Lessons Learned During the 1994 Sharing NASA Program
A White Paper by the NASA K–12 Internet Project

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Summary

This paper is intended for people who are interested in operating online interactive projects which connect working professionals with students and teachers to facilitate learning and exploration. It discusses two test projects mounted by NASA's K–12 Internet Initiative which connected K–12 students and teachers with science and engineering professionals over the Internet. Projects of this type are particularly important because they embody the kind of reformed science learning enunciated by the National Science Teachers Association and *Goals 2000*. Descriptions of the project specifics will be shared along with lessons learned and ideas for the future.

In general, our experience showed that interactive online projects were generally well received by all participants. Nevertheless, project management procedures and software need to be further refined in order to minimize the burden on participants and ensure the most enjoyable experience for everyone involved.

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Appendices with Project Details

Section 1: Introduction

The work presented in this paper was sponsored by the NASA High Performance Computing and Communications (HPCC) program. This program was funded by the December 1991 Federal legislation initiated by then–Senator Al Gore. A component supporting K–12 education was included in the HPCC mandate.

NASA's K–12 Internet Initiative team was organized in response, working from the Ames Research Center in Mountain View, California and Washington DC. A major activity of the group is "Sharing NASA With Our Classrooms", which is described in this paper. Other Initiative activities include:

- Internet videos and handbook production
- National leadership on K–12 Internet issues
- Operation of an Internet server at quest.arc.nasa.gov
- Curriculum development

The NASA K–12 Internet Initiative is uniquely situated to sponsor online interactive projects. Many people who work for NASA believe they are fortunate to have jobs that are fun and rewarding, and are eager to share these experiences with students. Teachers, in turn, feel that NASA resources, in the form of people, missions, and datasets, are worthwhile adjuncts to existing science curricula, particularly those that are being restructured to meet new national standards.

There are numerous benefits to providing schools with interactive access to this invigorating environment. Students glimpse real–world activities and begin to connect what they learn in school with possible careers. The excitement of ongoing science may help motivate some students to further pursue math and technical studies. Teachers establish links to experts who can help answer difficult questions and provide professional growth opportunities. NASA employees, contractors and researchers report personal enjoyment from the opportunity to share their vocations with interested amateurs through a project interface that insulates them from undue hardships.

As the number of Internet–connected classrooms grows exponentially, the thrill of connecting with classrooms may dull for researchers if the demand on their time isn't somehow moderated. Thus, the "*S*haring NASA" project is also an on–going research effort to ensure that classrooms retain adequate access to these precious people resources over time. We will develop and share information including helper software, models for project organization, communication processes and other mechanisms.

People interested in participating in ongoing discussion about the issues raised in this paper are invited to join an email group. To subscribe, send email to listmanager@quest.arc.nasa.gov. In the first line of the email, write the words "subscribe discuss–sharing" (without the quotes).

Our management deserves a great deal of credit in helping the authors deliver this work. NASA employees who have made significant contributions include: Paul Hunter at Headquarters, who leads NASA's Information and Infrastructure Technology and Applications (IITA) Program; also Jim Hart and Mark Leon from NASA Ames Research Center. Key management for Sterling Software include Mike DeFrenza and Jennifer Sellers.

Section 2: General Description of Interactive Projects

Interactive Projects enable connections between schools and NASA experts working on specific scientific missions (biosciences, astronomy, space exploration, and the like) via email and various forms of file transfer. A great deal of background information about the mission and its people is placed on–line, and mission updates are widely and frequently distributed. Using the scientific missions as a base, interactive projects support relationships between students, teachers, and professionals that transcend normal school boundaries.

Each of our interactive projects thus far has involved five distinct groups of people: students, teachers, professionals/experts, project organizers, and onlookers. It is important to remember that each group has different needs. A project may work well for one set of people while not meeting the needs of another group. Similarly, there are several project goals, some of which may conflict with one another:

- Contented and un–stressed experts
- Exciting learning situations
- Student insight into career choices
- Student observation/participation in situated science problem solving
- Teacher enhancement via association with expert mentors
- Minimal overhead for project organizers
- Automation where possible

As one example of these types of real or potential conflict, the primary task of professionals/experts is to do the jobs for which they are paid. This is particularly true in a work environment like NASA's with critical and dangerous operations. Safeguards must be maintained so that a worker dependent on email does not log in one morning to find a mountain of K–12 messages which bog down or overwhelm her professional tasks. In addition, experts should not be bothered with answering the same question over and over again. This is a situation in which the needs of one group (teachers and students) for easy, open access conflicts with those of another (the professionals/experts) for some insulation from the classroom and control over the access they allow.

Such requirements demand that some sort of buffer be placed between experts and classrooms. These buffers may be implemented through people–based administrative procedures, through automating software, or some combination of the two. The cost/benefit ratio of automation depends upon the nature of the interactions you wish to encourage. For instance, it is relatively easy to automate a question/response system if each query is considered unrelated to all the others. Under such a system there would be no consideration given to the fact that a class that asks a question about robots in space, for example, may have been carrying on an extensive correspondence with a particular scientist on that topic, and so the question might be randomly routed to a different expert.

If you want to encourage strong relationships between students/teachers and experts, however, you'll want all appropriate questions from a given source to go to the same experts. Thus, in the preceding example, you'd want all questions from that particular class that ask about space robots to go to the same scientist. While this might seem like a relatively easy task to automate, it proved too unwieldy for us to implement this time around. This is just one reason why people–based project management seems desirable for all but the most routine tasks, at least given our present capabilities.

We refer to the people who support the non–automated management functions as Smart Filters. These people could be individual volunteer helpers, teachers with motivated students, or paid employees. Smart Filters read the new mail and decide if a similar question was already answered (by database lookup). If not, then the question is unique and is forwarded to an appropriate expert to be answered. How well you recruit and train Smart Filters has a significant effect on the outcome of your project. Smart Filters themselves may also be mini–experts in a particular subject area, in which case they may respond to a question without involving a professional. This model works well when a high school group works together to cover a given subject, since their question–answering provides a rich learning experience for them.

Other tensions arise from the fact that project schedules and time frames will vary. One basic parameter is the duration of the period during which questions may be submitted. Establishing a brief interval for question submission will reduce the impact of the project on all parties. While this may be desirable for professionals, many classrooms would prefer relationships lasting more than a few weeks. A second parameter is the turn–around time you establish as a baseline for getting questions answered. This may range from a few hours (impractical, in our experience) to a few days (too long to hold classroom interest). Finally, the amount of lead time available between project conception, public unveiling, and full implementation will vary from case to case and will directly dominate many project decisions.

Section 3: Description of Live From Other Worlds

Live From...Other Worlds was a quick-turnaround project linking classrooms with NASA Antarctic researchers working on telepresence (remotely controlled robots) and exobiology (life on other planets). The driving force behind the organization of *Live From...Other Worlds* was Geoff Haines-Stiles, a producer of science television. The concept originated as a series of live TV broadcasts from Antarctica and a printed teacher's guide, but quickly expanded to include online materials, email updates, and the ability for students to ask questions of the remote researchers.

Geoff's project did not get a go-ahead from the relevant government authorities (NASA and NSF) until just a few months before researchers were due to be at McMurdo Sound. Without any scheduling flexibility, the implementation of this project was rushed and seemed always in danger of failure, and although the basic framework (live TV broadcasts, online mail, updates and questions) was supported, a number of related plans did not reach fruition. Nonetheless, the project seemed useful to the classrooms that participated, and everyone involved in the various aspects of the project (video, curriculum and online components) learned a lot about the practical issues involved in providing a mixed media education experience. The live broadcasts were televised on December 1st, 3rd and 7th of 1993. Online updates from Antarctica were delivered between October 13 and December 13, 1993, and experts were available to answers questions from schools from December 1 until early February of 1994.

A variety of on–line options were made available to participants, with email as the baseline. An automated maillist was created; once subscribed, people received updates from the Antarctic researchers and from the *Live From...Other Worlds* organizers about project logistics. Questions for experts were sent to a single address (ask-livefrom@quest.arc.nasa.gov) regardless of the topic, while five topic-specific maillists (robots, Mars, Antarctic lifestyles, oceans/marine ecology and computer networks) were created to distribute the question–answer pairs that were generated when scientists responded to the questions.

