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SEABED INTELLIGENCE

An effective approach for wide area detailed seabed mapping

Perth, 18th October 2017

10/13/2017

SWIRE SEABED

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Agenda

Introduction to Ocean Infinity & Partner
Background Story
Survey Equipment
Vessel Systems
Data Management and Processing Challenges
Mission Planning
Operational Status and Results

Ocean Infinity & partner

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WE OPERATE WORLDWIDE
COLLECTING HIGH RESOLUTION SURVEY DATA FROM THE SEABED

Proving a comprehensive seabed exploration system for water depth down to 6000 meter consisting of 6 (8) AUV's and 6 (8) USV's from one host vessel.

Ocean Infinity partnered with Swire Seabed who own and operate the vessel, do all project management, survey support, processing and reporting.

Evolution of efficient seabed mapping

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So why multiple?

The seabed survey started with led line,

Continued with single beam echosounders

Then Multi beam echosounders

Towed sensors, ROV, AUV

Survey ROV

And then the next must be a fleet of AUV's.... Up towards 900 line km a day..

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WE CALL IT SEABED INTELLIGENCE™

Ocean Infinity are explorers.
We go to unmapped locations to survey the seabed using the most advanced fleet of autonomous vehicles in the world.

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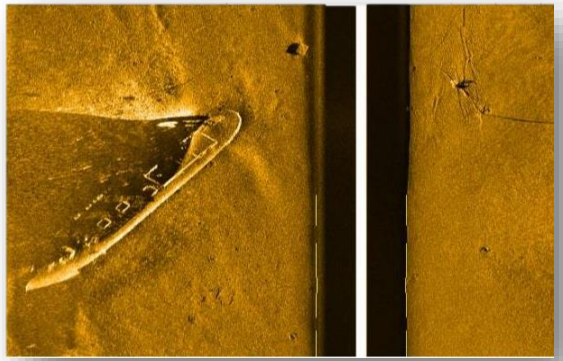
Benefits of multiple AUV's

- Performance optimization
- Carbon footprint reduced
- Robust and durable standardized equipment
- Reduction in AUV Operational Crew
- Simultanously operations



So why go for 6000 meter depth

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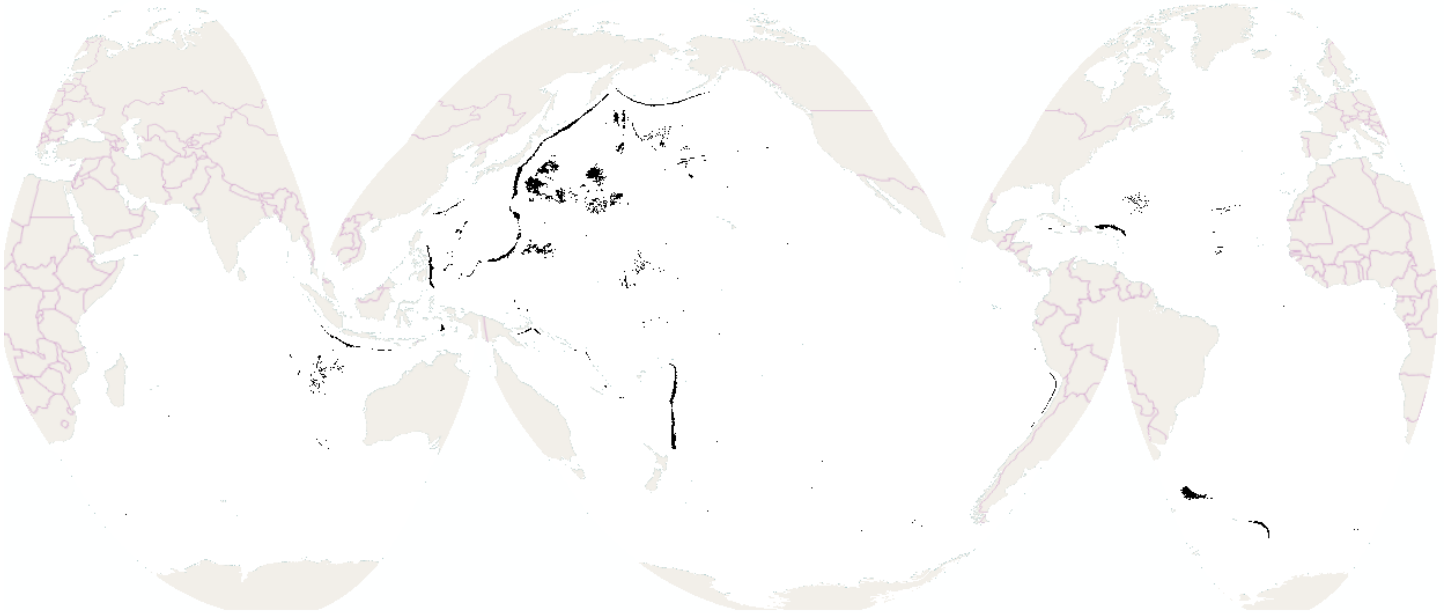

