

NOAA – UNH Joint Hydrographic Center

Recent USV Work in the PMNM



HYDROGRAPHIC SERVICES REVIEW PANEL





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DriX-5
iXblue - loaner



DriX-8
CCOM-OECI

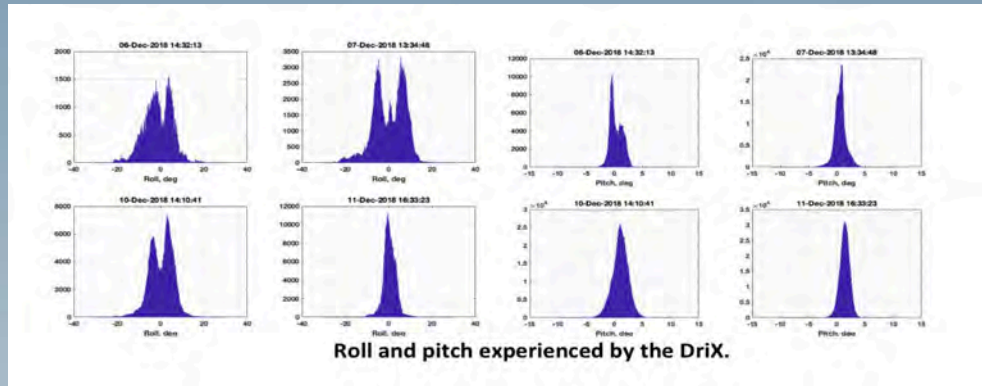


DriX-12
OCS-NMFS

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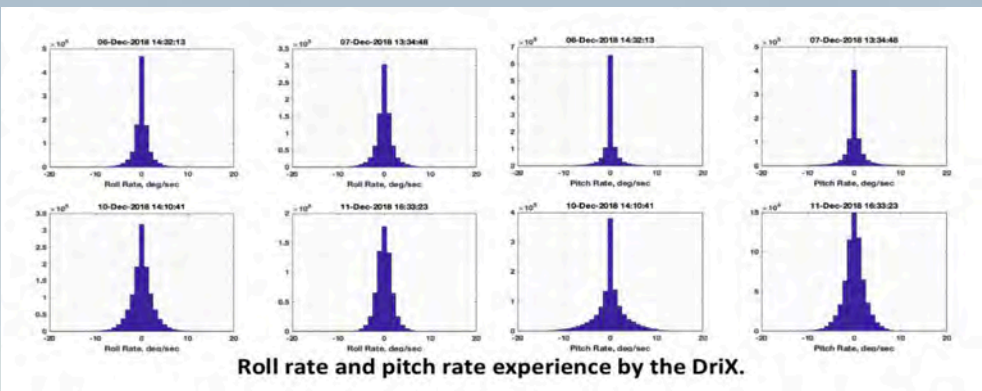
On a really rough day... DriX is amazingly stable

ROLL Wind Up to 35 knt winds



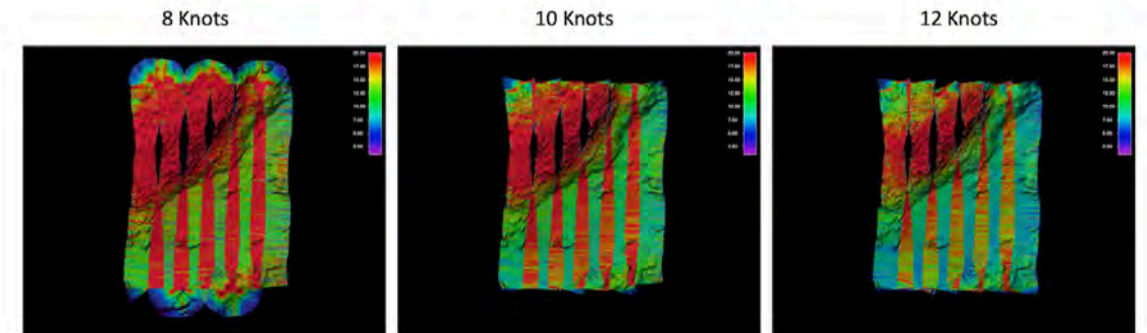
Roll and pitch experienced by the DriX.

