

Multi-Robotic Ocean Exploration:

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

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<https://www.sonardyne.com/marine-robotics/>



University of New Hampshire



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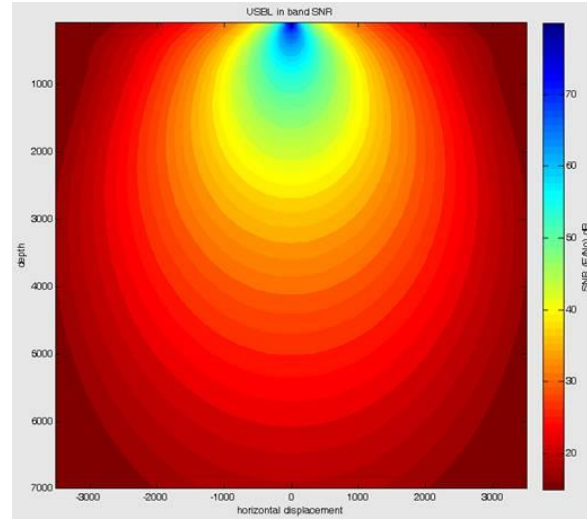


Image courtesy of Larry Mayer, UNH



- 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

Beacons for Positioning and Telemetry



- 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

ROS Sonardyne drivers (Developed by the University of New Hampshire)