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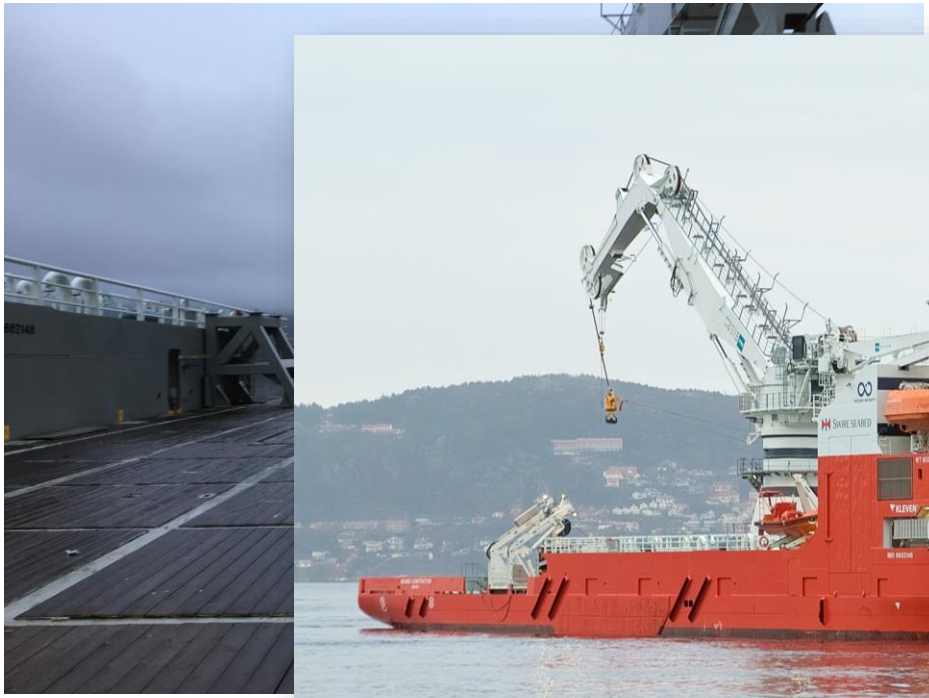

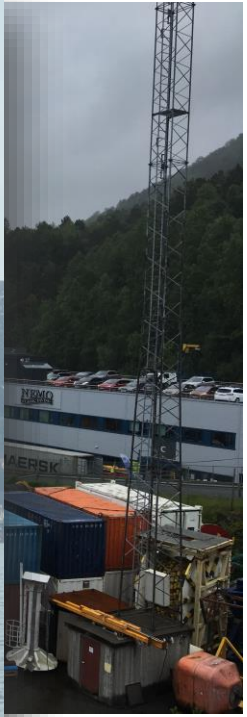

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SURVEY EQUIPMENT

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Hugin 6000

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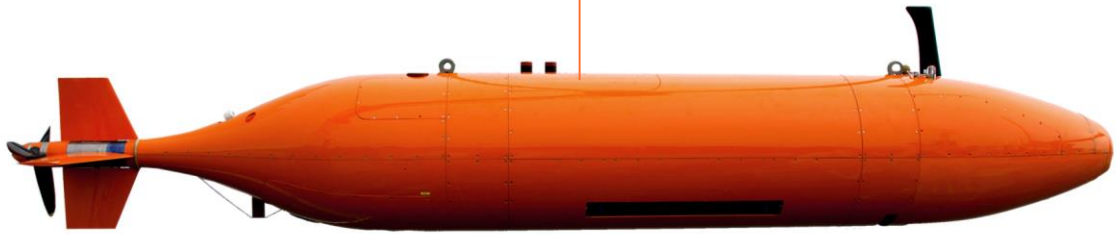
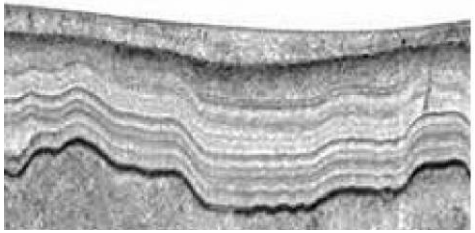
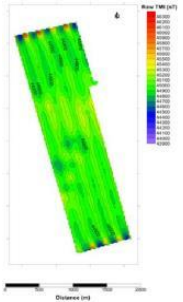
Autonomous Underwater Vehicle
The main survey system for seabed mapping