ROLL RATE

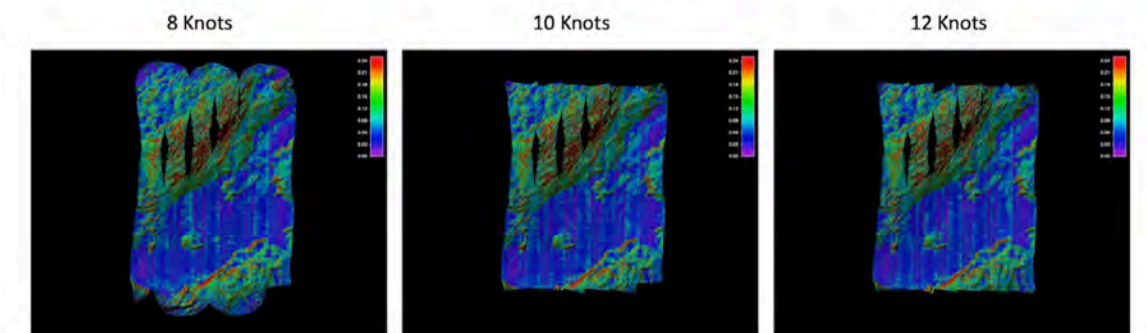


Roll rate and pitch rate experience by the DriX.

Data Density and Uncertainty at 8, 10 and 12 kts (2040 with dual-ping)



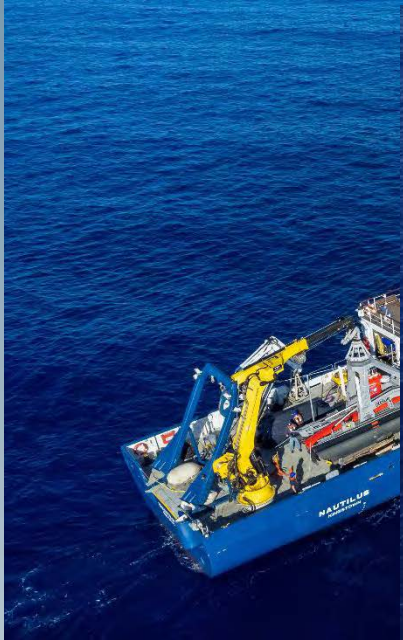
Data Density, 0-20 Soundings/m²



Uncertainty, 95% CI, 0-.25 m

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Installed on NAUTILUS Jan/Feb 2022 — 10 day SHAKEDOWN cruise



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Installed on NAUTILUS Jan/Feb 2022 — 10 day SHAKEDOWN cruise
OECI TECHNOLOGY CHALLENGE 06-22 May 2022

- Develop and demonstrate collaborative behaviors between multiple vehicles (ASV, USVs, and mothership) to “EXPAND THE EXPLORATION FOOTPRINT”



