APPENDIX XIX

Preliminary Response from DESSC to Fred Saalfeld dated 12/5/96

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

An association of institutions for the coordination and support of university oceanographic facilities.

MEMORANDUM

Date: December 5, 1996

To: Dr. F. E. Saalfeld, ONR

From: The DEep Submergence Science Committee
(M. Perfit- Chair, J. Bellingham, R. Collier, P. Fryer, M. Lilley, H. Milburn, D. Orange, C. Van Dover, C. Wirsen)

Subject: Preliminary Response from DESSC Regarding Long Range Scientific Objectives and Vehicle/Facility Requirements for Deep Submergence, and Transitioning of SEACLIFF for use by Academic Research

The following assessment is in response to your request for input from the DEep Submergence Science Committee (DESSC) regarding utilization of the U.S. Navy's deep submergence assets. The DESSC has deliberated via electronic mail and telephone to provide a preliminary assessment of deep sea scientific research objectives for the next few decades, and the projected requirements for deep submergence vehicle systems and facilities to meet those needs. In accordance with the DESSC's overall plan to include the perspectives and requirements of the deep submergence research community in this planning process, a more formal and comprehensive assessment of these issues will be carried out by a working group comprised of experienced users of deep submergence facilities. This ad hoc group will meet in early February and will submit a report to you in the Spring of 1997. In the interim, the DESSC considers it important to provide you and the agencies with a written statement concerning these matters that would help guide your policy decisions in the near-term.

We hope that this preliminary assessment is useful to you and welcome your comments. We will keep you appraised of our progress in getting community input on these important issues and plan for it to be an agenda item for discussion at the upcoming DESSC meeting at the San Francisco AGU.

Best Regards,

Michael Perfit

Mike Perfit, DESSC Chair

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Future Directions in Deep Submergence Science

The most recent, comprehensive assessment of -future deep sea research objectives for the coming decades was presented in a report titled, *The Global Abyss* (Fox et al., 1994), which was largely shaped by DESSC open forums and workshops prior to 1992. That report, which presents a balanced, multi-disciplinary view of deep sea research- present and future, identifies many important biological, chemical, geological, and engineering problems that require human presence, in situ or remotely, in the abyss. For example, relatively recent discoveries of deep ocean hydrothermal communities and hot (> 300'C) metal-rich vents on many segments of the mid-ocean ridge, documentation of the immediate after-effects of submarine eruptions on the northern East Pacific Rise, Gorda Ridge and CoAxial Segment of the Juan de Fuca Ridge, discoveries of extensive fluid flow and vent communities along continental margins and realizations regarding the extent of mid-water and deep crustal biomasses have revolutionized our concepts of deep ocean chemistry, biology, and geology. They also propelled deep submergence science, and the related fields of deep sea microbiology, sedimentology, biochemistry and biotechnology, to new research directions that will be the focus of concentrated investigations in the coming decades and have provided further impetus to investigate the processes which lead to the creation of 75 % of the Earth's crust. In addition, tectonic and geotechnical research at oceanic trenches, structural studies in transform faults and microplates, and continental margin and oceanic island studies related to catastrophic slope failure and seismic/volcano hazards, all are important areas of science that will be the focus of fundamental deep submergence research into the 21st century.

The disciplines involved are varied and the scales of investigation range many orders of magnitude from molecules and micron-sized bacteria to segment-scales of the mid-ocean ridge (MOR) system, 10's to 100's of kilometers long at depths that range from 2500 m to 6000 m and greater in the deepest trenches. Clearly the spectrum of scientific problems and environments where they must be investigated require access to the deep ocean floor with a range of safe, reliable, multi-faceted, high-resolution vehicles, sensors and samplers, operated from support ships that have global reach and good station-keeping capabilities in rough weather. Providing the right complement of deep submergence vehicles and versatile support ships from which they can operate, and the funding to cost-effectively operate those facilities, is both a requirement and challenge for satisfying the objectives of deep sea research in the coming years and into the next century. The DESSC, with input from the research community via the working group, will provide additional details on the vitality and relevancy of deep submergence research in our final report on this topic.