By the end of the project, their were 307 subscribers to the main update list. The total number of all question–answer maillist subscriptions was 112. In addition, a variety of information was put on–line at Quest for FTP, Gopher, and WWW retrieval.

Two types of project updates were sent regularly. One was the formal project status written by Dr. Carol Stoker and delivered once per week. The other, written by Dale Anderson and called *Dale's Dive Diary* was more chatty and informal. Dale's underwater dives in the Antarctic seas were featured in the television segments, generating student interest in his ongoing activities. (See Appendix A1 for a complete schedule of reports.)

Students and teachers were encouraged to send questions to the research team via email. During the nine weeks (including the Christmas holiday), approximately one hundred questions were received. About sixty of these questions were unique. Almost all were responded to in a timely fashion, although due to glitches in workflow procedures and the lack of automated tracking software a few fell through the cracks and went unanswered. We expect to correct this in future projects.

Live From…Other Worlds was the first Interactive Project mounted by the NASA K-12 Internet team, and we experienced our share of start–up problems. The maillist software (majordomo) was newly installed and not entirely understood. Several times we found ourselves scrambling to fix a previously undiscovered problem. Computer systems which are tasked to host such projects should be stable from both a software and hardware perspective well before the planned start. Our mistake here was to have the project deadline determine the schedule for software implementation, rather than the other way around.

Smart Filters for the project were recruited on a "first come, first served" basis. Little energy went into training these people or in making realistic assessments of their existing online skills. Thus, some Smart Filters were still learning email when we expected them to be working productively; others misjudged their availability and like many volunteers in other arenas, simply didn't live up to their commitments. As a result, the project managers wound up filtering almost all questions and answers themselves.

When the project was first announced online, not all of the details were finalized nor were the online components operational. Instructions for participation, rather than being presented in full at the outset, were instead intermittently diffused through a series of email messages. This confused the users and no doubt contributed to a smaller than expected participation. Another miscalculation involved our ability to produce Spanish translations of the updates and question–answer pairs. This proved to be too difficult to quickly organize with volunteer labor and thus we stopped with only a small percentage of text converted to Spanish.

Section 4: Description of FOSTER Online

FOSTER (Flight Opportunities for Science Teacher EnRichment)Online plugged an airborne astronomy missions group into cyberspace. These researchers flew on NASA's Kuiper Airborne Observatory (KAO) from early May through early June of 1994. The Kuiper team used an infrared telescope at 41,000 feet, where the altitude diminishes problems with atmospheric absorption. The exotic apparatus involved temperatures near absolute zero. The women and men of Kuiper conducted their research from both Hawaii and California. Throughout the month–long deployment, they shared the excitement of a NASA research project with K–12 classrooms via the Internet.

A variety of online options were made available to participants, with email as the base. An automated list (majordomo) was created; once subscribed, people received updates from the KAO staff and from the FOSTER Online organizers about project logistics. Email questions were sent to ask–foster@quest.arc.nasa.gov; a separate maillist was created to distribute all question–answer pairs. A maillist for unmoderated discussion between involved teachers was created.

By the end of the project, the number of subscriptions to the main update list, the question–answer maillist, and the discussion maillist was 320, 49, and 31 respectively. This does not include the large numbers of people who had access to the information via an intermediate source. For example, PBS Learning Link and America Online both reposted Quest information in a place more accessible for their respective users. Many other providers did likewise. No attempt was made to quantify these participants. In addition, a variety of information was put on–line at Quest for FTP and Gopher retrieval.

We had planned to send project updates daily, but as the project progressed their frequency diminished due to the many technical problems we experienced (See Appendix B2 for details). A video documentary about the research team was originally scheduled to be aired weekly via NASA TV starting May 11, 1994. However, production problems, scheduling snafus and the sudden announcement of a supermassive black hole conspired to push the first air date back into early June. This caused considerable frustration for many involved. During the project, a serious computer security incident disrupted the operation of the server computer. For approximately five days the computer was unavailable. In addition, for two weeks all project work was required to physically be done in one computer room. This was far less convenient than the network access normally available. As a result of these glitches only thirteen reports were posted over the thirty–two day period.

Students and teachers were encouraged to send questions to the research team via email. One hundred forty questions were received over five weeks. Virtually every question was acknowledged immediately and most questions were answered by an expert within a week (See Appendix B4 for details). Ninety–seven questions were unique and required an answer from an expert.

A single paid and highly–trained person performed all Smart Filter functions, spending approximately one hundred hours on the task (See Appendix B6 for more details). No attempt was made to incorporate volunteers or student Smart Filters. A paper log of all incoming questions and their status helped ensure that no questions were lost. Virtually all incoming questions were personally acknowledged swiftly and then forwarded to an expert. All email movement and tracking was done by hand. It is clear that simple routines could automate some tasks and greatly reduce the Smart Filter workload.

A total of 18 different KAO team members agreed to participate as experts. During the course of the project, a few additional astronomers who had heard about the project but hadn't originally been invited asked to participate.

The following background materials were placed online:

Information about the Kuiper Airborne Observatory
Biographies of the people involved in this work
An astronomy lesson plan
An archive of updates and question–answer pairs
Images and supporting background material

We suspected at the outset that the timing of the project would be difficult for most American schools, since it began just when most schools were winding down the school year. This assumption was confirmed when almost all of the project action took place during the first three weeks. An earlier start date would have helped, but this trade–off would have allowed less preparation time for the project coordinators and teachers. As it was, serious implementation didn't begin until early March. The first public announcement occurred on April 22, 1994. This was only 11 days before the project's starting date of May 3. In the United States, some K–12 schools finish their spring sessions as early as mid–May.

Despite the administrative difficulties we encountered, the project was judged an overwhelming success by its participants, even though they reported significant difficulty in fitting it in to their existing curricula (See Appendix B8 for details).Classrooms got prompt answers and felt connected to working science. Evaluation forms were filled with positive feedback and a wish for more such projects in the future. The NASA experts overwhelmingly enjoyed the project. None received too much mail; some even asked for more questions when their share slowed. As word leaked out, additional astronomers who were not originally included asked to participate.

Section 5: Lessons learned

In the course of conducting these projects we learned several important lessons which will guide our future efforts and which we believe are of use to others planning online interactive projects in any field. Some of these bear on the way the projects were experienced by their classroom participants, others on the administrative dynamic that determines how smoothly everything runs.

1. Teachers are best able to use projects that respect the constraints of the classroom.

Teachers don't have much time for preparation, especially on short notice, and the resources they choose for their classrooms need to be dependable. Therefore the more advance notice that can be given the easier it will be for teachers to integrate these projects into their regular curricula. Once the project begins, it's important that reports, updates, or new segments arrive consistently. If they do not, teachers may decide the project is not worth their class time and abandon it. Timeliness is also importance in sustaining interest on the part of kids. If you hold out the promise of establishing a relationship, however limited or transient, with someone "out there" it needs to be honored quickly and for the full extent of the project. Delays will be exacerbated by the use of experts who do not have access to or proficiency with email, as was the case with some of the aircraft pilots in the Kuiper project. Project organizers may benefit by establishing a separate Internet account dedicated exclusively to the project. This will segregate time-critical messages from normal everyday business. Also, a tendency emerged for a small number of teachers to be responsible for a large number of the questions asked.

2. Not all content experts are created equal.

We intended that experts would serve as more than clever databases, that they would stimulate students to write in with questions and excite and motivate them to pursue careers in science and engineering. This requires both enthusiasm and a particular personality type from your expert, one that is difficult to specify in a project description. Our recommendation is to evaluate potential participants as best you can for their online interpersonal and then closely monitor their interaction with the students to ensure it has the tone you seek. Boring experts can sound the death–knell of an interactive project.

Discussion groups related to the projects, whether LISTSERV or newsgroup based, need seed messages to get them going. Those for *Live From ...Other Worlds* and *FOSTER Online* didn't have these, and as result never really gained momentum. You may want to consider whether separate discussion groups for each sub–topic (i.e. Mars, telepresence, etc.) are really necessary to the overall success of your interactive project. The simpler the project structure the more likely it is that teachers will take full advantage of it. Therefore each potential component should be evaluated to see if it will pull its weight from the teacher's perspective.