UNH DriX



WHOI Mesobot



WHOI NUI



OET NAUTILUS

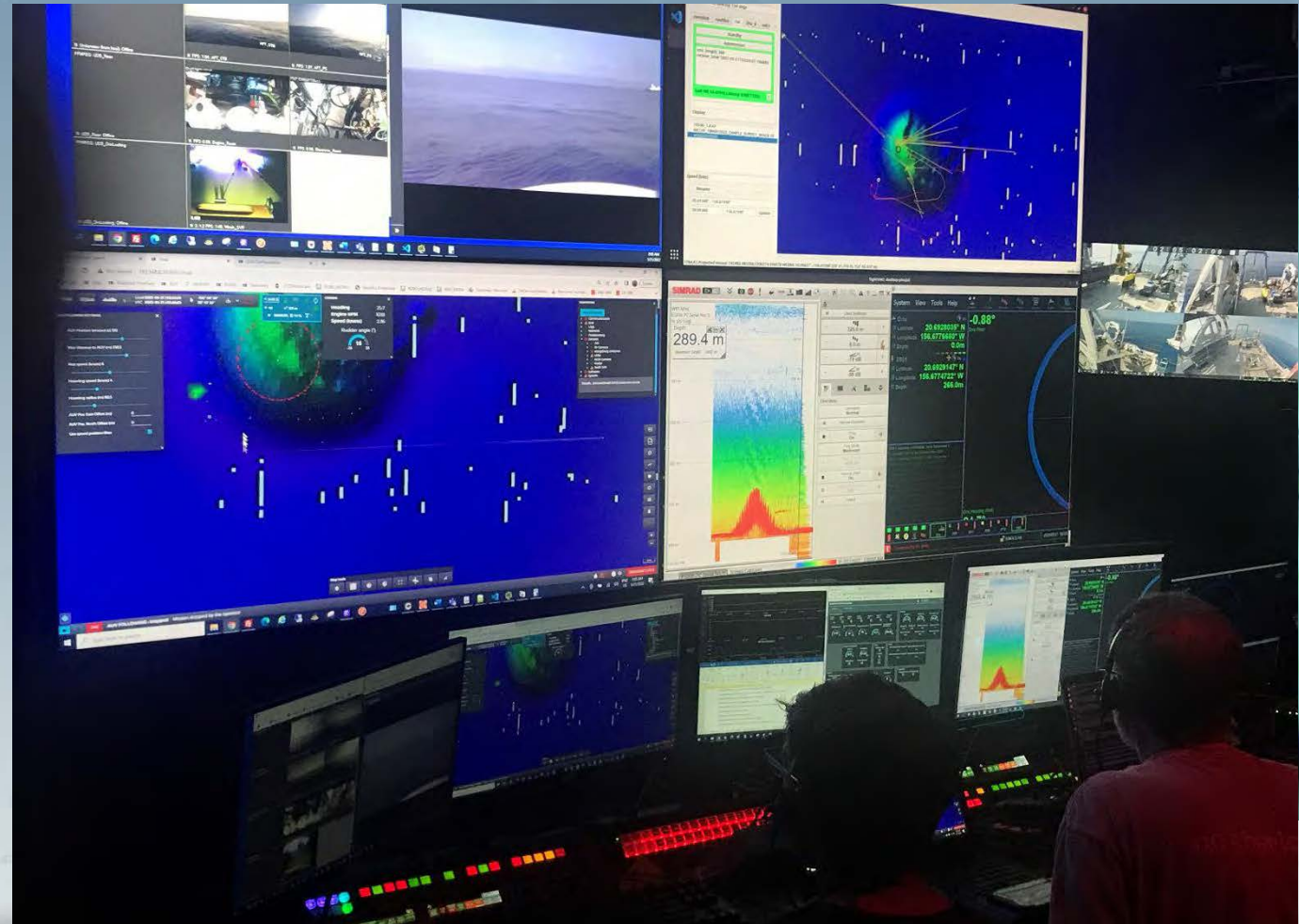


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OECI TECHNOLOGY CHALLENGE 06-22 May 2022



- DriX acoustically tracked Mesobot and NUI – automatically followed Mesobot and NUI, reported their positions and displayed DriX, Mesobot, NUI and NAUTILUS positions on DriX HDMI and UNH CAMP for full situational awareness – NAUTILUS free to carry on other activities within MBR telemetry range (~20 km)
- DriX – EK80 provided mid-water targets for Mesobot and seafloor targets for NUI – DriX sent commands to Mesobot and NUI to change speed, depth and heading and directed vehicles to targets.

