



# **Learning Technologies Project Management Plan Fiscal Year 1999**

**October 1, 1998**

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Learning Technologies Project Manager**

**Ames Research Center  
Moffett Field, CA**



**Project Plan**

**Learning Technologies Project (LTP)**

Agreements:

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**Learning Technologies Project Management Plan  
Concurrence Signatures of Agreement  
October 1, 1998**

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Education Division Deputy Manager, Dr. Malcom Phelps

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**Learning Technologies Project  
Management Plan FY99  
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# **Learning Technologies Project Management Plan FY99**

## **1. INTRODUCTION**

The NASA Learning Technologies Project (LTP) will use NASA's inspiring mission, unique facilities, and specialized workforce in conjunction with the best emerging technologies to promote excellence in America's educational system. LTP will work to enhance the public's scientific and technical familiarity, competence, and literacy. LTP will do this by capturing the educational potential of each NASA program and by conducting and facilitating educational projects at all levels of the American educational system.

LTP is a multi-center activity managed by the HPCC LT Project Office at the NASA Ames Research Center (ARC). LTP funds activities that use the National Information Infrastructure (that is, the Internet) and other technologies to foster reform and restructuring in math, science, computing, engineering, and technical education. LTP activities fall under the Educational Technology category of NASA's Education Program.

The NASA HPCC LTP Plan for Education flows from the NASA Strategic Plan. This Plan has been developed for FY98 - FY02. The document was created as a result of intensive collaboration between the NASA Office of Education and the NASA Office of Aeronautics.

LTP will maximize the delivery and impact of our education programs by engaging our research and contractor communities in the use of state-of-the-art educational technologies, and by developing partnerships with the education community. We seek to help the national education system to meet civilian aerospace needs and the broader scientific and technological needs of our nation. Special emphasis will be placed on encouraging historically underrepresented groups to pursue careers in science, mathematics, and engineering.

LTP efforts will be implemented by creating an on-line presence for NASA's missions. Our work will enhance the content knowledge, skills, and experience of teachers, capture the interest of students, and channel that interest into related career paths. Our plan will be achieved through the demonstration of integrated applications of science, mathematics, technology, and related subject matter of interest to the educational community. LTP will focus on life-long learning.

NASA's HPCC Learning Technologies Project is funded through the Educational Technology Division of NASA's Education Program and NASA's High Performance Computing and Communications (HPCC) Program, which has as its hallmark a strong internal management structure with a clear direction for the future. Leadership and coordination with NASA's education program are the responsibility of the HPCC LTP

Manager. HPCC LTP regional outreach offices will coordinate their activities with their respective field center's education program officers.

### **1.1 The LTP Vision Statement:**

NASA's 1997 Strategic Plan states that: "NASA is an investment in America's future. As explorers, pioneers, and innovators, we boldly expand frontiers in air and space to inspire and serve America and to benefit the quality of life on Earth."

The Learning Technologies Project will make a significant contribution to this vision by using leading edge technologies to deliver NASA mission content to classrooms across the nation.

### **1.2 The LTP Mission Statement:**

One of four strategic outcomes from the "Vision, Mission, and Goals" section of the NASA Strategic Plan is to "involve the educational community in our endeavors to inspire America's students, create learning opportunities, and enlighten inquisitive minds."

To support the NASA Strategic Plan and NASA's Educational Technology Program Implementation Plan, LTP researches emerging technologies such as the Internet. LTP then develops these technologies into high-quality and affordable learning environments connecting educators with NASA missions. Our intent is to support these educators in their own educational goals, in the goals of the educational systems in which they work, and in their efforts to improve those systems.

### **1.3 LTP Goals:**

The following are broad goals of LTP for the years from FY98 to FY02. These goals support the NASA Education Division goals and objectives, including those of the Educational Technology Program. The goals of the Learning Technologies Project are to:

- Promote the enhancement of the knowledge, skills and abilities of educators and students in the areas of science, math, technology and engineering.
- Make NASA missions and content accessible to the educational community.
- Promote large-scale integration of LTP products and services into the classroom.

## **2. OBJECTIVES**

The following are specific objectives LTP expects to have in place by FY02.

The objectives in combination will support enhancements for the way educators teach and will significantly contribute to the Agency's Strategic Outcomes in Education:

- Provide access and awareness to LTP products and services based on or derived from NASA missions that relate to math, science, engineering, and technologies.
- Deliver classroom-ready current and archived NASA information using innovative technology.

- Facilitate the infusion of LTP-unique technology models into schools across the nation.
- Forge high-leverage partnerships with both commercial and non-profit organizations.
- Provide educator training opportunities and materials for all LTP products and services using emerging technologies so that physical distance is no longer a barrier.

### **3. CUSTOMER DEFINITION AND ADVOCACY**

The primary customer of the LTP is the educational community. Specifically the students and the teachers comprise the target audience of our products. An expanded scope includes and people concerned with lifelong learning. LTP endeavors to include academia where possible as they are the primary mechanism to pre-service training. To the degree possible we will support these expanded areas.

The process used to ensure customer advocacy is predicated by four mechanisms.

- Evaluation
- Advisory Board Reviews
- Conference Interactions
- Dissemination & Feedback

Each of our projects contains an element of evaluation. This process insures that we are reviewing our work at the activity level and that what is presented to the educational arena is on target.

Advisory Board Reviews occur every six months to insure that our project is producing a product that is consistent with the views of academia and industry.

Conference interaction gives us face-to-face access to teachers and allows us to gather their views and input directly.

Dissemination of products is a primary delivery mechanism to reach teachers and students. User survey forms are completed by recipients of our data and returned to the project.

### **4. PROJECT AUTHORITY**

Ames Research Center is the Lead Center for the LTP. Supporting centers consist of;

- Ames Research Center (ARC)
- Dryden Flight Research Center (DFRC)
- Goddard Space Flight Research Center (GSFC)
- Jet Propulsion Laboratory (JPL)

- Lyndon B. Johnson Space Center (JSC)
- Lewis Research Center (LeRC)
- Langley Research Center (LaRC)
- John F. Kennedy Space Center (KSC)
- George C. Marshall Space Flight Center (MSFC)
- Stennis Space Center (SSC)

The GPMC responsible for the oversight of the project is Dr. Eugene Tu.

## **5. MANAGEMENT**

The activities of the LTP are performed by a combination of civil servants and support service contractors. Many of these management charts intermingle these two job classes. These charts are intended to be functional charts rather than direct reporting charts. In reality no support service contractor can direct a civil servant, but they can convey the project requirements as communicated by the project managers. In addition civil servants cannot direct civil servants at other centers. The LTP manager can dictate project requirements and control fiscal allocations.

In general this project is possible through the joint collaboration of civil servants and support service contractors. The spirit of these charts is to demonstrate the flow of communication for collection of data and dissemination of project requirements.

### ***5.1 LTP Level I Management***

NASA's LTP effort is managed through the HPCC Program Office at Ames Research Center (ARC) and reports to the Office of the Director at ARC and to the Director for Aviation Systems Technology Division at NASA Headquarters (HQ), who ultimately reports to the NASA Administrator.

The LTP accomplishes its mission through specific projects conducted by regional NASA centers, grants, cooperative agreements, NASA contracts and NASA sub-contracts. Level I management consists of HQ policy, the Ames Research Center Director, the HPCC Program Management, the HPCC Executive Committee and the Director of the Education Division.

### ***5.2 LTP Level II Management***

The LTP Level II Management is conducted via the Project Office located at ARC. The Office is supported by the LTP Manager, the Deputy LTP Manager, a small project support staff, and the Remote Sensing Public Access Center (RSPAC). LTP management is responsible for organizing, planning, staffing and implementing the LTP Management Plan. This includes integrating LTP activities across the Agency. The Project Office is responsible for managing and disseminating the fiscal budget at the seven-digit R-TOP level.

### **5.3 LTP Level III Management**

The LTP Level III Management is comprised of a Regional Outreach Center (ROC) Coordinator, Enterprise Projects Coordinators, a Special Projects (SP) Coordinator, the grants office Contract Officers (CO) and Contracting Officer Technical Representatives (COTR), and Procurement Office Cooperative Agreement COs and COTRs.

The NASA Centers participating in LTP are Ames Research Center, Dryden Flight Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory, Kennedy Space Center, Johnson Space Center, Langley Research Center, Lewis Research Center, Marshall Space Flight Center, and Stennis Space Center.

Each of these LTP elements has its own Project Manager who is responsible for managing the activity across the agency. The LTP manager will oversee all elements, working groups, and special projects.

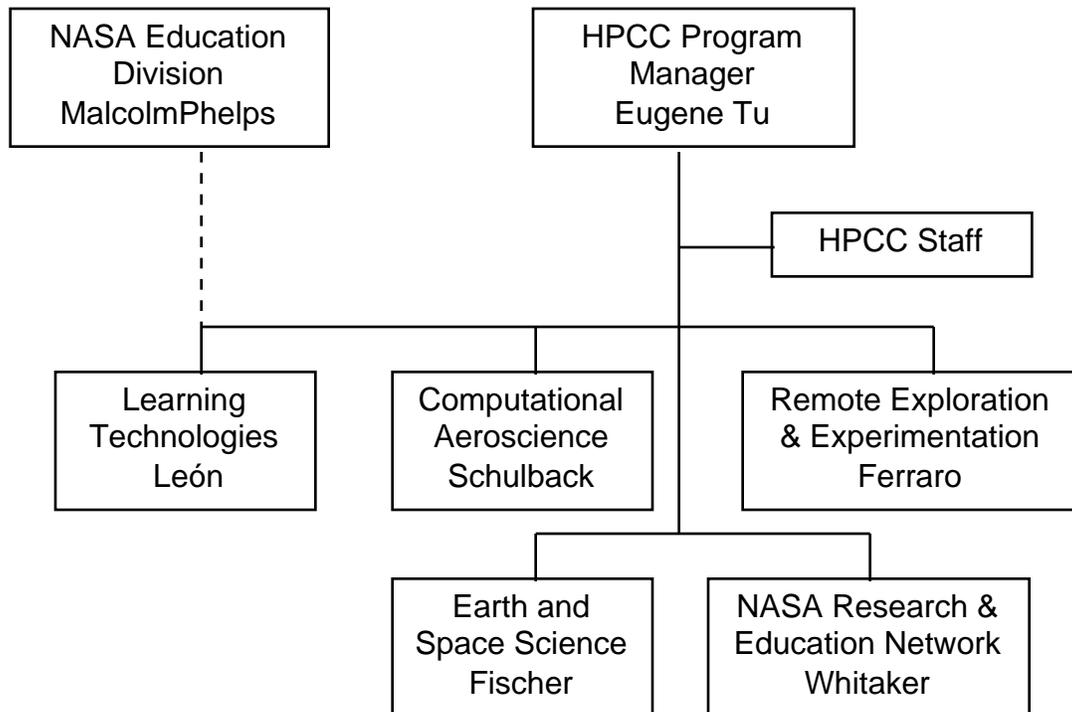
### **5.4 LTP Level IV Management**

Level IV Management consists of the regional outreach center managers, and the Principal Investigators (PI) for the grants and cooperative agreements. The respective organizational structures for each of these levels will be defined in subsequent sections.

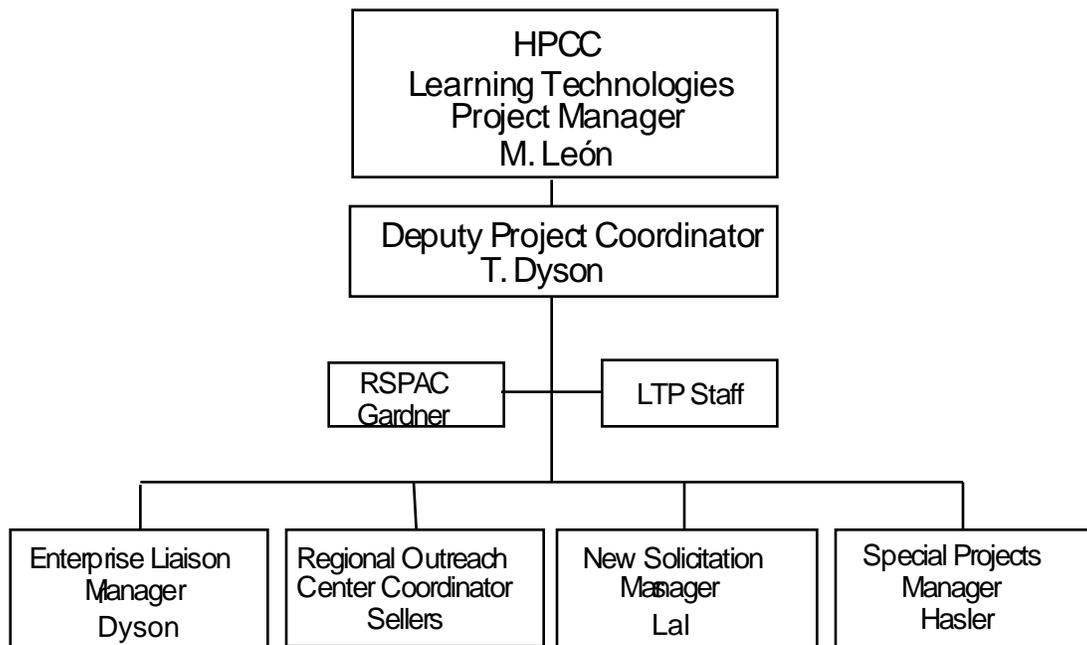
### **5.5 LTP Organizational Structure for FY99**

The support of all levels of management for the cooperative agreements, grants, NASA contracts and the supporting centers is crucial to the success of the LTP. These structures, as well as roles and responsibilities are spelled out below. Major management decisions require the concurrence of HPCC management and NASA Education Division.

**Figure 1: HPCC Organizational Chart for FY99**



**Figure 2: LTP Organizational Chart for FY99**

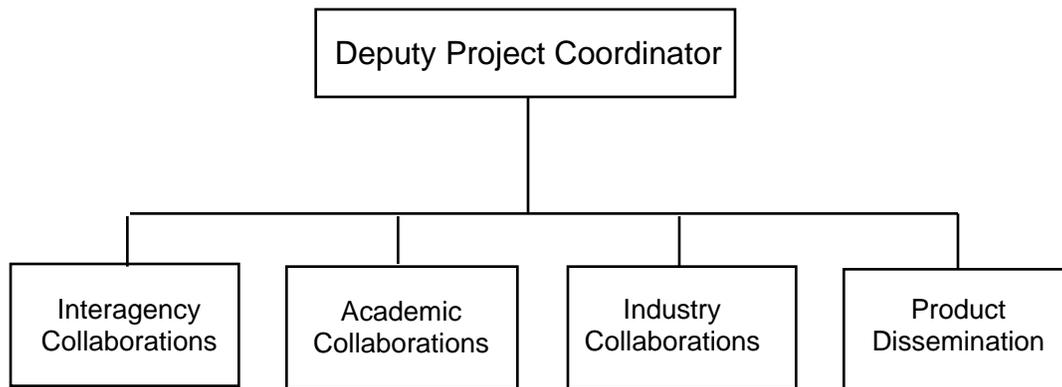


### 5.5.1 The Learning Technologies Project Office - Roles and Responsibilities

The LT Project Manager reports to the HPCC Program management located at ARC. The Project Manager is responsible for the overall management of the LTP including: implementation of the research and education programs; maintenance of the financial integrity of the project; constructing and maintaining the technology necessary to manage the project (databases, Web sites and mail lists); and preparing, submitting, and presenting reports, reviews, evaluations and projections to senior management.

### 5.5.2 The LTP Deputy Coordinator - Roles and Responsibilities

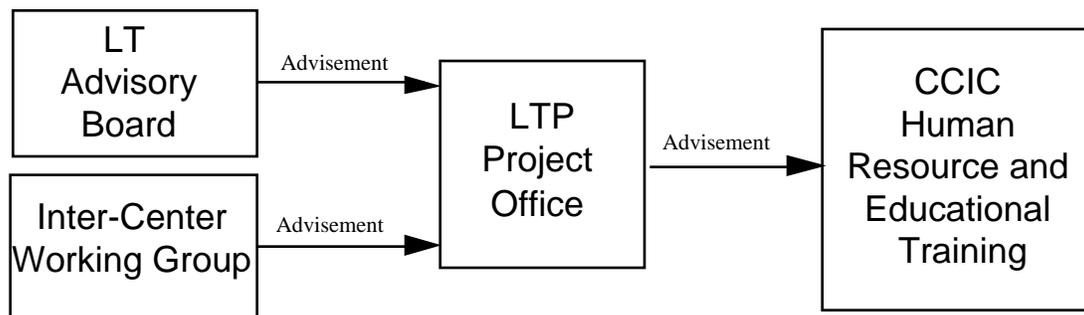
Figure 3: The Deputy Project Coordinator



As delegated by the Learning Technologies Project Manager, the Deputy Project Coordinator's responsibilities include, but are not limited to general support of the Project Office and LTP collaboration with academia, industry and other federal agencies. These responsibilities are discharged by the LTP Deputy Project Coordinator with assistance from the LTP staff and RSPAC Cooperative Agreement as required. Some requirements will be achieved by matrixing support from other LTP managers.

### 5.5.3 Project Advisement

Figure 4: Project Office Advisement



The Learning Technologies Project Office will use the InterCenter Working Group (ICWG) and the LTP Advisory Board as its steering committee.

LTP also holds a seat on the Committee for Computing, Information, and Communication (CCIC) on Educational Training and Human Resources (ETHR) at NASA Headquarters.

