Helping research vessels and robots to play nicely

Enabling multi-robot collaboration by integrating the Sonardyne Mini Ranger 2 system with the Robotic Operating System

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Head of Business Development

https://www.sonardyne.com/case-studies/a-new-world-of-multi-robot-ocean-exploration/

covelya GROUP

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wavefront.systems

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chelsea.co.uk

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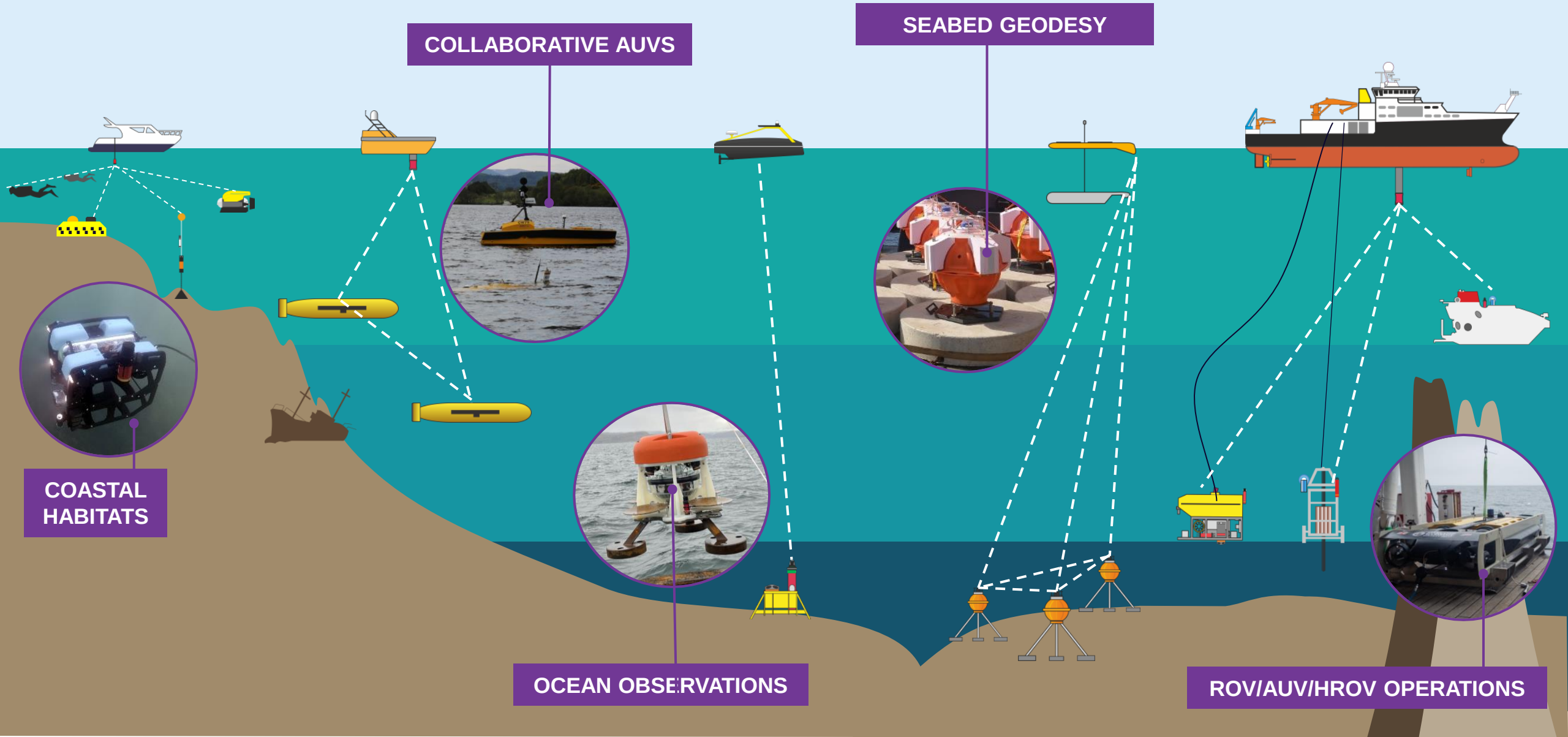
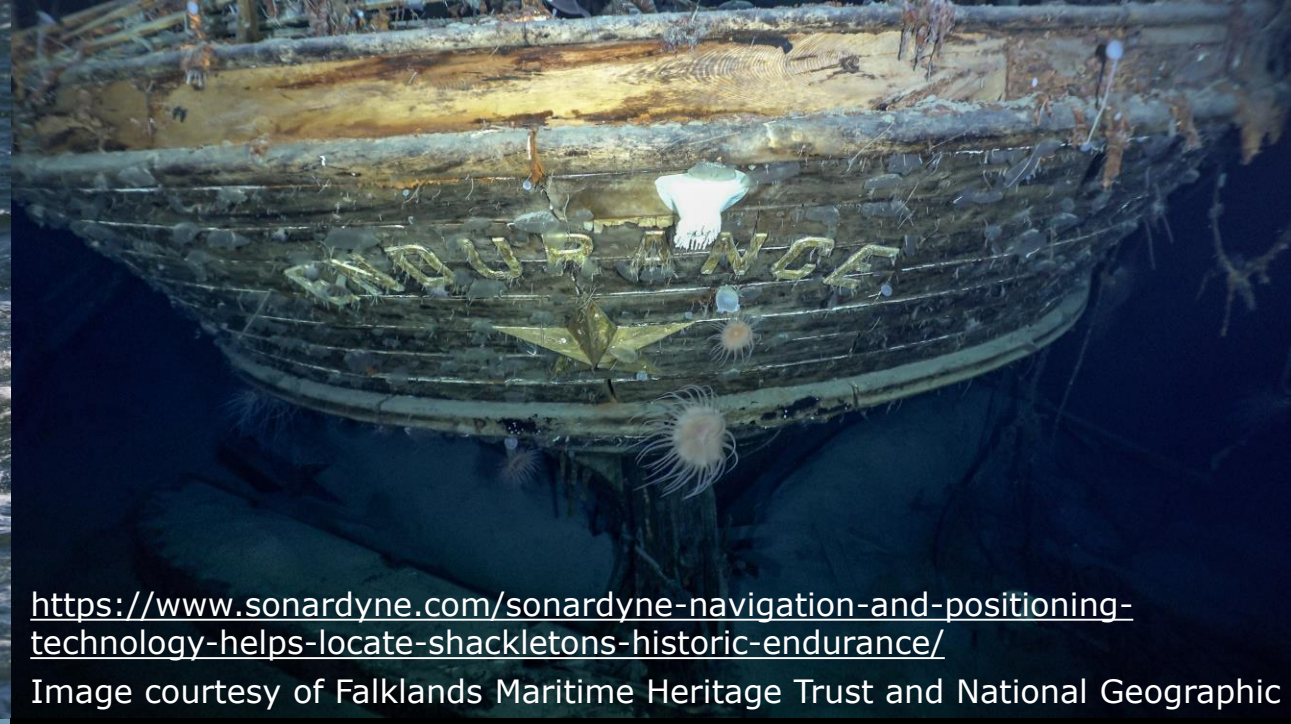