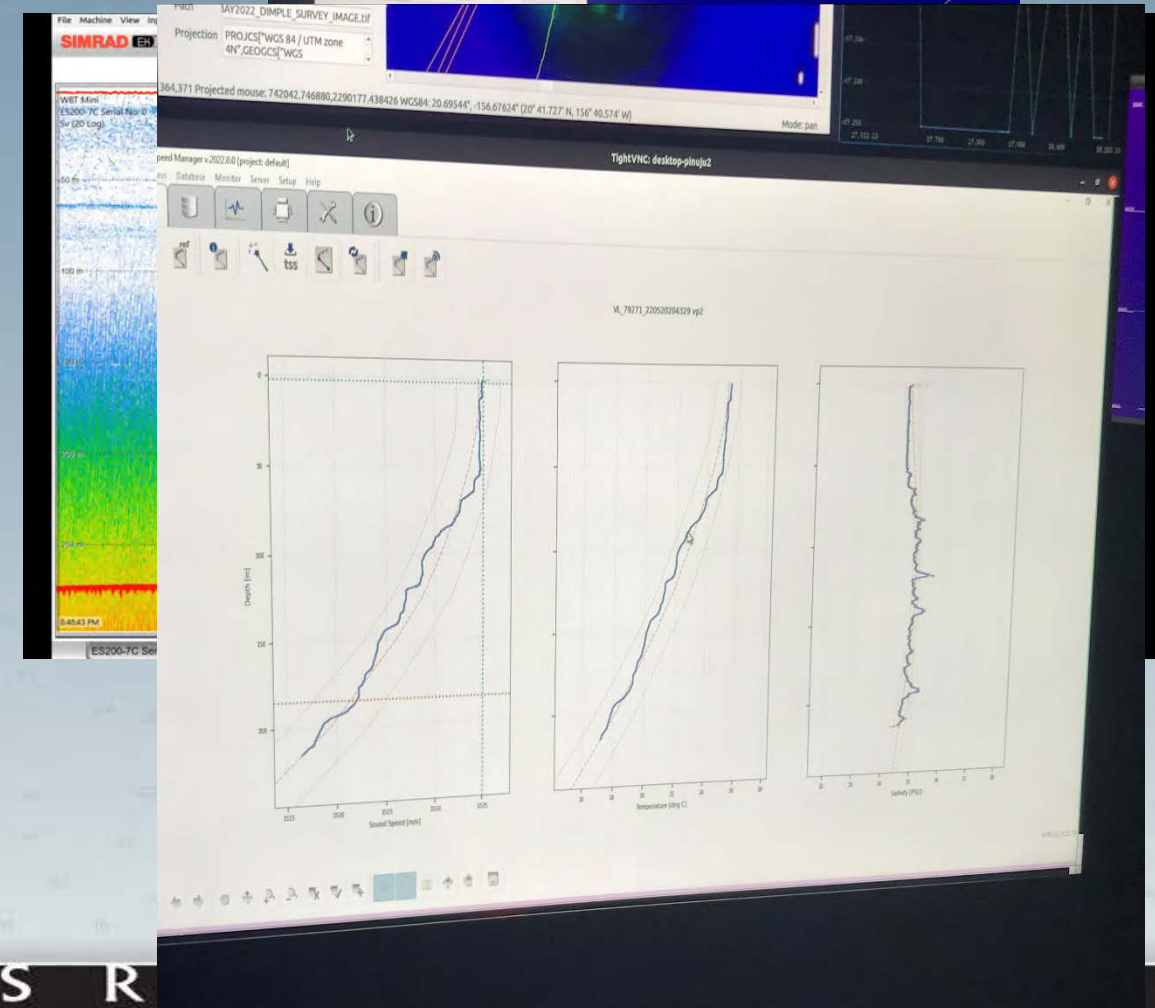




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OECI TECHNOLOGY CHALLENGE 06-22 May 2022

- Mesobot's arrival at target during sampling fully confirmed by direct indication of Mesobot on DriX's EK80 – DriX relays command to open eDNA sampler – **OPENS NEW WORLD OF "VERIFIED - DIRECTED SAMPLING"** -- Many potential new applications – including avoidance.
- Transmission of CTD measurements from Mesobot to ship via DriX for real-time input on water column properties