#### **5.5.4 ICWG Advisement**

The ICWG activities are open to anyone interested in the activities of this working group. The voting members of the ICWG are the ten Education Division officers from our participating centers, the LT project manager, the LT deputy coordinator, ten LTP outreach center managers, the four enterprise liaisons, the four NASA Enterprise Education officers the special projects manager and deputy, the new solicitation manager and deputy, and the educational liaison to Code FE. A total of 35 voting members exist. In general, decisions will be made through consensus.

Within the ICWG there are typically three or four active micro working groups at any given time. Currently the existing working groups are as follows:

- \* Multimedia Streaming Group (MSG) chaired by A. Federman (PO) and supported by ARC, Classroom Of The Future (CoTF), GSFC, JSC, LaRC, & LeRC.

- \* Evaluation Working Group (EWG) chaired by M. McCarthy (DFRC) , supported by ARC & LaRC.

- \* Special Events Working Group (SEWG) chaired by M. León (PO), supported by ARC, GSFC, LaRC, & LeRC.

#### **5.5.5 LT Advisory Board - Roles and Responsibilities**

The LT Advisory Board is comprised of a Chair and four members. Dr. Alberto Cañas is the current chair for FY99 and the board members are: Dr. Paul Feltovitch, Dr. Owen Gaede, Dr. Ken Forbus, Dr. Maureen McMahan, Dr. Kathleen Fulton, and Retired Vice Admiral Tim Wright.

The Learning Technologies Project is committed to insuring the technical and educational excellence of its products and services. To validate the quality of the project, LTP seeks outside assessment and guidance. Because LTP is committed to implementing changes that enhance the project's quality, feedback from the LTP Advisory Board will be used to focus the coming year's activity.

Potential Advisory Board members were invited to participate in April 1998; Feedback received from the Board will be implemented in FY99.

The LTP Advisory Board is made up of seven leading-edge experts in the field of computing and education. These individuals serve a term of one fiscal year.

The general role of the LTP Advisory Board is to examine Learning Technologies programs, products, and services and offer advice and guidance.

Specifically, the LTP Advisory Board will:

- Review yearly management plans submitted by the LT Project Office;
- Review yearly proposals submitted by LTP Regional Outreach Centers;
- Conduct an annual review of LTP programs for technical and educational merit;
- Help to shape any new solicitations offered by LTP; and
- Identify activities which merit greater or lesser emphasis.

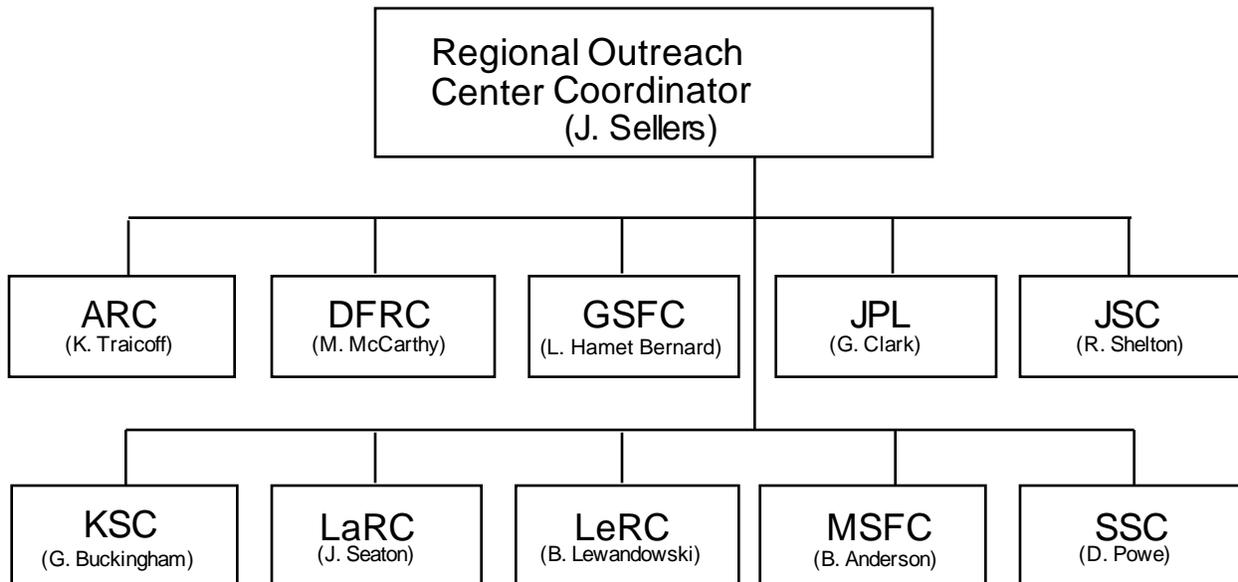
Advisory Board recommendations should be consistent with the LTP mission. According to the July 1997 Learning Technologies Project Plan for Education :

One of four strategic outcomes from the “Vision, Mission, and Goals” section of the NASA Strategic Plan is to “involve the educational community in our endeavors to inspire America's students, create learning opportunities, and enlighten inquisitive minds. ”

To support the NASA Strategic Plan and NASA's Educational Technology Program Implementation Plan , LTP researches emerging technologies such as the Internet. LTP then develops these technologies into high quality and affordable learning environments connecting educators with NASA missions to support them in their own educational goals, in the goals of the educational systems in which they work, and in their efforts to improve those systems.

### 5.5.6 LTP Regional Outreach Center Projects - Roles and Responsibilities

**Figure 5: Regional Outreach Center Organizational Chart**



The Regional Outreach Center (ROC) Coordinator is responsible for the coordination of activities of the NASA Center Projects within the ten LTP regional NASA centers. The ROC Coordinator will keep in regular communication with the regional centers to

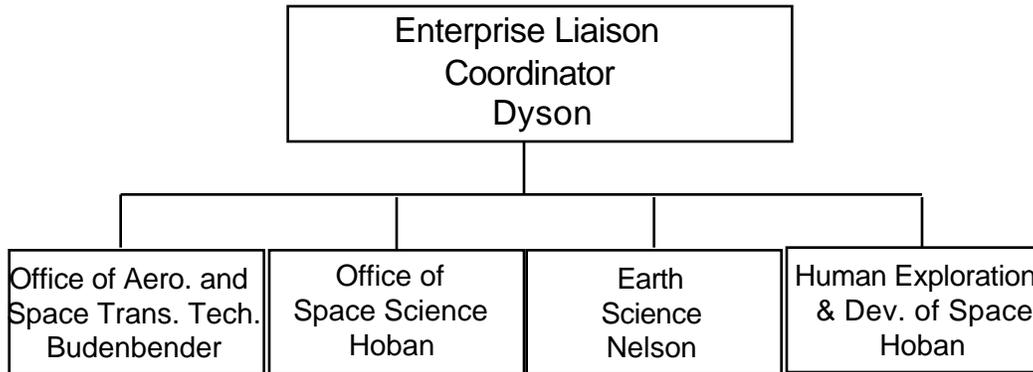
assure continued technical progress along with compliance with the financial and technical reporting requirements of the Project Office. The ROC Coordinator will also provide resource advocacy, as necessary, to the Project Office. Supporting NASA Centers will maintain a Regional Outreach Center Project Manager as a point of contact for the ROC Coordinator to prepare reports and briefings on project element implementation, and to oversee project activities at the center. This project manager will have the responsibility of managing the budget allocation from HQ as directed by LTP management.

Each ROC champions one or two specific thrusts. The following centers are distinctive in the following areas:

- ARC for Communicating NASA Science via Internet Multimedia
- DFRC for Evaluation of the LTP
- DFRC for WWW Learning Modalities
- GSFC for Curriculum Development Tools with Earth and Space Science
- JPL for Curriculum Development Tools with Space Science
- JSC for WWW Tools for Teachers
- KSC for Curriculum Development Tools with Aeronautics and Space Transportation Technology
- LaRC For Curriculum Development Tools with Aeronautics and Space Transportation Technology
- LeRC For Curriculum Development Tools with Aeronautics and Space Transportation Technology
- LeRC for Distance Learning
- MSFC for Curriculum Development Tools with Earth Science
- SSC for Curriculum Development Tools with Earth Science

### 5.5.7 LTP Enterprise Liaisons - Roles and Responsibilities

Figure 6: Enterprise Liaison Organizational Chart



The Enterprise Liaison (EL) Coordinator is responsible for the coordination of activities between the LTP Enterprise Liaisons and the four NASA Enterprises' Education Officers. The EL Coordinator will collect monthly reporting from each of the LTP enterprise liaisons. Each liaison will coordinate with the lead for education in each NASA Enterprise, including NASA Education Division Enterprise (Code FE) Liaisons. The EL coordinator will insure that the LTP ELs are coordinating with the Code FE liaisons. The LTP EL will also coordinate with CoTF.

### 5.5.8 LTP New Solicitation - Roles and Responsibilities

"Leading Educators to Applications, Research and NASA-unique Educational Resources in Science (LEARNERS)"

#### ***Purpose of the LEARNERS Solicitation***

- Stimulate the educational community with NASA-related content
- Develop Internet based curricula that facilitate the educational process.
- Develop Internet based technologies that facilitate the educational process.
- Utilize emerging information technologies.
- Create products that can be used in the formal classroom within 3 -5 years.
- Produce products that can be affordably replicated and easily disseminated.
- Empower the American educator in the formal classroom setting.
- Measure the effectiveness of these products on learning in the classroom.

#### ***LEARNERS Parameters***

- \$1.2M/yr for 5 years, 6M total over the life of the solicitation.
- Agreements will be funded from \$100K/yr to \$300K/yr
- Expecting six awards for 5 years

- 50% of the Awards will be tied to the Office of Aeronautics and Space Transportation
- Remaining solicitations must be tied to the other three enterprises
- HPCC LTP receives its funding from NASA Office of Education

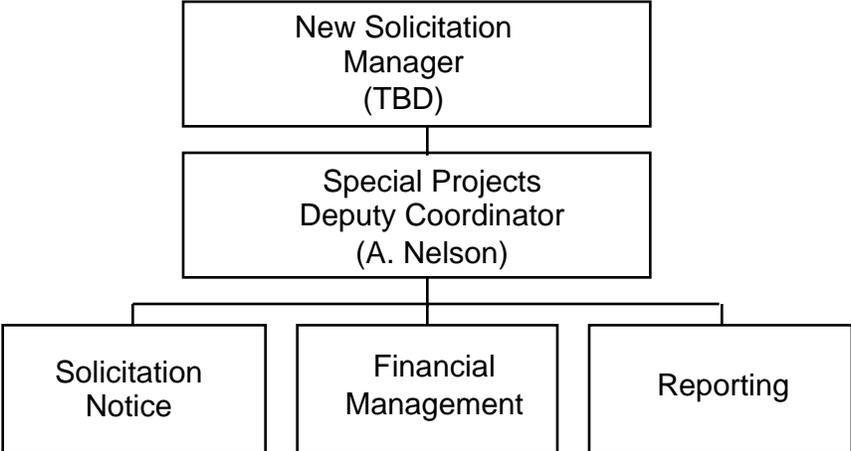
***LEARNERS Evaluation Criteria***

- Innovative integration and application of current and emerging information technologies
- Evaluation plan for measuring effectiveness on learning in the classroom
- Identification and adherence to specific national education standards
- Identification of specific NASA-related content
- Integration of NASA content with broader science &/or engineering
- Pre-service and In-service teacher training components
- Addressing underserved communities
- Serving students with special needs
- Extent and quality of cost sharing

***LEARNERS Schedule***

- 4th Quarter FY98 - Final version of CAN online
- 4th Quarter FY98 - 5-page proposals due  
(expanded Letters of Intent).
- 1st Quarter FY99 - 5-page selections announced.
- 1st Quarter FY99 - Full proposals from 5-page selections due.
- 2nd Quarter FY99 - Awards announced.

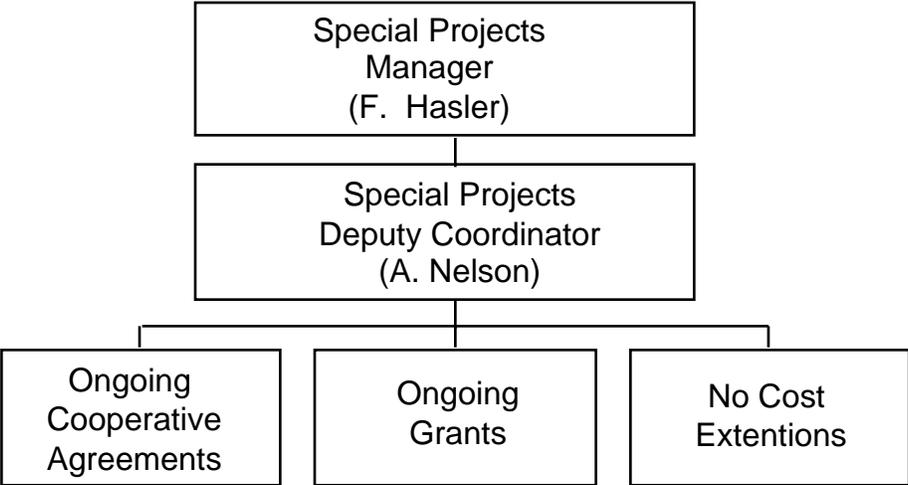
**Figure 7: New Solicitation Organizational Chart**



The New Solicitation Project Manager is responsible for generation of the Solicitation Notice , the proposal conference, the proposal peer review, the award process and the management of the new solicitation. The Manager will collect monthly reporting from each of the awarded projects for the purpose of reporting technical progress and milestone status to management. This project will extend until FY03. HPCC will attempt to seek supplemental funding through participation with other agencies.

**5.5.9 LTP Special Projects - Roles and Responsibilities**

**Figure 8: Special Projects Organizational Chart**



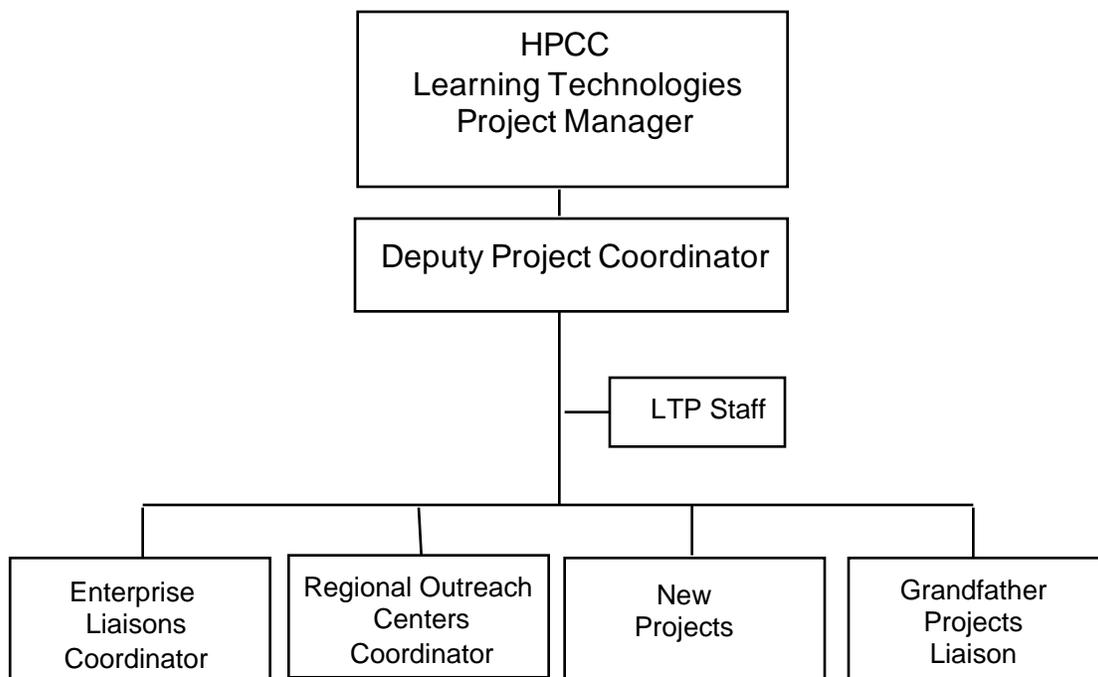
The Special Projects (SP) Coordinator is responsible for any on-going grants and cooperative agreements as well as grants and cooperative agreements that have entered into no-cost extensions. In addition, the SP Coordinator will maintain liaisons with the completed projects and solicit for their participation where appropriate. These no-cost extensions include carry-overs of the IITA project which concluded at the end of FY97. Projects that concluded at that time have been either continued under

separate commercial or other agency funding, or they have been archived on an LTP server (no funded work has been lost). In some cases, where funding has been completely terminated, RSPAC is supporting the archiving and maintenance of this work. The SP Coordinator will collect monthly reporting from each of the active projects for the purpose of reporting technical progress and milestone status to management.

### 5.5.10 LTP in FY00

LTP will continue the Regional Outreach Center work in FY00; however, it will transition away from the RSPAC project (which will be terminating FY99). LTP will support advocating for the continuation of the Observatory located at the NASA Independent Verification and Validation facility. However, no guideline funding exists at this time.

**Figure 9: Projected LTP Organizational Chart FY00**



The Project Office will remain responsible for the overall management of the LTP including: implementation of the research and education programs; maintenance of the financial integrity of the project; constructing and maintaining the technology necessary to manage the project (databases, Web sites, and mail lists); and preparing, submitting, and presenting reports, reviews, evaluations, and projections to senior management, working with the LTP staff to do so. The next Level of LTP management is composed of a Regional Outreach Center (ROC) Coordinator, a Enterprise Liaisons Coordinator, a New Projects Coordinator and a Grandfather Projects Liaison.