Present Status and Future Deep Submergence Vehicle and Facility Requirements

The U.S. academic research community has routine, observational access to the deep ocean and sea floor down to 6000 m depth via the National Deep Submergence Facilities operated for UNOLS by the Woods Hole Oceanographic Institution. The vehicle systems of the National Facility currently include the submersible ALVIN which can dive to a depth of 4500 m, and the remotely operated vehicle (ROV) Jason, Argo II imaging system, and DSL-120 sonar which can work at depths as great as 6000 M.

Over the past 5-7 years the U.S. Navy submersibles SEACLIFF and TURTLE, and ROV ATV have been made available for limited academic research through a cooperative arrangement between NOAA and the U.S. Navy's Submarine Development Group 1 in San Diego, CA. These vehicles have expanded opportunities for peer-reviewed deep submergence research off the U.S. west coast. SEACLIFF and ATV have provided the science community with some additional access to the deep sea and permitted observations to depths -6000 m, a depth range otherwise only available by using ROV Jason or the other tethered vehicles of the National Deep Submergence Facility. This increase of 1500 m over ALVIN's limits provides access to 37% more of the sea floor which represents an area that is greater than 90% of the surface area presently exposed on the continents.

A very limited amount of additional submersible diving by U.S. scientists to depths as great as 6000 m has been carried out in the southern East Pacific Rise, MidAtlantic Ridge, Hess Deep, and southwest Pacific using the French, Japanese or Russian submersibles Nautile, Shinkai-6500, and MIRS, respectively. Experience over the past few years. has shown that the use of foreign submersible assets, while conceptually appealing, is hampered by conflicting foreign national interests and differences in scheduling and funding processes. Consequently, access by U.S. investigators to those facilities is limited and will likely remain so.

These facts, coupled with the Navy's decision to decommission SEACLIFF, provide an important opportunity to define and plan the future vehicle composition of the U.S. National Deep Submergence Facility to meet the projected scientific objectives of the coming decades. The DESSC believes that there are three critical areas which must be addressed if the U.S. is going to continue to be a leader in the science and technology of deep ocean research. They are:

- A focused, cost-effective, and technically capable national deep submergence facility and operator,
- An integrated mix of vehicle systems including submersible(s), ROV(s), tethered mapping systems and AUVs, and
- A stable, federal funding base to support science, technology and enabling vehicle and ship facilities in the deep ocean.

A Single National Facility

Adequate and long-term funding of a National Facility, such as the one now operated by WHOI, is essential and the DESSC believes that it is important to continue to have a primary National Deep Submergence Facility. The vehicles operated by WHOI for UNOLS have proved to be, overall, the most cost-effective and productive systems in the world and have accomplished more than 80% of the total deep submergence peer-reviewed research since these vehicles were developed in the mid 1960's. Given the current federal funding constraints for both basic research and facilities support, and the level of technical knowledge and experience to operate deep diving submersibles, it would not be prudent at this time to consider developing additional National centers for operating deep submergence vehicle facilities.

Clearly there are a few other U.S. organizations which have deep submergence vehicles (e.g. MBARI with the ROVs TIBURON and VENTANA which can go to 4500 m and 1500 m depth, respectively, and HURL at the Univ. of Hawaii which operates the Pisces-V submersible which can go to 2000 m depth), and institutions such as Harbor Branch Oceanographic Institute with shallow water (<2000 m) vehicles. Those systems have the potential to supplement some of the facilities requirements particularly in certain geographic areas off the US coasts and in the mid-Pacific. However, the DESSC notes that although MBARI intends to integrate its ROV systems into mainstream U.S. academic research, the extent of this integration is, at this time, unclear. The HURL facility does provide support largely for deep submergence research around the Hawaiian Islands which is important. However, in recent years the number of science dives carried out has been somewhat limited because of funding constraints and construction of their new support ship the KOK.