3. Simplicity is the catchword for a successful project.

Our experience indicates that while a large complement of interactive components (discussion groups, multiple Listservs, email with experts, searchable databases, elaborate conference moderation) may be attractive to the project designers they don't necessarily add value for the classroom participants and may in fact be confusing. If you plan to use volunteers to assist in as content experts, moderators, or in some other ongoing capacity, plan to spend a lot of time and effort to keep these relationships working smoothly for all concerned. Consider volunteer components as another type of project overhead, rather than a device to reduce it: the main reason to include them may be to give them a particular type of learning experience, rather than because they will make your life easier. Keep in mind, too, that a good many of your participants will fail to follow even the most straightforward instructions regarding message addressing, file paths, and the like. Software–based toolkits for automating project functions like message translation will probably not be as helpful as you had hoped, if they can be gotten to work reliably at all.

3. Catch them while you can

If you expect to collect survey information from your classroom about their participation, do so promptly at the project's conclusion or, better yet, while the project is ongoing. Former participants can be difficult to track down and motivate where post-project surveys are concerned. This year we hope to increase survey participation by making available an HTML forms–based instrument to those users with high–end connectivity. We expect that this will be more engaging and enjoyable than a typical text-only survey.

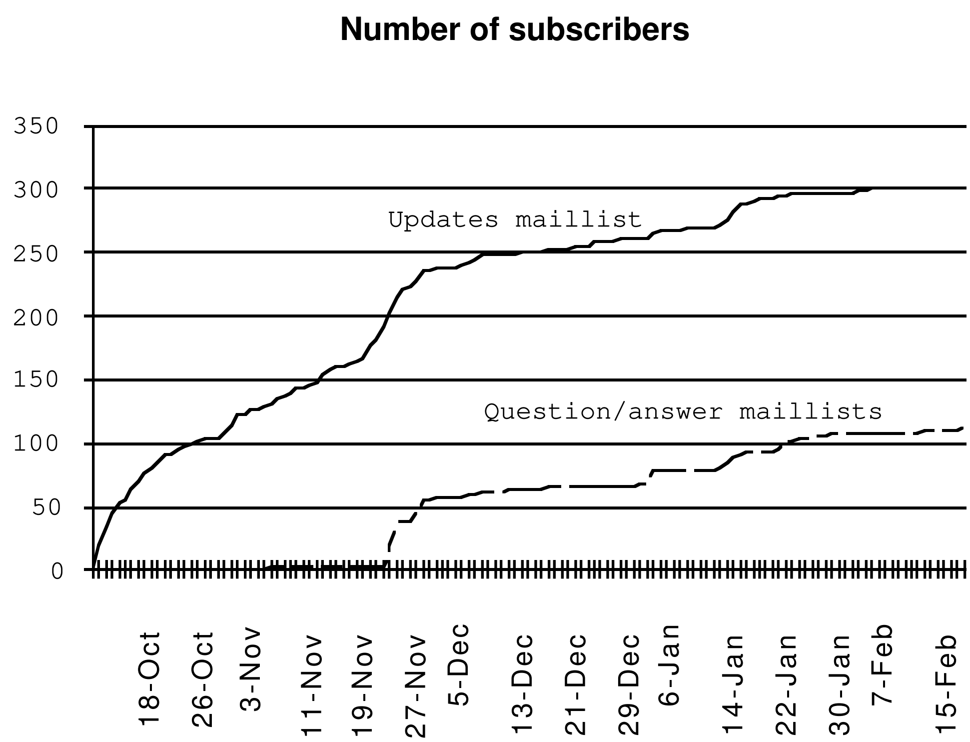
Section 6: Future Directions

The lessons we've learned as result of running interactive projects so far point clearly to future directions. The central worth of the projects, putting kids and teachers into structured relationships with practicing scientists and engineers, has been proven by participant feedback. Just as clearly, the technologies of project administration need to be refined further. As we indicated earlier, part of this is technical, and this year's projects will make extensive use of an HTML forms interface to all project functions for those participants who can make use of it, while retaining the text–only email access for those with low–end connectivity. We hope that such an interface will make it simpler for participants to make use of the numerous project components—Listservs, newsgroups, email, multimedia, database searches, and survey completion—while reducing the perceived complexity.

We intend to investigate further the potential role of students and teachers working together as project moderators, Smart Filters, and experts. This year's projects have begun with a concerted effort to recruit and train people interested in filling these roles. In addition to the large, open projects of last year, we will experiment with smaller Mentor Circle projects which we hope will grow organically at their own rate. We hope to be able to report on our 1995 experiences next year.

Appendix A: Live From...Other Worlds

A1 Project sign-up dates



A2 Schedule of update reports (Oct. Dec. 1993)

Dale Dive Diaries

October 15:	Arrived in New Zealand
October 19:	Antarctic driver's license
October 21:	Descriptions of the first two dives
October 23:	Cape Evans dive
November 2:	Underwater details
November 30:	Diving the Wall; also Thanksgiving in Antarctica
December 13:	Packing for home

Dr. Stroker's Project Status Reports

October 13	First contact from Antarctica
October 14	Weather Condition 3; setting up equipment
October 15	Undersea robot called TROV working
October 24	Hardware details
November 1	Training TROV drivers; broken fiber; Cape Evans trip
November 8	Remote driving from California
November 15	Line tangled and rescue operation
November 30	Summary of entire research campaign

A3 Question Topics

Amateur Radio
Antarctic Ecosystems
Antarctic on Weather
Antarctic's Ice Melt
Antarctic's Waste
Any special clothing required?
Anybody from Nevada?
Are the Whales affected?
Astronomy at South Pole
Comet crashing Jupiter in July
Controlling Pollution in Antarctica
Dinosaurs in Antarctica?
Educational Background Required
Electricity generated for TROV and Living
Enduring Antarctica
Exploring McMurdo Sound
Global Climate Change
Goals to Achieve
Hottest Temperature
How Much Exploration
How Rover Will Return
How are Young Researches selected
How are the researchers selected?
How bad is the global warming effect?
How cold is it?
How did McMurdo get its name?
How long does it take to get to South Pole?
How many in the group
How many people lived there?.
How much does Rover cost?
Length of Stay
Life in McMurdo Sound
Main Findings on McMurdo
Manned Mars Mission
Mars Colony Robotics
Martian's Meteorites found?
NSF involvement with TROV
Open for Mineral Exploration?
Ozone Holes
Ozone Holes Increasing?
Regarding Human Waste
Relacionado ballenas, focas, o pinguinos
Robot Motors
Rover Duration
Rover and Gravity
Snow levels in Antarctica
Stay over for winter?
Time Zone Difference
Type of Shelter
Underwater Camouflage
Unexplored areas near McMurdo
Voyager's current status?
Whales, Seals & Penguins
What Do You Missed Most?
What is the climate history?
What is the coldest temperature?
What type of food do you eat?
What's next?
Why Use Virtual Reality?
Wingless Midge

A4 Project announcement

From: Marc Siegel <msiegel@QUEST.ARC.NASA.GOV>
Subject: NASA's Live From...OtherWorlds project
To: Multiple recipients of list COSNDISC <COSNDISC@BITNIC.EDUCOM.EDU>

"LIVE FROM... OTHER WORLDS"

A pilot project using Space Technology to take students on "Virtual Field Trips" via Interactive Television and Computer Networks

"LIVE FROM... OTHER WORLDS" is a mini-series of 3 interactive television programs, currently targeted for broadcast on December 1st, December 3rd and December 7th, 1993 and airing LIVE at 13:00 hrs. Eastern, 10:00 hrs. Pacific and 08:00 hrs. in Hawaii. This demonstration project will focus on a fascinating scientific topic: how robot explorers open up areas of this world and others for discovery. It will show how "telepresence" research being conducted by NASA extends human eyes and minds to the depths of the Antarctic oceans as a prototype for techniques by which humans on Earth will in the future be able to probe the planet Mars. "LIVE FROM... OTHER WORLDS" will be supported by print and computer materials for students and teachers.