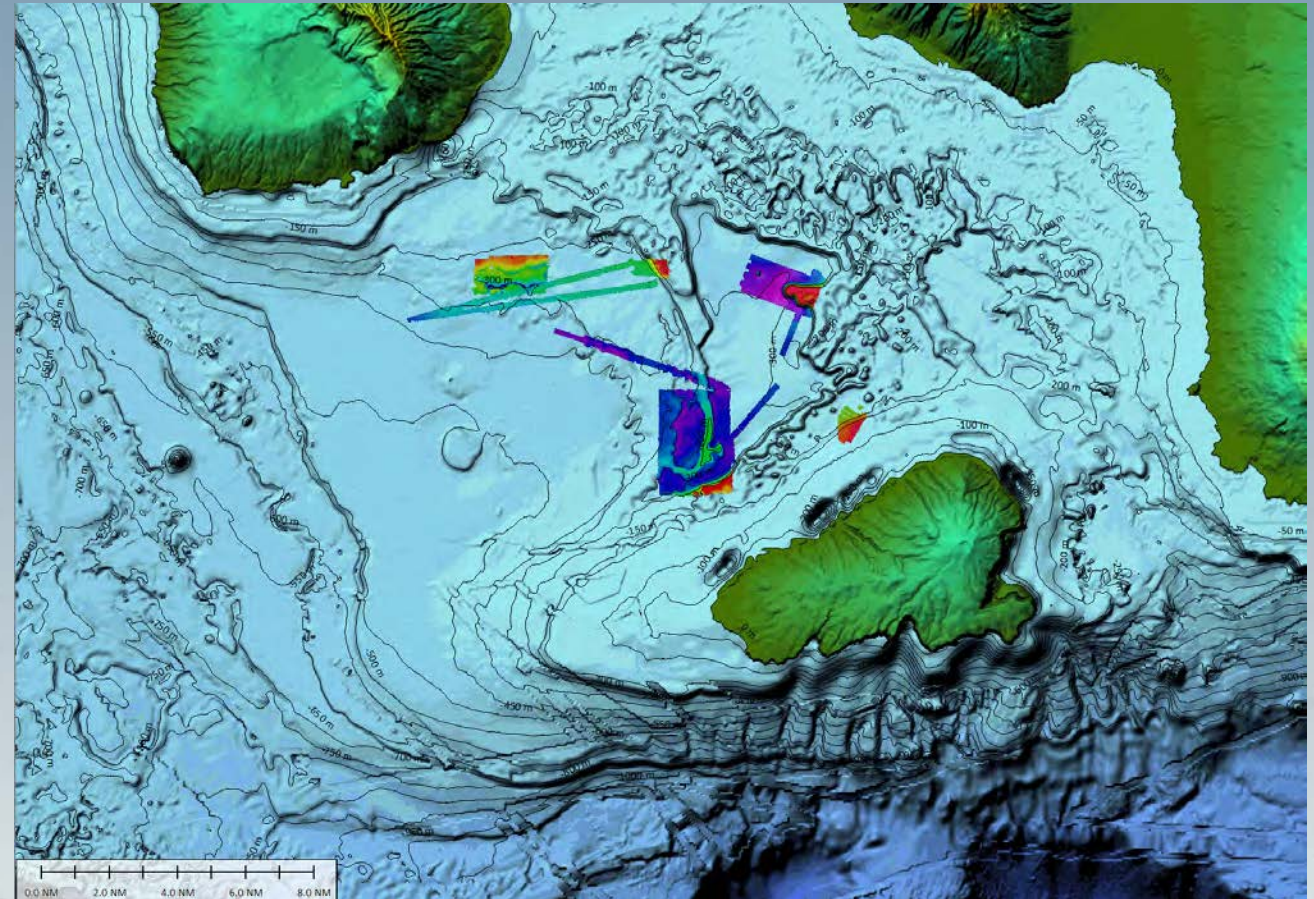




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OECI TECHNOLOGY CHALLENGE 06-22 May 2022

- Eight deployments (and recoveries!) of DriX including 14 hour overnight mission - NO DOWN TIME!!! - 6 mapping missions
- Launches very smooth and routine -- recovered by aut docking each deployment.
- Simultaneous mapping -- DriX mapped independently of NAUTILUS while NAUTILUS mapped as much as 14 km away
- Mapping data transmitted at end of each line – allowed full map product creation (including edited products) by end of survey





- **Andy Armstrong, LTJG Airlee Pickett - OCS**
- **Don Jones, LT Mary Beth Head - OMAO**