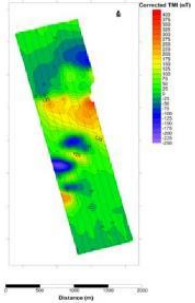


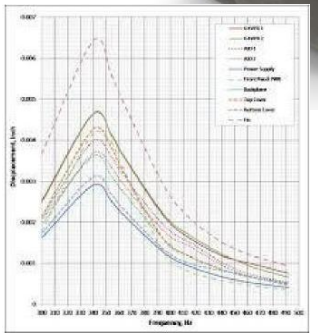
Sensors

- EM2040 Multi-Beam Echosounder
- Edgetech Sidescan Sonar
- Edgetech Sub-bottom profiler
- Catxh Color Camera
- Conductivity/Temperature/Depth (SAIV)
- Self Compensating Magnetometer



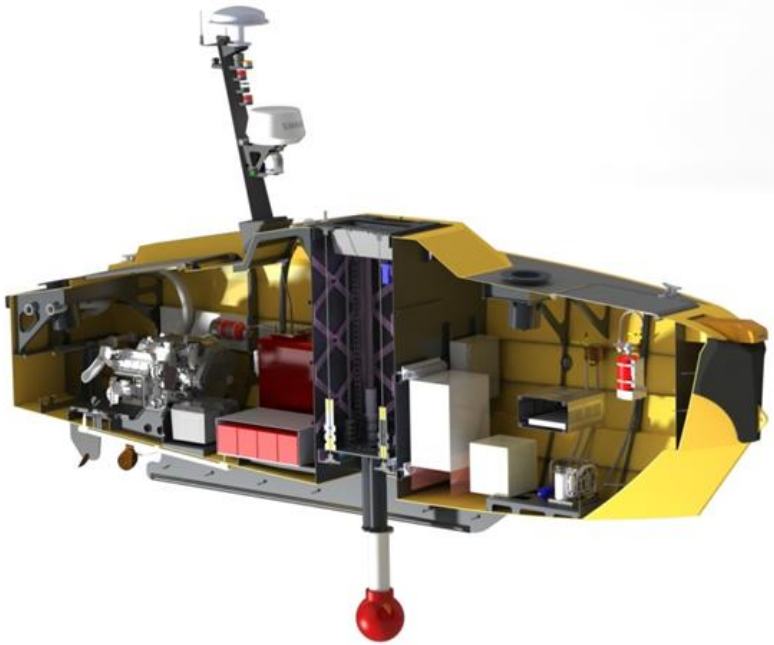






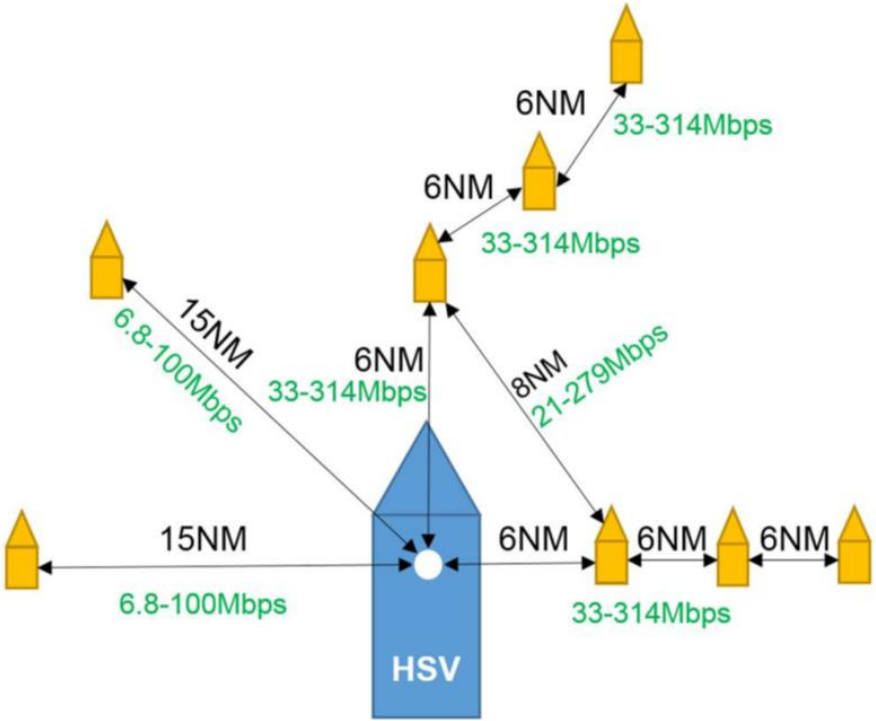
Unmanned Surface Vessels

UNMANNED



Telemetry
Radio Mesh
Acoustic HiPAP 502
Collision Avoidance
Radar
AIS
Warning / Stop Systems
Daylight Camera
Thermal Camera

