

E Mamana Ou Gataifale I - Multi-Vehicle Exploration of American Samoa (NA164)

August 10-28, 2024

- 16 days at sea
- 651 km² of seafloor mapped
- 16 Mesobot dives
- 8 DAP deployments
- 357 eDNA samples collected
- 38 live ship-to-shore interactions
- 711 ship-to-shore participants
- >100,000 live stream views
- >1,067,500 social media views

- ★ Expedition ports
- E/V Nautilus mapping
- Mesobot dive
- DAP deployment



OVERVIEW

On August 10-28, 2024, E/V *Nautilus* conducted the fourth annual telepresence-enabled expedition focused on integrating multiple emerging exploration technologies from partner institutions of the NOAA Ocean Exploration Cooperative Institute (OECI). The expedition used uncrewed surface vehicle *DriX* launched from a shore-based station in Pago Pago, in combination with autonomous underwater vehicle *Mesobot* and *Deep Autonomous Profiler (DAP)* launched from E/V *Nautilus*, to explore seafloor and water column habitats of American Samoa. During 16 days at sea, these advanced exploration technologies were used to map, survey, and sample deep ocean habitats around Tutuila Island, Ta'u Island, and Vailulu'u Seamount. A total of 27 scientists, engineers, educators, and students representing 10 institutions sailed on the expedition, who were supported by an additional 8 professionals who participated remotely via telepresence technology.

OPERATIONS SUMMARY

While high sea states limited operations for portions of the mission, the expedition successfully completed 8 *DAP* and 16 *Mesobot* deployments, many of which were closely coordinated with shore-controlled *DriX* operations. The expedition mapped 651 square kilometers of seafloor, including a large data gap southwest of Tutuila Island, and the entirety of [Vailulu'u Seamount, an active underwater volcano that had not been mapped since 2019](#). Guided by *DriX* fisheries sonar data, *Mesobot* was directed into specific portions of the water column for targeted sampling operations. *DAP* deployments added visual data on the seafloor down to depths of 4,700 meters, in addition to environmental DNA (eDNA) samples and data throughout the water column. Collectively, these multi-vehicle explorations surveyed midwater ecosystems from the sea surface to the seafloor, gaining important new information on the spatial and temporal dynamics of these largely unstudied marine ecosystems.



Geographic Focus: American Samoa, including within the National Marine Sanctuary of American Samoa

Main Operations: Multi-vehicle operations using USV *DriX*, AUV *Mesobot* & *Deep Autonomous Profiler*

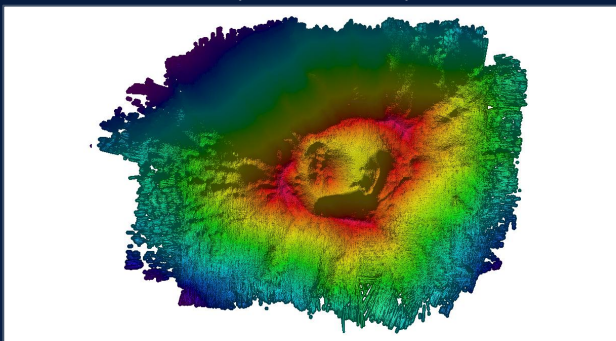
Sponsor: NOAA Ocean Exploration via the [Ocean Exploration Cooperative Institute](#)

Expedition Webpage: www.NautilusLive.org/cruise/NA164



DRIX SUMMARY

In contrast to previous multi-vehicle expeditions aboard E/V *Nautilus*, the expedition featured *DriX* deployments from a shore-based station in Pago Pago, with simultaneous operators controlling the vehicle remotely from American Samoa and the University of New Hampshire. *DriX* was operated more than 100 nautical miles from shore, a new *DriX* record, with deployments of up to 60 hours to meet E/V *Nautilus* for collaborative operations. The limits of the *DriX* operating window were tested as well, operating in high sea states sometimes exceeding 3 meters in wave height. *DriX* also supported several science objectives, which focused on mapping the seafloor of Vailulu'u Seamount using its multibeam sonar, and water column mapping using its fisheries sonar. The water column mapping data was used to direct *Mesobot* into specific midwater habitats for paired vehicle operations.