https://www.youtube.com/watch?v=4yJ3_fP1ZVs



https://www.sonardyne.com/sonardyne-navigation-and-positioning-technology-helps-locate-shackletons-historic-endurance/

Image courtesy of Falklands Maritime Heritage Trust and National Geographic

https://www.youtube.com/watch?v=dhpji6JptxE

https://youtu.be/D-7yKshUaH8?list=TLGGUYvOZQDo-fIyMDA5MjAyNA

Image courtesy of Voyis Imaging Inc. and Magellan

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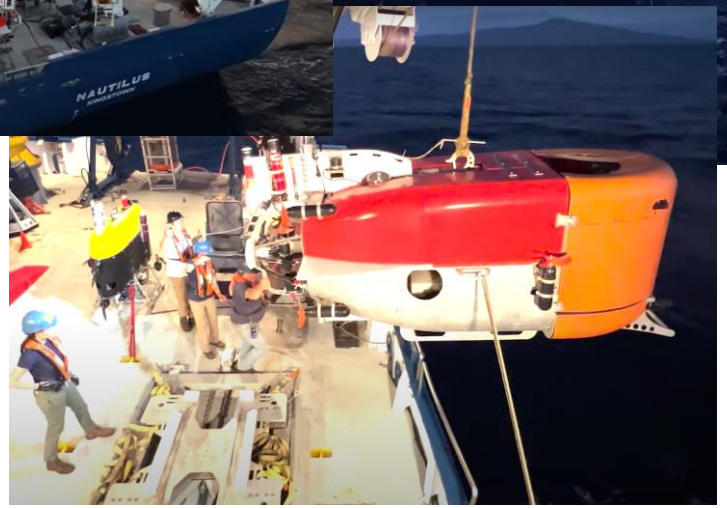


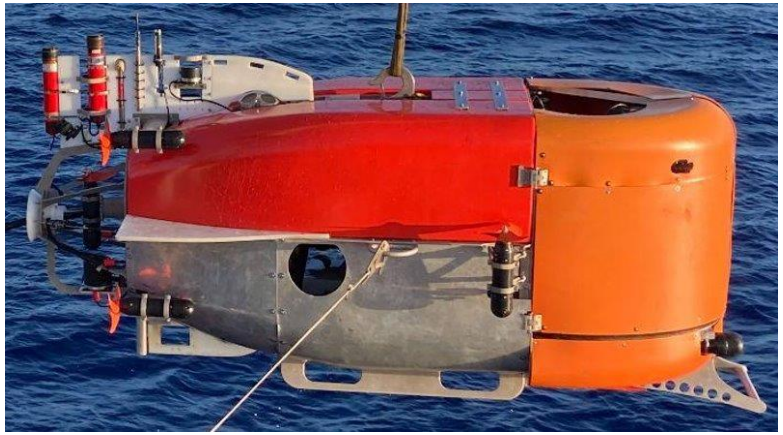
Images courtesy of Ocean Exploration Trust

"We are more than exceeding our goals of communication and collaboration with tracking and two-way communication among all three vehicles and the ship - using the ASV to follow the vehicles and as a relay when the vehicles get out of ship's range. All done with the Sonardyne systems"

Prof Larry Mayer, University of New Hampshire

https://www.youtube.com/watch?v=S9N6JcMYhpY
https://youtu.be/RvhIFaB1ofU

Helping research vessels and robots to play nicely: Meet the robots



Images courtesy of Ocean Exploration Trust

During the 2022 NOAA Ocean Exploration Cooperative Institute Technology Integration Cruise (aka: OECI Tech Challenge), The surface robot DriX worked with the underwater robots Mesobot and NUI allowing Nautilus to freely map the seafloor nearby.

The Sonardyne ROS driver was a key component used with Project11 on DriX which provided situational awareness and command and control

Helping research vessels and robots to play nicely: Providing the sub-surface/surface link - Mini Ranger 2