Radio Telemetry



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VESSEL SYSTEMS

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Launch and Recovery Systems

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AUV STINGER

USV DAVIT
L&R & Painter Boom & Popping nose cone for recovery

Seabed Constructor

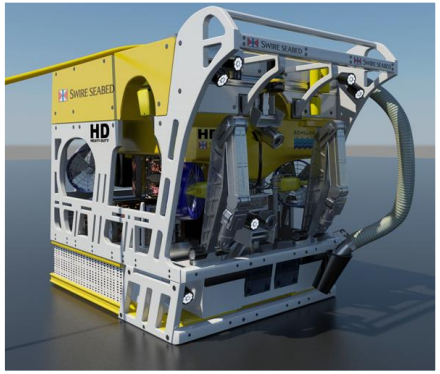
Seabed Constructor	
Design	MT 6022 MKII
Year	2014
Length	115.4m
Breadth	22m
Accommodation	102 PAX
Crane	250 Tonne AHC
Moonpool	7.2m x 7.2m
Cargo Deck	1300 m²

HOST SURFACE VESSEL

Workclass ROV

Schilling HD

- Heavy Duty Work Class ROV
- 150 shaft horse power (shp)
- 5000 meter depth rating
- Schilling TITAN 4 & ATLAS 7R Manipulator
- Payload 200 kg



Kystdesign

- Work Class Deepwater ROV
- 150 shaft horse power (shp)
- 6000 meter depth rating
- TITAN 4 Schilling Manipulator (7 Function) & Rigmaster Schilling Manipulator (5 Function)
- Payload 200 kg

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DATA MANAGEMENT AND PROCESSING CHALLENGES

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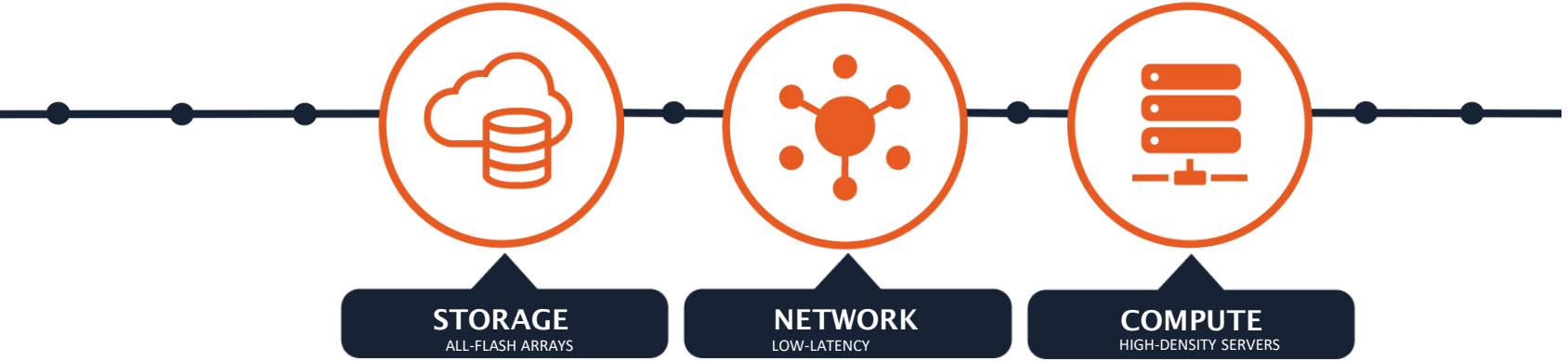
HARDWARE SOLUTIONS



STORAGE
ALL-FLASH ARRAYS

- Reliability, performance and instant access to huge data sets.
- The storage on-board the ship can handle ***120TB*** of generated monthly survey data, or over 600 average sized PC hard drives being filled up each month.

NETWORK
LOW-LATENCY

- Scalable network architecture
- The ***160Gbps*** backbone across the platform is equivalent to simultaneously transferring 100 high-definition movies every 30 seconds.

COMPUTE
HIGH-DENSITY SERVERS

- Deployed in building blocks, and joined together with virtualization to form a larger compute cloud.
- Each node is packed with the capability to run complex algorithms and image processing whilst independent enough to tolerate hardware failures.

Data Processing

Each AUV per 24 hours:

- 1 TB digital data
- 430.000 still images

Processing packages:

- Delph iXblue
- EIVA NaviSuite
- ESRI ArcGIS

Deliverables:

- SSDM format GIS data
- .bag compatibility
- Mosaic raster catalogs
- Field Reports

Turnaround production:

- Preliminary results within 24 hours after data on disk.