HYDROGRAPHIC SERVICES

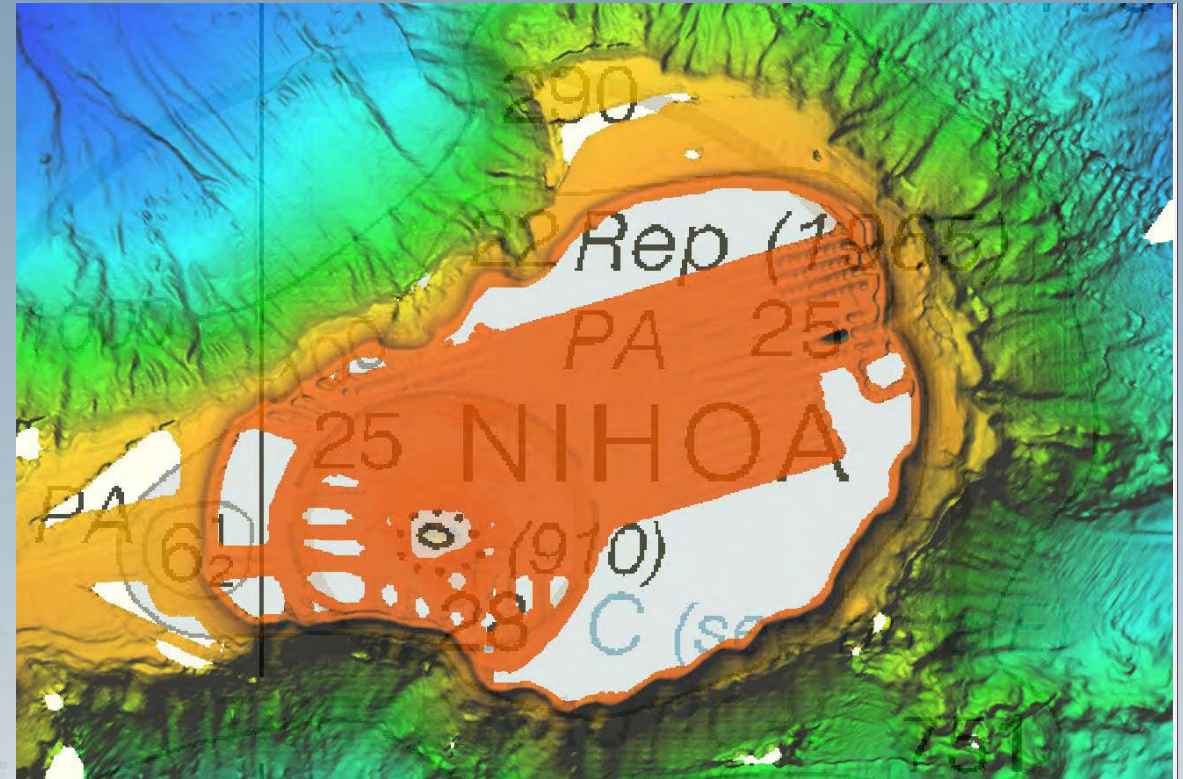


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OECI DUAL MAPPING TECHNOLOGIES

NA-142 16 July – 8 August Honolulu - Honolulu

- **JHC/OCS/OMAO goals:**
 - Develop protocols for dual vessel operations
 - Junction with recently collected LIDAR data
 - Fill gaps where LIDAR went to extinction and no MBES data existed – to NOAA standards
 - Redo sparse MBES from UH compilation
 - Compare mothership 30kHz MBES to shallow water 2040





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OECI DUAL MAPPING TECHNOLOGIES

NA-142 16 July – 8 August Honolulu - Honolulu

VERY CHALLENGING WEATHER.....

- **DriX launch and recovery on NAUTILUS (single-point pick w/crane) limited by weather and sea-state – likely similar to limits for manned launches on NOAA vessels (better w/davit)**
- **Once in water – DriX has excellent sea-keeping ability and can transit at high speed**



