m are detectable using the 500 kHz SSS even at speeds of up to four knots



Various HUGIN Sub-bottom Profiles



Various HUGIN Side Scan Sonar Examples (500 kHz)



Operational Limitations and Solutions

HUGIN has been operated in very challenging environments. From the icy waters of the Barents Sea to the very warm waters of the Indian Ocean offshore the Australian Coast

High water temperature solutions

- Lower speed
- Ice machine

Flying height

- Maximum is governed by the range of MBE and DVL
- Minimum is determined by the terrain and prior knowledge about it

Recover or Continue?

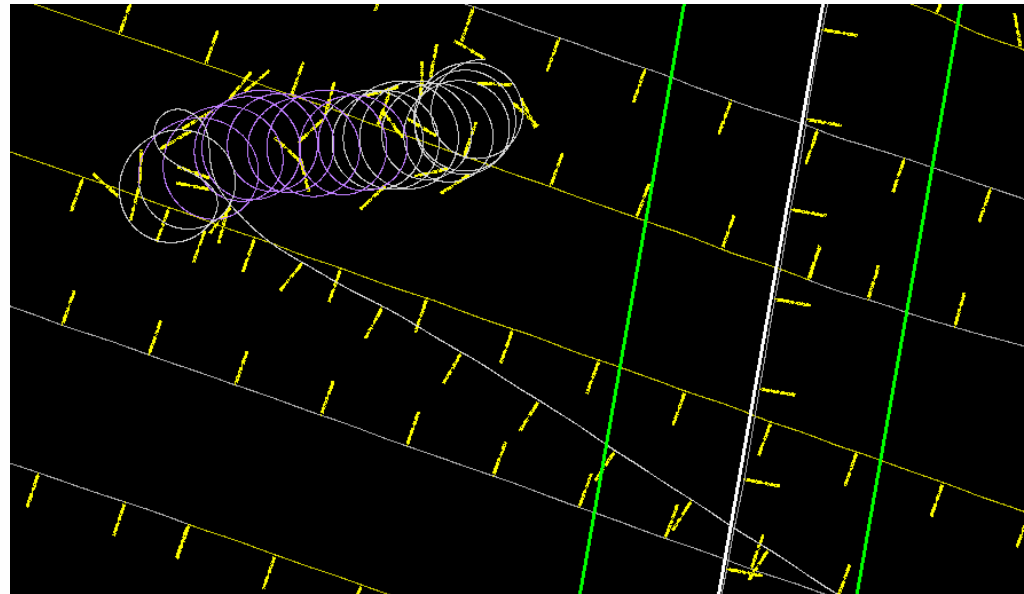
Before being commanded back into the mission when conditions allow, HUGIN can if necessary be programmed to circle and hold its position or jump ahead or back in the pre-programmed mission plan.

Circle

- **Busy traffic**
- **CTD profiles**
- **Re-boot of e.g. MBE system**

Jumps

- **Change of Clients priority**
- **Weather**
- **Re-run of lines**

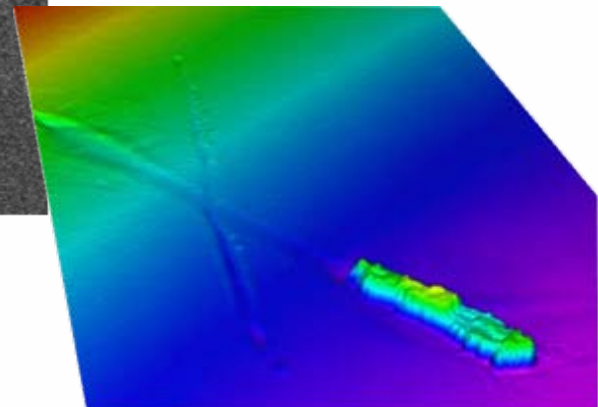
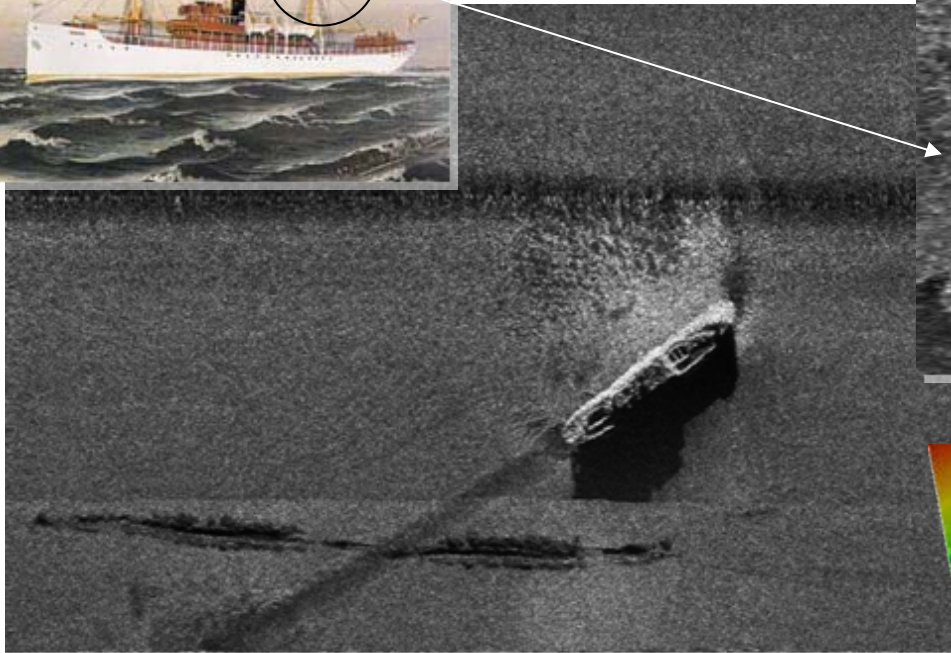


During short term bad weather conditions HUGIN can be kept submerged until the conditions improve due to its > 60 hours mission capability

Even the Crew are Flexible

We are proud to say that our HUGIN crew are all highly specialised but are all experienced from other fields in the survey business which means that many of the dedicated HUGIN crew are also multi-tasking. Technicians operating as ROV pilots and pilots as processors means that crewing levels are to a minimum.

Hugin 300-GC Data Examples



- SS NORWAY – SUNK 1917



Thank you!