

Ocean Exploration Advisory Board
A Federal Advisory Committee Act Board
June 12, 2020

Dr. Neil Jacobs
Administrator, National Oceanic and Atmospheric Administration (Acting) and Assistant
Secretary of Commerce for Environmental Observation and Prediction
14th and Constitution, NW
Washington, DC 20230

Dear Dr. Jacobs:

We are writing in response to RDML Tim Gallaudet's request for the Ocean Exploration Advisory Board (OEAB) to provide advice on the requirements for full-ocean depth exploration, the technologies appropriate for such exploration, and considerations of which NOAA should be mindful when making decisions about full-ocean depth exploration.

The OEAB convened a distinguished panel to provide information from different perspectives on these issues. Dr. Peter Girguis, Harvard University, Dr. Dijanna Figeroa, St Mark's Parish School, Brian Midson from the National Science Foundation, and Dr. John Grunsfeld, former NASA Chief Scientist, highlighted the importance of ocean exploration in understanding how ocean processes operate across a continuum of depths, the critical importance of "bringing the public along" on expeditions, and applying robots or human occupied vehicles in ways appropriate to the mission (and mindful of cost).

To explore fully Earth's Oceans, the entire range of geologic settings that arise, the full spectrum of environmental conditions present, and the diversity of life that the oceans sustain must all be considered. These aspects of deep ocean exploration represent essential ingredients of the national program of Ocean Exploration that NOAA leads and coordinates through its Office of Ocean Exploration and Research (OER).

The *Presidential Memorandum on Ocean Mapping of the United States Exclusive Economic Zone and the Shoreline and Nearshore of Alaska* (November 19, 2019) stresses the need to explore even into the very deepest parts of the ocean as we recognize that parts of the US EEZ still to be mapped and characterized include some of the deepest portions of both the Pacific and Atlantic Oceans (Mariana Trench and Puerto Rico Trench, respectively). There is rich opportunity in exploring all areas of the U.S. Exclusive Economic Zone. Some 98% of the global ocean, much of it unexplored, lies at depths up to 6500m and is already accessible through US robotic technology. Soon, the Human Occupied Vehicle (HOV) *Alvin* will be able to take US scientists there in person, too.

Accessing the deepest parts of the world's oceans, beyond 6500m, has remained an elusive technical challenge for both robotic systems and human occupied vehicles. All discoveries--whether made in person or via robots, contribute to humanity's collective knowledge. But discoveries made with humans

present in extreme environments can secure more productive scientific outcomes, more efficiently, but also provide for enhanced engagement with the public.

All ocean exploration, but in particular exploration using Human Occupied Vehicles, presents an opportunity to engage the public in an expedition. The public engagement elements of an expedition should be as carefully considered as the technical or scientific elements. No HOV dive should take place without the opportunity to “take the public along” as part of the expedition, to use the opportunity to engage, to educate, and to share the value and wonder of ocean exploration in the deep ocean.

NASA’s space exploration model is an instructive one for NOAA. Long before humans are sent on missions to Mars, robots have already begun to show the way and continue to help narrow exploration objectives. A robust public engagement program is part of every NASA mission. Similarly, we recommend a program that blends robotics judiciously with exploration in Human Occupied Vehicles: a program that advances our national capability to venture ever deeper into Earth’s unexplored ocean interior. Following NASA’s successful model, NOAA should focus on lower cost robotics, including robotics capable of full ocean depth exploration, while encouraging ocean exploration using the human occupied *Alvin*, a vehicle operated by the National Deep Submergence Facility for the ocean exploration and research community.

NOAA-OER should continue to develop access to new and emerging technologies that will extend our reach still further into the remaining 2% of the ocean’s depth currently inaccessible to most robots and to *Alvin*. For example, NOAA’s new Ocean Exploration Cooperative Institute has made an important start in this direction, supporting field-trials of a new *Orpheus* vehicle – a small, low-cost drone, designed for full ocean depth operations and developed thus far through via a private funding model, through a partnership between NASA’s Jet Propulsion Laboratory and the Woods Hole Oceanographic Institution. As we extend into every part of Earth’s oceans, the *Orpheus* concept represents an exciting and democratizing approach. The design vision calls for a small, low-cost asset, that can be deployed from research vessels of all sizes, worldwide, requiring no more specialized technical support than a CTD rosette. And developing innovative ways to engage the public, regardless of the technology used, should be integral to planning and executing ocean exploration expeditions.

Rather than a single investment in a high-value asset that only few will have the opportunity to access or employ, our recommended path forward:

- Offers the potential for widespread access to the entire ocean – not just to the deepest trenches but to everywhere in between--through next-generation low-cost, portable “pathfinder” drones that conduct first-order exploration to reveal where the most exciting new discoveries await.
- Maximizes returns, immediately, from the *Alvin* submersible which has the longest proven track record (decades) of any human operated vehicle worldwide and offers the broadest range of access to 98% of the global seafloor, in person, for a diverse U.S. user community.

To advance human presence in the deep ocean, we recommend that NOAA OER be proactive in helping shape the research program of the National Deep Submergence Facility (NDSF) vehicle *Alvin* when it returns to service in 2021. With its current upgrade to allow the vehicle to operate as deep as 6500m, US researchers will be able to reach 98% of the world’s ocean floor (and the vast volumes of ocean water-column overhead) in person: a space that previously few humans have ventured into. The national deep submergence science community is actively working together to anticipate the

opportunities that *Alvin* will afford for its Science in the Abyss program in the coming months (<https://ndsf.whoj.edu/alvin/workshop-alvin-in-the-abyss/>).

It is extremely timely, therefore, for OER to take a leading role in shaping the future use of *Alvin* precisely because of the opportunities about to arise -- to **explore** vast tracts of the ocean floor, expand our knowledge of what is present and help articulate new hypotheses for follow-on **research**. Both an expanded NOAA-OER competitive grants program and the National Oceanographic Partnership Program could present useful ways for NOAA to play a leading role in helping to shape this program of exploration and research.

The OEAB stands ready to expand on these recommendations as requested.

Sincerely,

A handwritten signature in black ink, appearing to read "C. Hume", written in a cursive style.

Ambassador Cameron R. Hume
Interim Chair