The project will use the rapidly developing capabilities of space technology and satellite television distribution to bring remote sites and dynamic researchers directly into classrooms across America in a series of electronic field trips. The students' guides on these voyages of discovery will be a diverse group of dynamic and eloquent researchers, men and women often in their late 20's and early 30's, who have made scientific achievement their entry ticket to a lifetime of discovery.

The interactive component of the programs will allow some students to question these researchers, live and on-camera. In order to permit an additional degree of interactivity not practicable during the broadcasts alone, computer-based "discussion centers" (via mail lists and newsgroups) will be used. This will allow other pupils and teachers to contact scientists seen during the programs through electronic correspondence for further information and with follow-up questions, . The email feedback will be organized by PBS LEARNING LINK and by NASA's K-12 NREN Initiative (National Research and Education Network). The on-line networks will also allow researchers in Antarctica and in America to post daily updates on their activities, allowing students a very personal window on what careers in science are really like. In addition, an archive of relevant materials will be kept on-line using modern Internet tools (anonymous FTP, Gopher and WAIS). Additional details about these services will be released shortly.

NASA has created an Electronic mail list to help interested parties keep informed of current developments regarding this project. To join this maillist, send an email message to listmanager@quest.arc.nasa.gov. In the first line of the mail message, write the following information: subscribe livefrom

As part of this project, NASA is collecting lesson plans which will be freely shared. Information is desired on the following topics: robotics/virtual reality/telepresence, Mars, Antarctica and marine ecology . If you have developed such curriculum supplements that you would like to make widely available, please send a note to livefrom-curriculum@quest.arc.nasa.gov. Please describe the content and targeted grade level. If the information is simple ASCII text, please include it with your note. If the curriculum supplement is in another form (for example, Hypercard stack or Postscript file), please provide details so that a proper transfer can be arranged.

Also, NASA would like to work directly with network providers to raise the quality of interaction between scientists and classrooms. The goal here is to encourage network providers to add value for their constituent subscribers by further organizing information or by coalescing questions and answers. If you represent a K-12 network provider (state network or other) and would like to explore this opportunity, please write to msiegel@quest.arc.nasa.gov.

The live television programs will be 35-40 minutes in length, designed for use within a normal classroom period (CHECK LOCAL LISTINGS FOR EXACT BROADCAST AND/OR RE-BROADCAST TIMES). The series will be distributed over Public Television stations and/or satellite educational networks such as SERC (Satellite Educational Resources Consortium) and outlets such as NASA/Select. The educational content of the project will be suitable for use by all Middle School grades, though upper Elementary students and High School grades 9 and 10 will find the programs interesting and instructive. Succinct and informative print packages (distributed in advance of the broadcasts) and on-line materials will suggest inter-disciplinary, hands-on classroom activities.

The project is being developed by some of PBS's most experienced producers of science specials and series (COSMOS, several NOVA programs, CREATION OF THE UNIVERSE, LIFE ON ICE, CHILDHOOD) and originates from WHRO, the Public Telecommunications Center for Hampton Roads, Virginia, a leader in the use of satellite technology for distance education.

A high point of the three programs will come in the second program when a group of students at NASA's Ames Research Center in California will be able to "drive" a robot camera system -- a Remotely Operated Vehicle or "ROV" -- 10,000 kilometers away, deep under the Antarctic ice. The first program will show why Antarctica serves as an analog for "other worlds" in space, and how technology being researched there can assist in the exploration of the planet Mars. The third and final program will show cutting-edge NASA research on "virtual reality", robotics and telepresence. Again an opportunity will be provided for live student interaction with expert researchers and advanced technology.

"LIVE FROM...OTHER WORLDS" will deliver the most contemporary science in an entertaining format, providing a unique face-to-face encounter with distant and exotic lands and the young men and women who are privileged to explore them, using television to inform, inspire, motivate and educate. Informal feedback and formal evaluation will contribute to the development of what is intended to become an ongoing series of 3 integrated video, print and computer projects each academic year, on such diverse but fascinating scientific topics as volcanoes, dolphins and dinosaurs, the possibility of extraterrestrial life and life as an astronaut.

CREDITS:
LIVE FROM...OTHER WORLDS is a production of GEOFF HAINES-STILES PRODUCTIONS in association with WHRO and THE INNERSPACE FOUNDATION. V-QUEST (Virginia Quality Education in Science and Technology), a State Systemic Initiative funded through the National Science Foundation, is an educational partner in the project. Hawaii Public Television, the State Department of Education and the University of Hawaii will provide a 3rd live origination site in addition to WHRO and NASA/Ames. The Internet support is made possible through funding from NASA's High Performance Computing and Communications Program (HPCC). The video production has been made possible in part by the support of NASA's "Mission from Planet Earth" Study Office and NASA's Education Division. Communications and other resources are being provided by Ames Research Center's NSI project (NASA Science Internet), the "Center for Mars Exploration" and the Telepresence Project, whose research in Antarctica has been funded by the Offices of Space Science and Advanced Concepts and Technology, as part of the joint NASA-NSF "Antarctica Space Analog Program". NSF's Office of Polar Programs provides operational and logistic support for all American research projects in the Antarctic.

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B1 Project timeline

B2 Project sign-up dates

B3 Schedule of update reports

B4 Question asking

B5 List of questions

B6 Project team time investment

B7 Project announcement

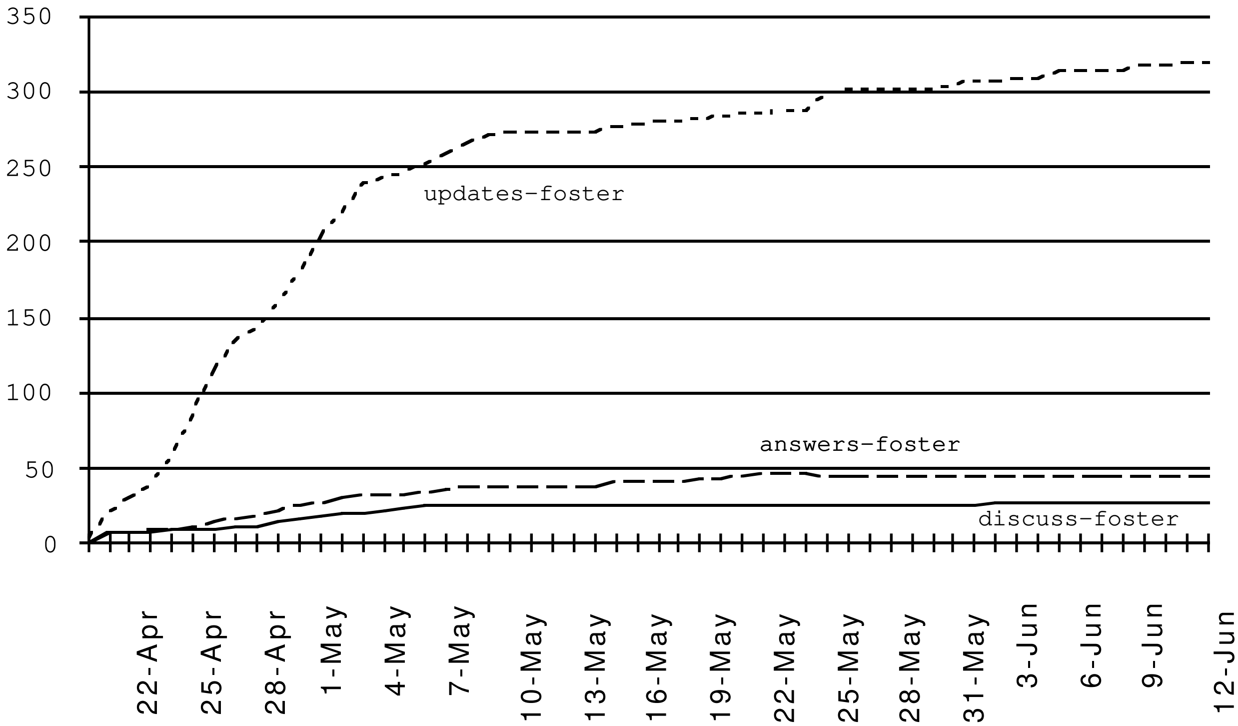
B8 Survey of Participants

B1 Project timeline (October 1993 June 1994)

