

APPENDIX XXI

A PRE-PROPOSAL

To the National Science Foundation

OPPORTUNITIES ASSOCIATED WITH PRODUCTION OF AN IMAX DOCUMENTARY ON SUBMARINE HYDROTHERMAL VENTS

J. R. Delaney, School of Oceanography, University of Washington, Seattle, WA 98195-7940

R. A. Lutz, Inst. of Marine & Coastal Sciences, Rutgers University, New Brunswick, NJ 08903

S. E. Humphris, Woods Hole Oceanographic Institution, Woods Hole, MA 02543

Introduction

An opportunity is arising within the coming three to six months that can benefit the U.S. Deep-Submergence Community. Private funding sources have agreed to provide major funding for production of a film focused on submarine hydrothermal vents. Steven Low, producer of several widely-acclaimed documentaries, and Emory Kristof, a National Geographic photographer, will be using two Russian MIR submersibles as camera and lighting platforms to film scenes of vent fields on the East Pacific Rise between 9 and 10° North and on the Mid-Atlantic Ridge in the TAG area near 26° North. Low and associates will combine these images into a 45-minute documentary film slated for world-wide distribution. This situation offers a much-needed opportunity to bring to the attention of the viewing public the vivid imagery and basic processes associated with submarine volcano-hydrothermal systems along the global spreading center network.

Philosophy

Our preliminary discussions with Low and Kristof have emphasized two key elements that represent basic scientific messages to be conveyed in such a documentary. First is the element of discovery and excitement that has characterized ridge crest research over the past 2 decades. The distilled message being that the seafloor may represent the last major earthbound frontier. The second element involves highlighting the interplay among geological changes that trigger shifts in vent water chemistry resulting in dramatic adjustments of the associated animal communities. In short, the rhythms of life at ridge crests are tied to volcanic episodicity rather than solar input cycles as in most surface ecosystems. Volcanoes, in the presence of liquid water, can sustain life independently of the sun. This is true on earth and may well be true on other planets. We hope this documentary can explore processes involved in, and consequences arising from, this powerful model of the role volcanoes may play in planetary evolution.

Issues of potential interest to the Deep Submergence Community

(1) At present the program does not involve ALVIN, despite the fact that it has been centrally involved in the both discovery and exploration of these fascinating systems for over one and a half decades. Low and Kristof are willing to have ALVIN involved as an integral part of the documentary if the submarine can

be made available at the appropriate times and in the appropriate places. Owing to ship scheduling constraints for the MIR's, the optimal time-frame is in the February-June window of 1996; the location of the IMAX filming is presently planned for the hydrothermal vent fields at 9°N and for the TAG site. Currently, plans call for the R/V KELDYSH to pass from Atlantic to Pacific in that time frame and for the AII to pass from the Pacific to the Atlantic, so it may not be possible to have the two systems together at both sites in the time interval specified. A primary goal of this pre-proposal is to explore parallel scientific and educational rationales for making ALVIN available during one or more of the at-sea filming sessions.

The 9°N EPR site is a vent system that has been extensively studied since the April, 1991 eruptive event. NSF is presently funding a continuing series of studies at this site through the Biological Oceanography, MG&G and Marine Chemistry Divisions. There are distinct scientific advantages to revisiting the 9°N site in that time frame to continue time-series sampling and other documentation of biological, geological and geochemical changes in the rapidly evolving hydrothermal system. The TAG site has recently been the focus of an entire Ocean Drilling Program drilling leg and has been sampled before, during and after the drilling. Appropriate documentation of additional changes at this point in time would add significantly to the story evolving as a consequence of drilling into an active hydrothermal system. In short, viable scientific reasons exist to visit both sites.

(2) Kristof will be using recently developed lighting systems on the seafloor that are unparalleled in current research activities along ridge crest systems. He expects to be able to fully illuminate areas half the size of a football field for use in the IMAX filming. This situation opens unique scientific opportunities to obtain (at a cost to the scientific community well below the real expense) comprehensive high-level digital stereo, as well as and high-definition video (HDV) imagery of large tracts of seafloor in a fashion that has never before been attempted. In concert with quality navigation, these images could become extraordinarily high quality, high resolution maps. The opportunity to obtain well navigated high definition, stereo imagery of both sites could move the study of seafloor hydrothermal systems into a new era. Placing a state-of-the-art Electronic Still Camera onboard ALVIN would further insure that maximum scientific advantage is taken of the illuminated seafloor with appropriate spatial control.

(3) A third opportunity to emerge from the program may be availability to the science community of a spectrum of unprecedented images. Much of the work will include techniques that involve high-definition video and other approaches to studying the seafloor. Kristof points out that, as in many such programs, a good deal of the initial imagery is not ultimately included in the final product. He and Low are offering access to these materials for a wide variety of research and educational purposes. With support from NSF, and advice from an NSF-appointed Advisory Committee, researchers and educators involved in the program could oversee a process by which a significant fraction of this "overflow" material (stereo imagery, HDV imagery, stills, etc.) is made available in a timely manner to potential users throughout the world. These issues may have to be explicitly negotiated based on the level of support provided by the scientific community.