The ROC Coordinator will continue to be responsible for the coordination of activities within the ten LTP regional NASA centers. The ROC Coordinator will keep in regular

communication with the regional centers. Supporting NASA Centers will maintain a Regional Outreach Center Project Manager as a point of contact, to prepare reports and briefings on project element implementation, and to oversee project activities at the center.

The Enterprise Liaison's Coordinator will be responsible for collaborating with the four NASA Enterprise Liaisons, Code FE Enterprise Liaison Officers, and the NASA CoTF. The Coordinator will establish lines of communication between the enterprises and monitor the joint development of new tools and resources that NASA's educational projects can benefit from. Monthly data will be reported to the LTP Office.

The New Project Coordinator will be responsible for the coordination of activities within the new space grants and cooperative agreements. The New Project Coordinator will collect monthly reporting from each of the new solicitations. Technical liaisons will be appointed to each of the cooperative agreements and grants for the purpose of reporting technical progress and milestone status to the COTR. The New Projects Principal Investigators will report to the technical liaisons. The technical liaisons will report to the New Solicitations Project Coordinator.

The Grandfather Projects Liaison will be responsible for communicating with the completed LTP & IITA grants and cooperative agreements. The Coordinator will establish lines of communication between the projects and monitor the development of new tools and resources. Monthly data will be reported to the LTP Office as available.

## **6. TECHNICAL SUMMARY**

The project requirements are presented inside appendix A along with their technical descriptions. This includes the allocation of these requirements among the systems to be developed and maintained. (The numbering, e.g., A1, refer to corresponding appendices.)

### *A1 Taxes and Liens*

The LTP Taxes and Liens role is to maintain the financial responsibilities of the LT project with respect to Ames Research Center.

### *A2 Office of Aero-Space Technology (OAT) Liaison Project*

The K-14 Office of Aero-Space Technology (OAT) Liaison has the primary goal of increasing aeronautics, aviation safety and space transportation and exploration awareness and correspondence between Code R , Code FE and Learning Technologies. The program also has the previous thrust of the K-14 Aeronautics programs.

### *A3 Earth Science Liaison Project*

The Earth Science Liaison Project will form a communication and collaboration bridge between the LT program and the Earth Science Enterprise (ESE).

### *A4 Office of Space Science and Human Exploration and Development of Space Liaison Project*

The goal of this project is to form a communication and collaboration bridge between the LT program and the Office of Space Science (OSS) and the Human Exploration and Development of Space (HEDS) enterprise.

*A5 Learning Technologies Project Office (Task 45)*

The LT Project Office support staff maximizes the delivery and impact of NASA online education programs. The Project Office explores emerging technologies and engages LTP customers in the use of these educational technologies. The Project Office provides technology dissemination through development and later, presentations and demonstrations. It also assists the LT Project Manager in developing partnerships with the greater educational community.

*A6 Learning Technologies International Projects*

LT International Projects seeks to increase awareness of NASA's Learning Technologies with international partners.

*A7 Learning Technologies Cooperative Agreement Notice Solicitation*

The LT Cooperative Agreement Notice attracts and procures approximately six projects that will integrate the Internet and other information technologies to direct the unique knowledge that flows from NASA's aeronautics, space and Earth system research into the K-12 classroom. Collectively, these projects will represent all four NASA Enterprises.

*A8 Learning Technologies New Solicitation Conference*

The new solicitation conference facilitates the dissemination of the Cooperative Agreement Notices.

*A9 Learning Technologies Regional Conference*

The LT Regional Conference facilitates the interactions of all LTP participants.

*A10 ARC Learning Technologies Regional Projects*

Sharing NASA: Sharing NASA is a suite of projects which use network technology to make NASA programs accessible to students by connecting them in an exciting, interactive way with NASA scientists, engineers and others in math- and science-based careers. As we continue to develop our expertise in conducting these projects, we will also continue to spread the word among NASA organizations about our capabilities of doing educational outreach.

Learning Technologies Channel: This year the LT Project intends to continue operation of the Learning Technologies Channel (LTC). The LTC provides educators and the general public with a location on the Internet that allows them to participate in live events such as lectures, conferences, virtual field trips, and online courses.

*A11 Dryden Flight Research Center Learning Technologies Regional Project*

The Dryden Learning Technologies Project centers on the Web-Enhanced Learning Environment Strategies (WELES). The WELES were developed as part of a three-year educational research project with the Pennsylvania State University. This is the

final year of this educational research. Next year, we intend to reinstate our effort evaluation of NASA Web sites intended for educational use.

*A12 Goddard Space Flight Center Learning Technologies Regional Project*

The Goddard Space Flight Center (GSFC) Education Office, through its curriculum support component of the NASA and GSFC education frameworks, is charged with providing materials that support both national standards and state curricular frameworks, as well as incorporate the knowledge being generated through NASA enterprises.

*A13 Jet Propulsion Laboratory Learning Technologies Regional Project*

Telescopes In Education (TIE) Program: The TIE project enables students of all cultural backgrounds and economic status, including those with physical disabilities, to increase their knowledge of astronomy, astrophysics, and mathematics; improve their computer literacy; and strengthen their critical thinking skills. TIE makes it possible for young people to conduct actual research, make discoveries in the areas of astronomy and astrophysics, and even publish their independent discoveries in appropriate science journals or the popular press.

Project SPACE Program—Sun, Planets, Asteroids, Comets, Exploration: The Project SPACE (Sun, Planets, Asteroids, Comets Exploration) Program is a NASA/Jet Propulsion Laboratory educational technology program which integrates advanced computer technology, complex scientific data sets and a variety of scientific technologies into educational curriculum resources, models, simulations and classroom activities that support the national reform efforts in science and mathematics education. Project SPACE educational curriculum resources are designed for Middle and Secondary School Educators and Students.

*A14 Johnson Space Center Learning Technologies Regional Project*

The JSC LT Regional Project provides affordable networking technology to a variety of school environments to enrich the K-12 education process. It develops and distributes unique network applications that promote the technology and use of the National Information Infrastructure, and it disseminates NASA information, particularly math and science materials.

*A15 Kennedy Space Center Learning Technologies Regional Project*

Virtual Science Mentor Project: The Kennedy Space Center's Virtual Science Mentor (VSM) program seeks to increase the number of mentors at KSC by 28 mentors (43%) and make the expertise of scientists and engineers available to schools throughout the state of Florida. Using state-of-the-art desktop videoconferencing equipment, KSC scientists and engineers will integrate with 65 classrooms throughout the state and mentor students using Internet-based curriculum, provide support for the Sunshine State Standards of Education, judge science fairs, coordinate and evaluate science projects, introduce and reinforce the use of educational technologies and increase the awareness of NASA education programs and initiatives.

Space Team Online: Space Team Online concentrates on the people of NASA involved in diverse careers who contribute to the space shuttle and space station

programs. The project involves close collaboration with Kennedy Space Center and Johnson Space Center.

#### *A16 Langley Research Center Learning Technologies Regional Project*

**Distance Learning:** In FY 99, the LaRC LTP seeks to make LTP training and NASA content easily accessible to educators, students, and the general public at any time of the day, regardless of their location. Common topics for discussion at many LTP meetings are the issues of scalability, dissemination, and training related to LTP projects. This element addresses all three of these concerns and the results of this project are anticipated to be of benefit to LTP projects at other NASA centers, in addition to the primary K-12 audience.

**Interactive Projects:** The LaRC LTP will continue to develop strategic collaborations with NASA researchers and the educational community in a variety of areas to develop self-sustaining online projects, learning resources, and communications methods which support NASA's educational outreach efforts and expose students to unique NASA information and research. Some of the proposed activities include Aero Design Team Online, EarthKAM, Atmospheric Sciences, Robotics, CON<sup>2</sup>ECT video series, Kids' Corner and NASA/CNES.

#### *A17 Lewis Research Center Learning Technologies Regional Project*

**Educational Technology Applications:** The educational technology applications, or content, developed by the NASA Lewis LTP, focuses on software simulations and Web-based information and activities. Simulations of aeronautics-related concepts are created, along with grade-appropriate lessons that prompt students to discover basic scientific principles or to engage in problem-solving activities.

**Internet Access Research:** The NASA Lewis LTP is committed to researching, prototyping and testing emerging networking technologies that can be used in an educational setting to connect schools to the Internet economically and efficiently. Access to the Internet will allow the schools to use the educational content available on the World Wide Web at the NASA LeRC LTP Web site as well as other educational Web sites.

**Wide-spread Dissemination:** The NASA Lewis LTP uses various methods to disseminate information about the content developed and the research completed. These methods include videoconferencing, use of the Learning Technologies Channel, programming over WVIZ-TV, Cleveland's Public Broadcasting Station, through participation at conferences and publications.

#### *A18 Marshall Space Flight Center Learning Technologies Regional Project*

The Marshall Space Flight Center LT Regional Project—the Earth System Science Education Pilot Testing and Dissemination Project—will conduct a pilot test a set of Earth and space science resources developed in support of NASA's Earth Science Program and being made available on the World Wide Web as part of the FY99 Goddard Space Flight Center LTP Proposal. It will also develop a new set of K-4 Earth and space science resources for the Web in support of goals and objectives of the NASA Earth Science Enterprise, utilize a network of teacher training sites established

as part of the Alabama Research and Education Network, use the Internet as a major communication vehicle for the dissemination of Earth and space science curricular support materials, and assist in the development of a resource bank of Earth and space science activities using Internet Web sites linked to the resources of the Earth and space science directorates at NASA/Goddard and at the NASA/MSFC Global Hydrology and Climate Center (GHCC).

*A19 Stennis Space Center Learning Technologies Regional Project*

The Stennis Space Center LT Regional Project proposes the development and implementation of a one Carnegie unit, Web-delivered, high school science course called Spatial Information Sciences. Stennis Space Center is the Lead Center for Commercial Remote Sensing and is responsible for implementing the NASA HQ directed Workforce Development Education and Training Initiative. This initiative will establish world-class remote sensing academic and research centers of excellence in Mississippi, and will thereby address the critical remote sensing workforce shortage, enabling the growth of the industry in Mississippi, and removing one of the major roadblocks for industry growth across the nation.

*A20 Remote Sensing Public Access Center Project (RSPAC)*

The two major areas of RSPAC activity are LTP support, particularly technical support to the LTP, and outreach activities, support, and materials for the dissemination of information to the public about NASA, LTP projects and activities, and Earth and space sciences via the Internet, RSPAC Web sites, CD-ROMs, and conferences.

*A21 University of North Dakota Volcano World*

The University of North Dakota Volcano World project maintains the online presence of VolcanoWorld. It will add Landsat 7 and Earth Observing System (EOS) AM1 data as they become available, and install a kiosk at Hawaii Volcanoes National Park.

*A22 University of North Dakota Distance Learning*

The University of North Dakota Distance Learning Project will provide university courses over the Internet-based on NASA technology. Funding from this grant will be used to teach one or more short courses similar to TeleRobotics, develop new technologies and methodologies for teaching SPACE.EDU courses, develop a potential software product for teaching via the Internet, and inform a broad educational community of our progress via publications and presentations at national and international meetings.

*A23 COMSAT Project*

The COMSAT Project will provide a resource for demonstrating Learning Technologies.

*A24 Learning Technologies Project Office Local Projects*

The LTP Office Minority Student Programs will provide challenged youth and minorities opportunities in Internet-based learning.

## 7. SCHEDULES

The LTP Office shall approve all schedules and schedule modifications. Metrics will be decided at the beginning of the fiscal year and approved in this plan.

### 7.1 LTP Major Milestones

The schedule of deliverables for the LTP Education Project is shown below in Tables 4 and 5.

**Table 1: HPCC LTP PCA Milestones**

Demonstrate breakthrough learning technologies	9/02
Complete educational agreements with industry and academia	9/05

**Table 2: HPCC LTP Level I Milestones**

LT1: Dissemination of learning technologies and applications into K-12	9/01
LT2: Develop and demonstrate breakthrough technologies that serve as a catalyst for learning environment using scientific data	9/02
LT3: Solicit and implement LEARNERS II agreements with industry & academia	9/03
LT4: Publish results of LEARNERS agreements with industry and academia fostering interactive processes utilizing NASA data over the internet.	9/04
LT5: Archive all Learning Technologies Project data for the educational community	9/05

**Table 3: LTP Level II Milestones by Element**

Learners CAN Awarded	9/99
Execute four technology demonstrations to high level audiences	9/99
Conduct 10 Sharing NASA Events	9/99
Conduct 100 events nationwide over the Learning Technology Channel	9/99
All projects are compliant with Educational Division Computer Aided Tracking System (EDCATS)	9/99
Complete the validation of the Web Enhanced Learning Environment Strategies (WELES).	9/99
Evaluation of '98 GSFC Investigations completed by scientists, aerospace specialists in workshops, Ambassadors, and other Earth science teachers and students in their classrooms. WWW template developed, final revisions, approval, and available on the Internet for all	9/99

Telescopes In Education (TIE) control available over the internet.	9/99
Presentation or demonstration at national educator conferences: four of five of the following: National Science Teachers Association (NSTA), Association for Supervision for Curriculum Development (ASCD), International Technology Education Association (ITEA), Community College Foundation (CCF), National Education Computing Association NECA, and Computer Using Educators (CUE)	9/99
Roll-out of SIMON version 3.0	9/99
Prototype Internet-based haptics unit complete	9/99
Aeronauts 2000 online & EngineSim available on CD ROM	9/99
Dissemination of LTP technology and applications into 7,500 schools.	9/00
Dissemination of LTP technology and applications into 10,000 schools.	9/01

### **7.2 LTP Minor Milestones—Level III**

HPCC LTP Level III project milestones are listed below and can also be found in appendix A of this LTP Level II Project Plan. Approximately one Level III milestone is expected for every hundred thousand dollars.

Note: Numbers (e.g., A1) refer to corresponding appendices.

#### **A1 Taxes and Liens**

<b>Milestone</b>	<b>Target Completion Date</b>
\$50K of over run, payback, and computing tax committed and obligated	12/99
FY99 HPCC Tax, Head Tax and Advisory Tax will accrue slowly	09/99

#### **A2 Office of Aero-Space and Technology (OAT) Liaison Project**

<b>Milestone</b>	<b>Target Completion Date</b>
All projects are required to submit an annual report the end of each fiscal year for the management plan.	09/99

#### **A3 Earth Science Liaison Project**

<b>Milestone</b>	<b>Target Completion Date</b>
All projects are required to submit an annual report the end of each fiscal year for the management plan.	09/99

**A4 Office of Space Science and Human Exploration and Development of Space Liaison Project**

<b>Milestone</b>	<b>Target Completion Date</b>
All projects are required to submit an annual report the end of each fiscal year for the management plan.	09/99

**A5 Learning Technologies Project Office (Task 45)**

<b>Milestone</b>	<b>Target Completion Date</b>
Supercomputing '98 LTP Booth	11/98
National Science Teachers Association conference network	03/99
InterCenter Working Group Video Conference	01/99
InterCenter Working Group Video Conference	03/99
InterCenter Working Group Video Conference	05/99
InterCenter Working Group Video Conference	07/99
InterCenter Working Group Video Conference	09/99

**A6 Learning Technologies International Projects**

<b>Milestone</b>	<b>Target Completion Date</b>
Live international coverage of historic John Glenn's Space Shuttle flight via the Internet	11/98
Select technical demonstrations	3/99
Design and develop strategies for demonstration implementations	6/99
Conduct French Space Agency (CNES) demonstration	9/99

## **A7 Learning Technologies Cooperative Agreement Notice Solicitation**

<b>Milestone</b>	<b>Target Completion Date</b>
Final draft of CAN online. Email announcements sent out.	12/1/98
Online Pre-Proposal Conference with online chat sessions	01/14/99
Short proposals due. Review begins.	03/01/99
Request for full proposals sent out	04/05/99
Full proposals due	05/03/99
Final selection committee meets	06/01/99 - 06/04/99
Winning proposals awarded	06/10/99
Winning proposals negotiated and signed	07/15/99 - 08/01/99

## **A8 Learning Technologies Solicitation Conference**

<b>Milestone</b>	<b>Target Completion Date</b>
Meetings to be held in conjunction with the CAN from GSFC	12/98

## **A9 Learning Technologies Regional Conference**

<b>Milestone</b>	<b>Target Completion Date</b>
Meetings to be held in conjunction with the LTP Advisory Panel at Kennedy Space Center	05/99

## A10 ARC Learning Technologies Regional Projects

<b>Milestone: Sharing NASA</b>	<b>Target Completion Date</b>
Continue operating STO, ADTO, MTO and WON projects throughout school year	10/98
Support TGIR Conference	10/98
Place ADTO lessons for wind tunnel test online	10/98
Incorporate JSC's Qwhiz software in Sharing NASA projects	11/98
Complete ADTO's first collaborative event	12/98
Survey Women of NASA audience	01/99
Survey Shuttle Team Online audience	02/99
Begin STO collaborative event	03/99
Implement a student puzzle/contest for STO	04/99
Virtual Take Our Daughters To Work Day	04/99
Complete ADTO's second collaborative event	04/99

