

The Jason Project / NOPP Collaborative

Steve Coan and Tim Armour
www.jasonproject.org

APPROACH

With support from NOPP, the JASON Foundation for Education participated in an independently supported research cruise aboard *Atlantis III* involving the ROV JASON and deep submergence vehicle ALVIN. Researchers on this expedition studied the Guaymas Basin area. This effort was part of the JASON IX oceans program. The JASON Project curriculum, interactive Internet components, and field research opportunities for students produced for this expedition were linked with the research being undertaken by scientists aboard the *Atlantis III*. Participating students also studied deep-sea structure, marine chemistry, and geological and biological oceanography.

Materials and programs developed through this important partnership with NOPP are available on a continuing basis. Curriculum materials, images and data are available online at our website above.

JASON IX featured research on deep-water and mid-water systems within Monterey Bay, including sea surface chemical mapping of phytoplankton, acoustic telemetry for organisms within the water column, tectonic and hydrologic studies of deep-water venting systems, geochemical analysis of bottom substrate, mid-winter ecology (1km) above Monterey Canyon, deep-sea benthic bacterial studies, and benthic ecology of Monterey Canyon and cold seep ecology.

JASON IX also featured research conducted on site in Bermuda. Students learned that Bermuda consists of a diversity of habitat sites. Generally nutrient poor, these sites include blue-water/deep-sea, slope, mid-water, coral reefs and surface systems. Researchers explained their studies on nutrient cycling, including phytoplankton circulation and geochemical analysis; water quality; and mid- and deep-water ecology, including bacteria, zooplankton, protozoan and larger organisms (via acoustic telemetry). Each research program was incorporated into the Bermuda Atlantic Time Series program (BATS) which monitors each of the different habitats over time and provides a global perspective of change including climatic change. Additional affiliated research activities include preservation of an island and its original inhabitants (among which are many seabirds which were believed to be extinct), freshwater quality, Karst limestone caves, and acoustic research on humpback whales.

The research conducted on this expedition highlighted the structure of the oceans by showing that they consist of shallow-, mid-, and deep-water systems. Students learned about the surface, pelagic, and benthic components of each system and the different habitats that can be found within each component, based on the variability of the substrates and nutrients available. For example, comparisons were made between the nutrient-poor systems of Bermuda, including coral reefs which recycle nutrients efficiently, the eutrophic condition of Monterey Bay, and the active conditions of the East Pacific Rise. Students also observed how monitoring these systems could provide a general understanding of global change within the oceans and the oceans' role in climate change.

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WORK COMPLETED

Each of the four tasks that the JASON Foundation engaged in with support from NOPP augmented a comprehensive educational program which brought the expedition directly into schools and communities throughout the United States and abroad via satellite and Internet technologies. The narrative provided below for each task includes a description of teacher and student access to the expedition research.

Task I: Establish Internet Access to the East Pacific Rise Expedition

With support from NOPP, the JASON Foundation broadened the delivery of live, interactive expedition activities to include direct Internet access by students at schools throughout the United States to remote research locations. This effort augmented the existing satellite telecast to accommodate and promote the increased levels of interaction now possible through the Internet. For the Guaymas Basin expedition, the JASON Foundation used the Internet to provide students with a virtual window into the researchers' world on board *Atlantis III*. The JASON Foundation facilitated an active communication between working scientists and the students, allowing students to actually access and analyze the expedition's emerging data.

To accomplish this goal, the JASON Foundation designed and established the system necessary to capture the researchers' data and provide students with access to it via the Internet. This entailed procuring and configuring shipboard hardware and software components that allow for the capture, digitization, and transmission of video and audio streams, as well as traditional text-based data via the Internet. These segments required careful planning and pre-production activities by both the curriculum developers and expedition team to ensure that the interactive sequences are engaging, instructive, and permit a high degree of interactivity and communication.

Ensuring that schools had the ability to access and interact with the expedition on the Internet was critical. Well in advance of the expedition, the JASON Foundation prepared and posted on its Internet homepage technical support materials for students and teachers who planned to participate in the interactive Internet component of the expedition. The JASON Foundation provided guidance on its homepage to assist project participants in downloading StreamWorks, a software application which enables schools to receive live audio and video images through the Internet. The JASON Foundation also provided information to schools equipped with CU See Me technology for accessing live program components.