Oct:	Project initially conceived
Feb:	Decision to proceed; planning begins
Mar 23:	Design review for online organization
Apr:	Recruit experts, identify authors of updates, identify online materials
Apr 21:	Request for expert biographies
Apr 22:	Project announcement on CoSN
Apr 25:	Project announcement on Net Happenings
	Video originally scheduled
May 3:	Start of questions
	Video plays on NASA Select TV
June 10:	End of questions
August:	Surveys completed

B2 Project sign-up dates

Number of subscribers



B3 Schedule of update reports

Flight Update May 2,1994	Science goals of deployment
Flight Update May 5	Getting ready to leave for Hawaii
Flight Update May 7	Chopper failure
Flight Log of May 7	Chopper failure log entries
Trip to Hawaii on May 7	Details of flight
Flight Update May 9	Lots of people on team
Flight Update May 10	Details of a successful flight
Flight Update May 11	Experimenter change
Flight Update May 13	Flight canceled, scuba diving instead
Flight Update May 14	New exotic equipment (very, very cold!)
Flight Update May 15	Routine flight details
Flight Update May 23	New instrument called FIFI

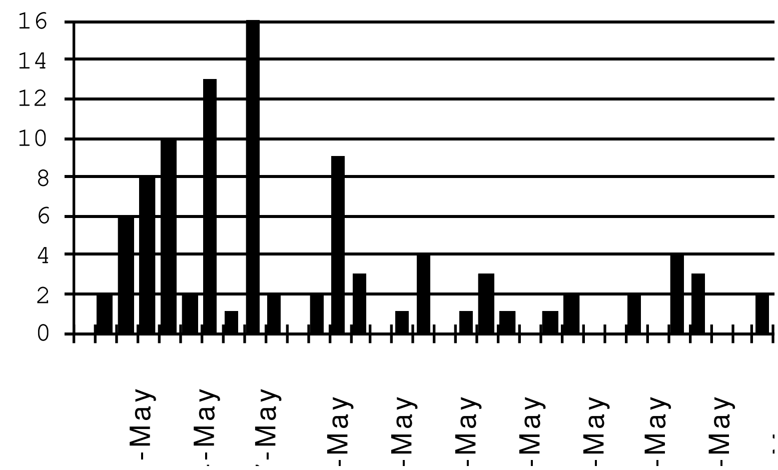
Flight Update May 27 Busy deployment

B4 Question asking

A total of 138 individual questions were asked. Of these, 41 questions were answered by the Smart Filter (because it was a duplicate, it was in reference material or it was irrelevant). The remaining 97 questions were forwarded to experts.

The chart below shows the arrival dates of unique questions which needed to be answered by experts. The x-axis is the specific day, the y-axis is number of questions arriving on that day.

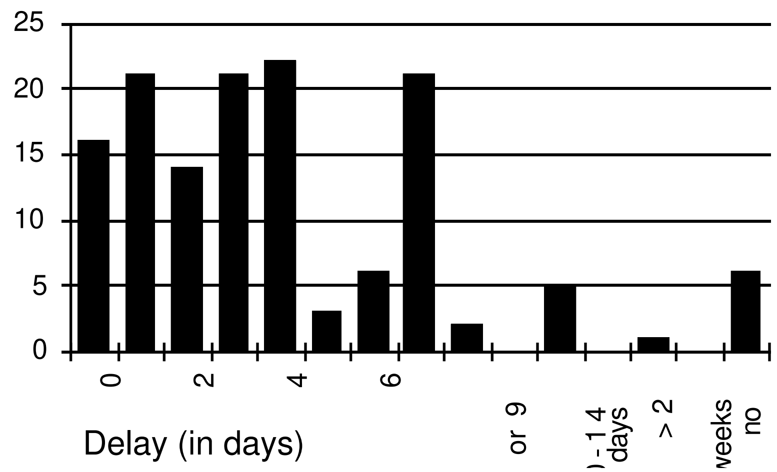
The vast majority of questions arrived during the first two weeks of the project.



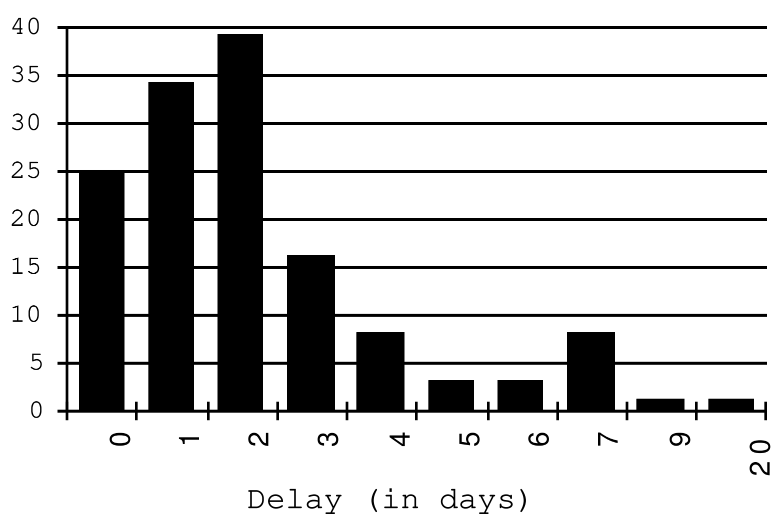
Only basic guidelines were provided to help determine appropriate questions for submission to NASA. A handful of teachers accounted for the bulk of all questions. No limits were placed on number of questions allowed per teacher. The busiest questioner sent in 39 individual questions. The next five busiest teachers each sent in 20, 11, 10, 8 and 8 questions each, respectively. The other questions were submitted by teachers with one to six questions each. Only eleven teachers limited themselves to a single question. If question demand needs to be moderated, some limit might become necessary on the maximum questions per teacher.

The delays in answering questions are diagrammed below:

Histogram showing delay between first asking and receiving the answer to a question (x-axis is delay in days, y-axis is number of questions answered with given delay)



Histogram showing Smart Filter delay between date question first asked and initial Smart Filter processing (x-axis is delay in days, y-axis is number of questions answered with given delay)



B5 Question Topics

50 foot power in 6 foot space
A Comet in Auriga
About Saturn's rings
Annular Eclipse on May 10, 1994
Being a Pilot
Broken Telescope
How does the edge of atmosphere look?
How many people need to operate the telescope?
How to collect atmosphere
How to view stars at high speed
How was Kuiper Named?
Injuries on KAO
Interest in Space
Invisible Star
Jet Streams in high altitude
KAO crash and safety
KAO's type of aircraft
Kuiper Pronouciation
Learning about far away stars
Life on Comets?
Maximum Altitude for KAO
Methane Ice vs. Water Ice
Minimum age to be on KAO
New Solar Systems
Non-gravity environments
Observation of Annular Eclipse from KAO
Origin of Methane
Other Locations besides Hawaii
Other Telescopes on board KAO
Other gasses in space
Planet Moon
Planets sharing the same orbit
Power of Telescope
Radon Experiments
Rho Oph Coordinates
Salary compensations for KAO team members

Scared to fly?
Schools for Pilots
Seen anything weird?
Shoemaker-Levy
The formation of Jupiter
The importance of learning about stars
The size of KAO staff
Type of Telescopes Used
Venus' gaseous atmosphere
Washrooms on KAO
Water landing in case of crash
When and why use KAO?

When do pilots sleep?
Where do particles come from
Why do you choose Hawaii
Why not used the Shuttle
Why outerspace is so cold
Why study dust
Why use infrared telescope
Women on Flight & Experiment Crew
Building Blocks of Life
C-141 Size and Name
Choosing the pilots
Collecting data and observing eclipse on May 10 from KAO
Comet colliding with Jupiter
Constellation called Lynx
Do you enjoy your work?
Educational Requirement for KAO staff
Electronics devices on KAO
Food on KAO
Gas in space
Gravity and Stars
Harmful particles in dust
Has the moon any gender?
How did Earth get its name?
How do comets move so fast?

B6 Project team time investment

The majority of the on-line work done by the project organizers was done by three people: Edna, Khamsa and Marc. The hours listed directly below are very rough estimates. The data for Smart Filtering is precise because it was measured throughout the experiment.