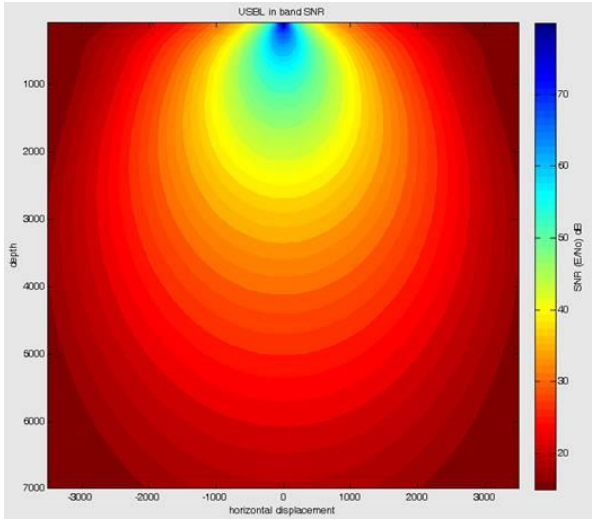


Image courtesy of Larry Mayer, UNH

- Ranger 2 software with robotics pack
- HPT 3000
  - MF (20–34 kHz)
  - <4,000m tracking (with ER option)
  - <15mm ranging precision
  - Positioning repeatability: <1.3% of slant range 1 Drms / 0.9% 1 Sigma (internal MRU) <0.2% of slant range 1 Drms / 0.14% 1 Sigma (external MRU)
  - Integrated MTi-30 Xsens MRU
  - Ethernet-based comms

Helping research vessels and robots to play nicely: Beacons for tracking and telemetry

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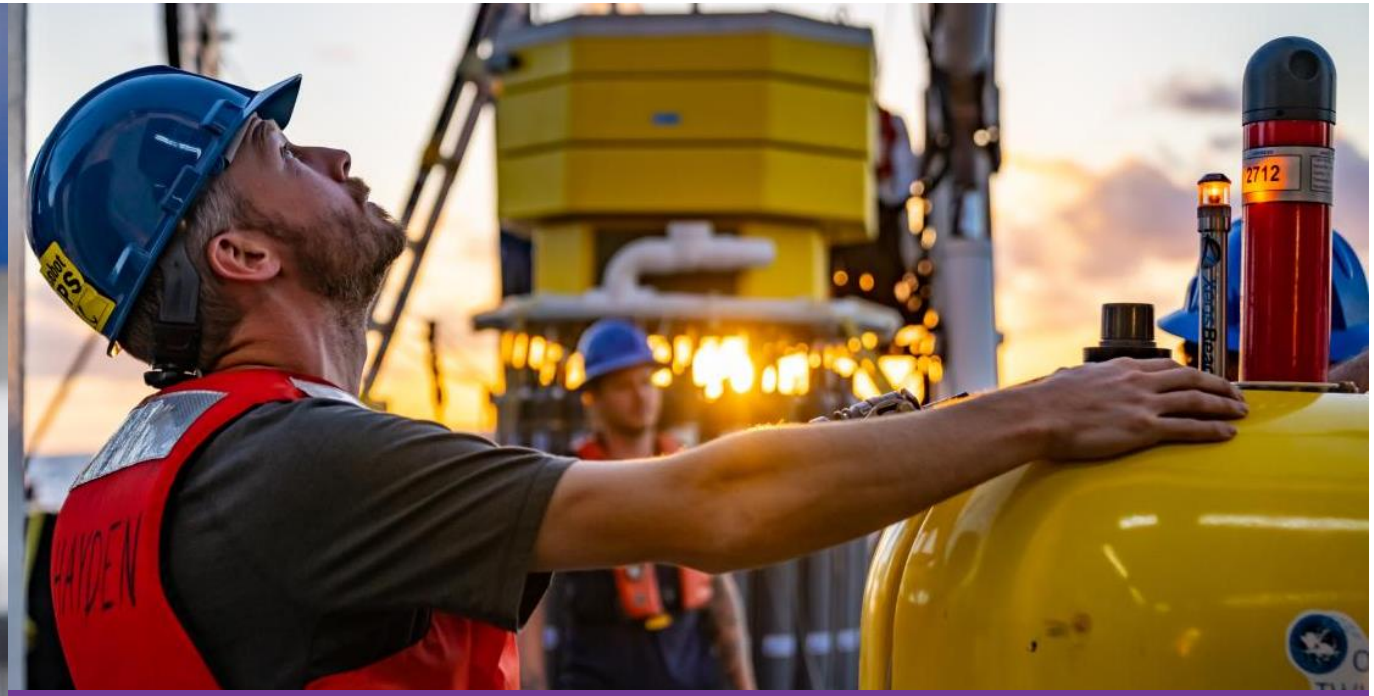