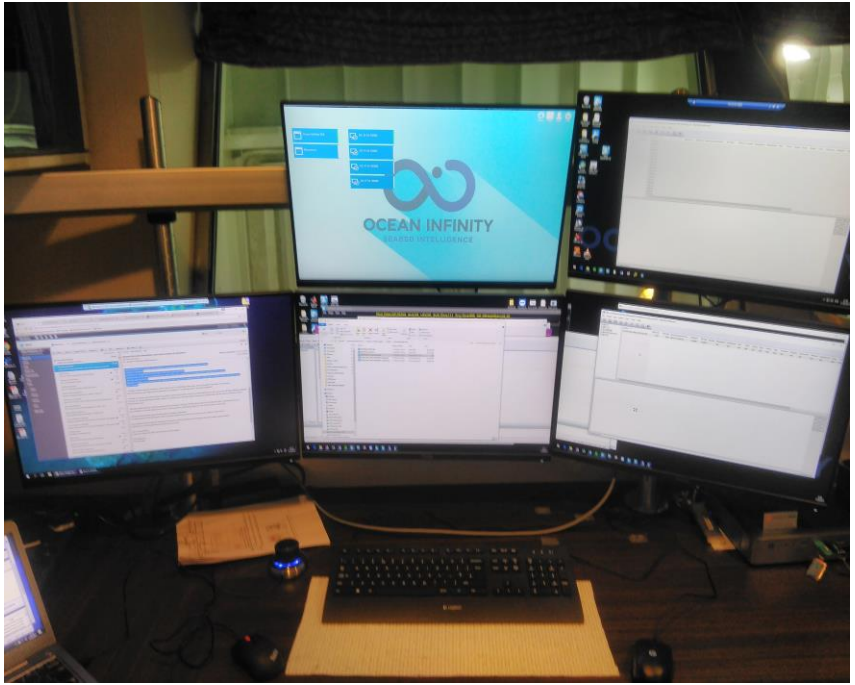
Automatic Data Processing

- Virtual machines set up on 7 workplaces
  3-5 monitors depending on use

- One virtual macine workplace is for the
  Eiva WFM user interface
  This in turn remote control one or more
  additional virtual machines.

- One data processor on shift dedicated to
  navigation and MBE basic processing only.

- Record so far is processing of 3 auv dives in
  less than one 12h shift.
  Total of 125h of data.



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MISSION PLANNING

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MISSION PLANNING

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Simultaneous Mission Issues

- Maintenance management of multiple USV and AUV.
- HSV position management to maximise radio telemetry to USV.
- Payload management with multiple survey specifications.
- Launch and recovery bottlenecking.
- Emergency intervention.

Simultaneous Mission Solutions

- Integrated maintenace schedule into MP software.
- HSV mission planning component.
- Payload command bank available pre-dive and mission simulator for payload settings QC.
- Reactive planning learning from realtime L&R timing, intelligent launch staggering.
- Emergency protocols for various emergency events.

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OPERATIONAL STATUS

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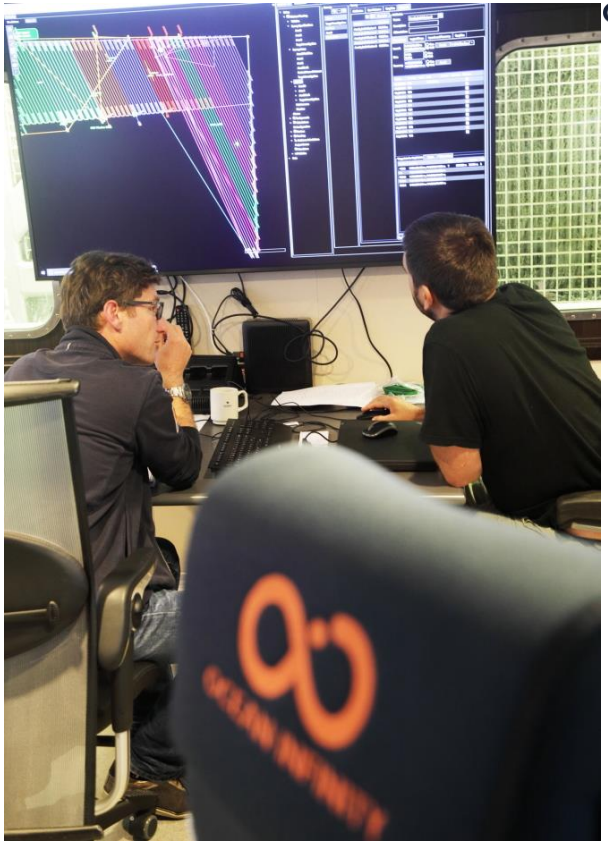
Operational status