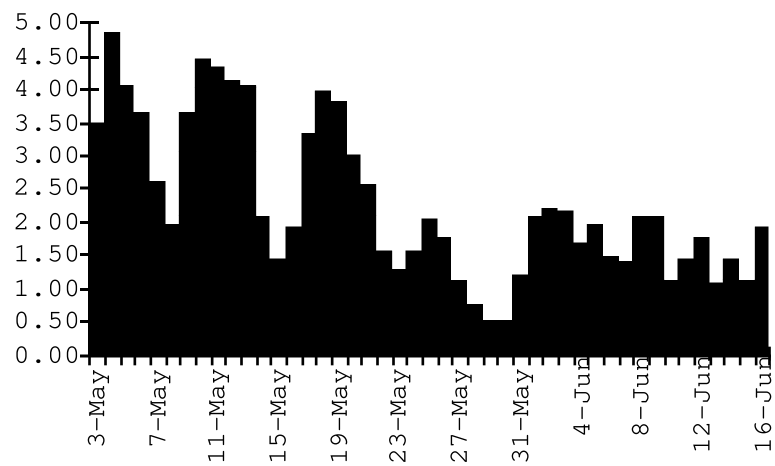
Project planning (March-April)

Edna	50 hours
Khamsa	30 hours
Marc	20 hours

Project implementation (May-June)

Edna	50 hourse
Khamsa	25 hours
Marc	50 hours
Smart Filter	103 hours

Smart Filter hours per day (no automation)



(Data results from moving 5-day average)

B7 Project announcement

NASA is pleased to announce FOSTER On-line, another project in the "Sharing NASA with our Classrooms" series.

FOSTER On-line will plug an airborne astronomy missions group into cyberspace. These researchers fly on NASA's Kuiper Airborne Observatory with an infrared telescope at 41,000 feet; the altitude diminishes problems with atmospheric absorption. The women and men involved in this research will be based in both Hawaii and California in May and early June. During this time they hope to share the excitement of a NASA research project with K-12 classrooms via the Internet.

Frequent project updates will be sent almost every day. Students and teachers will be encouraged to send question to the team via Email. Various background materials including articles, lesson plans and images will be made available via gopher and FTP. A video documentary about the research team will be aired via satellite once per week. The remainder of this message will provide details on the various components.

Project updates and announcements

To receive reports on the status of the research project and other announcements, please send an Email note to:
  listmanager@quest.arc.nasa.gov

In the first line of the message, write the words:
  subscribe updates-foster

Within a few minutes, you should receive a confirmation note that you have been added to the list of participants. You may sign up for this service today. The frequent updates will start arriving on May 3 and should continue until June 10 of 1994.

Sending Email to the research team

The men and women of the research team will be available to answer questions from K-12 students and teachers. We will acknowledge and answer all questions as quickly as possible. Our goal is to provide some type of personal response within a day or two.

These questions will be accepted from May 3 to June 10, 1994.

To send a message during these times, address the Email to
  ask-foster@quest.arc.nasa.gov

In the subject field, please put the letters "QA:" before a descriptive subject. The following example should illustrate this idea

```
TO:         ask-foster@quest.arc.nasa.gov
FROM:       your Email address
SUBJECT:    QA: bumpy ride?
Hello,
```

I am a seventh grader from Amarillo, Texas. I saw that the weather was bad in Hawaii yesterday. Did this cause your flight to be bumpy? Is it still possible to use the telescope when there is a lot of turbulence.
Thanks, Susie Hernandez

If you or your class have several questions that are unrelated, it would be best to send separate messages instead of one message with many different questions.

All of the question-answer pairs will be placed on-line. If you would like to receive ongoing Email with answers to previously asked questions, please send an Email note to:
  listmanager@quest.arc.nasa.gov

In the first line of the message, write the words:
  answers-foster

On-line repository of background material

Information related to this project will be made available on the Internet on our server at quest.arc.nasa.gov. Included on-line will be material about the Kuiper Airborne Observatory, the mission plan, the people involved in this work, lesson plans, an archive of updates and question-answer pairs, images and other goodies.

Some of this information is available now and more material will be continuously added until June 10.

This repository may be accessed using either Gopher or Anonymous FTP.

To use Gopher, open a connection to quest.arc.nasa.gov.

The main menu will look something like this:

1. NASA K-12 Information/
2. Frequently Asked Questions about Internet in School
3. Global Quest: A Video about the Internet in Schools
4. "Networks: Where Have you Been All My Life" Essay Contest Winners/
5. Announcing Space Design Contest
6. Other K-12 Gophers/
7. Other Interesting Gophers/
8. NASA Network Information Gopher/
9. NASA Topics/
10. NASA NREN K-12 Initiative (Our Sponsor)

Choose the first menu choice (NASA K-12 Information/) and you will see something like this:

1. The Teacher's Guide to the Internet/
2. Science Resources for Teacher K-12/
3. Student Resources/
4. Live From...Other Worlds/
5. FOSTER On-Line/
6. Recent Network Happenings/
7. Connect with Spacelink <TEL>
8. Network Guide & Directions/

At this point choose the fifth option (FOSTER On-Line) and you will be surrounded by a wealth of information about this group of researchers. Choose whatever is interesting to you. The menu will look something like this:

1. README: About the FOSTER On-Line Project
2. About Flight Opportunities for Science Teacher EnRichment (FOSTER)../
3. KUIPER AIRBORNE OBSERVATORY (KAO) /
4. Ask FOSTER - Questions and Answers Section/
5. Mission Updates and Activities/
6. Airborne Astronomy Lessons/
7. Biographies of the KAO team
8. Background Materials/
9. Images/
10. SOFIA - NASA's 21st Century Observatory/

Information may also be retrieved using Anonymous FTP. Depending on your service provider, the specific program for Anonymous FTP will vary. Popular programs include FTP and Fetch. In any case, an Anonymous FTP session starts with you requesting a connection to quest.arc.nasa.gov. The word "anonymous" is entered as the login name. Your own Email address (for example: mavis@zip.school.edu) is entered as the password. Once you have connected, you will receive a login message that looks like this:

```
230-WELCOME to the NREN K-12 ftp archive at NASA Ames Research Center.
230-All useful files are in the pub directory. To start, type the command
230-cd pub
```

You should begin by changing to the directory called

   pub.

Again the specifics of how to do this will depend on your software and service provider. From here, you should change to the directory called

   FOSTER-OnLine

You must type this exactly as it appears, including proper capitalization. At this point you will receive a message that looks like this:

```
250-This FOSTER On-Line subdirectory contains the following sections:
250-
250-  - README
250-  - About FOSTER
250-  - Kuiper Airborne Observatory
250-  - Ask FOSTER: Question & Answers
250-  - Mission Updates and Activities
250-  - Airborne Astronomy Lessons
250-  - Biographies of the Research Team
250-  - Background Materials
250-  - Images
250-  - SOFIA - NASA's 21 Century Observatory
```

At this point, please list out the files and retrieve the information which seems useful to you.

On-line discussion with other teachers

A mailing list has been created to facilitate discussions among teachers using this on-line project. This forum will allow teachers to share ideas, discuss potential classroom activities, benefit from one anothers' experiences, and perhaps build a community of like minded educators. The discussion will not be moderated or filtered.

If you would like to take part in this dialogue, please send an Email note to:
  listmanager@quest.arc.nasa.gov

In the first line of the message, write the words:
  discuss-foster

Feedback or comments

NASA welcomes your ideas on how to make this and future projects better. Please address any constructive ideas to feedback-foster@quest.arc.nasa.gov.

Video documentary available

NASA will be broadcasting a 30 minute documentary about the Kuiper Airborne Observatory. This video will air over NASA Select TV for four consecutive Wednesdays starting on May 11 at at 2:00pm Eastern time (5/11, 5/18, 5/25, 6/1). The program will also repeat at 6:00pm, 10:00pm and 2:00am (the next day). The documentary will be immediately followed by a 12 minute video called Global Quest: The Internet in the Classroom

NASA Select may be downlinked without cost from satellite by using the following parameters: SpaceNet II satellite, transponder 5, 69 degrees west longitude, frequency 38.8 MHz, Audio 6.8MHz, Horizontal polarization

The following is a more complete description of the video program.