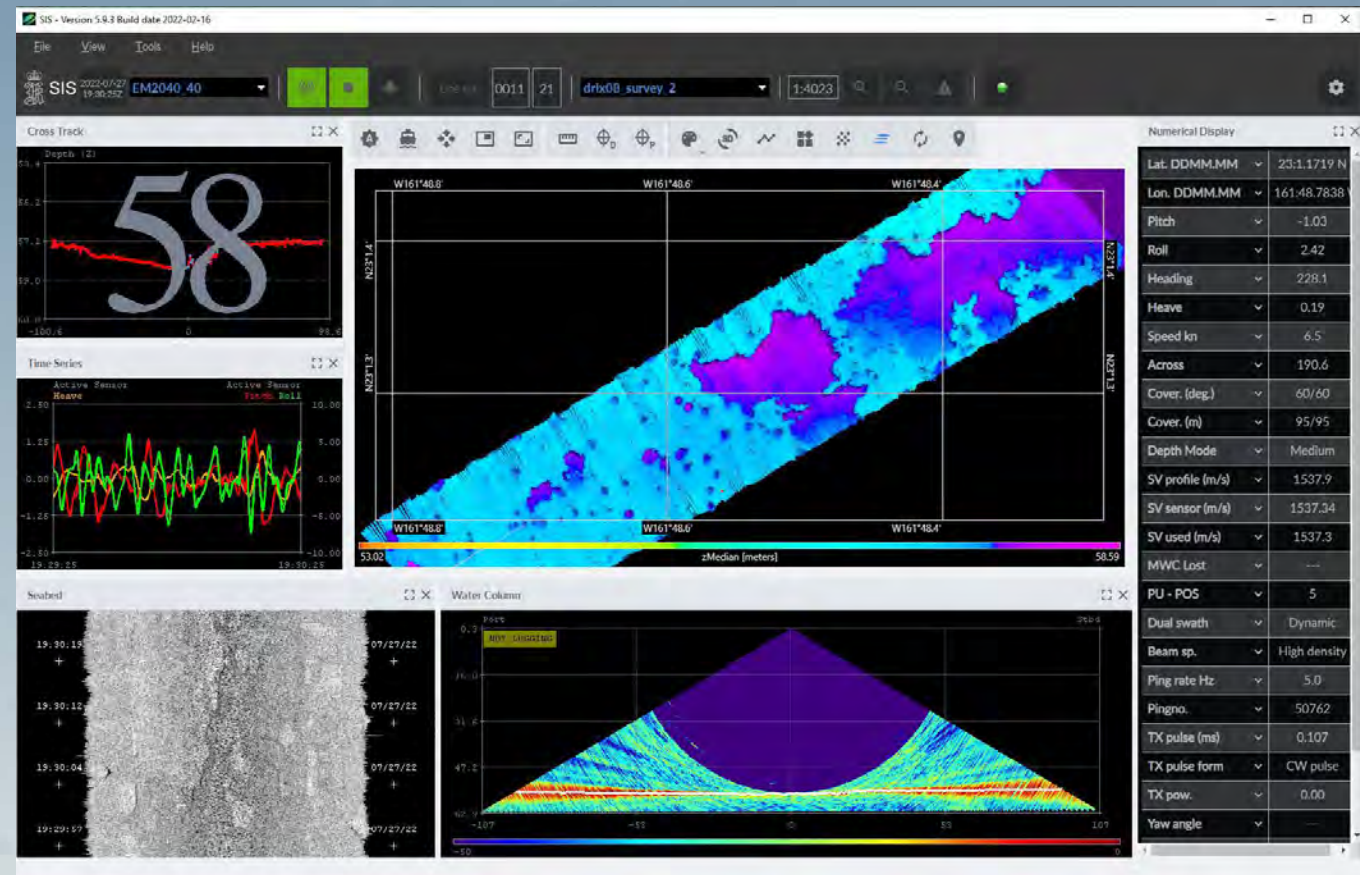


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OECI DUAL MAPPING TECHNOLOGIES

NA-142 16 July – 8 August Honolulu - Honolulu

- **DriX speed and endurance allowed us to steam to lee of islands, launch vehicle and keep in water for several days**
- **DriX can survey at high speed with with little data degradation**