Performed 4 projects so far with the AUV solution:

- 1st project was the size of Faroe Islands or Singapore in 9 days, 1700km2. Primarily SSS and MBE data logged and processed within 24 hours
- 2nd project was 1440km2 area surveyed,18x AUV dives. Primarily SSS and MBE data logged and processed within 24 hours
- 6 AUV's doing survey simultaneously
- Area surveyed last month 5944sq km

Operational status

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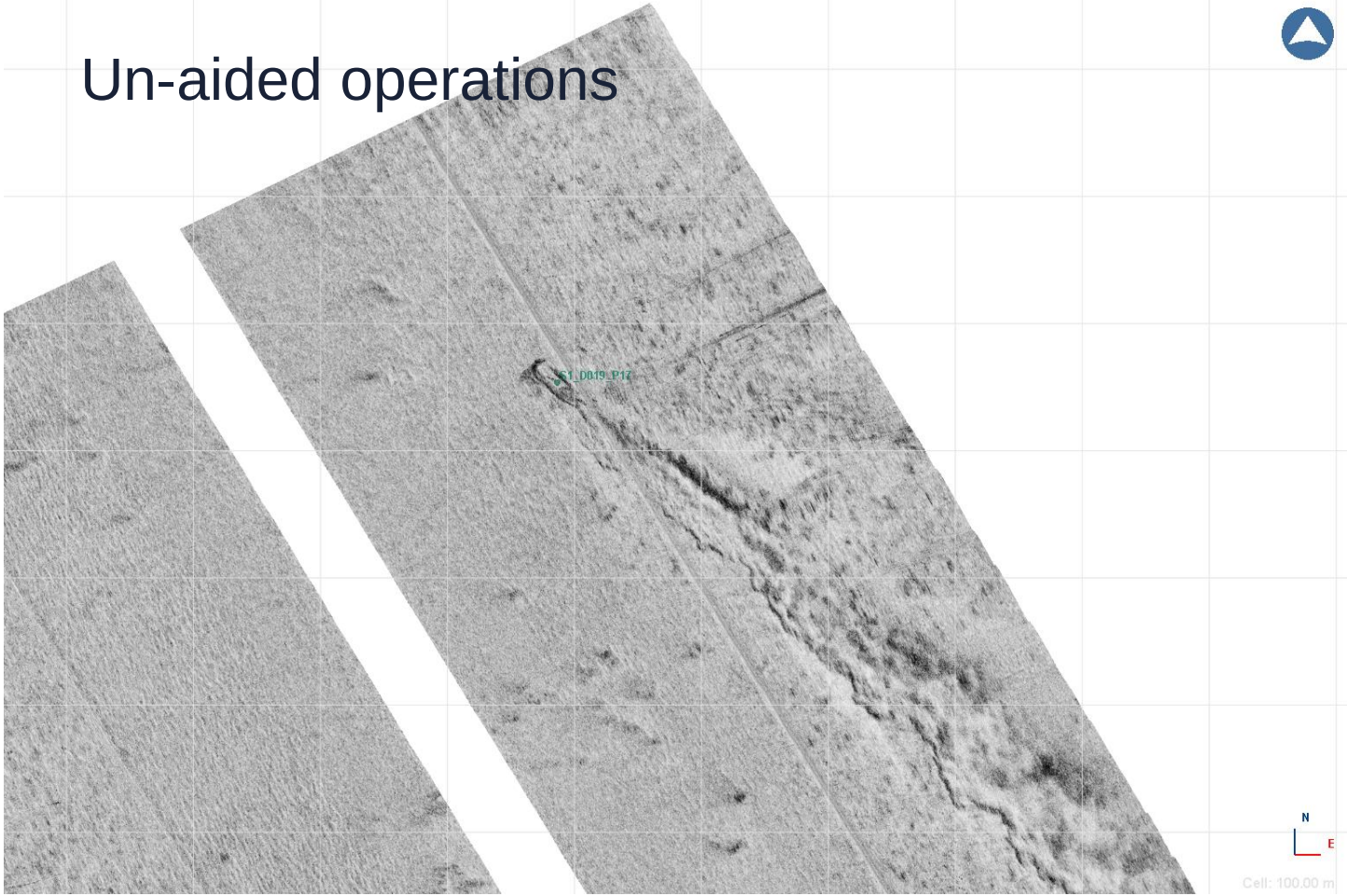
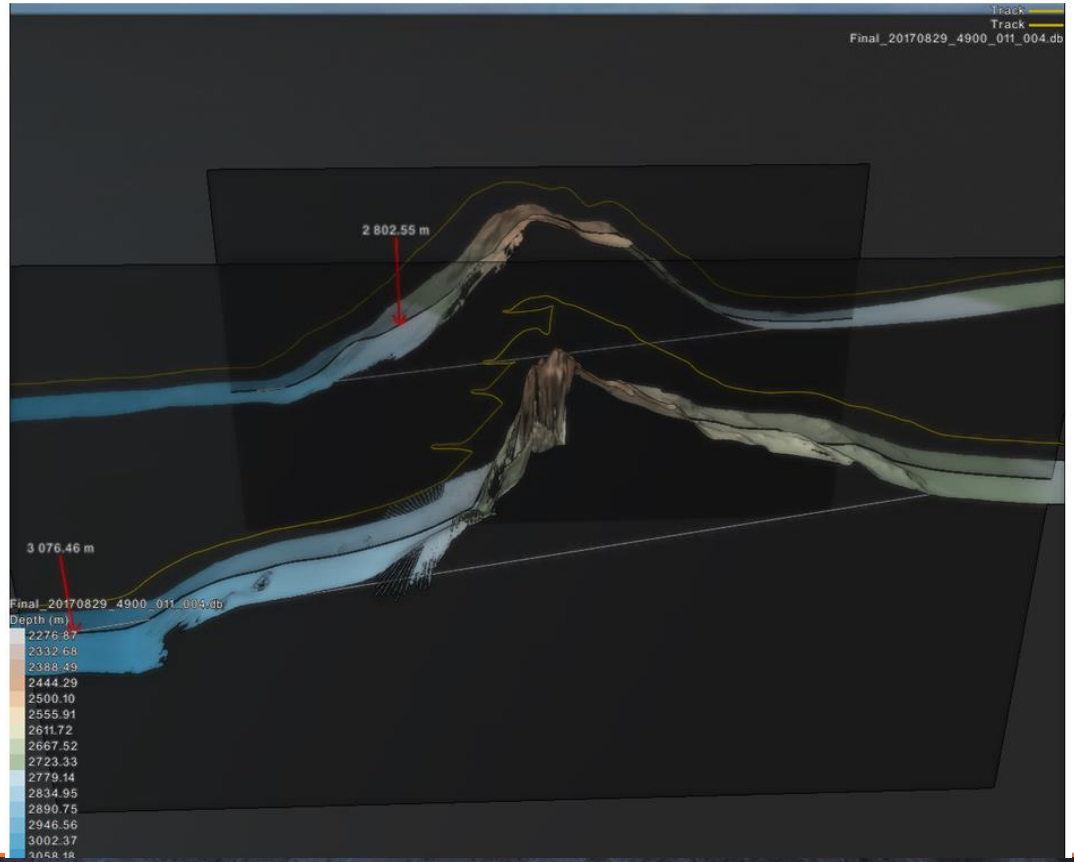
Un-aided operations