For this task, JASON provided all planning, design, and logistical services for the development and implementation of the Internet component. Internet support was provided by the National Geographic Society. Satellite uplink technology was provided by Williams and Vyvx Companies. The task leaders for this component were the JASON Foundation, supported by National Geographic Society and EDS. Additional support was provided by the expedition team and curriculum developers to ensure that the curriculum and Internet components of the project were compatible.

Total NOPP expenditures for this component of the project were: \$60,000

Task 2: Establish Permanent, Interactive Access to Researchers at Their Labs and Institutions

Traditionally, JASON Project Expeditions have presented students and teachers with broad levels of information about the expedition sites and the research approaches of participating scientists through live telecasts and specific activities that link to the Project's themes. Past projects have not, however, included a post-expedition component that allows participants to continue to follow the work of scientists once they return to work at their laboratories and research institutions. For the first time, the JASON Foundation expanded the scope of its Project Expeditions by enabling students and teachers to follow the researchers back to their labs. There, participants could see first-hand the culmination of the expedition research to learn how scientists use and analyze the data they collected in the field and report on their findings.

By extending the period of contact between the expedition scientists and students, the JASON Foundation engaged students in a deeper understanding of the significance of the research conducted during the Guaymas Basin expedition.

In addition to establishing the interactive stations, the JASON Foundation also supported its Manager of Educational Systems, who was the dedicated project coordinator for this component. This individual was responsible for overseeing the procurement and installation of the systems at each of the facilities, as well as coordinating the delivery of programs that augmented the Guaymas Basin part of the expedition curriculum. Early in the project, this work involved extensive coordination with the expedition team and project's curriculum developers, who provided design and development support for all curriculum components of the JASON Foundation's expedition website. In addition, this individual established and disseminated the project schedule to participating schools, established standardized Internet procedures and protocols to maximize opportunities for student interactivity, and provided general logistical and technical support to participating schools.

The JASON Foundation for Education provided all planning, design, and logistical services for the development of the Internet component of this task. Content development was led by the JASON Foundation in collaboration with the Institute for Exploration. The National Geographic Society hosted the site on its servers, and provided additional technical and logistical support. Satellite uplink technology was provided by EDS. The task leads for this component were the JASON Foundation for Education and the Institute for Exploration, who coordinated the establishment of the interactive stations, developed programmatic content, and provided technical and logistical support to participating schools. The expedition scientists and researchers also played a leading role in the development of interactive program materials.

Total NOPP expenditures for this component of the project are \$192,884

Task 3: Develop Advanced Program and Curriculum Modules Designed Specifically for the Internet

With support from NOPP, the role of the JASON Project homepage has been significantly expanded to more actively engage students in interactive projects that promote critical thinking. In collaboration with our partners, we developed new modules that provided students with advanced Internet-based learning opportunities in ocean science and enabled them to design their own research projects related to the oceans. In addition, professional development opportunities for teachers have been offered through a for-credit course in ocean science at the University of Wisconsin-Milwaukee.

1. **Teacher Development Course.** In collaboration with the University of Wisconsin-Milwaukee, the JASON Foundation offered through the Internet a professional development course for teachers. To design the course, University of Wisconsin curriculum developers collaborated with both the JASON Project curriculum team and the expedition scientists to design a professional development program for teachers of science. Using the expedition site as a case study, the course covered deep-sea structure, marine chemistry, geological and biological oceanography, and the development of hydrothermal systems. The course also provided teachers with training in the development and use of innovative strategies for effectively presenting ocean-based curriculum materials in the classroom.

The course consisted of text and video lectures, video clips, and audio sequences accessible through the JASON Project's homepage to enrolled teachers. The course also consisted of chat sessions among teachers and researchers and provided participants with a host of related resources upon which they could draw for assignments and reports. Teachers enrolled in this program also developed, submitted, shared, and discussed lesson plans for course credit with their peers throughout the United States.