<b>Milestone: Learning Technologies Channel</b>	<b>Target Completion Date</b>
Begin Astrobiology lecture series	10/98
"Eye of the Storm" hurricane events	10/98
Support TGIR conference	10/98
"The Cutting Edge"-NASA TV programs on Oceans	10/98
Host online Space Station tours	10/98 - 12/98
Kid video festival	12/98 - 05/99
Revise LTC pages	01/99

## A11 Dryden Flight Research Center Learning Technologies Regional Project

<b>Milestone</b>	<b>Target Completion Date</b>
Complete the validation of the Web Enhanced Learning Environment Strategies (WELES).	09/01/98 - 02/28/99
Write WELES technical report	03/01/99 - 04/15/99
Conduct a large group field study.	09/01/98-12/30/98
Write field study technical report	01/02/99 - 02/15/98
Conduct an impact study.	01/01/99 - 06/15/99
Write impact study technical report	06/15/99 - 07/31/99
Refine the WELES teacher training manual and reflection tool.	10/01/98 - 06/30/99
Refine and document an exportable teacher workshop.	07/01/99 - 09/30/99
Refine the WELES Web site.	10/01/98 - 09/30/99
Write journal article reporting on the results of the small group study	10/01/98-01/31/99
Write journal article reporting on the results of the field trial	02/01/99 - 05/31/99
Write journal article reporting on the results of the impact study.	06/01/99 - 09/30/99
Proposals to the NSTA and AECT national and INET international conference will also be written to report on these results	02/99, 05/99, 06/99
Develop an implementation plan	06/01/99 - 09/30/99

## A12 Goddard Space Flight Center Learning Technologies Regional Project

Milestone	Target Completion Date
Evaluation of '98 Investigations completed by scientists, aerospace specialists in workshops, Ambassadors, and other Earth science teachers and students in their classrooms. WWW template developed, final revisions, approval, and available on the Internet for all	10/01/98
Steering committee convened, preparation and planning of Summer '99 workshop and review of '97 and '98 program	12/01/98
Provide final report on Investigation evaluation process, submitted by Dr. Gil Austin	12/98
Complete pilot testing of '97 and '98 Investigations and analyze evaluation data each semester	01/99 and 06/99
Workshop held at GSFC	07/12/98 - 08/05/98
Evaluation of '99 investigations, final revisions, approval, and availability on the Internet for all	08/08/99 - 09/30/99

## A13 Jet Propulsion Laboratory Learning Technologies Regional Project

Milestone: Telescopes in Education	Target Completion Date
LTP reports submitted monthly as funding allows.	10/98 - 09/99
Annual LTP report submitted	07/99
HPCC annual report submitted	08/99
LTP Annual proposal submitted	09/99
Participate in 2 LTP-required conferences	TBD
TIE training provided on Mount Wilson once per quarter as funding allows.	12/98, 03/99, 06/99, and 09/99
Provide hands-on training twice during summer break as funding allows	09/99
Attend at least three conferences - one per quarter as funding allows	12/98, 03/99, 06/99, and 09/99
Update the Web site monthly	10/98 - 09/99

### A13 JPL Learning Technologies Regional Project, continued

Milestone: Project SPACE	Target Completion Date
Internet/Curriculum Support Products: Teacher Curriculum Support Products and Student Activities delivered monthly	10/98 - 09/99
Teacher Inservices/Workshops conducted	01/99 - 09/99
Presentation or demonstration at national educator conferences: four of five of the following: NSTA, ASCD, ITEA, CCCF, NECC, and CUE	09/99
Teacher/Student curriculum products in Project SPACE Web site Library	09/99

### A14 Johnson Space Center Learning Technologies Regional Project

Milestone	Target Completion Date
Qwhiz construction, Internet tournaments and evaluation	12/98
SIMON enhancements	12/98
Initial consultation with scientists and educators for ROVer Ranch (R <sup>2</sup> )	12/98
Roll-out of SIMON version 3.0	03/99
More Qwhizzes and tournaments	03/99
Initial object design and prototype implementation of R <sup>2</sup> components	03/99
More Qwhizzes and tournaments	06/99
R <sup>2</sup> implementation	06/99
More Qwhizzes and tournaments	09/99
R <sup>2</sup> Component and integration testing	09/99
R <sup>2</sup> Teacher evaluation	09/99
R <sup>2</sup> Beta release	09/99

### A15 Kennedy Space Center Learning Technologies Regional Project

Milestone	Target Completion Date
Integrate new mentors into the VSM program, provide startup assistance with hardware/software and materials.	11/98
Produce Virtual Science Handbook	11/98
Integrate Internet Science Fair	05/98
Continue to develop products and place them on the Web site for access, as well as implement other methods of dissemination. Coordinate with LTC for live events at KSC. Provide technical and curricular support for KSC mentors.	12/98 - 09/99

### A16 Langley Research Center Learning Technologies Regional Project

Milestone: Distance Learning	Target Completion Date
Module 1 Complete (technology training emphasis)	11/98
Module 2 Complete (NASA content emphasis)	03/99
Paper documenting initial findings completed	08/99

Milestone: Interactive Projects	Target Completion Date
Kids Corner fully functional	12/98
Middle school robotics challenge complete	02/99
Rough draft of paper documenting challenge complete	02/99
Prototype Internet-based haptics unit complete	09/99
Virtual reality in K-12 education literature survey complete	09/99

## A17 Lewis Research Center Learning Technologies Regional Project

Milestone	Target Completion Date
Beginner's Guide to Aerodynamics problem sets field-tested	05/99
Beginner's Guide to Aerodynamics addition of "thrust" topic	12/98
Beginner's Guide to Aerodynamics presentations Webcast over the Learning Technologies Channel	10/98, 01/99, and 04/99
FoilSim problem sets field-tested	05/98
FoilSim presentations Webcast over the Learning Technologies Channel	10/98, 01/99, and 04/99
EngineSim Beta available	10/98
EngineSim Instructional Manual complete	12/98
EngineSim background information complete (BGA-thrust)	12/98
EngineSim problem sets complete	07/99
EngineSim Web site complete	09/99
EngineSim available on CD ROM	09/99
EngineSim presentation Webcast over the Learning Technologies Channel	09/99
Aeronautics mission lesson plans for grades 8-12 field-tested (NASA Lewis Science Lessons)	05/99
NASA Lewis Science Lessons online	10/98
Aeronauts 2000 second round of field-testing complete	11/98
Aeronauts 2000 online	01/99
Educational Wind Tunnel operational at FDR Middle School	12/98
FDR Middle School staff trained on use of Educational Wind Tunnel	01/99
FDR Middle School staff-developed activities complete	04/99
100 FDR Middle Schools students have participated in Educational Wind Tunnel activities	6/99
Over the Horizon (Oth) Networking Technology grant in place	12/98
Purchase Oth equipment	02/99
Oth equipment installed in schools	06/99
Oth data collection system in place	08/99

AIRNet data collection system in place	10/98
AIRNet teacher training complete	11/98
AIRNet data collection complete	04/99
AIRNet report of findings complete	06/99
AIRNet conference presentation paper complete	07/99
INMARSAT Satellite Terminal Project equipment tested and configured	10/98
Completed final tests on INMARSAT station	12/98
Digital Multimedia Testbed 5000: PC purchased	10/98
Video Conference Workshops: FoilSim	10/98, 11/98, 01/99, 02/99, 03/99, 04/99
Video Conference Workshops: Beginner's Guide to Aeronautics	10/98, 11/98, 01/99, 02/99, 03/99, 04/99
Video Conference Workshops: NASA Educational Web Sites	10/98, 11/98, 01/99, 02/99, 03/99, 04/99
Video Conference Workshops: EngineSim	09/99
NASA Educational Channel live presentations broadcast	10/98
NASA Educational Channel survey of viewers complete	05/99
Tel*Ed Conference	10/98
Supercomputing '98 Conference	11/98
National Science Teachers Association (NSTA) Conference	03/99
International Technology Educators Association (ITEA) Conference	03/99
National Educational Computing Conference (NECC)	06/99

## A18 Marshall Space Flight Center Learning Technologies Regional Project

Milestone	Target Completion Date
Assist with the evaluation of '98 GSFC Investigations completed by Earth science teachers and students in their classrooms; WWW template will be developed, approved, and made available on the Internet	12/31/98
Selection of investigation development and pilot testing teachers to participate in introductory workshops	10/01/97 - 12/31/98
Conduct five regional workshops in cooperation with Alabama Research and Education Network (AREN) sites	01/01/99 - 04/30/99
Collect pilot testing evaluation materials and submit to GSFC	05/01/99 - 05/31/99
Assist GSFC staff with the evaluation of '98 investigations, final revisions, approval, and availability on the Internet for all	08/01/99 - 09/30/99

## A19 Stennis Space Center Learning Technologies Regional Project

<b>Milestone</b>	<b>Target Completion Date</b>
Implement Content Development Contract (Non-LTP funding source)	11//98
Curriculum Writing Team Finalizes Course Structure	11//98
Design Basic Web Structure	02/99
Create/Test Quiz/Test Item Generating Engine	02/99
Create/Test Participant Password, Log-on, General Server Security	03/99
Create/Test Participant Password, Log-on, General Server Security	03/99
Port Content to Web Structure	06/99
Develop Help Desk Protocols/Scenarios	07/99
Field Test with "Summer School" Students	08/99
Conduct "Summer School" Formative Evaluation	08/99
Incorporate Changes From "Summer School" Experience	08/99
Full Implementation Mississippi Student Version (Restricted Access)	09/99 - 12/99
Launch Unrestricted Access Version (Freely Available on the Web)	09/99
Conduct Summative Evaluation	01/00

## A20 Remote Sensing Public Access Center Project

Milestone	Target Completion Date
West Virginia Science Teachers Association	10//98
International. Society for Technology & Education	12//98
National Science Teachers Association Global Summit	12/98
Society for Information Technology & Teacher Education International Conference	03/99
International Conference on Mathematics/Science Education & Technology	03/99
National Science Teachers Association Annual Conference	03/99
West Virginia University Academic Computing Technology Fair	04/99
World Conference on Educational Multimedia, Hypermedia & Telecommunications	06/99
LTP Conference	05/99
Bell Atlantic World School	TBD

## A21 University of North Dakota Volcano World

Milestone	Target Completion Date
New materials online monthly	10/98 - 09/99
Submit annual report	07//99

## A22 University of North Dakota Distance Learning

Milestone	Target Completion Date
Submit annual report	09/99

## A23 COMSAT Project

Milestone	Target Completion Date
Implement INMARSAT account	12/98
Procure portable NT workstations	01//99
Integrate systems	02/99

## A24 Learning Technologies Project Office Local Projects

Milestone	Target Completion Date
Hispanic Essay Contest announced	03/99
Hispanic Essay Contest awarded	05/98
Hispanic Essay Contest summer Interns to Space Camp	07/98
Bay Area Minority Student Program interviews and selections	04/99
Santa Clara County Robotics Competition: school prepared for competition	10/98
US FIRST Western Regional Robotics Competition	03/99
US FIRST National Robotics Competition	05/99

### 7.3 LTP PCA Metrics

PCA metrics will be established by the EWG and approved by Program management during FY99 and FY00.

### 7.4 LTP Level I Metrics

Level II Metrics for LTP grow out of the guiding principles, goals, and outcomes discussed earlier. The method for reporting metrics to the Education Division Computer Aided Tracking System (EDCATS). Information from the monthly reports (below) will be summarized by the Regional Centers and entered into EDCATS. The Project Office will also make independent entries as appropriate

**Table 4: LTP Level I Metrics and Related Outcomes**

Metric	Related Outcome(s)
1) Awards and recognition received	<ul style="list-style-type: none"> <li>LTP is recognized by the academic and industrial communities</li> </ul>
2) On-line: Web statistics (hits, Kb transferred, unique addresses) per month	<ul style="list-style-type: none"> <li>LTP is visible and findable</li> <li>Well-defined technical training path</li> <li>Large-scale integration of LTP into classrooms</li> </ul>
3) Off-line: Number of conferences and other external activities	<ul style="list-style-type: none"> <li>LTP is visible and findable</li> </ul>
4) Number of "referenceable" papers submitted by LTP and affiliates	<ul style="list-style-type: none"> <li>Raised level of math, science, engineering, and technology awareness</li> </ul>
5) Number of schools and underserved schools served by LTP projects	<ul style="list-style-type: none"> <li>Raised level of math, science, engineering, and technology awareness</li> </ul>

Each center must make a reasonable effort to meet these five metrics. The agency is likely to judge the project by its numerical success in these areas.

Metric 1 will be calculated at one major award for every \$100K spent on the project rounded to the nearest whole number. If a project budget is \$150K, 1.5 prestigious awards, rounded to two prestigious awards will be required to meet this metric.

Metric 2 will be calculated at a minimum of one hit per dollar. If a center has a budget of \$300K, the metric would be at least 300,000 hits for the year. In general most projects far exceed this metric in a single month, however the lower boundary has been set.

Metric 3 will measure one major conference or public activity for every \$100K rounded to the nearest whole number. If a project has a budget of \$220K per year, it is expected to support 2.2 events, rounded to two events.

Metric 4 will be calculated at one paper for every \$100K rounded to the nearest whole number. A center receiving \$500K would be expected to produce at least five papers during the year.

Metric 5 will be calculated at three schools for every \$10K. A center with \$20K would be expected to have data on six schools that it has supported in some fashion. Note this could be as simple as preparing an Internet kit for the school or doing an Internet activity. In general this can be a very low level of personal involvement, but enough for the school to know that NASA is providing it with something.

**Table 5: LTP Level I FY99 Target Metrics**

<b>Metric</b>	ARC	DFRC	GSFC	KSC	JPL	JSC	LaRC	LeRC	MSFC	SSC
1) awards & recognition	5	2	2	0	3	2	2	2	0	0
2) # of hits	500K	195K	160K	20K	310K	215K	200K	220K	20K	20K
3) # of activities	5	2	2	0	3	2	2	2	0	0
4) # of papers	5	2	2	0	3	2	2	2	0	0
5) # of schools	150	59	48	6	93	65	60	66	6	6

**Table 6: LTP Level II Optional Metrics Reported as Necessary**

<b>Metric</b>	<b>Related Outcome(s)</b>
<ul style="list-style-type: none"> <li>Number of instructional materials based on needs assessment</li> </ul>	<ul style="list-style-type: none"> <li>Raised level of math, science, engineering, and technology awareness</li> <li>Partnerships, both for-profit and non-profit</li> <li>Large-scale integration of LTP into classrooms</li> <li>Raised level of math, science, engineering, and technology awareness</li> </ul>
<ul style="list-style-type: none"> <li>Number of teacher training institutions using LTP materials for pre-service teachers</li> </ul>	<ul style="list-style-type: none"> <li>Raised level of math, science, engineering, and technology awareness</li> </ul>
<ul style="list-style-type: none"> <li>Number of official school curricula using LTP institutional materials</li> </ul>	<ul style="list-style-type: none"> <li>Large-scale integration of LTP into classrooms</li> </ul>
<ul style="list-style-type: none"> <li>Number of students and teachers, and number of underserved students served by LTP projects</li> </ul>	<ul style="list-style-type: none"> <li>Raised level of math, science, engineering, and technology awareness</li> </ul>
<ul style="list-style-type: none"> <li>Number of unique technologies piloted in schools</li> </ul>	<ul style="list-style-type: none"> <li>LTP-unique technology models are in place</li> </ul>
<ul style="list-style-type: none"> <li>Number of collaborations with NASA-related scientists and engineers</li> </ul>	<ul style="list-style-type: none"> <li>Partnerships, both for-profit and non-profit</li> </ul>
<ul style="list-style-type: none"> <li>Number of high-level educational partnerships (universities, museums, national organizations, science centers, state &amp; local education bodies, industry)</li> </ul>	<ul style="list-style-type: none"> <li>Partnerships, both for-profit and non-profit</li> </ul>
<ul style="list-style-type: none"> <li>Matching funds &amp; in-kind services generated from outside LTP</li> </ul>	<ul style="list-style-type: none"> <li>Partnerships, both for-profit and non-profit</li> </ul>
<ul style="list-style-type: none"> <li>Number of teachers trained nationwide in use of LTP materials (includes demographics and follow-through)</li> </ul>	<ul style="list-style-type: none"> <li>Well-defined technical training path</li> </ul>

### **7.5 LTP Level II Reports**

The Level II reportable metrics selected below represent how well the respective projects are doing toward producing the desired results identified in the table of outcomes listed above. The table below specifies the data collection methodology and responsibility. This information will be recorded at the Project Office level.

The Project Office will also routinely report results or unusually successful (or unusually unsuccessful) efforts to the HPCC Program Office and other senior management. The Learning Technologies Project Office will be responsible for taking any necessary follow-up action as required. Project contributions and results will be among the criteria used by the Project Office in determining future budget allocations for proposals that are competed between Centers.

**Table 7: LTP Metrics and Data Collection for all Levels**

<b>Metric</b>	<b>Data To Be Reported Monthly</b>
<ul style="list-style-type: none"> <li>Amount of awards or recognition received</li> </ul>	<ul style="list-style-type: none"> <li>Each project reports new pilots to its respective coordinator</li> </ul>
<ul style="list-style-type: none"> <li>On-line: Web statistics (hits, Kb transferred, unique addresses) per month</li> </ul>	<ul style="list-style-type: none"> <li>Each project reports hit and domain statistics to its respective coordinator (alternatively this can be collected by RSPAC)</li> </ul>
<ul style="list-style-type: none"> <li>Off-line: Number of conferences and other external activities</li> </ul>	<ul style="list-style-type: none"> <li>Each project reports type of conference participation and demographic make-up to its respective coordinator</li> </ul>
<ul style="list-style-type: none"> <li>Number of “referenceable” papers submitted by LTP and affiliates</li> </ul>	<ul style="list-style-type: none"> <li>Each project reports numbers and type of collaboration to its respective coordinator</li> </ul>
<ul style="list-style-type: none"> <li>Number of schools and underserved schools served by LTP projects</li> </ul>	<ul style="list-style-type: none"> <li>Each project reports school name, location, and point of contact to its respective coordinator (alternatively this can be collected by RSPAC)</li> </ul>

The LTP will all report directly to EDCATS in addition to all other requirements.