https://github.com/CCOMJHC/sonardyne_usb

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

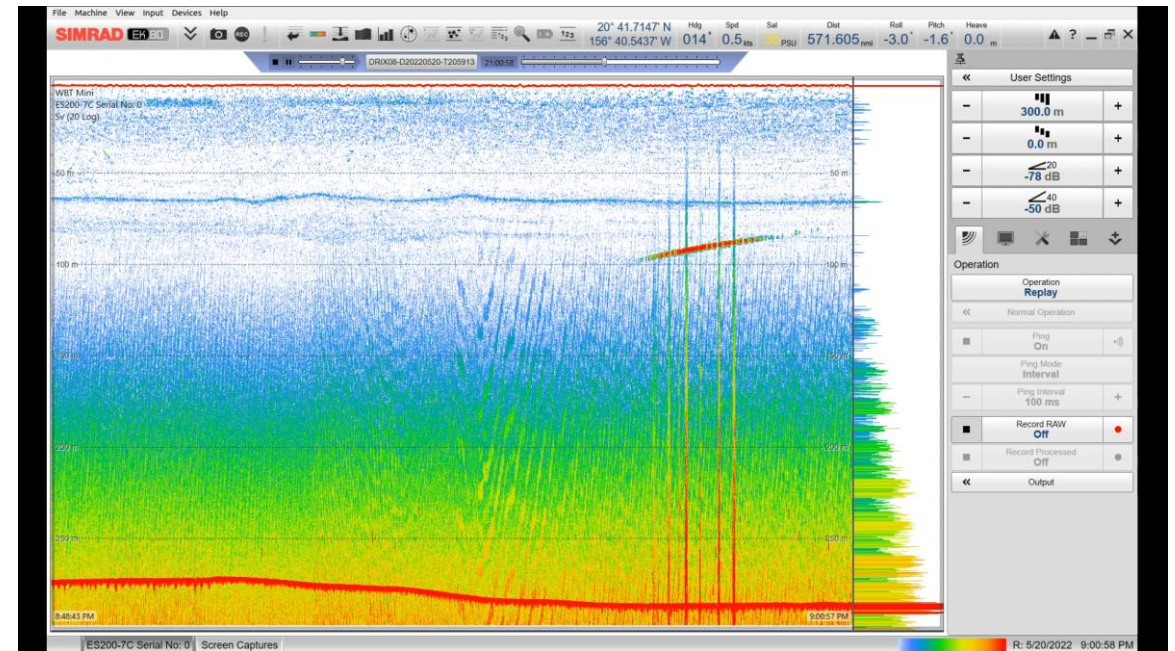
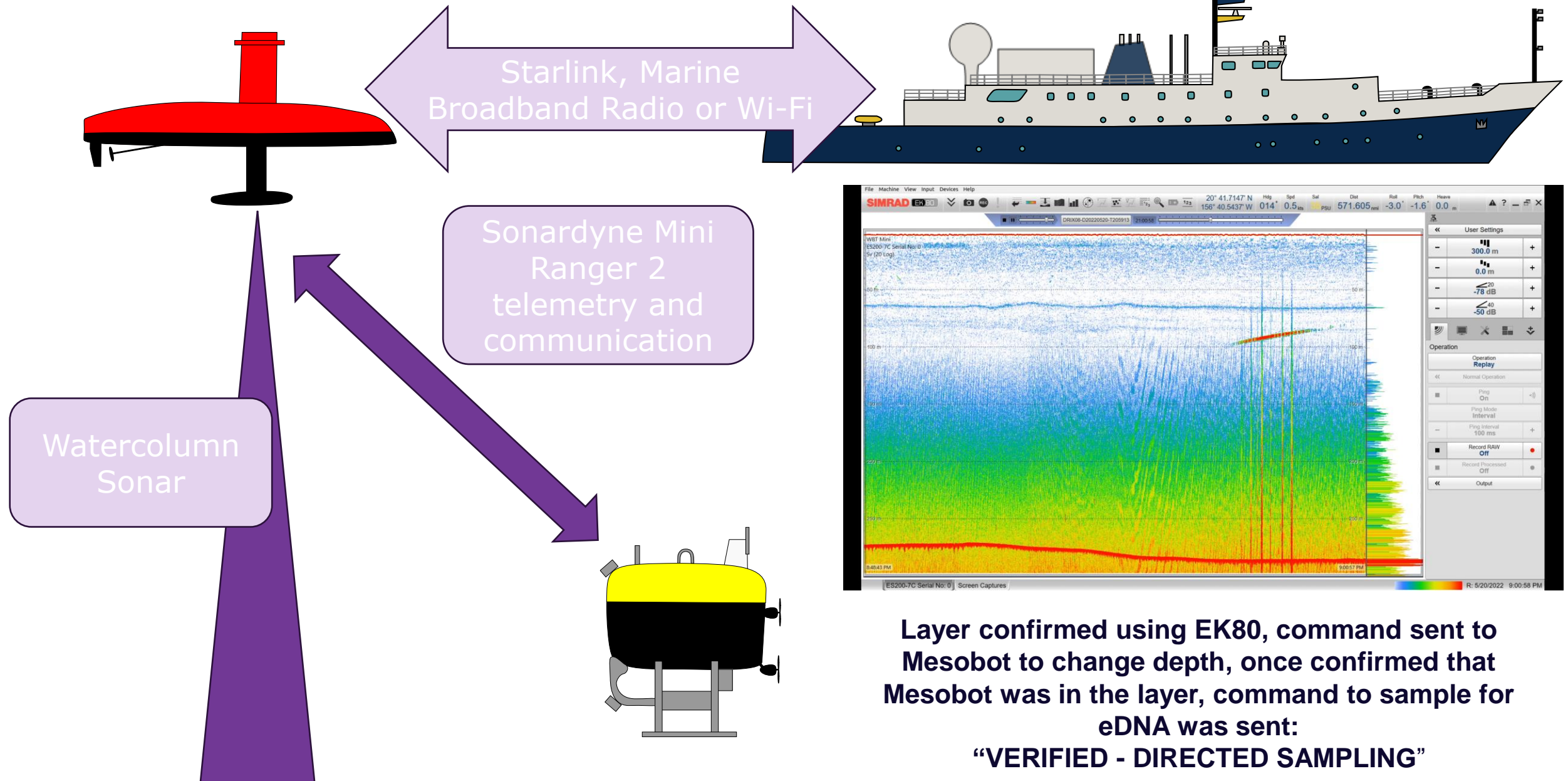
```
time receive_time
string address
string message
```



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.

