NAGW-4174

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January 31, 1996

Ms. Barbara Cephas
NASA HQ
Code HWG, Rm 4C70
300 E. Street, SW
Washington, DC 20546

Dear Ms. Cephas,

Please consider this the final report for the project *Science On-Line (SOL) – An Innovative Partnership to Coordinate Development of On-line Space Science Lesson Plans Based on EUVE and other NASA Mission Information and Data.* This project was funded by NASA Astrophysics Division grant NAGW-4174. The period of this grant was August 1, 1994 to January 31, 1996. Dr. Roger Malina was Principal Investigator; I was Project Manager.

We enclose the Project Report, authored by Robyn Battle and me. This report provides substantive detail on the SOL project design and structure, description of teachers' strategies for lesson plan development, and the legacy of SOL in teachers' communities and school sites.

One goal of ours has been to investigate viable strategies to support the long-term development of Internet-based activities within a partnership among research institutions, centers of informal science education, and teachers. This long-term support is being provided beyond the period of performance of the grant through the establishment of resource centers at the museum and research institution sites where the necessary expertise to provide such support resides. Thus, an essential component of this project has been the creation of four teacher resource centers which continue to provide a suitable environment for teachers to visit the partner sites and be supported in the use of, and access to, on-line services, resources, and principally the newly created lesson plans.

Out of the six lessons that SOL Project teachers began to develop in November, 1994, three of them attained a high degree of completion by end of July, 1995. Of the remaining three, two lessons are essentially complete, while one lesson is still significantly under development. The SOL Report includes further detail on the completion of each lesson, and identifies some key issues that affected the lesson plan and pilot testing phases.

The SOL Project immersed teachers in lesson plan development using unique Internet

capabilities and Earth and Space Science data from NASA missions and other sources. Some of the conclusions that can be drawn from the work carried out by SOL project participants over the past year are summarized as follows:

- Availability of creative time for lesson plan development is an important constraint
- Most resources available on the Internet have to be adapted for use in the K-12 community because they are presented at levels that are too technical and/or undocumented
- Input from scientists appears essential when using and adapting specialized data sets
- Input from teachers and cognitive scientists appears essential to address issues of age-appropriateness, school curriculum context, and lesson structure
- Technical support appears essential for teachers and facilitators previously unexposed to the World Wide Web and HTML
- In-depth involvement of teachers in SOL led to many positive consequences in schools, teachers' social context, leadership roles, advice to schools on infrastructure design, etc.
- Several effective lesson plan development strategies using the Internet have emerged
- A tiered model of flexible and effective Internet-based resource design has emerged

The SOL Project description, which includes the teacher-developed SOL lessons, as well as the results of the evaluation, is accessible through the World Wide Web. Based on teacher feedback, we are creating resources with a wide range of structure, from "grab Bag" to "Resources for Creating Your Own Activities" to "Ready-made Lessons." The URL for the prototype SOL Home Page can be found at:

http://www.cea.berkeley.edu/Education/SOL

The SOL Web server continues to grow through the contributions of teachers that use the partner sites resource centers to create new classroom materials. Videotaped interviews with teachers and students have been made available, as well as data acquired from the off-site evaluations. We are continually revising the material presented in response to formative evaluation and feedback obtained from teachers and other end-users.

The SOL Project is the basis for a follow-up effort, entitled *Science Information Infrastructure*, which has led to the continuation of the partnerships established by the SOL Project. It involves science museums, teachers and research institutions. The purpose of these long-term partnerships is to stimulate public awareness and use of the rich resources of remote sensing data from NASA and other institutions and to deliver this information to the general community.

The national *Science Information Infrastructure (SII)* links six major science museums to each other. The system provides a conduit for Earth and Space Science data and the associ-

ated scientific expertise from research institutions and other remote sensing data providers by channeling data to the science museums. The infrastructure establishes a framework of robust Internet connectivity spanning the country between public resource centers in science museums, which are in turn linked closely with research centers. The K-12 and general public communities can obtain information through the resource centers created in collaboration with local teachers. In turn these teachers continue to extract information from the centers and apply it to development of lesson plans that will enhance science curricula. As part of the *Science Information Infrastructure Education Project,* the SOL Web server will undergo in-depth pilot testing by teachers and personnel from the New York Hall of Science and Science Museum of Virginia.

I'd like to take this opportunity to kindly acknowledge the receipt of this grant, which has allowed us to discover exciting and useful results which may serve as a model for other NASA missions similarly interested and involved in K-12 education.

Sincerely,

Isabel Hawkins

Dr. Isabel Hawkins
Astronomer
Director of Science Education
NASA EUVE Satellite Project

cc: Patricia Gates, UCB Sponsored Projects Office (letter only)
Sharon Lilly, CEA Contracts & Grants
Dr. Jefferey Rosendhal, Technical Officer
Dr. Roger Malina, P.I.
Kevork Garabedian, Accounting (letter only)
CASI

SOL Publications

Refereed Articles:

Hawkins, I. and Battle, R. 1996, accepted for the 80th Annual Meeting of theAm erican Education Research Association, New York City, April 8-12, 1996. Science On-Line: Partnership Approach for the Creation of Internet-based Classroom Resources.

Battle, R. and Hawkins, I. 1996, accepted for the 80th Annual Meeting of the A merican Education Research Association, New York City, April 8-12, 1996. The Creation of Internet-based Practices for Teacher-Developed On-Line Classroom Resources.

Conference Proceedings:

Hawkins, I., etal. 1996, Astronomy Education: Current Developments, Future Coordination", ASP Conference Series, ed. J. R. Percy, p. 215-217. Science On-Line - Earth and Space Science for the Classroom.

Abstracts:

Hawkins, I., Christian, C. A., Battle, R., Malina, R. F., and Craig, N. 1994, Bull. Amer. Astr. Soc., 26, No 4, p. 1311. Science On-Line - Earth and Space Science for the Classroom.

Popular Articles:

Alcorn, K. Hawkins, I. Christian, C., Battle, R., and Malina, R.F., 1995, NASA Science Information Systems Newsletter, 35, 23, "Education on the Internet."

Workshop Presentations:

June 1995: Bay Area Earth Science Academy. Summer Workshop. Presentation on Science On-Line - Earth and Space Science for the Classroom. San Jose State University, San Jose, CA.

July 1995: Electrical Engineering and Computer Science, UC Berkeley, Teachers and the Internet Summer Workshop. Presentation on Science On-Line - Earth and Space Science for the Classroom.

Invited Colloquia:

Nov 1995: Dr. I. Hawkins, UCLA Physics and Astronomy Department Colloquium: Effective Strategies for Engaging Scientists in K-12 Education: "Science On-Line and Science Information Infrastructure Projects."

Nov 1995: Dr. I. Hawkins, Dr. Nelli Levandovsky, and Robyn Battle: Center for Studies in Higher Education, UC Berkeley, Instructional Technology Seminar Series. "The Interactive University, - Science On Line"

Nov 1995: Dr. I. Hawkins, Dr. Nelli Levandovsky, and Robyn Battle: Presented at the UC Berkeley Vice Chancellor & Provost Carol Christ's Seminar on University-Community Issues for Teachers. "The Interactive University, - Science On Line"

Jan 1995: Dr. I. Hawkins, Lockheed Solar and Astrophysics Laboratory, Palo Alto, California. "Science On-Line Project and the CEA Science Education Outreach Program."