Un-aided operations



Magnetometer data

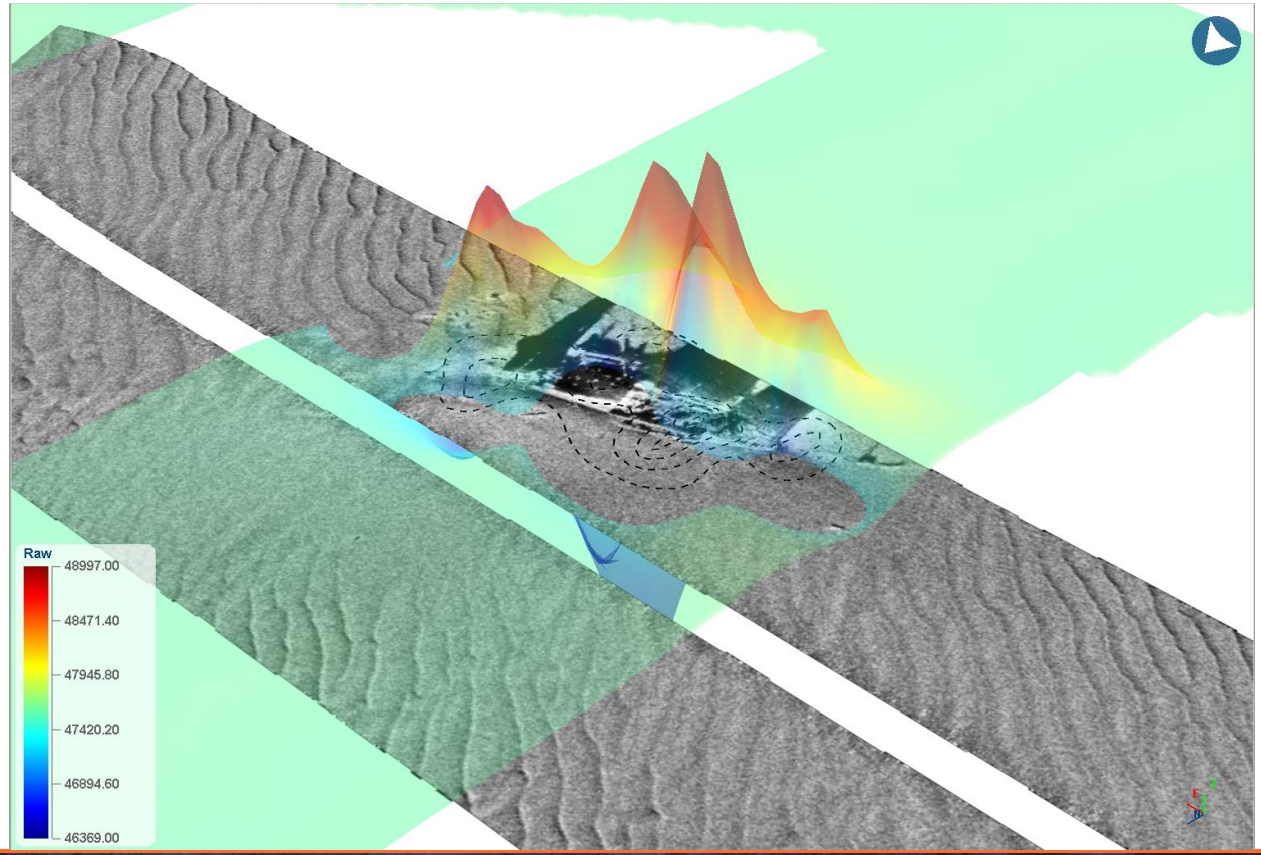


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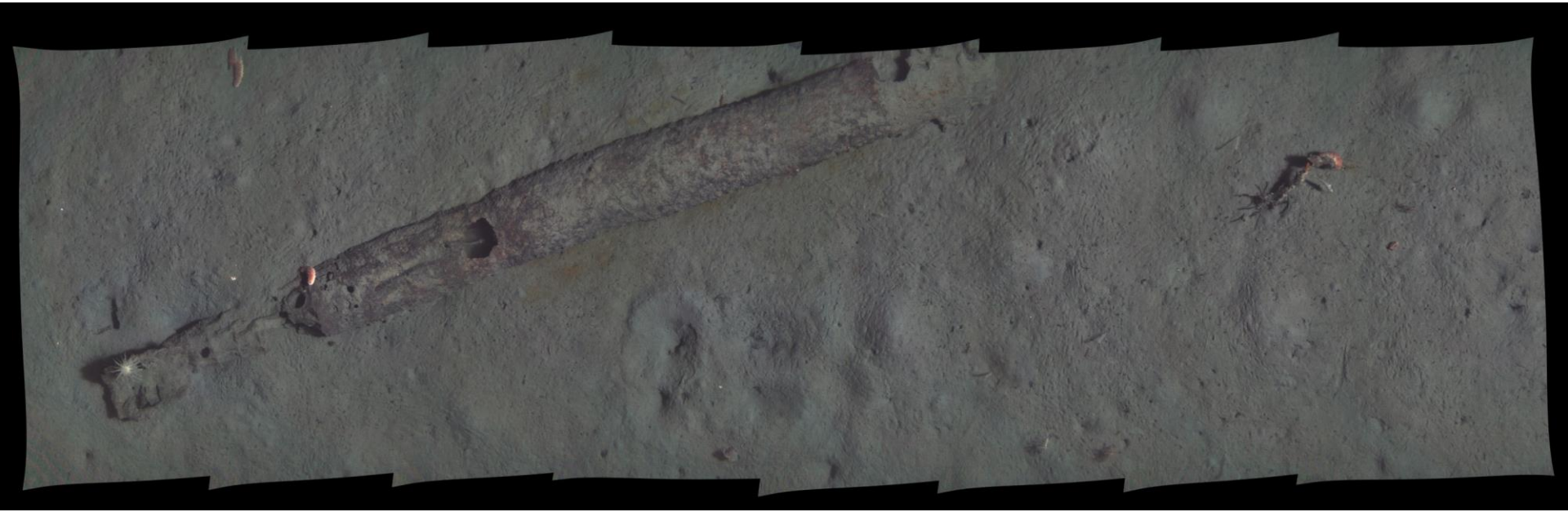
Photo mosaic



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Thank you for your attention

Any Questions

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