

Maintaining Progress Toward a Replacement for the Alvin Submersible

A Recommendation from the Deep Submergence Science Committee

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The DEep Submergence Science Committee (DESSC) of the University National Oceanographic Laboratories System (UNOLS) supports the efforts of the National Deep Submergence Facility (NDSF) to design and build a replacement for the Alvin submersible. Alvin has evolved to its current configuration over 37 years of operations. This submersible provides the US academic community with a very effective and essential, routine capability to access the deep ocean and seafloor. The design has proven extremely versatile and useful for a wide variety of scientific field programs at depths up to the current 4500m capability¹. The many discoveries and scientific articles made possible through the use of Alvin are well documented in the lay and scientific literature². Numerous upgrades to Alvin operational and science systems have improved the capabilities of the submersible, particularly over the last decade as advances in submergence technology have escalated. However, the original physical configuration and some of the operational sub-systems and components have become difficult to maintain and are the limiting factors in the NDSF's ability to improve the submersible. A new vehicle is a critical need.

A design study for replacement of the Alvin submersible that will lead to a set of functional, technical specifications required to bid on and build a new research submersible has been funded by two of the agencies that support the NDSF (NSF and NOAA). This effort is the outgrowth of a continuum of community-wide discussions and workshops regarding the future needs of the US deep submergence science community that began in 1997.

The new submersible design, as requested by the research community in the various planning documents³, specifies improvements in many aspects of the vehicle. These include:

- Greater speed
- Improved science sensors and tools
- Improved maneuverability
- Increased power for propulsion and payload
- Greater endurance and improved ergonomics (longer dive time, especially when being used to maximum depth capability)
- Better visibility and lighting
- Improved navigation
- Improved safety systems
- Improved manipulation ability
- Greater external sample storage and increased science payload
- Better communications
- Improved data collection, logging and interface capability to science instruments
- Comprehensive engineering, operational, and science-utilization documentation

- Depth capability to 6500-7000m (depending on technical feasibility and cost-benefit analysis)

The new submersible, with its improved systems and greater depth capability will access 99% of the ocean's depths. The new design will continue to permit operation of the new Alvin submersible by a single pilot on a routine (daily) basis, with two science observers on each dive. All the above improvements would be possible while maintaining deployment capability from the existing support ship with no major modifications to the ship design, or submersible launch-recovery system.

The DESSC recommends and supports a new Alvin. It will continue working with the NDSF and the New Alvin Design Advisory Committee, toward achieving the engineering and science systems design specifications as currently being developed by the NDSF. DESSC is unanimous in its support of this effort and that the NDSF receive appropriate federal funding so that the initiative can move forward on a timely basis. Currently, the time frame envisioned for completion of the design specifications, construction and availability of the new submersible to the marine science community is of the order of 4-5 years. It is the opinion of the DESSC that any delays to the current plan will be extremely counterproductive to the progress of deep submergence science in the US, and that every effort should be made to implement this plan.

Although the DESSC realizes that there is interest in accessing depths greater than ~6500-7000m for scientific research, it stresses that there is a critical need to maintain the excellent existing capabilities to conduct experiments at the range of depths where the majority of current Alvin users have research interests (~1000-4500m). The DESSC does not support a plan to build an occupied submersible with full-ocean depth (11,000 m) capability.

The DESSC has been active in supporting and fostering Remotely Operated Vehicle and Autonomous Underwater Vehicle technology and believes that those vehicle systems offer the most promise to effectively and efficiently conduct scientific research in the deepest ocean. It will continue to maintain aggressive support and campaign for continued development of ROV and AUV systems to benefit oceanographic research at all depths. Ultimately, the needs of the US academic research community will best be served by a broad spectrum of vehicle and ship facilities to access the deep ocean and seafloor. This diversity of oceanographic research infrastructure is essential to maintaining US leadership in the ocean sciences in the 21st century.

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1. See <http://www.whoi.edu/marops/vehicles/alvin/index.html> for basic information about Alvin and its equipment.
 2. For a list of publications from research using the Alvin submersible, the reader is referred to the following web address where a compilation is kept up to date: <<http://www.whoi.edu/marops/vehicles/alvin/index.html>>.
 3. Listing of reports of previous workshops and meetings that relate to the need for submersible facilities to support US oceanographic science:
 - DESCEND Workshop: <<http://www.gso.uri.edu/unols/descend/descend.htm>>
 - NSF Physical Oceanography Futures Workshop: <http://www.joss.ucar.edu/joss_psg/project/oce_workshop/apropos/>
 - NSF Chemical Oceanography Futures Workshop: <http://www.joss.ucar.edu/joss_psg/project/oce_workshop/focus/>
 - NSF Biological Oceanography Futures Workshop: <http://www.joss.ucar.edu/joss_psg/project/oce_workshop/oeuvre/>
 - The Life in Extreme Environments (LExEn) initiative (NSF) Report: <<http://www2.ocean.washington.edu/lexen/>>
 - NSF Marine geology and Geophysics Futures report FUMAGES: <<http://www.joi-odp.org/FUMAGES/FUMAGES.html>> and <http://www.joss.ucar.edu/joss_psg/project/oce_workshop/fumages>

- "A National Initiative to Observe the Oceans." . A white paper endorsed by the Consortium for Oceanographic Research and Education (CORE) that describes a balanced, science-based implementation strategy for integrating a system of long-term, interdisciplinary ocean observations
- The Global Abyss: An assessment of deep submergence science in the United States, UNOLS Office, Univ. of Rhode Island, Narragansett, RI, 1994