**7.6 Project Metrics for Grants and Cooperative Agreements**

These milestones represent technical milestones accomplished as represented by financial commitments from this office, coupled with disbursements from the procurement. The metric for success is meeting all milestones on schedule. Note: the financial schedule for specific proposals will be listed in the Approved Annual Fiscal LTP Proposal Plan.

**7.7 LTP Financial Metrics**

All Learning Technologies Projects will work with an accounting methodology that will allow them to track accruals versus expenses. At a minimum, LTP tasks and subtasks shall maintain metrics that track progress in meeting Office of Aeronautics budget performance requirements. These requirements are that there be 83% accrual of FY funds by the end of Sept. and 100% obligation of funds by the end of the calendar year 1998. Failure to meet these goals shall result in either withdrawal of FY funds or in reduction of the following FY guidelines. Line organizations at each NASA field center are responsible for meeting or exceeding these performance targets.

Funding will be provided by Code FE and Code R during the next fiscal year. Currently code FE does not have this requirement; however, since Code R is managing the project all components shall adhere to this metric. It is likely that the whole Agency will be migrating toward this metric.

## 8. RESOURCES

### 8.1 Financial

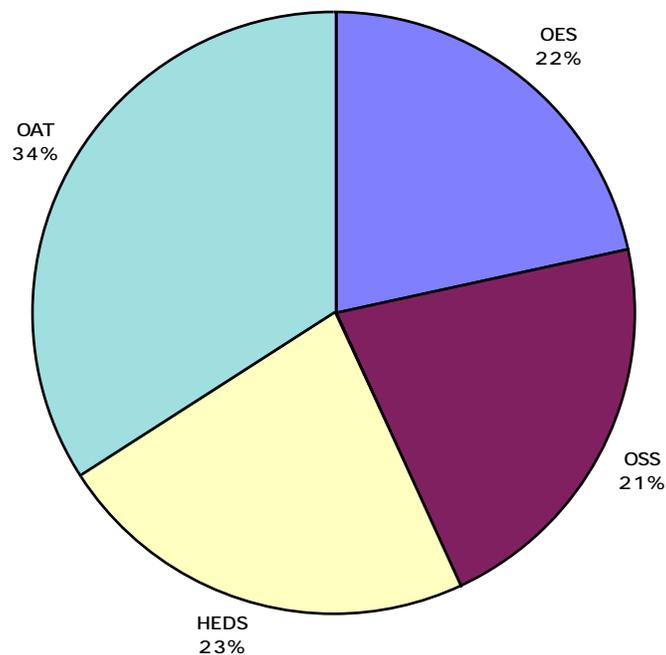
Funding and workforce budgets have been coordinated among the various NASA centers participating in the LTP. The LTP budget profiles for the fiscal years FY99 - FY03 are shown in the following table in millions.

**Table 8: LTP Multi-Year Budget Plan**

FY	Amount	Code FE	Code R
1999	\$ 5.0 M	\$ 4.0 M	\$ 1.0 M
2000	\$ 4.0 M	\$ 4.0 M	\$ 0
2001	\$ 4.0 M	\$ 4.0 M	\$ 0
2002	\$ 4.0 M	\$ 4.0 M	\$ 0
2003	\$ 4.0 M	\$ 4.0 M	\$ 0

**Table 9: LTP Budget Plan by NASA Enterprise**

Budget Spending by NASA Enterprise



<b>NASA Enterprise</b>	<b>FY99</b>
Office of Earth Science	\$1,078 K
Office of Space Science	\$ 1,071 K
Human Exploration and Development of Space.	\$ 1138 K
Office of Aero-Space Transportation	\$1713 K

Note: table rounded to nearest thousand.

**Table 10: LTP Budget Plan for Fiscal Year 1999**

ARC	Taxes	\$299,000	
ARC	External projects	\$935,000	
ARC	Project Office	\$516,000	
ARC	K-Grey (Traicoff)	\$500,000	
<b>ARC</b>			<b>\$2,150,000</b>
GSFC	New solicitation	\$800,000	
GSFC	New solicitation/ Liaison Earth	\$145,000	
GSFC	Enterprise Liaison SS & HEDS	\$170,000	
GSFC	Distance Learning	\$100,000	
GSFC	K-Grey (Fisher/Hamet)	\$160,000	
<b>GSFC</b>			<b>\$1,475,000</b>
<b>DFRC</b>	K-Grey (Duke/ McCarthy)	\$150,000	<b>\$150,000</b>
<b>JSC</b>	K-Grey (Shelton)	\$215,000	<b>\$215,000</b>
<b>JPL</b>	K-Grey (Ferraro/ Clark)	\$310,000	<b>\$310,000</b>
<b>LaRC</b>	K-Grey (Seaton)	\$230,000	<b>\$230,000</b>
<b>LeRC</b>	K-Grey (Lewandowski)	\$220,000	<b>\$220,000</b>
<b>SSC</b>	K-Grey (Powe)	\$50,000	<b>\$50,000</b>
<b>KSC</b>	K-Grey (Buckingham)	\$50,000	<b>\$50,000</b>
<b>MSFC</b>	K-Grey (Anderson)	\$50,000	<b>\$50,000</b>
	<b>HPCC Learning Technology</b>		<b>\$5,000,000</b>

**Table 11: LTP Tentative Budget Plan for Fiscal Years 2000 - 2003**

HPCC Learning Technologies					
HPCC/Code FE Learning Technologies		FY00	FY01	FY02	FY03
ARC	LT Program Office Sterling 625(Leon/Sellers)	\$350,000	\$350,000	\$350,000	\$350,000
ARC	Taxes: NCO, Code D, Head,	\$80,000	\$80,000	\$80,000	\$80,000
ARC	LT Technical Support	\$35,000	\$35,000	\$35,000	\$35,000
ARC	Minority Student	\$25,000	\$25,000	\$25,000	\$25,000
ARC	LTP Conference	\$10,000	\$10,000	\$10,000	\$10,000
ARC	Enterprise Liaison OASTT	\$50,000	\$50,000	\$50,000	\$50,000
GSFC	LT Special Projects/New Soli	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000
GSFC	LT Special Proj./ Ent. Liaison ES	\$145,000	\$145,000	\$145,000	\$145,000
GSFC	Enterprise Liaison SS & HEDS	\$170,000	\$170,000	\$170,000	\$170,000
ARC	K-Grey (Traicoff)	\$500,000	\$500,000	\$500,000	\$500,000
GSFC	K-Grey (Fisher/Hamet)	\$160,000	\$160,000	\$160,000	\$160,000
DFRC	K-Grey (Duke/McCarthy)	\$150,000	\$150,000	\$150,000	\$150,000
JSC	K-Grey (Shelton)	\$215,000	\$215,000	\$215,000	\$215,000
JPL	K-Grey (Ferraro/Clark)	\$310,000	\$310,000	\$310,000	\$310,000
LaRC	K-Grey (Seaton)	\$230,000	\$230,000	\$230,000	\$230,000
LeRC	K-Grey (Lewandowski)	\$220,000	\$220,000	\$220,000	\$220,000
SSC	K-Grey (Powe)	\$50,000	\$50,000	\$50,000	\$50,000
KSC	K-Grey (Buckingham)	\$50,000	\$50,000	\$50,000	\$50,000
MSFC	K-Grey (Anderson)	\$50,000	\$50,000	\$50,000	\$50,000
HPCC Learning Technology		\$4,000,000	\$4,000,000	\$4,000,000	\$4,000,000

The budget numbers represent totals for the performing centers and cooperative agreements. Unspecified balances represents program reserves, various program taxes, and funds for interagency endeavors, as well as unallocated funds that will be disbursed to the centers for such things as basic research, industry, consortia, and special initiatives. Due changes in workforce during fiscal year 99, there will likely be allocation changes between the centers for FY00.

## 8.2 Workforce

The direct civil service (CS) and in-house support service contractor (SSC) workforces committed by the NASA centers to the program are shown in the following table in full-time equivalents (FTE).

**Table 12: LTP Workforce Plan by Fiscal Year**

<u>Center</u>	<u>FY98</u> Civil Service	<u>FY99</u> Civil Service	<u>FY00</u> Civil Service	<u>FY01</u> Civil Service	<u>FY02</u> Civil Service	<u>FY03</u> Civil Service	<u>FY04</u> Civil Service
Proj. Office	1.0	1.0	1.0	1.0	1.0	1.0	1.0
ARC	.5	.5	.5	.5	.5	.5	.5
DFRC	.1	.1	.1	.1	.1	.1	.1
GSFC	.6	.6	.6	.6	.6	.6	.6
IVV	.2	.2	.1	.1	.1	.1	.1
JPL	.1	.1	.1	.1	.1	.1	.1
JSC	.5	.5	.5	.5	.5	.5	.5
KSC	.1	.1	.1	.1	.1	.1	.1
LaRC	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LeRC	2.0	2.0	2.0	2.0	2.0	2.0	2.0
MSFC	.1	.1	.1	.1	.1	.1	.1
SSC	.1	.1	.1	.1	.1	.1	.1
Total	6.3	6.3	6.2	6.2	6.2	6.2	6.2

## 8.3 Procurement Strategy

Procurement will be in accordance with normal procedures for R&D activities at the procuring centers. Competitive procurements will be used to the maximum extent practicable. When time is a critical factor, innovative procurement practices permitted by any variance to procurement regulations for the Federal High Performance Computing and Communications Program shall be used. Among the procurement vehicles which are expected to be utilized on the HPCC Program are Support Service Contracts, Grants, NASA Research Announcements, Task Order Contracts, Cooperative Agreements, Fixed Price hardware purchases and leases, and cooperation with other Federal agencies.

## 8.4 Process for Center Proposals - FY99

The procedure below allows for corrective action, enhancing integration, targeting projects, and avoiding duplication.

- Each center proposes for next fiscal year (LTP and Education coordinate)
- Project Office reviews/filters to align with LTP goals
- Centers review: InterCenter Working Group (ICWG) peer review
- Two representatives from each center vote (budget is fixed —"guidelined")

### **8.5 Proposal Procedure for FY00**

The points below refer to regional center proposals for FY99.

The procedure below allows for corrective action, enhancing integration, targeting projects, and avoiding duplication.

- Each center proposes for next fiscal year (LTP and Education coordinate)
- Project Office reviews/filters to align with LTP goals
- InterCenter Working Group (ICWG) conducts peer review
- AECC conducts review of any project containing an Aero Component
- Two representatives from each center vote on proposals (budget is fixed —"guidelined")
- Following approval, money will be allocated by either 506 authority from HQ or subauthorization from ARC.

### **8.6 Principles of Proposal Process FY00**

Joint signatures by the NASA Officer of Education and LTP will be required where there is fiscal sharing or in-kind support provided by the Education Office. A concurrence signature by the Education Office is required for all other proposals.

## **9. CONTROLS**

The primary point of control for the Learning Technology Project is the annual budget that exists as a grandfathered requirement from the NASA Education Division to HPCC. This annual budget of four million dollars was directed by the administrator from the Information Infrastructure Technology and Applications Program to the NASA Education Division to be held for NASA's LTP. In the event of a guideline change, signoff must occur from the OAT Enterprise Associate Administrator and code FE Division Chief.

LTP typically is responsible for one PCA milestone every two years. This requirement can only be changed by working with the HPCC executive council, HPCC Program Manager, Code FE Division Chief, and the HPCC Program Manager. Such changes are subject to approval by the Administrator.

Software and data produced in the performance of a contract related to NASA HPCC research that is critical to the development of an enabling or high leverage technology will be designated as "Limited Exclusive Rights Data." Commercially sensitive information that is generated under formal cooperative research agreements between NASA and non-Federal parties is protected by the recently amended (October 1992)

NASA Space Act of 1958. Data produced under such an arrangement will be protected from Freedom of Information Act (FOIA) requests for a period of 5 years after the date of dissemination.

NASA center management, working with industry and NASA HPCC researchers, is responsible for identifying sensitive technologies. These technologies are handled in such a way that their dissemination to foreign companies, laboratories, and universities is restricted. The NASA HPCC Office will adopt conventional security techniques of isolating critical technology from "open" exchange systems until acceptable multi-level security techniques and policies have been developed.

Negotiated License Agreements are used to restrict access to privately developed technology performed under the auspices of the NASA HPCC Program. These agreements provide NASA with limited rights to use proprietary data or designs in NASA in-house or cooperative research projects. These agreements specify limits on the distribution and use of the proprietary data by NASA and NASA-licensed entities.

Some software and information developed solely within the NASA HPCC Program may be subject to protection under the Export Administration Regulations (EAR) or the International Traffic in Arms Regulations (ITAR), which are export controls established by law. The participants in the HPCC Program will follow applicable export control laws. These regulations establish lists or categories of technical data and/or products that may not be exported without an approved export license. (Note that the definition of "exported" includes "disclosed" and "discussed" as well as published.)

## **10. IMPLEMENTATION APPROACH**

The work breakdown structure for the LTP has been defined to have a management component and five major elements: 1) Educational Technology; 2) Teacher Enhancement; 3) Curriculum Improvement; 4) Student Support; 5) Systemic Change/Collaboration. It is anticipated that each field center with K-Gray sub tasks will have activities in several or all of these areas. (See also appendix A1, Taxes and Liens.)

## 10.1 K-12 Education Work Breakdown Structure (WBS)

**Table 13: K-12 Education Work Breakdown Structure (WBS)**

Objective	Center(s) Supporting this Work
<ul style="list-style-type: none"> <li>Provide access to LTP products and services based on or derived from NASA missions that relate to math, science, engineering, and technology.</li> </ul>	<ul style="list-style-type: none"> <li>ARC, DFRC, GSFC, JPL, JSC, KSC, LaRC, LeRC, MSFC, SSC</li> </ul>
<ul style="list-style-type: none"> <li>Deliver classroom-ready current and archived NASA information using innovative technology.</li> </ul>	<ul style="list-style-type: none"> <li>ARC, DFRC, GSFC, LaRC, LeRC</li> </ul>
<ul style="list-style-type: none"> <li>Facilitate the infusion of LTP-unique technology models into schools across the nation.</li> </ul>	<ul style="list-style-type: none"> <li>ARC, JPL, LaRC, LeRC, SSC</li> </ul>
<ul style="list-style-type: none"> <li>Forge high-leverage partnerships with both the commercial sector and non-profit organizations.</li> </ul>	<ul style="list-style-type: none"> <li>ARC, DFRC, GSFC, JPL, JSC, KSC, LaRC, LeRC, MSFC, SSC</li> </ul>
<ul style="list-style-type: none"> <li>Facilitate access to and awareness of LTP products and services.</li> </ul>	<ul style="list-style-type: none"> <li>ARC, DFRC, GSFC, JPL, JSC, KSC, LaRC, LeRC, MSFC, SSC</li> </ul>
<ul style="list-style-type: none"> <li>Provide educator training opportunities and materials for all LTP products and services using emerging technologies so that physical distance is no longer a barrier.</li> </ul>	<ul style="list-style-type: none"> <li>ARC, DFRC, LaRC, LeRC</li> </ul>

## 10.2 NASA Field Center Responsibilities

**Table 14: Field Center Support by NASA Enterprise**

NASA Enterprise	Centers Supporting this Work
<ul style="list-style-type: none"> <li>Earth Science (ES)</li> </ul>	<ul style="list-style-type: none"> <li>GSFC, JPL, JSC, LaRC, MSFC</li> </ul>
<ul style="list-style-type: none"> <li>Office of Space Science (OSS)</li> </ul>	<ul style="list-style-type: none"> <li>ARC,GSFC, JPL, JSC, LaRC</li> </ul>
<ul style="list-style-type: none"> <li>Human Exploration and Development of Space (HEDS)</li> </ul>	<ul style="list-style-type: none"> <li>ARC, JPL, JSC, LaRC</li> </ul>
<ul style="list-style-type: none"> <li>Office of Aeronautics and Space Transportation Technology (OAT)</li> </ul>	<ul style="list-style-type: none"> <li>ARC, DFRC, JSC, KSC, LaRC, LeRC, SSC</li> </ul>

**Table 15: Field Center Support by NASA Center**

<b>Center</b>	<b>OES</b>	<b>OSS</b>	<b>HEDS</b>	<b>OAT</b>
ARC	0%	25%	50%	25%
DFRC	0%	0%	0%	100%
GSFC	50%	50%	0%	0%
JPL	25%	50%	25%	0%
JSC	25%	25%	25%	25%
KSC	0%	0%	0%	100%
LaRC	25%	25%	25%	25%
LeRC	0%	0%	0%	100%
MSFC	100%	0%	0%	0%
SSC	0%	0%	0%	100%

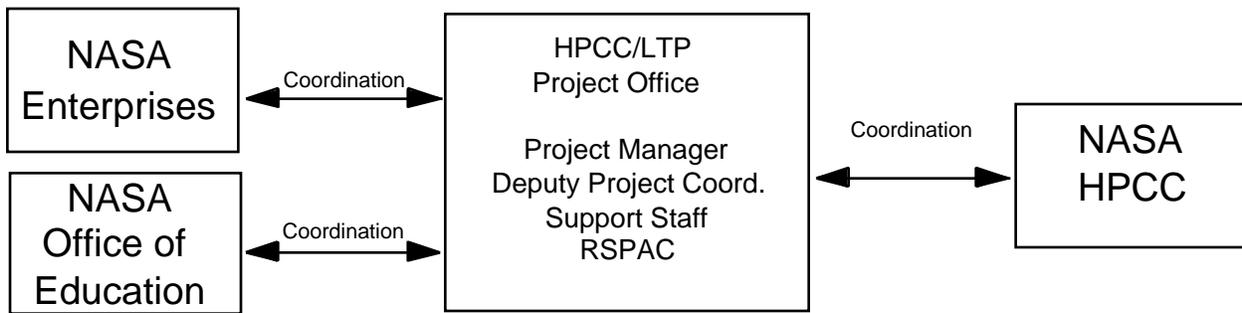
## **11. ACQUISITION SUMMARY**

Free and open competitive procurements will be used to the maximum extent possible. Among the procurement vehicles that is expected to be put to use in the NASA LTP are NASA Research Announcements (NRA), NASA Cooperative Agreement Notices (CAN), and Request for Proposals (RFP). These vehicles will result in grants, cooperative agreements and contracts. Cooperative Agreement Notices (CAN) will be used to the maximum extent possible for the incorporation of technology and applications into the Program. Interagency agreements for joint R&D endeavors and the utilization of early prototype systems will also be used. As a result, many of the projects funded through these agreements reach out to the disadvantaged and underserved.