2. **Internet-Based High School Course for Students.** The University of Nebraska at Lincoln designed and delivered an accredited high school course on ocean science through its Communications, Learning, and Assessment in a Student-centered System (CLASS) Project partnership. This university-based, fully accredited independent study high school is the only such institution in the United States. CLASS is a unique project designed to allow students worldwide to take interactive University of Nebraska-Lincoln high school and college courses via the World Wide Web. For this project, the JASON Foundation collaborated with the University of Nebraska's independent study high school to develop an ocean studies course that incorporated electronic interaction among students, instructors, field researchers, and other external resources. The program was designed to encourage independent learning by allowing students to personalize courses by exploring paths through a variety of materials, including global digital libraries, video and audio clips, and customized course materials.

Total NOPP expenditures for this component of the program are \$175,000.

Task 4: Create Five Statewide School-Based Interactive Telecommunication Centers

With the assistance of NOPP, the JASON Foundation has established statewide presence and interactive capabilities in Rhode Island, Connecticut, Nebraska, Massachusetts, and Mississippi. In addition, California, Wisconsin and Florida benefited directly from this project through support for institutions of higher education, and outreach programs.

The JASON Foundation has significantly increased each state's capacity to receive the full range of JASON IX program components for the Guaymas Basin expedition. Specifically, teachers in these states will be able to participate in professional development opportunities offered through the University of Wisconsin-Milwaukee. Students gained access to both the satellite and Internet-based components of the program, including the live satellite telecasts, Internet access during and after the expedition, and distance-learning opportunities offered through the University of Nebraska at Lincoln.

Total NOPP expenditures for this component of the program are \$672,116

RESULTS/IMPACT/APPLICATION

The program built upon an extensive educational and research infrastructure developed by the JASON Foundation for Education and its partners for implementation during the 1997-98 school year. For *JASON IX: Oceans of Earth and Beyond*, Bermuda and Monterey Bay were chosen as expedition venues because they are centers of oceanographic research. The Bermuda Biological Research Station (BBRS) and the Monterey Bay Aquarium Research Institute (MBARI) are leading research institutions that will act as research partners and hosts for JASON IX. BBRS has established a long-term monitoring project, the Bermuda Atlantic Time Series (BATS), which tracks the connection between ocean systems and climate change. Much of MBARI's research focuses on the Monterey Bay National Marine Sanctuary (MBNMS), administered by the National Oceanographic and Atmospheric Association (NOAA), which is also an institutional partner and host for JASON IX. Selected scientists affiliated with BBRS, MBARI, and MBNMS joined JASON IX as host scientists or researchers.

JASON has already developed an extensive network of partners related to the JASON IX expedition, including the partners collaborating on this proposal. JASON also receives a broad range of technology support for its expedition broadcasts and Internet programming. Principal providers of this support are the National Geographic Society (NGS), which hosts JASON's Internet site, Electronic Data Systems (EDS), a JASON founding sponsor that provides equipment and support for live expedition broadcasts. Additional technical partners include the U.S. Navy's Office of Naval Research (ONR), which supplied JASON with research equipment and vessel access, and Eastern Research Group (ERG), an environmental consulting company that conducted an evaluation of JASON IX.

JASON also has a variety of partners that deliver JASON programming and provide educational support on a regional level, including Primary Interactive Network Sites (PINS) and the Florida and Connecticut state departments of education. The twenty-three PINS include educational, research, and cultural institutions such as the Clark County School District (Las Vegas, NV), the NASA-Johnson Space Center (Houston, TX), the Denver Museum of Natural History, and the University of Wisconsin-Milwaukee. These sites recruit teachers and schools to participate in JASON expeditions, host professional development workshops for teachers, show the expedition broadcasts for large groups of students, and offer other services depending on their capabilities. Connecticut and Florida include JASON expedition broadcasts and other JASON programming on their statewide networks, available to all classrooms by broadcast or video.

PINS estimates, expedition evaluations, and Internet activity suggests that JASON reaches approximately two million students and 15,000 teachers each year. Almost all of these teachers receive some professional development training from JASON, through workshop attendance or video, and approximately 350,000 students participate comprehensively in the expedition by attending an expedition broadcast and conducting related curriculum and Internet activities.