Kuiper Airborne Observatory: NASA's Telescope in the Stratosphere

This documentary program introduces to the public one of NASA's least known and least expensive but scientifically most productive projects: an airborne observatory which takes astronomers into the stratosphere.

Through the 36" telescope which is mounted on a modified Lockheed C-141 cargo jet, astronomers gather light in infrared wavelengths from objects as close as a local asteroid and as far as a quasar billions of light years away. The program follows one flight of the Kuiper Airborne Observatory. On board the Kuiper as it travels at 41,000 feet from its base at Moffett Field in Northern California to the Mississippi River and back are University of Chicago astronomers who are mapping the great nebula in the constellation of Orion where stars are being born. On board are two teachers from the San Jose Unified School District who are participating in a NASA program designed to enhance science education.

This documentary itself provides an exciting and informative introduction to contemporary astronomy. For in telling the story of the airborne observatory, the program gives the history of major discoveries that have resulted from flights that astronomers have taken on the Kuiper. These discoveries include the rings of Uranus, the presence of organic chemicals and water ice on Halley's Comet, and the elements that were spewed into space by the spectacular explosion of Supernova 1987A. The astronomy that has occurred on the Kuiper throws light on the origin of life on Earth, the composition of stars, the intense activity that is occurring at the center of the Milky Way and the process whereby galaxies are formed.

The program reveals the unique technologies used on board the Kuiper to wrest secrets from the universe. These include supercooled data collection instruments, and the telescope's compressed air and gyroscopes systems which enable it to remain fixed on a distant object despite turbulent flying conditions. Interconnected networks of computers navigate the aircraft, collect the data, point the telescope, and track the flights. In addition, basic astronomical concepts such as electromagnetic radiation and the uses of spectrographic analysis are also presented.

Designed for audiences ranging from junior high students to the general public, featuring interviews with leading astronomers and photography from NASA space probes and on board the Kuiper Airborne Observatory, this documentary provides a unique and inspiring look at astronomy in action.

B8 Survey of participants

Section 1: Notification and announcement

How did you learn about FOSTER On-line?
Through CoSN listserv, Schoolnet, Spacelink, Net-Happenings, EDNET, Delphi's Edtech Custom Forum, NESWNET, forward from a friend or helper, armadillo-watch@chico.rice.edu, from other NASA Internet programs, NASA Select TV

Approximately what date did you sign up for this project?
See Appendix B2

Do you have ideas about other places we should announce similar projects?
To previous project particpants
Magazines/publications which schools usually receive (like "National Geographic")
The Scout Report (scout@internic.net)
Net-happenings, NOVAE, CoSN, Kidsphere, FrEDMail
Businesses that you are associated with, public schools, and other college campuses
USENET(alt.space.news, all available k-12 science interest groups)
Professional journals, AFT/ATA journals
Commericial nets -- AOL, Prodigy
Nasa Select TV

Ideally, how much notice would you need about a similar project for it to be useful to you?
Teachers answered across a range, from one week to two months. If the response from all teachers was averaged, the result is about one month of of lead time. Particpants who weren't teachers needed no lead time.

How clear were the announcement instructions you received on how to participate in the FOSTER On-line project?
_____ 1: Crystal clear........5: Confusing
Of 22 responses:

11 chose a rating of 1	3 chose a rating of 3
6 chose a rating of 2	4 chose a rating of 4

Other comments:
"I think this is a great idea. Once people know about it, it should become quite popular"
"It would help to have some reference stuff available in many different forms - hard copy, previously published articles and so. Could add this to the gopher."
"It was hard for me because our school is Year Round and I went off-track at the wrong time for this to be real beneficial to the students."
"I learned what a valuable resource an "expert" can be. Especially when he takes the time to respond to personal questions."
"Even now i am still unsure how to access the video segments that were mentioned. Are they only on a specific cable channel. Are there other methods for obtaining the information?"
"This was one of the finest Internet classroom projects so far. I wasn't quite sure how best to use it. Another time that would not be a problem. The answers are a treasure of information. They were well written and easy to understand, and they provided current and profound insights in addressing the questions."

Section 2: Updates (reports from the project team)

How well did the frequency of the updates meet your needs?
_____ 1: The right number of reports 5: Not enough reports
Of 17 responses:

8 chose a rating of 1	1 chose a rating of 4
5 chose a rating of 2	1 chose a rating of 5
2 chose a rating of 3	

One person said, "The more the better. We can always hit 'D'"

How consistent did you find the reports?

_____ 1: Very consistent 5: Spotty and inconsistent

Of 18 responses:

5 chose a rating of 1 | 1 chose a rating of 4
5 chose a rating of 2 | 2 chose a rating of 5
5 chose a rating of 3

Comments were:

"I thought the spottiness and inconsistency, such as it was, was a useful illustration of the way science works."

"Another some were great...others not so hot"

In future projects, ideally how often would you like to receive a report?

Of 20 responses:

4 chose "once/week"
11 chose "twice/week"
1 wrote in 2-3 times/week
4 chose "once/day"

Did the level/complexity of the reports match your classroom needs?
_____ 1: Just right 5: Too complex

Of 9 responses:

4 chose a rating of 1 | 2 chose a rating of 3
1 chose a rating of 2 | 2 chose a rating of 4

Did the level/complexity of the reports match your classroom needs?
_____ 1: Just right 5: Too basic

Of 5 responses:

4 chose a rating of 1 | 1 chose a rating of 2

One person wrote, "Since the reports covered the whole range, I thought it was OK. You can't be all things to all people."

Other comments:

"Give Juan Rivera a raise."

"I subscribed the last couple of days of the service, so I didn't receive any actual reports"

"More detail of the research results would have helped"

"My students are probably among the younger groups to be involved in FOSTER. While many aspects of what appeals to a younger audience (quicktime movies, sound files, image files) will also appeal to junior high and high school students, the more advanced descriptions are pretty tough for a sixth grader."

"I found the reports very informative, so to me they were just right if more details on the electronics were possible that would also be a plus."

"This idea of sending updates via the internet is a great way to inform a large variety of people! "

Section 3: Ask-foster (Email to experts)

Did you submit any questions to FOSTER On-line? If not, please skip to the next section.

Of 23 responses:

18 answered 'No' | 5 answered 'Yes'

How quickly was your question acknowledged?
_____ 1: Very promptly........5: Not at all

Of 4 responses:

4 chose a rating of 1

How quickly was your question answered?
_____ 1: Very promptly........5: Not at all

Of 3 responses:

2 chose a rating of 1 | 1 chose a rating of 3

One person wrote, "Promptly enough for me"

How would you rate the quality of the response?
_____ 1: Very good........5: Poor

Of 4 responses:

4 chose a rating of 1

One person wrote, "Excellent. In general the responses were on the level suited to the question and to the level of the students."

Did the level/complexity of the question match your classroom needs?
_____ 1: Just right 5: Too complex
Of 4 responses:
3 chose a rating of 1 1 chose a rating of 2

Section 4: Reading question–answer pairs

Did you receive the question–answer pairs from the answers-foster mailing list? If not, please skip to the next section.
Of 22 responses:
17 answered 'No' 5 answered 'Yes'

How would you rate the quality of the response?
_____ 1: Very good........5: Poor
Of 5 responses:
5 chose a rating of 1

Did the level/complexity of the question match your classroom needs?
_____ 1: Just right 5: Too complex
Of 2 responses:
1 chose a rating of 1 1 chose a rating of 4

Section 5: On-line information

Did you use gopher or FTP to access the information on quest.arc.nasa.gov? If not, please skip to the next section.
Of 20 responses:
15 answered 'No' 5 answered 'Yes'

How would you rate the organization of the information on Quest?
_____ 1: Well organized 5: Poorly organized
Of 4 responses:
1 chose a rating of 1 1 chose a rating of 3
1 chose a rating of 2 1 chose a rating of 4

How reliable was your ability to connect with Quest?
_____ 1: Very reliable 5: Unreliable
Of 5 responses:
2 chose a rating of 1 1 chose a rating of 4
2 chose a rating of 2
One person wrote, "ftp access was down in the last couple of weeks of school"

What information did you find most useful?
"COLOR IMAGES!!!!!!!!"
"The graphic of the aircraft"

What type of information would you like to see for future projects?
"Graphics in GIF or other IBM compat. format"
"More background material regarding the specific objectives of the mission."
"QUICKTIME MOVIES!!!!!!!!! SOUND!!!!!!!!! MORE IMAGES!!!!!!!!!!!!!!!!!!!"
"Perhaps more graphics"

Other comments:
"The question–answer part of the project was excellent!!!!!!"