## **12. PROGRAM/PROJECT DEPENDENCIES**

### ***12.1 Cooperation with Other NASA Programs***

The LTP maintains a liaison with NASA's other education programs, including the Education Division Offices residing at NASA field centers and the Education Division at NASA Headquarters. An LTP Educational Liaison position has been created to insure that all Learning Technologies educational products created out of the LTP will be coordinated with NASA's Education Division.



## **12.2 Cooperation with Other Organizations**

A key concept of the High Performance Computing and Communications Program is early and continuing interaction with, and involvement of, the domestic academic communities. The LTP will actively foster this relationship through workshops, periodic in-depth reviews, and planning and review activities as appropriate. These workshops and review activities are designed to elicit direct, unfettered feedback from some of the nation's best experts in the field of scientific education in primary, secondary and post-secondary educational environments regarding the goals, objectives, priorities and structuring of the programs planned under LTP.

LTP has established a Advisory Board consisting of key individuals in the domestic academic communities. This Planning and Review Team will meet at least annually in coordination with the LTP budgeting and planning process but will be consulted and kept informed regularly.

**Table 16: Interaction with Other Organizations, Excluding School Partnerships**

<b>Center</b>	<b>Major Liaison Activities</b>
Project Office	<ul style="list-style-type: none"> <li>• Access America Board</li> <li>• ARPA (Advanced Research Projects Agency)</li> <li>• CoSN (Consortium of School Networking)</li> <li>• CUE (Computer Using Educators)</li> <li>• Department of Commerce</li> <li>• Department of Defense</li> <li>• Department of Education</li> <li>• Department of Energy</li> <li>• Eisenhower National Clearinghouse</li> <li>• ISTE (International Society for Technology in Education)</li> <li>• ISOC (Internet SOCIety)</li> <li>• NCTM (National Council for Teachers of Mathematics)</li> <li>• NEA (National Education Association)</li> <li>• NHU (National Hispanic University)</li> <li>• NII (National Information Infrastructure)</li> <li>• NSF (National Science Foundation)</li> <li>• NSTA (National Science Teachers Association)</li> <li>• NetDay Committee</li> </ul>
ARC	<ul style="list-style-type: none"> <li>• California State Teachers Association (CSTA)</li> <li>• US Department of Education</li> <li>• The JASON Project</li> <li>• The Discovery Channel</li> <li>• SpaceNews</li> <li>• GTE/Americast</li> <li>• Institute for Computer Technology</li> <li>• The GLOBE Program</li> <li>• Other California state &amp; local education organizations</li> </ul>
DFRC	<ul style="list-style-type: none"> <li>• California State</li> </ul>
GSFC	<ul style="list-style-type: none"> <li>• Maryland State</li> </ul>
JSC	<ul style="list-style-type: none"> <li>• Clear Creek School District</li> <li>• Texas Education Network (TENET)</li> <li>• Other Texas state &amp; local education organizations</li> <li>• Mississippi State University (Research, Rehabilitation, &amp; Training - Center on blindness and low vision)</li> </ul>

JPL	<ul style="list-style-type: none"> <li>• Los Angeles County Office of Education (LACOE)</li> <li>• The California State Department of Education Science Framework Committee</li> <li>• California Museum of Science and Industry, Los Angeles, CA</li> <li>• California State</li> <li>• Mitsubishi</li> <li>• Air Touch</li> <li>• Software Bisque</li> <li>• Mount Wilson Institute</li> <li>• Naval Observatory</li> <li>• Celestron</li> <li>• Mead Instruments</li> <li>• Santa Barbara Instruments Group</li> <li>• Silicon Graphics</li> <li>• Boston Museum of Science</li> <li>• Little Thompson Science Foundation</li> <li>• Hayden Planetarium</li> <li>• Griffith Observatory</li> </ul>
KSC	<ul style="list-style-type: none"> <li>• Florida state and local education organizations</li> <li>• Florida Gulf COAT University</li> <li>• Florida State Commissioner of Education</li> </ul>
LaRC	<ul style="list-style-type: none"> <li>• Virginia state &amp; local education organizations</li> <li>• Elizabeth City State University</li> <li>• US Department of Housing and Urban Development</li> <li>• Virginia Space Grant Consortium</li> <li>• Unified Research Laboratories</li> <li>• WHRO Public TV</li> </ul>
LeRC	<ul style="list-style-type: none"> <li>• Ohio state</li> <li>• Ohio Space Grant Consortium,</li> <li>• WVIZ-TV (Cleveland Public TV)</li> </ul>
MSFC	<ul style="list-style-type: none"> <li>• Alabama state &amp; local education organizations</li> </ul>
SSC	<ul style="list-style-type: none"> <li>• Mississippi state &amp; local education organizations</li> </ul>

### 13. AGREEMENTS

Customers for HPCC research include CoSMO and SOMO, NASA's crosscutting computing and communication service entities, and Agency crosscutting design and analysis initiatives.

#### Internal agreements:

LTP and NREN are currently working on some leading-edge Internet communication technology to support educational projects.

#### External agreements

LTP is expected to maintain a presence on the HPCC Educational Training and Human Resource (ETHR) working group. Currently LTP is responsible for maintaining a Web site for this group.

Drafted MOUs from FY 96 between LTP and DoE, DoEd, ARPA, NSF, & CICNET were never signed and have since become null and void.

Currently LTP maintains certain Letters of Intent between local schools for specific opportunities through the end of FY00. These letters are with Broadway High School, San Jose, California and Foothill High School, San Jose, California. In addition to these two high schools, LTP maintains an ongoing relationship with East Palo Alto School, Ronald McNair, as a result of an MOU signed in 1995 between the Administrator and the school.

A Space Act Agreement between NASA LeRC and the Educational Television Association of Metropolitan Cleveland (WVIZ-TV) for the creation of a NASA Educational Channel on an Instructional Television Fixed Services Channel was signed July 27, 1998.

## **14. PERFORMANCE ASSURANCE**

LTP will work with industry, academia and other federal agencies to assure the quality of their products.

### **14.1 General**

The LTP will leverage off of its relationship with the Educational Training and Human Resources working group to debut new technologies.

### **14.2 Reliability**

Each project is responsible for utilizing evaluation mechanisms on their deliverables such that all software and interactive systems are 95 percent reliable.

### **14.3 Quality Assurance**

The NASA Education Division and the intercenter working group will have the opportunity to review all data content and assure 100 percent accuracy in all NASA data.

### **14.4 Performance Verification**

For FY99, the IVV facility located in Fairmont, WV, will perform all software verification for LTP. The RSPAC Cooperative Agreement will expire in July of FY99. Following closure of this agreement, LTP will utilize the ICWG as the primary source of performance verification.

### **14.5 Software Assurance**

For FY99, the IVV facility located in Fairmont, WV, will perform all software assurance for LTP. The RSPAC Cooperative Agreement will expire in July of FY99. Following closure of this agreement, LTP will utilize the ICWG as the primary source of performance verification.

## **14.6 Maintainability**

It is the requirement of the LTP that all project software is supported and easily maintainable by the end user. A primary requirement is that the software be easily replicable and inexpensive for the user to run on typical desktop systems.

## **15. RISK MANAGEMENT**

The deliverables in this project will be adjusted to deal with uncertainties in both funding and technical progress as is appropriate for a project pushing the state of the art. The scope of the deliverables will be adjusted in order to deal with unforeseen events. For example the number of LTP project applications which are demonstrated, and the extent to which tasks may be undertaken to support these areas, may be executed via modified proposals and adjustments to the cooperative agreements. In all cases, responsible risk assessment must be made of all dissemination of all new technology that is implemented into schools.

### **15.1 Overview**

In the development of technology, risk arises from two general sources. First, each of the Projects face *technical risk*; that is, risk resulting from unexpected developmental difficulties. The LTP was planned with a portfolio of risk versus payoff. While the minimum success criteria is expected to be achieved, there are some high-risk high-payoff elements in the projects. Second, projects face *resource/schedule risks*, which involve factors beyond the control of the LTP management and sometimes beyond the control of NASA.

### **15.2 Technical Risk**

NASA's HPC mission requires currency with the leading edge of technology and a direction that is consistent with the future. To minimize the potential risk of investing resources in the wrong technology, NASA frequently meets with industry and other Federal agencies to help plan the future of the technology.

Systems software developed to-date is built on conventional personal computers and similar architectures. To minimize the risks of software development, NASA is leading efforts to pool the resources of the 12 participating government agencies and strengthen collaborative efforts with industry and academia.

It is critical that NASA continues to pursue a quick and responsive procurement mechanism for acquiring experimental software that is compatible the user community. To minimize the potential risks, NASA has developed in-house procurement vehicles that permit rapid vendor responses. NASA also partners with other Federal agencies to leverage off other procurement vehicles.

As a partner in an overall Federal program wherein high-risk research is shared by other participating federal agencies, NASA portions of jointly sponsored research initiatives are often dependent on funding and work commitments made by partner institutions. This risk is mitigated through cooperative planning with the other agencies to ensure a cohesive plan with no unforeseen consequences.

The detailed technical risks of the project are encapsulated in the various sub-projects. The project-level (Level 2) technical risks are shown in the table below.

**Table 17: Technical Risk Assessment**

<b>Risk</b> (probability without mitigation)	<b>Impact</b>	<b>Mitigation</b>
<ul style="list-style-type: none"> <li>• Educational Community requirements change (low)</li> </ul>	<ul style="list-style-type: none"> <li>• Products do not meet customer requirements</li> <li>• Increased customer efforts required to adapt products</li> <li>• Reduced technology transfer success</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor potential changes in customer requirements</li> <li>• Adapt approach to consider possible changes</li> </ul>
<ul style="list-style-type: none"> <li>• Educational projects do not meet expected interactive performance (medium)</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced benefit at user level</li> </ul>	<ul style="list-style-type: none"> <li>• Re-allocate resources to high payoff technologies and applications</li> <li>• Use system analysis to guide needed trade-off decisions on technology and application payoff</li> </ul>
<ul style="list-style-type: none"> <li>• NASA content project activities are duplicative and/or not coordinated with a different LTP project (high)</li> </ul>	<ul style="list-style-type: none"> <li>• Inefficient use of program resources</li> <li>• Valuable project activities not funded</li> </ul>	<ul style="list-style-type: none"> <li>• Facilitate project-level integration and coordination</li> <li>• Re-allocated resources to reduce inappropriate technical duplication</li> </ul>

To help understand and mitigate technical risk at the LTP level, the LTP is monitored on a regular basis by specialists external as well as internal to NASA. In addition to the regularly scheduled reviews, the overall LTP and each individual project have technical working groups to bring external peer-reviewed input to the technical activities.

### **15.3 Resource/Schedule Risk**

NASA's LTP interactive testbeds are critical to ensure the future success of NASA's Education Division mission. NASA partners with other Federal agencies and industry to use their facilities when necessary. NASA has established an allocation and scheduling system for its testbeds that ensures best possible use of the facilities. Additionally, NASA is pursuing more cost-effective means of providing versatile testbeds for the future.

Resource reduction is an area of relatively high risk to the LTP Project. Annually, or more frequently, the project faces budget challenges from the Agency, Enterprise, or Center levels. The Project office outlines descope options that seek to accommodate

these resource reductions, while maintaining the overall goals of the project. Effects within the program are often reflected in changes to Level-2 and Level-3 milestones, with the associated reduction in TRL and increase in technical risk to the Level-1 milestones. In more severe situations, changes to Level-1 milestones will be proposed in a revised program plan and, if necessary, a revised PCA. In extreme cases, project termination may be required.

The Table below presents an overview of the overall resource/schedule risks faced by the LTP, their potential impact, and the mitigation actions either taken or to be taken by the Project.

**Table 18: Table Resource/Schedule Risk Assessment**

<b>Risk</b> (probability without mitigation)	<b>Impact</b>	<b>Mitigation</b>
<ul style="list-style-type: none"> <li>• Partners do not meet resource commitments (medium)</li> </ul>	<ul style="list-style-type: none"> <li>• Project activity descoped</li> <li>• Reduced TRL</li> </ul>	<ul style="list-style-type: none"> <li>• Formal MOU/MOAs</li> <li>• Periodic senior management reviews</li> <li>• Formal joint plans/teams</li> </ul>
<ul style="list-style-type: none"> <li>• Reduction/loss of funding (high)</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced TRL for program products</li> <li>• Near-term milestones delayed or descoped with long-term milestones descoped or eliminated</li> <li>• Project or element terminated with loss of benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Advocate benefits to customers/stakeholders</li> <li>• Re-plan based on project descope priorities</li> <li>• Re-plan based on program descope priorities</li> </ul>

## 16. ENVIRONMENTAL IMPACT

There are no environmental impacts generated by this project.

## 17. SAFETY

Standard safety regulations are maintained by all NASA civil servants and contractors as required by the individual field centers and Principle Investigator (PI) locations.

## 18. TECHNOLOGY ASSESSMENT

LTP is an education technology and applications project that pursues technologies that are between five and twenty years of maturity. Applications in the areas of K-12 education, the four NASA enterprises, and HPCC project areas are used as drivers of LTP's technology research, providing the requirements context for the work that is done.

LTP conducts research activities intended to prove feasibility, develop and demonstrate educational technologies for eventual introduction into the NASA's Education Program. In addition, LTP conducts education technology outreach demonstrations that are essentially at TRL 7-8.

## **19. COMMERCIALIZATION**

Commercialization opportunities will be exploited through Space Act Agreements, Cooperative Research Agreements and Memoranda of Understanding with industry. Joint projects in high-risk areas will be pursued on a cost-sharing basis with industry and in close collaboration with government laboratories and academia. NASA will foster horizontal partnerships between NASA and multiple companies within the aerospace sector. The NASA LTP Project Office will also foster the vertical integration of collaborative teams between hardware suppliers, third-party software vendors, and members of the U.S. aerospace community. Lastly, the LTP Project Office sponsors and conducts technical meetings and workshops and promotes the publication of scientific and technical papers to maintain the flow of technology from NASA to industry and academia.

## **20. REVIEWS**

The LTP manager and Deputy Project Coordinator will submit reports on a regular basis and hold reviews periodically to evaluate technical and administrative progress on the LTP.

Comprehensive program reviews are conducted to evaluate the progress of the project and give critical feedback to the project managers. In addition to appropriate NASA personnel, representatives from other federal agencies, academia and industry may be invited to participate. Reviews are conducted in accordance with established policies and procedures.

### **20.1 Reviews**

LTP has four primary reviewing entities. The strongest is the Advisory Board which meets once a year to review all of the projects and provide guidance. In addition the advisory board reviews all of the project plans prior to their approval in the management plan. The second most influential review is the annual review. The whole LTP contingent meets to discuss and review the project. The third reviewing agent is the Intercenter Working Group. This panel meets once every two months to collaborate and exchange views on the status of project development. It is an open forum designed to improve the LT product. The fourth review process is conducted once every two weeks by the immediate LT management where by projects are assessed and corrected where necessary

The Regional Projects are responsible for regular review of their agreements and subtasks by the appointed technical liaisons. This should be handled in the form of regular telecons and at least one site visit per year. The LTP Office will conduct at least one review of each cooperative agreement and grant.

## **20.2 Reports**

All elements and projects are responsible for providing monthly and annual project reports. Centers with ROC subtasks are required to provide the information necessary for these reports on time. All projects will be required to provide information for the LTP Annual Report. All types of data may be requested

## **21. TAILORING**

The HPCC Program will be managed and implemented in accordance with the normal procedures used by the Aero-Space Technology Enterprise for Systems Technology Programs. There are no major deviations from these procedures.

## **22. CHANGE LOG**

Changes to LTP since inception in 1993:

1. December 1992. HPCC IITA K-12 Project initiated
2. June 1993. HQ makes ARC lead Center for IITA K-12 Project
3. May 1995. HQ moves IITA Project Office to ARC
4. March 1996. Out-year milestones. Eliminated IITA milestones due to funding cuts.
5. September 1997. IITA project ends due to funding cuts.
6. October 1997. LT Project initiated. IITA education activities and milestones transferred to LT.