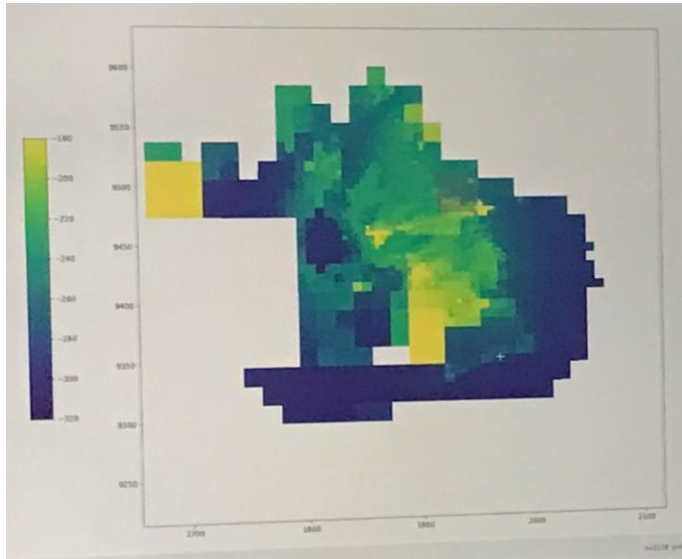


The Sonardyne ROS driver was a key component used with Project11 on DriX which provided situational awareness and command and control

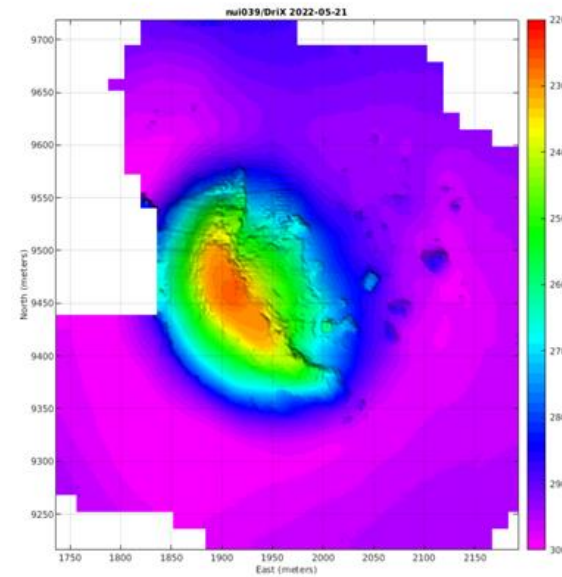


Layer confirmed using EK80, command sent to Mesobot to change depth, once confirmed that Mesobot was in the layer, command to sample for eDNA was sent:
“VERIFIED - DIRECTED SAMPLING”

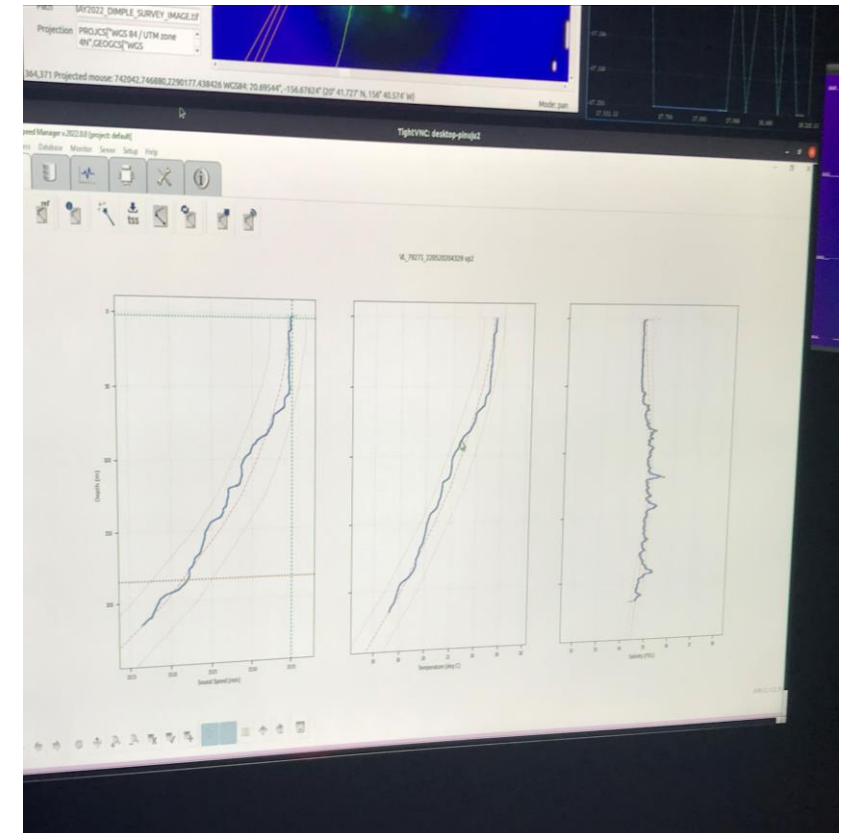
- NUI “Co-Exploration”
- Both MBES mapping and camera data via DriX acoustic relay.
- Transmission of CTD measurements from Mesobot to ship via DriX for real-time input on water column properties



