Deep Submergence Science Committee (DeSSC) Recommends Acquisition of a Medium-Sized Remotely Operated Vehicle (mROV) to the National Deep Submergence Facility

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DeSSC

The Deep Submergence Science Committee (DeSSC) strongly encourages the addition of a working-class, medium-sized Remotely Operated Vehicle (mROV) to the National Deep Submergence Facility (NDSF). The addition of an mROV would facilitate greater accessibility of deep-sea research, provide redundancy for a heavily used asset, and facilitate increased inclusion and accessibility across a diverse user group and suite of stakeholders. In particular, we propose an ROV of similar capability to ROV Jason, but designed for use on smaller research vessels, including the Regional Class Research Vessels (RCRV). This vehicle would also allow new avenues of research through being available for extended research cruises; long duration ROV cruises are often in conflict with the diverse suite of science already supported by ROV Jason and, thus, a second and highly capable ROV would facilitate research in polar or otherwise difficult to support regions of the globe.

ROVs are a cornerstone of deep ocean research across disciplines and are heavily utilized in ocean science at all latitudes, supported by a wide variety of funding streams including NOAA, NASA, ONR, private donors, and NSF. Of note, ROVs are critical for supporting diverse large-scale projects, which includes providing the required annual service of the Ocean Observatories Initiative (OOI) regional nodes. As highlighted in the 2015 Sea Change report, the NDSF Asset ROV Jason is used for much of this research and has been fully scheduled and oversubscribed for decades. In recent years, even during the SARS-CoV-2 pandemic, ROV Jason has averaged 161 days of use per year; this number is either at the limit of what the vehicle can support or what is able to be scheduled on the size class of ship that ROV Jason requires, depending on the year. Since 2009, NSF has needed to contract outside of the US for ROV support (e.g., the Canadian Scientific Submersible Facility's ROV ROPOS) as American assets were unable to meet the funded research needs of the US academic community. However, the use of contracted ROVs has previously led to last minute cruise cancellations as a result of vehicle failure, indicating that there is significant risk to the use of non-NDSF vehicles. In addition, contract ROVs do not necessarily or by default meet the established UNOLS/NSF standards for data products and archiving that are employed by the NDSF.

An NDSF mROV would bring increased capability and accessibility to American deep-submergence scientists, while capitalizing on existing NDSF resources and their framework for cruise planning, data management, and scheduling. ROVs capable of deploying on small to medium research vessels are currently missing from the NDSF facility, but with technological advances, such ROVs are increasingly capable of being utilized for a significant proportion of research needs. In contrast to the other, smaller ROVs that are available commercially, an NDSF mROV would provide US scientists dedicated access to the vehicle, with freedom from competition with other scientific entities and industry. With the improvement of single-body systems (i.e., the ROV does not need a second vehicle to concurrently be in the water to support its activities) less deck space is needed. ROV Jason is frequently obligated to ride Global and Ocean class vessels in different portions of the globe, often making it unavailable for near shore work in the US EEZ, as well as polar cruises. In particular, ROV Jason is required for ~2 months a year in prime northern hemisphere sea condition windows to service the OOI array for at least the next 10+ years. This makes a core NDSFs asset obligated when many researchers would be using the vehicle for their funded research projects; an ROV capable of being deployed on an RCRV would be far more nimble in supporting these other projects in weather windows where they would be most effective.

Finally, the current scheduling and ship constraints make it difficult to support NSF RAPID proposals that allow scientific response to unforeseen events and opportunities. A new mROV would improve the possibility that US deep-submergence scientists could respond quickly when the need arises.

Near shore cruises on smaller research vessels provide invaluable field experience for early career scientists, including those that are from groups underrepresented in science. Concurrently, coastal and regional research ships are important emblems of of the academic research fleet and ocean science for coastal communities. An exciting aspect of the three new RCRVs is their ability to support science "in the backyard" of taxpayers and communicate the applicability of ocean research to regional stakeholders. It is not by chance that the Gulf-Caribbean Consortium will operate an RCRV named after Gilbert R. Mason, a prominent civil rights activist, highlighting that this vessel class and their nearshore mission will advance necessary equality efforts within the Geosciences and other disciplines. The mROV proposed here would provide access to the deep ocean for many of the communities that will be served by the RCRVs, even though they have been underserved historically and excluded from science for generations. High bandwidth ship-to-shore connections open up new possibilities for inclusion, stakeholder engagement, public outreach and STEM education. Direct integration of remote access/telepresence for both outreach and technical assistance is increasingly valued and not all ROV assets are designed for data-cloud transmission and outreach. Providing opportunities to utilize expanded bandwidth with the proposed mROV will further community objectives to broaden participation in deep-sea science.

Deep-sea research is not without potential challenges and risks and is made more risky by the lack of redundancy in the UNOLS deep-submergence fleet. For example, shipping and customs delays, global supply chain issues, and the impact of SARS-CoV-2 on global travel can cause significant delays that have cascading effects on ship schedules and funded research. It is common for ROV Jason to have cruises on opposite sides of the globe scheduled without a break, putting significant stress on the incredibly unique, skilled, and relatively small NDSF workforce. Complementary vehicles, especially if designed to have similar parts and systems, would facilitate reduced stress and may also increase retention of the workforce by diversifying the location, duration, and types of NDSF work opportunities.

As highlighted in the "Sea Change: 2015-2025 Decadal Survey of Ocean Sciences", ROVs are "important to almost all decadal science priorities, demonstrating a broad utility across many scientific disciplines" and concurrently "limited by the geographic restrictions that occur due to scheduling" even though polar and littoral research using ROVs is expanding. Polar regions are at the forefront of climate change and, as encompassed within "Navigating the New Arctic", these areas should be epicenters of research. Yet it has historically been difficult to support deep-submergence work in polar regions due to the extended deployments required for polar work conflicting with the need for assets elsewhere. NSF's significant investment in polar research is also expanding, and an ROV that had the scheduling room and design to be deployed on the forthcoming NSF Icebreaker would create significant capability at both poles.

Almost twenty years ago, a 2004 NRC study titled "Future Needs in Deep Submergence Science" stated "It is apparent that realizing the vision of deep ocean research will require access to a broader mix of more capable vehicles than are currently available through the NDSF." A medium size but working class ROV would directly address this ongoing need and add to the portfolio of science that can be supported. Currently, there are other ROVs available for use by US scientists, but in many cases they are geographically limited and/or tied to a particular research vessel. This mROV would be complementary to existing US assets and housing this proposed vehicle at NDSF would allow sparing and in place data streams to facilitate rapid integration and use by the academic research fleet users.

In short, DeSSC strongly recommends the addition of a RCRV-capable mROV to the NDSF, allowing redundancy, increasing capability, and improving equity for US deep-submergence science and the broader oceanographic community.