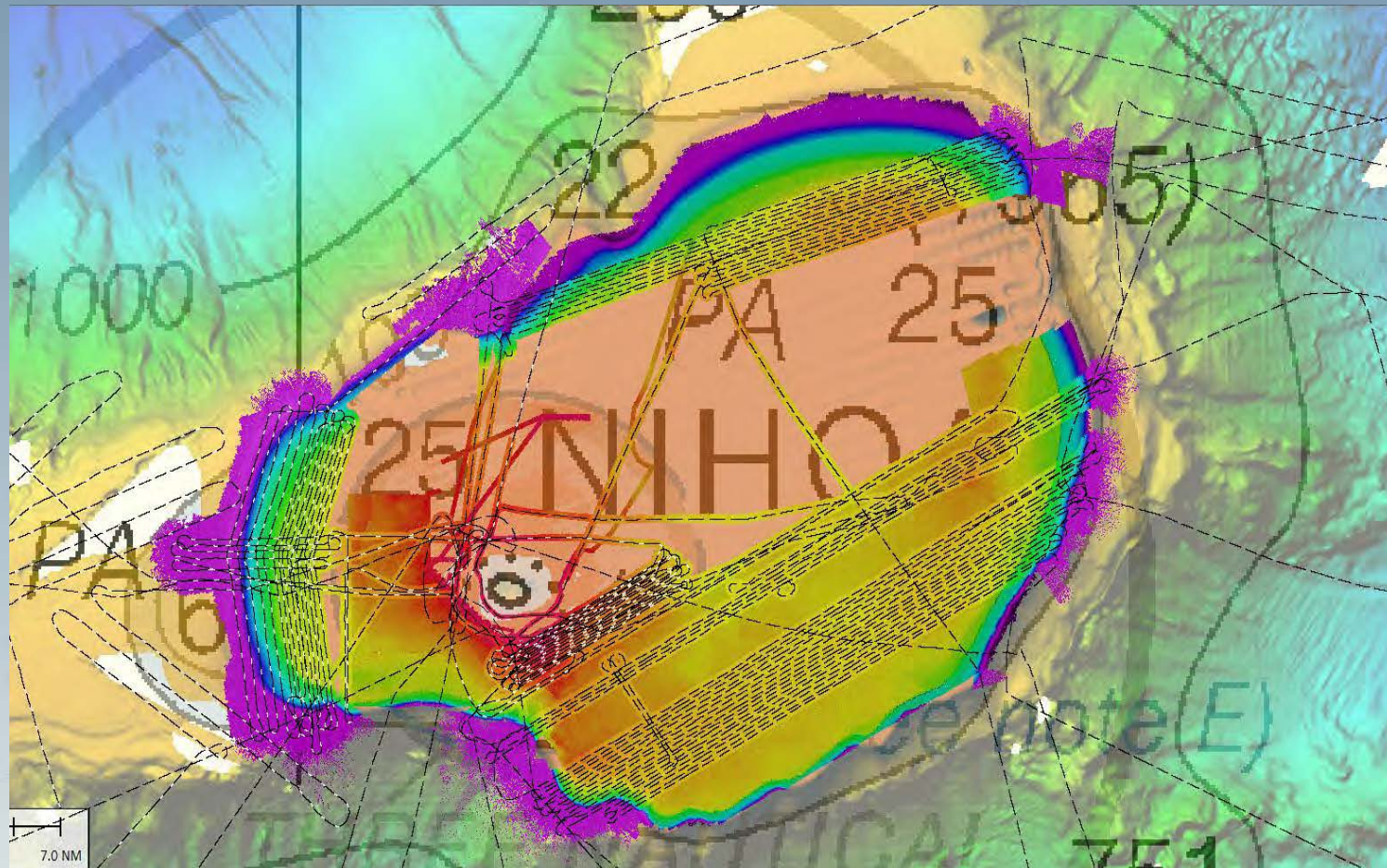


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OECI DUAL MAPPING TECHNOLOGIES

NA-142 16 July – 8 August Honolulu - Honolulu

- Dual vessel operations were simple – full data telemetry and situational awareness to limit of MBR (~20 km)
- >95% of data collected met or exceeded NOAA specifications for water depths
- Many junctions with LIDAR, old MBES and NAUTILUS MBES
- LIDAR collected to ellipsoid – no VDATUM transformation model – working on best tide model

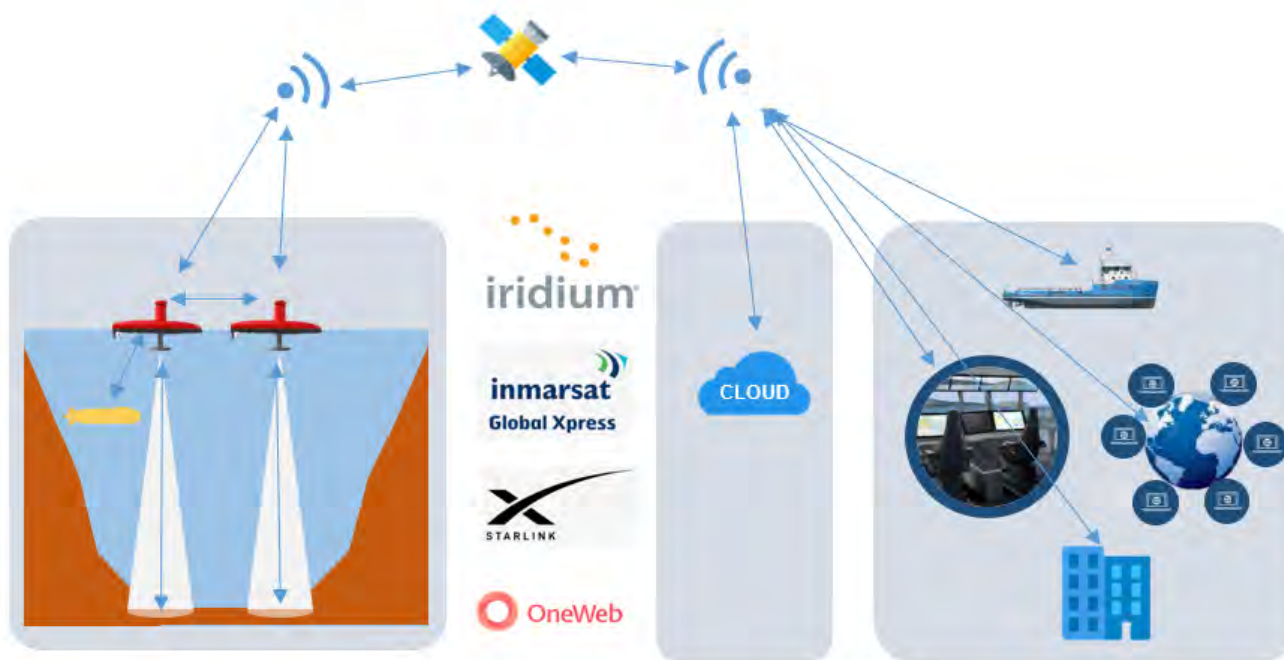




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What's Next???

DRIX OTH CONNECTIVITY



- Real Time control User experience
- Multi-cameras situational awareness:
 - Full 360° RGB
 - High Field of view IR
- More advanced radar awareness

- Medium to high resolution DTM from MBES
- Payload data upload (partial) during mission execution
- More advanced visualization of heavy data producer (watercolumn data)