Vehicle Systems

To meet present and future research and engineering objectives, particularly with a multi-disciplinary approach, deep submergence science will require a mix of vehicle systems. Vehicle depth capability should be to -6000 m to allow for research over the widest range of tectonic, sedimentologic and geographic environments that will be investigated in the decades to come. As deep submergence science investigations extend into previously unexplored portions of the southern East Pacific Rise, Indian Ocean ridges and southern Mid-Atlantic ridge, it is critical that we have the capability to dive to greater depths than is now possible with ALVIN. Submersibles, which provide the cognitive presence of humans and heavy payload capabilities will be critical to future observational, time-series and observatory-based research in the coming decades. ROVs and tethered systems, especially when used in closely-timed, nested investigations offer unparalleled maneuverability, mapping and sampling capabilities with long bottom times and without limitation to human/vehicle endurance. The combination of submersible, ROV and tethered systems on the new UNOLS deep submergence support ship ATLANTIS, and a nested

survey approach, will permit cost-effective exploration and detailed investigation and sampling of remote sea floor areas. AUVS, both smaller, faster designs like the MIT-Odyssey, and the slower more maneuverable type WHOI-ABE vehicle will provide unprecedented access to the deep ocean and sea floor without dedicated support of a surface ship. They will not, however for the near future, be able to complete the essential manipulative tasks that submersibles or ROVs effectively accomplish nor will they be able to operate at depths greater than -6000 m.

The committee understands that the Navy and NAVSEA have requested WHOI to provide a technical assessment and costing of how to best integrate SEACLIFF into the National Deep Submergence Facility. The DESSC endorses this plan, and believes that the deep submergence technical expertise at WHOI and their operational knowledge of Navy DSV systems, and how they differ or are the same as ALVIN's, makes this the logical approach to evaluating the technical and cost issues. Based on scientific and programmatic considerations, the committee believes that only a few of the many options presented by Dr. Saalfeld in his letter to Dr. Perfit, could be viable. Probably the most cost-effective and advantageous of these options would entail combining the best attributes of ALVIN and SEACLIFF to produce a cost-efficient and capable deep diving submersible with a depth range of -6000 m. Ignoring, for the moment, the considerable technical and budgetary issues that must be addressed in accomplishing this integration, the committee notes that if such an option is considered, that it will be important for the resulting submersible to retain all of the excellent science capabilities and operational characteristics (safety, reliability, maneuverability, bottom time) which ALVIN currently has. We say this because it is likely that the principal operating range for a majority of peer-reviewed deep submergence science will continue to be in the range of 2500-5000 m water depth.

The various options presented by Dr. Saalfeld as well as other options proposed by DESSC and the science community will be discussed and evaluated and reported on in the Working Group report.

Funding Support

Perhaps the most serious and biggest impediment to integrating SEACLIFF into the US deep submergence program is the lack of an adequate and stable funding base. To their credit, the federal agencies and WHOI were able, in this restricted funding climate, to bring to fruition a new deep submergence support ship - R/V ATLANTIS, which will provide integrated deep submergence vehicle operational capabilities that are unique in the world. However the DESSC believes in order to successfully utilize and maximize the scientific assets of SEACLIFF, ONR, NSF and NOAA must work together with the community to ensure that adequate funding is provided to support the operational, engineering and ship facilities required to carry out the science and engineering programs. NSF has largely shouldered the burden of support for the facilities and science programs in recent years. In this time of fiscal restraint, funding is clearly not available for an additional facility to maintain and operate SEACLIFF, nor is funding likely to increase to levels that could support science for parallel programs. Placing additional financial burdens on the funding agencies, without a clearly defined source of new or additional funding at this time would likely put the current successful deep submergence program at WHOI at risk.

At present, the DESSC suggests that the federal agencies work together with the operators at WHOI and the DESSC to fully evaluate the feasibility of melding SEACLIFF and or its components into the National Deep Submergence Facility so that improved submersible facilities could be available to the science community as well as the Navy for operational and strategic needs. The DESSC views that consideration of this important topic now capitalizes on: 1] momentum provided by the new support ship, 21 recent upgrades of science sensors and imaging capabilities of vehicle systems funded by NSF, ONR and NOAA, and implemented by WHOI, and 3] the exciting new science problems and research initiatives to be addressed by deep submergence science, and the potential for them to be focal points for science education at all levels and public interest in the oceans. As mentioned above, DESSC has arranged for a onetime meeting of a UNOLS working group consisting of DESSC representatives and some experienced members of the oceanographic community. The charge to that working group, which will meet in early February 1997, when more information regarding funding and feasibility are available, will be to provide ONR and other relevant government funding agencies with a comprehensive evaluation of the issues in question, and the academic research community with an assessment of needs for deep

submergence vehicles in the 21st century.