(4) An unusual educational opportunity could consist of involving a separate film crew and several high school teachers and students aboard the ATLANTIS II during the entire program to provide on-site documentation and higher visibility of research conducted on the ALVIN-AII system. The goal would be twofold: to involve teachers directly in exciting research with the understanding that classroom material of value to all schools could be prepared from the experience. Also, showing involvement of students in the actual research process allows students across the country to identify with the spectrum of opportunities available in basic research. This activity could be separate from, but parallel to, the effort, or it may become a component of the documentary itself if it is done properly. The effect would be substantially enhanced if it were possible to publicize the approach before-hand. Participants could become central figures in follow-on workshops for teachers across the country. Significantly improved

teaching materials could be provided for all workshop participants from "overflow products" of the entire program and high school curricula throughout the country could benefit substantially (see 3 above).

(5) An additional scientific possibility includes the strong interest that SAIC, Inc. has in developing a deep ocean-capable, laser line-scanning device for mapping the seafloor. The resolution of a bathymetric map produced from such a system would be measured in millimeters. A shallow water version has produced stunning images of brine pools at the seafloor in the Gulf of Mexico. The potential for digitally draping high-definition photographic images directly on the line-scanned bathymetry would allow full optical definition of large seafloor features such as the entire TAG mound, or major sections of the small axial valley ("axial summit caldera") at 9°N in all its volcanic, tectonic and hydrothermal complexity. In both cases, rock formations and associated fauna would be resolved with comparable high resolution. Again, the issue of quality navigation becomes important; without participation of scientists in the program there will be little reason for film makers to insist on precision navigation. SAIC, Inc. representatives seem anxious to have this system become part of the program and would consider an especially accelerated development program if the opportunity existed to use the instrument on ALVIN during the program.

Public Awareness of Deep Submergence Oceanographic Research

The U. S. Deep Submergence Community has rarely been as aggressive or as effective as the NASA community in capturing the public eye with the basic messages and the excitement of our research. Yet scientifically we have discovered earth systems and volcanic processes that easily rival and basically complement discoveries that NASA scientists and engineers have made in the solar system within the past two decades. This imbalance is in part because most of us are funded by specific grants from NSF. Rarely do we apply for (and, in general, NSF research sections do not provide) funds for public outreach related to our individual research programs. But the situation also exists because we the community have rarely gotten behind an opportunity to publicize the activities in which we are so deeply involved. The potential exists in this situation. The issue is how to optimize the benefit to our community.

The Proposal

We propose that a combined scientific/publc awareness cruise consisting of 12 dives at either the 9°N site or the TAG site take place sometime within February-June, 1996 window to be coordinated with the film scheduling. Cruise participants would consist of 12 scientists (selected on the basis of the key science to be conducted), 3 members of a video crew, and 4 additional participants selected from U.S. high schools. The scientific studies would involve continuing documentation of evolving biological, geological and geochemical changes taking place in either of the areas currently scheduled for IMAX filming. An additional focus would be to obtain unprecedented imagery of the active vent systems in their volcano-tectonic setting. While conducting scientific research, ALVIN would be a focal point of the documentary filming through close coordination with the IMAX crew. In parallel with the scientific effort, a high-profile educational program involving actual students and teachers could be conducted and recorded in a fashion targeted for high schools around the country. If done properly, such an educational program could substantially raise public interest levels in scientific and related careers involving planetary exploration and basic science.

Budgetary Issues

If ALVIN and NSF are indeed to be involved, it is necessary to proceed rapidly. Decisions must be made within a month as to whether the program should go forward. The estimated cost of the program overall is about \$6 million. The industrial contacts involved have tendered \$3 million. The primary costs borne by

NSF would be in the facility support; twelve ALVIN dives would be required on site in order: 1) to allow a serious scientific program to be conducted, 2) to allow sufficient availability of the submarine for documentary efforts, and, 3) to insure quality navigational results. Additional costs would include the expenses of the scientists involved - salary, lab and sampling costs, analyses, etc. Other costs would involve travel for all participants and the costs of selecting both a film crew and the students and teachers to be involved. Actual costs of the film crew may be born privately with sufficient lead time for planning. These "scientific/educational" expenses are likely to be close to \$300,000 not including institutional overhead.

Immediate Steps

If this letter is favorably received, we will assemble details and specifics related to the issues and opportunities sketched herein and produce a formal proposal. It is our understanding that a significant amount of additional funding from sources other than NSF must be raised in the near-term to insure that the entire program comes to full term. Some of the fund-raising will have to be conducted by the scientific institutions represented in the program. We plan a meeting early in December involving all potential participants including both members of the Low/Kristof team, representatives of supporting agencies, selected members of the advisory committee, several educators, the principal investigators and additional scientists who may be involved. The goals of this early meeting would include at least the following items: definition of essential details of scheduling, participation of all scientists, all financial requirements and responsibilities, fund-raising timeliness materials and imagery ownership, responsibilities for the intellectual caliber of the product, and any royalty issues related to intellectual and/or artistic contributions. Following the meeting we will be able to submit a formal proposal to NSF by early January. With this pre-proposal we formally request that \$25,000 be made available for advanced planning purposes. Planning will require coordination among all the parties mentioned above, and will involve significant travel for the P.I.'s and other scientists involved in the program. A present no salary money is requested.

Contact information

John R. Delaney - (206) 543-4830; jdelaney@u.washington.edu; FAX (206) 543-0275.

Richard A. Lutz (at sea 'til mid-December) - atlantis@atsvax.rsmas.miami.edu - subject:Scil.

Susan E. Humphris - (508) 457-2000 ext. 3451; susan@copper.whoi.edu; FAX (508) 457-2150.