- Simultaneous USBL navigation with two way SMS telemetry (AvTrak 6)
- High data rate (9kbps) acoustic modem
- <7000m depth operation
- Variant options include remote transducer, OEM and Nano

Images courtesy of Ocean Exploration Trust

Helping research vessels and robots to play nicely: ROS driver and message definitions

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ROS

- **ROS Sonardyne drivers (Developed by the University of New Hampshire)**
  https://github.com/CCOMJHC/sonardyne_usbl

- **modem_node**
  The modem_node.py node provides topics for sending and receiving SMS messages using `sonardyne_msgs/SMS` messages and for sending and receiving raw modem commands using `std_msgs/String` messages.
  Supports serial, TCP or UDP connections.

- **ranger_node**
  The ranger_node.py node subscribes to asynchronous position updates from the Ranger software and publishes them as `geographic_msgs/GeoPointStamped` messages.
  Uses XML base UDP remote control protocol.

ROS Message Definitions
https://github.com/CCOMJHC/sonardyne_msgs

Position.msg

```
Header header
string UID
float32 age
string category
string name
float64 latitude
float64 longitude
float32 depth
string history
```

SMS.msg

```
time receive_time
string address
string message
```

Helping research vessels and robots to play nicely: Directed sampling

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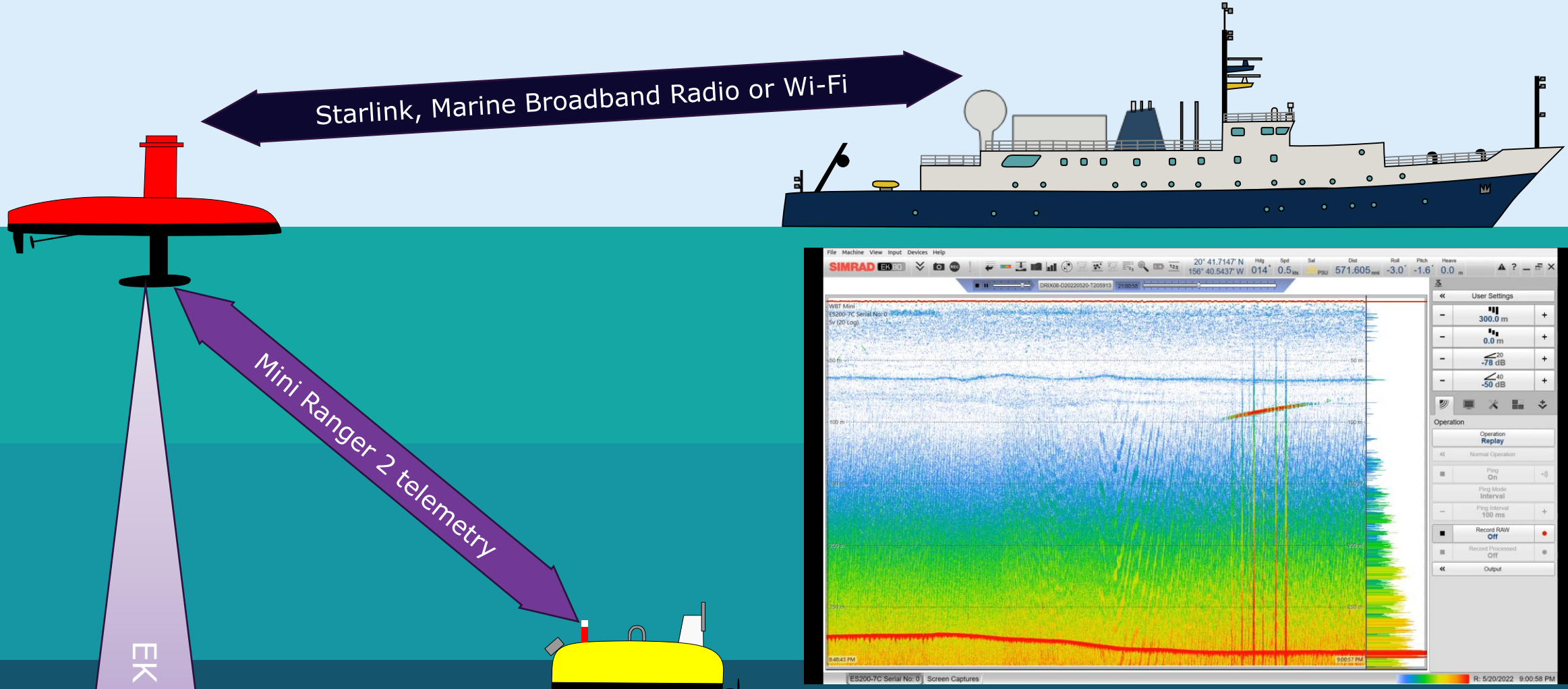