Realtime “CO-EX”
Transmitted Data



Post Deployment Data





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



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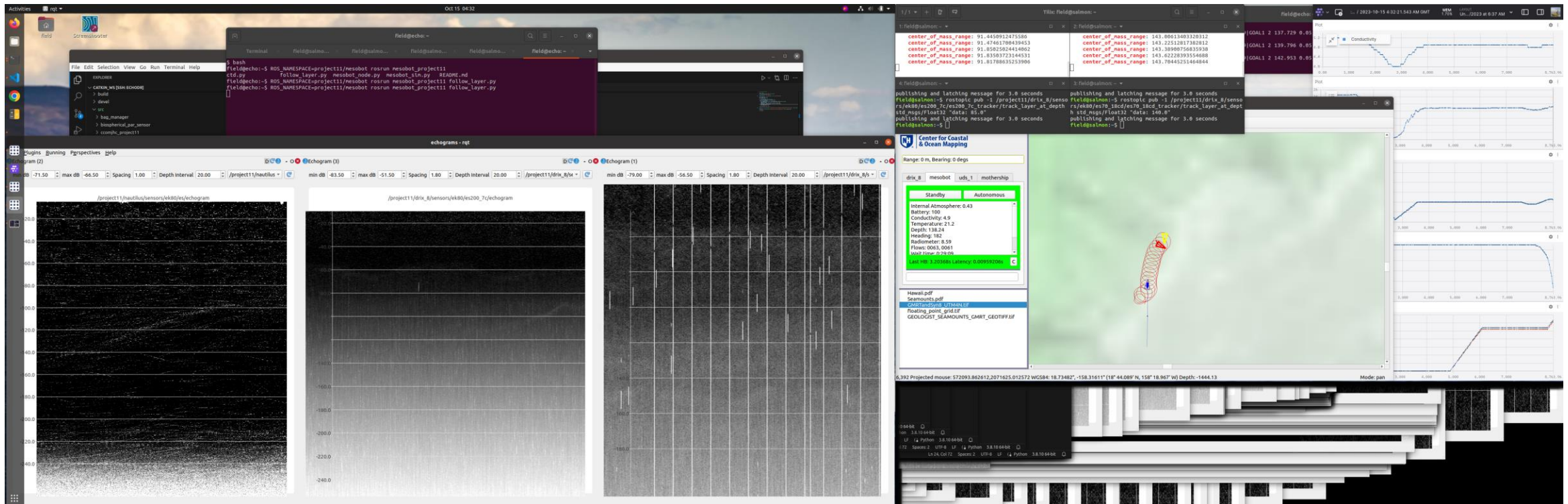
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Breaking News! October 2023 Tech Challenge Cruise



Building on the success of the 2022 Tech Challenge cruise, Mesobot and DriX cooperation was improved.

- Verified Directed Sampling was refined using offset orbits
- Automatic layer tracking was implemented as well as layer following by Mesobot. The Sonardyne system using the ROS driver was a key component for making this happen.





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KINGSTOWN

Ocean Exploration
Trust

Thank you for your time today

Any Questions?

<https://www.sonardyne.com/marine-robotics/>

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