## **23. REFERENCES**

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- 1994 Learning Technologies: A Report to the HPCCIT LT Task Group. January 4, 1994.
- 1993 The National Information Infrastructure: Agenda for Action, the Information Infrastructure Task Force. September 15, 1993.
- 1993 High Performance Computing and Communications Program, Program Plan. Office of Aeronautics, National Aeronautics and Space Administration, August 1993.
- 1995 K-12 Outreach Proposal Plan.
- 1996 K-12 Outreach Proposal Plan.
- 1997 IITA K-12 Education Proposal Plan.

- 1995 The High Performance Computing and Communications Information Infrastructure Technology & Applications K-12 Internet Education Project Program Evaluation Report October 1995.
- 1994 IITA K-12 Annual Report.
- 1995 IITA K-12 Annual Report.
- 1995 IITA K-12 Evaluation Report Briefing to L. Holcomb at NASA HQ November, 1995.
- 1996 NASA Communicating Science, A Celebration of Accomplishments.
- 1996 NASA Communicating Science, A Celebration of Accomplishments (Second Printing).
- 1996 IITA Products Guide.
- 1996 IITA Annual Report.
- 1996 IITA K-12 Annual Report.
- 1997 IITA Annual Report.
- LTP Five-year Plan for Education.

## 24. ACRONYMS

ADTO	Aero Design Team Online
AECC	Aeronautics Education Council Committee
AIRNet	Alabama Internet, Inc.
ARC	Ames Research Center
AREN	Alabama Research and Education Network
ASCD	Association for Supervision for Curriculum Development
ARPA	Advanced Research Projects Agency
CA	Cooperative Agreement
CAN	Cooperative Agreement Notice
CCF	Community College Foundation
CCIC	Committee for Computing, Information and Communication
CICNet	Computing, Information and Communications network
CNES	French Space Agency
CO	Contract Officer
CoSMO	Consolidated Supercomputing Management Office
COSN	Consortium of School Networking
CoTF	Classroom Of The Future
COTR	Contracting Office Technical Representative
CS	Civil Service
CUE	Computer Using Educators
DoE	Department of Energy
DoEu	Department of Education
DFRC	Dryden Flight Research Center
EDCATS	Educational Division Computer Aided Tracking System
EL	Enterprise Liaison
EOS	Earth Observing System
ESE	Earth Science Enterprise
ETHR	Educational Training and Human Resources
EWG	Evaluation Working Group
FDR	(Middle School)
FTE	Full Time Equivalents
FY	Fiscal Year
GHCC	Global Hydrology and Climate Center

GSFC	Goddard Space Flight Center
HEDS	Human Exploration and Development of Space
HPCC	High Performance Computing and Communications
HQ	Headquarters
ICWG	InterCenter Working Group
IITA	Information Infrastructure Technology and Applications
ISOC	Internet SOCIety
ISTE	International Society for Technology in Education
ITEA	International Technology Education Association
LT	Learning Technologies
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
K-12	Kindergarten through 12th grade
KSC	Kennedy Space Center
LaRC	Langley Research Center
LEARNERS	Leading Educators to Applications, Research and NASA-unique Educational Resources in Science
LeRC	Lewis Research Center
LT	Learning Technologies
LTC	Learning Technologies Channel
LTP	Learning Technologies Project
MOU	Memorandum of Understanding
MSG	Multimedia Streaming Group
MSFC	Marshall Space Flight Center
MTO	Mars Team Online
NASA	National Aeronautics and Space Administration
NECA	National Education Computing Association
NECC	National Education Computing Conference
NII	National Information Infrastructure
NRA	NASA Research Announcement
NSF	National Science Foundation
NSTA	National Science Teachers Association
OA	Office of Aeronautics
OAT	Office of Aero-Space Technology
OSS	Office of Space Science
OtH	Over the Horizon

PCA	Program Commitment Agreement
PI	Principal Investigator
PO	Project Officer
R <sup>2</sup>	ROVer Ranch
RFP	Request for Proposal
ROC	Regional Outreach Center
RSPAC	Remote Sensing Public Access Center
SEWG	Special Events Working Group
SIMON	School Internet Manager Over Networks
SOMO	Space Operations Missions Office
SP	Special Project
SPACE	Sun, Planets, Asteroids, Comets, Exploration
SSC	Support Service Contractors
SSC	Stennis Space Center
STO	Space Team Online
TIE	Telescopes in Education
TIGR	Turning Goals Into Reality
TRL	Technical Risk Level
UPN	Universal Project Number
U.S.	United States
USFIRST	U.S. For Inspiration and Recognition of Science and Technology
VSM	Virtual Science Mentor
WBS	Work Breakdown Structure
WELES	Web-Enhanced Learning Environment Strategies

## **25. APPENDIX A: PROJECT PLANS**

### **Contents**

- A1 Taxes and Liens
- A2 Office of Aero-Space Technology (OAT) Liaison Project
- A3 Earth Science Liaison Project
- A4 Office of Space Sciences (OSS) and Human Exploration and Development of Space (HEDS) Liaison Project
- A5 LT Project Office (Task 45)
- A6 LT International Projects
- A7 LT Solicitation
- A8 LT Solicitation Conference
- A9 LT Regional Conference
- A10 Ames Research Center LT Regional Projects
- A11 Dryden Flight Research Center LT Regional Project
- A12 Goddard Space Flight Center LT Regional Project
- A13 Jet Propulsion Laboratory LT Regional Project
- A14 Johnson Space Center LT Regional Project
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- A20 Remote Sensing Public Access Center (RSPAC)
- A21 University of North Dakota (UND) Volcano World
- A22 University of North Dakota (UND) Distance Learning
- A23 COMSAT Project
- A24 LT Project Office Local Projects

## **25.1 A1 Taxes and Liens**

### **1. Goals**

The goal of the LTP Taxes and Liens is to maintain the financial responsibilities of the LT project with respect to Ames Research Center.

### **2. Approach**

This program contains six specific actions that need to be taken to maintain LT's financial health. These actions will occur at the beginning of the fiscal year.

#### *2.1 Implementation Strategies.*

- HPCC Head Tax: These funds will be committed and obligated at the beginning of FY99 by the program office to support a Raytheon Task.
- Head Tax will be drawn upon as RMO desires.
- This Advisory Tax will be committed and obligated to a Wang Task at the beginning of FY99
- The SuperComputing Tax will be paid back to NAS as owed from FY98.
- The Wang Over Run will be committed, obligated and accrued to the Wang Task that is over spent.
- The CAS Payback will be provided back to CAS as a LT JO for them to spend against at the beginning of FY99.

#### *2.2 Collaboration With Other LTP Centers.*

This particular proposal includes no partnering.

### **3. Milestone Timeline**

- 1st Q FY99 \$50K of over run, payback and computing tax will be committed and obligated.
- FY99 HPCC Tax, Head Tax and Advisory Tax will accrue slowly.

### **4. Deliverables**

Travel will be provided for the five-person Learning Technologies Advisory Board.

### **5. Evaluation**

The evaluation will be based purely on meeting a 83-percent accrual metric for the listed funds by end of FY99. 100 percent of all funds must be accrued by end of first quarter FY00.

### **6. Dissemination and Public Relations**

NA

## 7. Budget

TAX	HPCC Tax	\$105,000
TAX	Head Tax on 9.7 FTE @ 13.3K/Head Tax	\$129,000
TAX	Advisory Group Travel Tax	\$15,000
TAX	Super Computing Tax	\$10,000
LEIN	Wang Over run from FY98	\$10,000
LEIN	CAS Payback from FY98	\$30,000
	<b>Taxes and Liens</b>	<b>\$299,000</b>

## **25.2 A2 Office of Aero-Space Technology (OAT) Liaison Project**

### **1. Goals:**

The K-14 Office of Aero-Space Technology (OAT) Liaison has the primary goal of increasing aeronautics, aviation safety and space transportation and exploration awareness and correspondence between Code R , Code FE and Learning Technologies. The program also has the previous thrust of the K-14 Aeronautics programs.

All K-14 projects meet and/or exceed the National Standards. All projects have a diversity component where minorities, physically challenged and women are targeted. All projects will also have an on-line Internet component.

The following projects have subcategories :

- a) Lego Data Acquisition Project (LDAPS)
- b) Cislunar Aerospace Incorporated (K8AIT)
- c) InfoUse Incorporated, Plane Math
- d) Aviation Academy
- e) SPARK
- f) Florida International University (FIU)
- g) Mass. Corporation for Education Telecommunications (MCET)
- h) Aerodynamics in Sports Technologies

In the area of robotics development and programmatic implementation for the Agency, the OAT Liaison will design and develop a new outreach component in the areas of robotic and telerobotic applications.

In the area of high school and college student management, some students who are considered "as risk" youths need direct supervision and training.

### **2. Approach:**

- a) *LDAPS* is cross-disciplined. It uses teacher training in the summers. In the training sessions, teachers learn math and science principles and how to tie them in with the LDAPS curriculum. They are trained on the use of the Web and learn how to create and develop Web pages. The teacher training is incorporated and reviewed by Langley's Office of Education and K-12 Langley Manager Jeff Seaton.

Collaborative efforts are formed with Lego (in Denmark) and Edu-Tech. Ties are also involved with Tufts University and MIT.

- b) *Cislunar* has target partners ranging from the Hispanics migrant farm workers to schools for the hearing impaired to hospitals with bedridden children. NASA ties are with the Program Office at Ames, Tom Clausen and Garth Hull in the Office of Education and the AESP program (Aerospace Encounter). Training is done on-line and through teacher training.

- c) *InfoUse* has a range of collaborative partners. Partners range from Kinkos to San Francisco Airport to ATA (Alliance Technology Association). The Ames program office as well as Ames office of Education (Garth Hull) have provided input on the educational components and the technical support. Julie Pollitt has provided guidance in the area of wind tunnel active lesson plans. Training is done online. Items are specially designed for the physically challenged.
- d) *Aviation Academy* has collaborative partners with FedEx, FAA, and local Tennessee colleges. They are actively working with NASA/Lewis HPCC/K-12 manager Beth Lewandowski. Their approach is interesting as a liaison in engineering. They combined hands-on with instructional materials to give a different teaching approach. Training is done in and out of the classroom.
- e) *University of Idaho* works with NASA/Dryden Education Director Lee Duke. They have collaborative partnerships with HP, who provides technical guidance and computer support and usage practices. Summer teacher training is done on site for teachers in the K-12 program from the Nez Perce and Coeur d'Alene tribe.
- f) *Florida International University* works with Langley Education Director Sam Massenberg. They have on-line training as well as training at Florida International University. As they work with a diverse population, their needs have been catered to those they serve.
- g) *MCET* utilizes a unique approach through satellite broadcast. Some sessions are taped and some are live. Viewers can call in and ask questions. Teachers can tape the sessions or watch them live. Each session has many interactive lessons that can be done in the classroom. They work closely with the NASA Langley office of education manager Dr. Shelly Canright.
- h) *Aerodynamics in Sports* utilizes the sport of tennis to draw students into aeronautics. Wind tunnels at NASA Ames are utilized.

The engineering process of computational simulation to wind tunnel testing is used to demonstrate the research and design process.

### **3. Milestone Timeline**

All projects are required to submit an annual report the end of each fiscal year for the management plan.

### **4. Deliverables**

All projects are required to deliver an on-line presentation as a deliverable. All projects must serve under-represented/diverse groups. All projects will meet the national standards for math and science. All projects will increase the understating and base knowledge of engineering and aeronautics. Engineering will assist in the aid and development of a different teaching mechanism, which will in turn increase math, science, aeronautics and engineering knowledge. Teaching practices will be adjusted to incorporate the new changes.

### **5. Evaluation**

Evaluation is done through a variety of methods. EDCATS is actively used by all projects. Data is distributed through teacher training events and sporadically throughout the year. Projects are also assessed on their compliance with PCA milestones. Projects will be assessed in deliverance of a changed curriculum and higher testing scores.

Additional needs assessment is performed jointly through Penn State University and NASA Dryden for aeronautics and robotics projects.

Managerial assessment is performed through Via Associates under Laura Fienstone.

## **6. Dissemination**

All projects will be disseminated on a national and international level. All projects are available via the World Wide Web. MCET additionally has a satellite component that is broadcast and can be reached on your television cable system. Teacher training and hand-out material will be distributed. White papers, MOUs, and collaborations will be made available. All projects will attend national and local conferences and events. Each project has additionally been tied to schools in a variety of geographical locations throughout the country.

## **7. Budget**

**Total**

**\$120K**

### **25.3 A3 Earth Science Liaison Project**

#### **1. Goals**

To form a communication and collaboration bridge between the LT program and the Earth Science Enterprise (ESE).

#### **2. Approach**

Most of the particulars of this new effort will be worked out at a management conference to be held October 22, 1998, in Tucson, Arizona. In broad strokes, the liaison will:

- Present and demonstrate LTP products to ESE staff and scientists.
- Seek out non-LTP efforts within the ESE to determine what links would be productive.
- Foster collaborations between LTP and ESE.

##### *2.1 Implementation Strategies.*

TBD. These will include but not be limited to: Web searches for ESE educational material; attending ESE seminars and presentations; phone calls and meetings with ESE staff, initially targeting NASA Headquarters, Goddard Space Flight Center and Marshall Space Flight Center; and coordination with the AESP program, initially targeting the Goddard Space Flight Center participants.

##### *2.2 Collaboration with Other LTP Centers*

(See 2.1 above.)

#### **3. Milestone Timeline**

TBD

#### **4. Deliverables**

None

#### **5. Evaluation**

TBD

#### **6. Dissemination and Public Relations**

As currently conceived, this effort will consist completely of dissemination and public relations.

#### **7. Budget.**

SSC labor	0.5 FTE	\$70K
SSC Travel		5K
<b>Total</b>		<b>\$75K</b>

## **25.4 A4 Office of Space Science and Human Exploration and Development of Space Liaison Project**

### **1. Goals**

To form a communication and collaboration bridge between the LT program and the Office of Space Science (OSS) and the Human Exploration and Development of Space (HEDS) enterprise.

### **2. Approach**

- Present and demonstrate LTP products to OSS and HEDS staff and scientists
- Seek out non-LTP efforts within the OSS and HEDS to determine what links would be productive.
- Foster collaborations between LTP and OSS/HEDS

#### *2.1 Implementation Strategies*

Strategies will include but not be limited to: Web searches for OSS and HEDS educational material; attending OSS and HEDS seminars and presentations; and phone calls and meetings with OSS and HEDS staff.

### **3. Milestone Timeline**

TBD

### **4. Deliverables**

None

### **5. Evaluation**

TBD

### **6. Dissemination and Public Relations**

As currently conceived, this effort will consist completely of dissemination and public relations.

### **7. Budget**

SSC labor:

OSS Liaison	0.5 FTE	\$85K
HEDS Liaison	0.5 FTE	\$85K

**Total: \$170K**

## **25.5 A5 Learning Technologies Project Office (Task 45)**

### **1. Goals**

The LT Project Office support staff maximizes the delivery and impact of NASA online education programs. The Project Office explores emerging technologies and engages LTP customers in the use of these educational technologies. The Project Office provides technology dissemination through development and later, presentations and demonstrations. It also assists the LT Project Manager in developing partnerships with the greater educational community.

### **2. Approach**

The LT Project Office performs these functions through the implementation of technical research and education programs; constructing, maintaining and coordinating the technology necessary to manage the project; preparing, submitting, and presenting reports, reviews and projections to senior management and other actions which assure the overall integrity of the project. Staff provide general project management support of the Project Office, LTP community outreach, an LTP presence at conferences and conventions, and general LTP industry collaborations including LTP product dissemination.

The Regional Outreach Center (ROC) Coordinator is responsible for the coordination of activities of the NASA Center Projects within the ten LTP regional NASA centers. The ROC Coordinator keeps in regular communication with the regional centers to assure continued technical progress along with compliance with the reporting requirements of the Project Office. The ROC Coordinator also provides resource advocacy, as necessary, to the Project Office and coordinates bimonthly teleconferences.

### **3. Milestone Timeline**

SuperComputing '98 LTP Booth	11/98
National Science Teachers Association conference network	03/99
InterCenter Working Group Video Conferences	11/98
	01/99
	03/99
	05/99
	07/99
	09/99

### **4. Deliverables**

- Learning Technologies Project monthly reports
- Bi-monthly InterCenter Working Group Video Conferences
- Conference Support

### **5. Evaluation**

The LT Project Office is responsible for ensuring that metrics for LTP activities are entered into the EDCATS system. In FY99 this will be done at the center level with LT Project Office oversight.

## **6. Dissemination and Public Relations**

The LT Project Office works with the regional centers, other groups in NASA, and outside of NASA to disseminate LTP products and services.

## **25.6 A6 Learning Technologies International Projects**

### **1. Goals**

Increase awareness of NASA's Learning Technologies with international partners.