Section 7: The overall experience

Overall, how worthwhile did you find your total FOSTER On-line experience?
_____ 1: Very worthwhile........5: Not worthwhile at all

Of 23 responses:
11 chose a rating of 1 — 5 chose a rating of 3
6 chose a rating of 2 — 1 chose a rating of 4
One person wrote," Potential for much more with more prior notice, more interaction."

Overall, how did your students like their FOSTER On-line experience?
_____ 1: Very much........5: Not at all
Of 7 responses:
1 chose a rating of 1 — 2 chose a rating of 3
4 chose a rating of 2
Comment:" a small group os students would give it a 1, while the majority would have rated it a 2 or 3"

Would you recommend to another teacher that she participate with her class in a project like FOSTER On-line?
__Yes __No
Of 20 responses:
20 answered 'Yes' — nobody answered 'No'

How easy was it to work FOSTER On-line into your curriculum?
1: Very easy........5: Very difficult
Of 7 responses:
1 chose a rating of 1 — 3 chose a rating of 3
1 chose a rating of 2 — 2 chose a rating of 5
Comments:
"It diddn't really fit, we just did it"
"Coming at the end of the year was really bad timing; with more time and at a different time very easy"

Please describe how you used the information provided with your class.
"I'm a parent. I came into the class every ten days or so and did some FOSTER stuff with the kids."
"It fit in nicely with our coverage of telescopes in my Earth-Space science class"
"Read and posted the updates on the bulletin board. Provided copies of the background material for group reading and discussion then required group development of questions which were focused on the materials. Grouped and e-mailed the questions from home. Shared the answers with the class. Each student received a copy of her/his answer."
"My class and I read letters and composed questions together. We connected to and downloaded from arc.quest. and read some of the researcher biographies and viewed the color hypercard stacks by ExInEd"
"Sharing, discussing, delving into maps and ideas presented."
"Presented aspects of the reports which pertained to my third grade lessons on condensation, weather, atmosphere, etc"
"I personally followed the reports sent, but because of my teaching schedule I was unable to work it in to the existing curriculum at that time. We are in the slow process of establishing internet access at our school site which kept me from full participation in FOSTER On-line."
"I teach my children at home. We explored the topics as you brought them up"
"I'll be sharing it with next year's class."
"It was an extra credit project for those students enrolled in my physics classes who were interested in astronomy"

How can we make future projects like FOSTER On-line more useful to you?
"Make it available to the local schools. They don't have Email."
"Let me get on the plane with you. Send information from the flying teachers. "
"QUICKTIME MOVIES!!!!!!!!! SOUND!!!!!!!! MORE IMAGES!!!!!!!!!!!!!!!!!!!"
"More time to plan"
"More advance notice"
"It was great the way it was. Just provide similar projects in the future."
"I was unclear what some of the experiments involved, therfore, we were not sure what kinds of questions to ask, or if it was appropriate to ask general astronomy questions."
"More of the same."
"The reports were very sparse on this project, however I am sure this was due to the problems experienced. The reports should however take some priority as the public is looking forward to them.. "
"Interesting news (mail) is most important thing"

What was the best thing about FOSTER On-line?

"It was so interesting."
"Having the actual scientists and people directly involved with the Kuiper answer questions."
"The reality of it. Getting reports from the people doing the work was very insightful. I think this is the next best thing to having the students actually on the plane. Even studying the necessary skills won't tell you about the sleepless nights or the unexpected equipment failures in the same way as hearing it while it's happening from the people it's happening to. :-) Also the thrill of being there doing the science came thru very well."
"Feeling of a personal contact on the aircraft. Real world [especially the gravel in the engines] type problems"
"The excitment when the answers came back."
"Real correspondence with the technicians and scientists involved was important to the students, even if they didn't fully comprehend the mission."
"IMAGES!!!!!!!!!!!!!!!!!!!! and connecting on-line....and getting questions answered by experts...."
"Being privy to "real science" and providing myself and students with an opportunity to witness something we would have no other access to."
"Something that is happening NOW"
"The immediacy/intimacy of the reports. I wish I had been able to share the reports themselves with the class, but they were too complex and time-consuming to fit in the short time period I had to work in."
"It provides a direct, nearly realtime link between scientific theory as studied in the classroom and application in the real world."
"Talking with the experts"
"The detail and quality of the answers."
"Being exposed to some of the newest information as it occurs is a great experience for me! I try to keep up with some of the more interesting topics but it always seems impossible. Thru FOSTER On-Line and the concept it supports alot of GOOD information can be desceminated to a large and diverse group of people each making use of a different segment of the info. for their own purposes."
"Best: reading the updates of Juan Rivera"
"The best thing is that I can see the latest news of this program when I am in Japan."

What was the most frustrating thing about FOSTER On-line?
"Maybe conglomerate a couple of questions/answers with each other so that people who are subscribed to the answers folder aren't deluged with so many messages (I ended up unsubscribing to the answers folder because there were too many messages for me to try to read!)?"
"Not being there myself. :-)"
"The updates fizzled out. Our last group of answers I received the night after the last school day."
"when quest.arc was unavailable"
"Dearth of messages"
"Not having students to become involved"
"Not knowing when the rports would be coming"
"The problem with the computer when the enormous list of To: was present."
"I didn't figure out what was happening until school was over. Too much happening at that time to take on something new."
"Finding out about FOSTER-Online near the end of the project! I would have really liked to have been involved from the start!"
"Not being able to see the video"

Other comments:
"I have over 50 hours of jet stick time, and thousands of hours of high tech scope time. How can I get an application to fly with you? [in a timely manner please"
"I need to get the whole package including the information to be available and how to access the information before starting a project for the class. I was just a sideline observer for this one. "
"An outstanding project. HOW can I acquire the video tapes?"

Section 8: About you

What grade level(s) do you teach?
Of 13 responses:
1 responded with grade level K-1
1 responded with grade level 1-3
1 responded with grade level 6th grade bilingual
1 responded with grade level 6/7
1 responded with grade level 6-8
1 responded with grade level 6-12
2 responded with grade level 7/8

2 responded with grade level 8
1 responded with grade level 9-12
1 responded with grade level 10-12
1 responded with beginnning college_no math required

What subjects do you teach?
Earth-Space Science
Chemistry, physical science, computer science
Multiple subjects
Technology--gave this to science teachers, 6th and 8th grade
MATH/SCIENCE
Social Studies(History)
Science, P.E., special ed
Earth Science
Math/Science
Science
Physics

For others, what is your vocation?
Computer Programmer Analyst
I'm not a teacher, I work as a systems administrator for the Math Department of university
Parent
Director of Data Processing, K-12 School District
I will be a junior in college this fall (graduating class of 1996).
I'm a "software engineer" (tho' I really prefer the term programmer)
Graduating Senior in college
Producer/director, ISU Media/Distance Learning Center
My job is to keep the Scientists and Teachers at RSMAS's equipment in working order
I'm 4th grade of University student.

Besides yourself, how many other teachers and students did you share this project with?
_____ **Teachers**
The following responses were received: 6,3,2,1,3,1,3,3-5
_____ **Students**
The following responses were received: 2, 50+,100+, 85, 28, 48,200,24,2,20

Other comments:
Next time will plan so that a teacher who is still on-track can participate.

Section 9: Other comments

Please share any other thoughts or ideas you have on FOSTER On-line
"I'm glad to see NASA launching services onto the new media of communication!"
"Thanks for the experience."
"This was a beginning, so next time it will be more beneficial to me and with proper planning I will be able to get the students involved."
"GREAT PROJECT!!"
"I hope that there are plans to continue this project."
"Looking forward to more projects like FOSTER"
"I think FOSTER On-Line should announce itself more on the net"
"Status report were very exciting.I am looking forward to seeing reports."