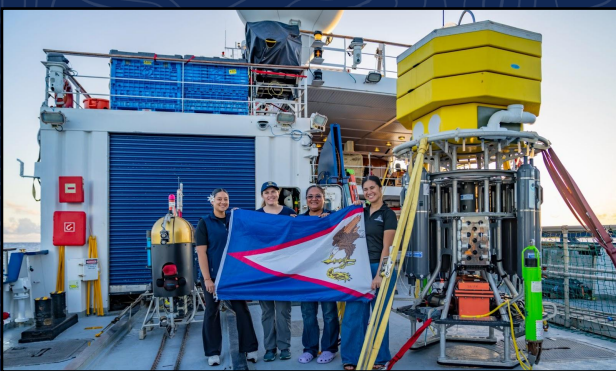


MESOBOT SUMMARY

Mesobot was deployed 16 times, often in tandem with *DriX*, during which it surveyed midwater environments for over 84.5 hours at depths down to 750 meters. Using significant upgrades to its camera lighting, and a new optical lure to attract midwater organisms, *Mesobot* recorded a wide variety of midwater biodiversity. In addition to collecting high-resolution video, *Mesobot* was equipped with two eDNA multi-samplers, a radiometer, fluorometer, CTD, and miniature autonomous plume recorder that collected continuous environmental data on each deployment.

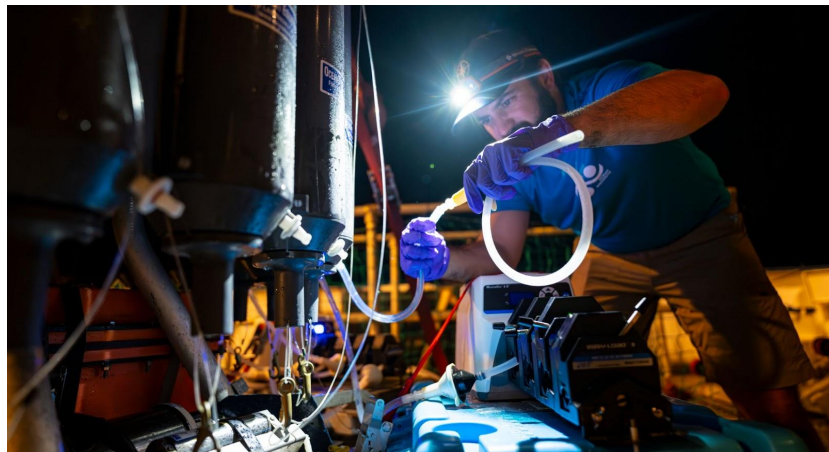
DAP SUMMARY

The expedition included 8 successful *DAP* deployments down to 4,700 meters for a combined time of over 41.5 hours. Continuous video, CTD environmental, and passive acoustic data were collected during each deployment, in addition to collecting water for eDNA samples, including some obtained via a new large-volume eDNA sampler rated to 6,000-meter depth. Each deployment surveyed the entire water column from surface to seafloor, thereby adding important information about the links between the seabed and water column ecosystems.



eDNA SAMPLING SUMMARY

A total of 357 eDNA samples were collected over the course of the expedition, which will provide important baseline information about the marine biodiversity of American Samoa. This included 198 collected using autonomous samplers mounted on *Mesobot*, 44 using an autonomous sampler mounted on *DAP*, and 115 samples obtained by filtering water collected by the Niskin bottles mounted on *DAP*. *Mesobot* samples were collected above, within, and below layers of acoustic backscatter identified on *DriX*. *DAP* samples spanned depths between the sea surface down to 4,700 meters, thereby providing a complete cross-section of midwater ecosystems.



EDUCATION & OUTREACH

Over the course of the expedition, live-stream video feeds received over 100,000 views, and highlight videos garnered another 12,000 views. Expedition content on OET's TikTok channel gained over 822,000 views, plus posts on Instagram, Twitter, Facebook, and LinkedIn attracted over 245,500 impressions. While at sea, the team created [10 new education and outreach products](#) and hosted 37 live ship-to-shore interactions with schools, community events, and professional meetings, reaching over 700 people across 12 US States, American Samoa, Canada, Malaysia, and Ecuador. One professional educator and eleven university students sailed on the expedition, including two via OET's Science Internship Program. Following the expedition, [a ship tour event welcomed educators, students, and community members](#) onboard E/V *Nautilus* while docked in Pago Pago. Early expedition results were featured in 7 media stories.

DATA ACCESS

Data collected on this expedition will be sent to repositories for archiving and public distribution. Data collected by E/V *Nautilus* and *DriX* will be sent to the [Marine Geoscience Data System](#) and [Rolling Deck to Repository](#). Data collected by the *DAP* will be submitted to the [Open Portal to Underwater Soundscapes](#) and the [National Centers for Environmental Information](#), whereas *Mesobot* data will be archived at [Woods Hole Oceanographic Institution](#). Once eDNA samples are processed, genetic data will be made publicly available via the [National Center for Biotechnology Information Sequence Read Archive](#), and DNA aliquots will be sent to the Smithsonian Institution for archiving. Highlight images, background information, and educational materials developed during the expedition are available via the [expedition website](#).

ACKNOWLEDGEMENTS

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