

SUMMARY OF WORKSHOP CONFERENCE ON

"RESEARCH USE OF DEEP MANNED VEHICLES"

Over a hundred operators, users, and sponsors of deep submersibles convened at Woods Hole, Mass. on 21-22 November, 1966 for a two-day workshop on problems of common concern. Since several submersible groups have been working separately and on distinct problems with considerable success for the past year, there was a desire to share experiences, to discuss common problems and to consider next desirable steps. The scope of the meeting was broadened by the participation of key individuals with national administrative responsibilities, members of the French bathyscaphe team and several newcomers to the field, including representatives from Canada and England. Scientists from seven major laboratories reported on underwater work in geology, fisheries, search, recovery, turbulence, and acoustics.

Operators of nine research submersibles outlined their craft, operating methods and experiences. About four hundred dives, ranging from a hundred meters to nearly ten thousand meters deep, have been made in the last two years, of which over half were for scientific purposes. Many of these dives were shallow ones to acquaint a variety of oceanographers with the possibilities and limitations of research submersibles. Differences in submersibles and procedures resulted in operational breadth and an improved understanding of submersible problems. These discussions were particularly profitable to those now building new submersibles.

Marine geologists emphasized how varied and dynamic some areas of the sea floor are. They stressed the importance of direct observation of the sea floor to study bottom processes, physiography, sediment type and character and identification of rock and rubble. Experimental procedures were described, some hypotheses were suggested and bottom photographs were shown that included areas along Scripps Canyon, Puerto Rico Trench, Tongue of the Ocean, Bermuda slope, Mediterranean Sea and the edge of the Atlantic continental shelf.

Marine biologists described observing bottom animals, their population density and adaptation to their habitat, and the collecting of epibenthic fauna. Examples of stirring up of bottom sediments by bottom living creatures were described. Marine life observations and studies included plankton, shrimp, tuna and the large deep sharks found off California.

Other users described experiments in bottom navigation, inspection of bottom equipment and initial attempts to measure mid-depth turbulence. Considerable emphasis was placed on the development of a modern, small area

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survey capability including bottom sampling and slope measurements. Scientists emphasized the importance of a balanced observational program using either surface ships or submersibles, whichever best serves the objective.

Sponsors noted the maturing character of the submersible program and its growing importance to marine research, but pointed out the difficulty of rearranging or increasing budgets to accommodate new techniques. They emphasized the importance of cooperative efforts and, where practical, the establishment of common criteria on which to base cost effectiveness. Special budgeting for use of submersibles by small laboratories was considered and it was believed that this could be initiated and eased by cooperation between laboratories involved. Objective statements as to what work can best be done from submersibles or surface ships are essential.

Comments and Preliminary Conclusions

- 1) The meeting succeeded in its primary purpose of interchanging information and ideas. Several common problems in navigation, visibility, accessory components and instruments were identified for later study by small groups of specialists.
- 2) The presentations showed that submersibles have established a useful plateau for underwater exploration and simple work. There was general agreement that the present capability should be firmly established by improving instruments, logistic support, handling at sea, navigation, window optics and by acquiring a few more submersibles. More modular construction would facilitate periodic incorporation of modernized components and interchange of specialized instrumentation.
- 3) A new higher plateau of technical and operational capabilities should be initiated by building a few specialized submersibles, each to emphasize one or two essential characteristics. These include operating depths to six thousand meters, rough weather handling, much better visibility, maneuverability and a self-sufficient submersible for research and development work on the continental shelf.
- 4) Experience with special advanced design submersibles seems essential before realistic estimates can be made of the eventual utility and cost effectiveness of submersibles in research and engineering efforts. Meanwhile, scientific results are being obtained and field experience, good although spotty, is helping guide future plans. The present

combination of private, military and commercial operation has provided technical and administrative flexibility on a national scale. Long term commitments for use, including rental, would improve logistic efficiency and speed development of components and instruments.

- 5) There was considerable interest but little time to consider long range plans but it was suggested that many of the objectives discussed could logically combine into a cooperative program. One program might be an exploratory trans-oceanic passage along the sea floor. Such an investigative path across the ocean would teach us much about ocean ridges, rift valleys, sea mounts, bottom currents, small scale topography and magnetics, rock outcrops and mineralized zones. It would provide much better understanding of the geographic patterns and habits of bottom dwelling and mid depth marine life. It would also encourage the development of deep submergence capabilities needed for other objectives.

Different scientific and survey groups at different times and under different sponsorship could undertake appropriate technical portions and geographic segments of the crossing. Such a program could embrace an interesting combination of the purposes behind the Lewis and Clark Expedition and behind the Indian Ocean Expedition. Some segments of the traverse would merit intensive survey for scientific and commercial purposes and a few of these special areas could be considered for lengthy occupation. It was believed that some such composite venture, which could be started now, would produce a useful variety of scientific, commercial and international results while improving undersea technology.