Layer confirmed, command sent to to change depth, once confirmed that Mesobot was in the layer, command to sample for eDNA was sent: "VERIFIED - DIRECTED SAMPLING"

Helping research vessels and robots to play nicely: near real-time data for operational decision making

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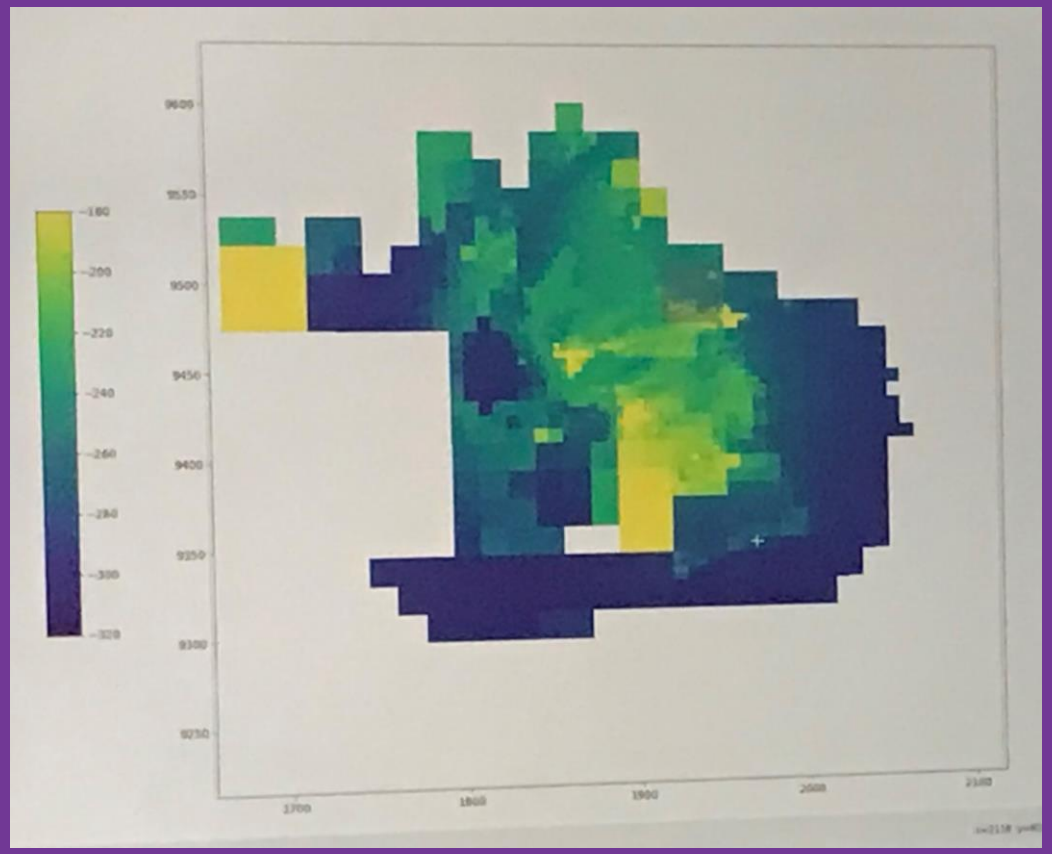
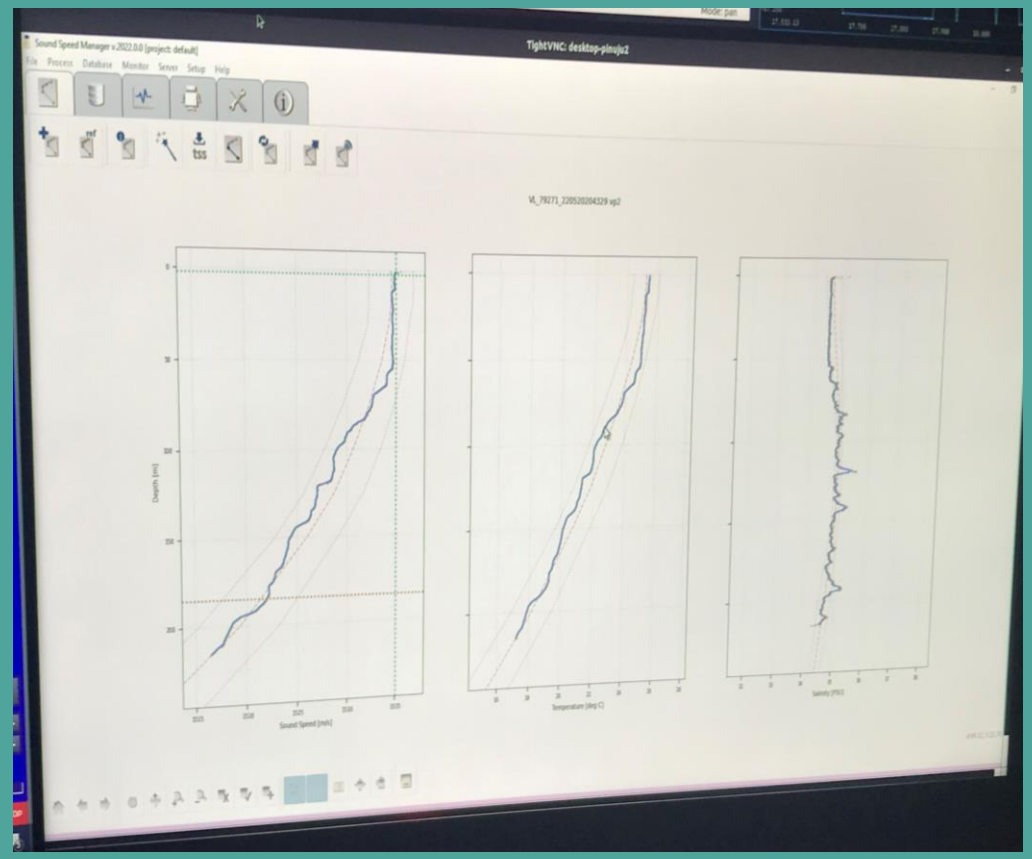
NUI “Co-Exploration”

Both MBES mapping and camera data via DriX acoustic relay.



Images courtesy of Ocean Exploration Trust

Transmission of CTD measurements from Mesobot to ship via DriX for real-time input on water column properties



Helping research vessels and robots to play nicely:
In conclusion… but not quite, cool video to follow

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The combination of the Sonardyne Mini Ranger 2 system with a ROS driver for integration with Project11 was a key building block allowing the rapid development of technologies for marine robot cooperation.

University of New Hampshire

CCOM JHC

Sonardyne


Courtesy of Ocean Exploration Trust
NAUTILUS
KINGSTOWN

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Thank you for your time today

Any questions?

Contact Geraint West:

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sonardyne.com