### **2. Approach**

- *International Projects*
  - Access and collect all international requirements
  - Design and develop solutions to challenging international tasks
  - Moderate the implementation of cutting-edge technologies
  - Task and track execution of deliverables
- *Interagency Projects*
  - Coordinate with other Federal agencies as necessary to satisfy LTP international objectives
  - Operate within a coordinated budget to achieve project objectives
- *Leading-edge Technology Platforms*
  - Design and develop RealAudio™ testbed to serve 5000 schools
  - Implement testbed as LTP budget permits

### **3. Milestone Timeline**

- 1st Quarter FY99: Live international coverage of historic John Glenn's Space Shuttle flight via the Internet
- 2nd Quarter FY99: Select technical demonstrations
- 3rd Quarter FY99: Design and develop strategies for demonstration implementations
- 4th Quarter FY99: Conduct French space agency (CNES) demonstration

### **4. Deliverables**

Technical demonstrations.

### **5. Evaluation**

Successful implementation of leading-edge technologies platforms.

### **6. Dissemination and Public Relations**

Coordinate with other Federal agencies as necessary to satisfy LTP international objectives.

### **7. Budget**

Support Service Contractor	0.67 FTE	\$40.0K
Non Civil Servant Travel		\$5.0K
Facilities, logistics, rentals		\$1.0K
<b>Total</b>		<b>\$46.0K</b>

## **25.7 A7 Learning Technologies Cooperative Agreement Notice Solicitation**

### **1. Goals**

To attract and procure approximately six projects that will integrate the Internet and other information technologies to direct the unique knowledge that flows from NASA's aeronautics, space and Earth system research into the K-12 classroom. Collectively, these projects will represent all four NASA Enterprises.

### **2. Approach**

These projects will be procured using a Cooperative Agreement Notice (CAN) titled Leading Educators to Applications, Research and NASA-related Educational Resources in Science (LEARNERS). We will do as much of this solicitation online as is possible.

#### *2.1 Implementation Strategies*

The LEARNERS CAN will be advertised via email and postcard mailing using distribution lists from each of the NASA Enterprises and the NASA HQ Education Office. The LEARNERS CAN will also be advertised in the Commerce Business Daily.

The LEARNERS CAN will be made available over the Internet from various servers in the LTP program including RSPAC, the Quest server and the Visualization of Remote Sensing Data (RSD) server.

Short (~five-page) proposals will be submitted online. These short proposals will be evaluated by mail and/or online by a diverse panel of evaluators in order to select approximately 30 superior proposals. Those 30 proposers will then be asked to submit a full (~30-page) proposal. A final evaluation panel will then read all 30 proposals, meet together for a selection conference and recommend a small subset for selection to the selection official.

#### *2.2 Collaboration with Other LTP Centers*

The selected cooperative agreements will be procured through the Goddard Space Flight Center Procurement Office.

### **3. Milestone Timeline**

December 1, 1998	Final draft of CAN online. Email announcements sent out.
January 14, 1999	Online Pre-Proposal Conference with online chat sessions
March 1, 1999	Short proposals due. Review begins.
April 5, 1999	Request for full proposals sent out
May 3, 1999	Full proposals due
June 1-4, 1999	Final selection committee meets
June 10, 1999	Winning proposals awarded
July 15-August 1, 1999	Winning proposals negotiated and signed

#### 4. Deliverables

Signed Cooperative Agreements

#### 5. Evaluation

On-time selection of superior projects.

#### 6. Dissemination and Public Relations

The LEARNERS CAN will be advertised via email and postcard mailing using distribution lists from each of the NASA Enterprises and the NASA HQ Education Office. The LEARNERS CAN will also be advertised in the *Commerce Business Daily*.

The LEARNERS CAN will be made available over the Internet from various servers in the LTP program including RSPAC, the Quest server and the Visualization of Remote Sensing Data (RSD) server.

Successful proposals will be announced via normal NASA Press Release channels.

#### 7. Budget

Awarded Cooperative Agreements		\$975K
Evaluation Panel		10K
Travel, Civil Servant	\$5K	
Travel. Non Civil Servant	3K	
Meeting rooms, mailing, logistics	2K	
CAN preparation, dissemination, proposal collection/tracking		95K
SSC labor 0.7 FTE	\$95K	
<b>Total</b>		<b>\$1,080K</b>

## **25.8 A8 Learning Technologies New Solicitation Conference**

### **1. Goals**

Facilitate the dissemination of the Cooperative Agreement Notices.

### **2. Approach**

Gather the perspective applicants from abroad via the Web using the Learning Technology Channel for the purpose of presenting the opportunity and asking questions over the Web.

### **3. Milestone Timeline**

December 1998 Meetings to be held in conjunction with the CAN from GSFC.

### **4. Deliverables**

Meetings.

### **5. Evaluation**

Participants will fill out online surveys.

### **6. Dissemination and Public Relations**

These meetings will be for prospective applicants only.

### **7. Budget**

Non Civil Servant Travel	\$3.0K
Brochures and Publications	\$2.0K
Facilities, logistics, rentals	\$5.0K
<b>Total</b>	<b>\$10.0K</b>

## **25.9 A9 Learning Technologies Regional Conference**

### **1. Goals**

Facilitate the interactions of all LTP participants.

### **2. Approach**

Gather the LTP participants from NASA Centers and from externally funded projects in one place to allow face-to-face sharing of ideas, accomplishments and aspirations.

### **3. Milestone Timeline**

March 1999 Meetings to be held in conjunction with the LTP Advisory Panel at either Kennedy Space Center or Goddard Space Flight Center.

### **4. Deliverables**

Meetings.

**5. Evaluation.** Participants will fill out online EDCATS survey.

### **6. Dissemination and Public Relations**

These meetings will be for LTP and Education Office participants only.

### **7. Budget**

Non Civil Servant Travel	\$3.0K
Invited Speakers	0.5K
<u>Facilities, logistics, rentals</u>	<u>6.5K</u>
<b>Total</b>	<b>\$10.0K</b>

**25.10 A10 ARC Learning Technologies Regional Projects  
NASA Ames Quest Team FY 99 Proposal**

***Sharing NASA  
Learning Technologies Channel***

***Introduction***

In Fiscal Year 1999, the NASA Ames LTP team again proposes two major activity areas: Sharing NASA and the Learning Technologies Channel. Our intention is to build on the success that these activity areas have had in the past, expanding the scope of existing activities, improving the content and delivery of resources, and aggressively seeking to expand our audience.

**25.10.1 Sharing NASA**

Sharing NASA is a suite of projects which use network technology to make NASA programs accessible to students by connecting them in an exciting, interactive way with NASA scientists, engineers and others in math- and science-based careers. As we continue to develop our expertise in conducting these projects, we will also continue to spread the word among NASA organizations about our capabilities of doing educational outreach.

**1. Goals**

- Use NASA-related topics to enhance teachers' content and pedagogical knowledge in mathematics, science and technology.
- Use NASA-related topics to enhance teachers' capabilities to design and implement more stimulating and engaging lessons and experiences for students.
- Cultivate an awareness of career opportunities in mathematics, science and engineering. Inspire students to pursue technical careers through use of the Internet and by focusing on dynamic and enthusiastic people doing exciting work at NASA.
- Connect NASA with public

**2. Approach**

Sharing NASA projects focus on the people behind-the-scenes, and most of these projects have consistent project elements such as biographies, field journals, chats, email Q&A, etc. We have learned that short-duration projects present various difficulties for teachers; this year as in last, we intend for all our projects to last throughout the school year whenever possible.

In conducting these projects, we intend on using the following implementation strategies:

- Customer Involvement

We rely very heavily on educator input in designing Sharing NASA projects. Input from evaluations of previous projects are incorporated into the planning of future projects. We receive constant feedback throughout a project in the form of email, QuestChat comments, surveys, and conference interactions. Evaluations from participants are solicited throughout each project.

- Integration with NASA Education Office

The Ames K-12 team is very mindful of its relationship with the Education Office and makes every effort to keep them informed of our activities. This summer, we met with the Ames Education Office to brief them on our FY 99 plans and solicit their ideas and feedback.

- High-level partners

This year we are renewing our partnerships with the JASON Project and are continually pursuing partnerships with other organizations external to NASA.

- Training

Our projects include suggestions for use in the classroom, and forums for teachers to discuss this issue with other educators and with us.

In order to fully maximize LTP results, the following collaborations are planned for Sharing NASA Projects:

- Lewis Research Center (LeRC)

In partnership with various NASA LeRC researchers, LeRC LTP will provide information and Web pages to Aero Design Team Online coordinators in order to represent NASA LeRC more fully as part of the Aero Design Team Online project.

Also, LeRC LTP will facilitate Franklin D. Roosevelt Middle School's involvement in the Wright Flyer Online project.

- Langley Research Center (LaRC)

LaRC LTP is helping Aero Design Team Online recruit and manage ADTO volunteers.

- Johnson Space Center (JSC)

Quest will incorporate Qwhiz into several Sharing NASA projects (beginning with Space Team Online). Quest plans to take Qwhiz from beta test to operations. JSC and Quest will negotiate actions to be taken on bug-fixes and function changes.

- Robotics: LaRC/LeRC/JSC

Quest hopes to host a chat series with robot experts from these centers.

- Kennedy Space Center (KSC)

KSC LTP will support Space Team Online by coordinating KSC experts and hosting live events.

- Dryden Flight Research Center (DFRC)  
Proposal to do QuestChats for ERAST project
- Marshall Space Flight Center (MSFC)  
Proposed use of Alabama network to spread the word about Quest.

### **3. Milestone Timeline**

- Oct. 98 Continue operating STO, ADTO, MTO and WON projects throughout school year
- Oct. 98 Support TGIR Conference
- Oct. 98 Place ADTO lessons for wind tunnel test online
- Nov. 98 Incorporate JSC's Qwhiz software in Sharing NASA projects
- Dec. 98 Complete ADTO's first collaborative event
- Jan. 99 Survey Women of NASA audience
- Feb. 99 Survey Shuttle Team Online audience
- Mar. 99 Begin STO collaborative event
- Apr. 99 Implement a student puzzle/contest for STO
- Apr. 99 Virtual Take Our Daughters To Work Day
- Apr. 99 Complete ADTO's second collaborative event

### **4. Deliverables**

Projects that connect students nationwide with real NASA experts and assist educators in integrating the Internet into the curriculum, including:

- Shuttle Team Online  
Focused on NASA's human space flight program, including the space shuttle and the International Space Station.
- Aero Design Team Online  
ADTO is about NASA's diverse aeronautics mission and features aero experts from Ames, Lewis and Langley Research Centers. A significant part of this year's ADTO will be Wright Flyer Online, focusing on the Wright Flyer Project in which a full-sized replica of the 1903 Wright Flyer, flown in the first-ever, powered flight, will be tested in a wind tunnel at NASA Ames Research Center. Quest was also awarded \$50,000 by the Federal Consortium for Education which will be used to enhance ADTO and WFO.
- Women of NASA

Various NASA women online through chats and biographies to serve as role models, encouraging young girls towards science/technology careers. Also available are resources for teachers who are trying to deal with the issue of gender-equity. Women of NASA is less involved than other Sharing NASA projects; for example, no email Q&A service is provided. Several Women of the World special events, including Virtual Take Our Daughters To Work Day, will be scheduled to share careers outside of NASA.

- Mars Team Online

MTO is about the men and women who work on uncovering the mysteries of Mars. It is currently operating as a scaled-down project, offering chats and email Q&A, as well as a plethora of static resources, but with little new content and no collaborative activities.

## 5. Evaluation

The customers of each project will be periodically surveyed through email and Internet to assess their likes and dislikes and to provide us with feedback on how we can improve the projects. In addition, after each Web chat, we encourage users to complete one of three online surveys depending on whether they registered and participated, registered but did not participate, or observed only.

We have been using survey software that automatically compiles the results. This makes it much less labor intensive to get results. These surveys are conducted via email and the Web. The addresses come from both the project's email list and a registration page which is available on the Web.

Typical questions we ask are:

- What is your involvement with, or interest in, Project X?
  - a) As a K-12 teacher working in a public or private school actively using it with students.
  - b) As a K-12 teacher or educator using it for professional development but currently not with K-12 students.
  - c) As an adult working with students in an informal or after-school setting.
  - d) Other.
- If you used this project with students, please indicate how many students were involved.
- How would you rate this project/event/etc., on a scale of 1 to 5 where 1 is poor and 5 is excellent?
- We are interested in which parts of Project X you used. Please check all of the resources that you used or read
  - a) Biographies of NASA people
  - b) Field Journals

c) QuestChats

d) Email Q&A

## 6. Dissemination and Public Relations

- Delivery over the Internet
- Advertisement via maillists, conferences, speaking engagements, etc.
- Spread the word via the thousands of teachers who have previously utilized our projects
- Quest Public Service Announcement played on TV Stations across the country

## 7. Budget

Labor (SSC)	\$332,600
Hardware/Software	\$15,000
Travel (SSC)	\$15,000
Directorate Taxes	\$7,400
<b>Total</b>	<b>\$370,000</b>

## **25.10.2 Learning Technologies Channel**

This year we intend to continue operation of the Learning Technologies Channel (LTC). The LTC provides educators and the general public with a location on the Internet that allows them to participate in live events such as lectures, conferences, virtual field trips, and online courses.

### **1. Goals**

- Through integration of various network technologies, remove the barriers of distance, budgets, etc., allowing educators nationwide to virtually come together to attend various lectures and workshops.
- Conduct meaningful activities that attract large numbers of participants.
- Accommodate low- and high-end users.

### **2. Approach**

Various technologies will be used to broadcast lectures and events over LTC, including Web graphics, QuestChat, RealMedia, and occasionally CU-SeeMe and MBone. A concerted effort will be made to improve the layout and presentation of LTC, making the site more user-friendly and encouraging increased participation.

In conducting these projects, we intend on using the following implementation strategies:

- Customer Involvement

Evaluations from participants will be solicited at the end of each event in an effort to continually improve our offerings.

- Integration with NASA Education Office

We will be working with the Ames Education Office to broadcast teacher workshops over the LTC and with the Headquarters Education Office to broadcast NASA TV educational programming.

- High-level Partners

Last year we partnered with several outside organizations in order to provide a wide variety of content. This year we intend to continue to pursue partnerships, internal and external to NASA. LTC programming is currently being planned for FY99 with organizations including the Department of Education, NOAA, GTE/Americast, Texas Park and Wildlife Department and NASA TV.

- Training

LTC will be a forum for teacher training. For example, presentations on using LTP aero resources in the classroom will be online in October.

The following LTP collaborations are planned for LTC:

- Jet Propulsion Laboratory

Quest person on-site at JPL to help coordinate LTC programs on JPL topics (i.e., Mars or Cassini). Project SPACE will have an opportunity to become familiar with LTC in a hands-on way.

- Kennedy Space Center

Quest will work with KSC people to help them turn the PAER workshops into LTC virtual events.

- Lewis Research Center, Langley Research Center

LeRC and LaRC are providing RealMedia presentations for educators on using their aero resources (FoilSim, Off to a Flying Start).

- Learning Technologies Project

Quest's LTC is part of the LTP Digital Audio Testbed.

### 3. Milestone Timeline

Oct 98	Begin Astrobiology lecture series
Oct 98	"Eye of the Storm" hurricane events
Oct 98	Support TGIR conference
Oct 98	"The Cutting Edge"-NASA TV programs on Oceans
Oct-Dec 98	Host online Space Station tours
Dec 98-May 99	Kid video festival
Jan 99	Revise LTC pages

### 4. Deliverables

- Online access to live and archived events via integrated Internet technologies. Examples of programming include:

#### Eye of the Storm

Special events that will explore many aspects of Hurricanes.

#### Astrobiology Series

Series of lectures by leading astrobiology experts at Ames Research Center, focusing on six important questions dealing with life and the universe.

#### Turning Goals into Reality

The TGIR Conference is being held at LeRC as means to provide a progress report to the American people on aeronautics. LTC will simulcast conference proceedings, provide interactivity via a chat room, host virtual tours of several facilities, and provide presentations to educators on using LTP aero resources.

#### NASA...On the Cutting Edge

A series of exciting, interactive educational live shows from the NASA Teaching from Space Program at Oklahoma State University, in cooperation with OSU's

Educational Television Services. LTC will be simulcasting two programs on oceans, followed by a chat session with the scientists.

Space Station Tours

Monthly live tours of the International Space Station mockup and training facility. Questions for the tour guide are accepted via a chat room.

Satellite Town Meetings

Monthly broadcast of the Department of Education Satellite Town Meetings with Secretary Richard Riley. Questions for Secretary Riley are accepted via a chat room.

**5. Evaluation**

Surveys of various events will be conducted via email.

**6. Dissemination and Public Relations**

- Delivery over the Internet
- Advertisement via mail lists, conferences, speaking engagements, etc.
- Spread the word via the thousands of teachers who have previously utilized our projects

**7. Budget**

Labor (SSC)	\$100,000
Hardware/Software	\$17,400
Travel (SSC)	\$10,000
Directorate Taxes	\$2,600
<b>Total</b>	<b>\$130,000</b>

## **25.11 A11 Dryden Flight Research Center Learning Technologies Regional Project**

The Dryden Learning Technologies Project centers on the Web-Enhanced Learning Environment Strategies (WELES). The WELES were developed as part of a three-year educational research project with the Pennsylvania State University. This is the final year of this educational research. Next year, we intend to reinitiate our effort evaluation of NASA Websites intended for educational use.

### **Teacher Training & Tools for Web-Based Science, Math and Technology Instruction and Learning**

#### **1. Goals**

The purpose of this research grant is to develop, implement and evaluate instructional material to allow teachers to use NASA-related materials on the World Wide Web effectively and efficiently for teaching science, math, and technology, and to investigate the impact of this material on teaching and learning.

The results of the first two years yielded the development of the Web Enhanced Learning Environment Strategies, a teacher-friendly method of enhancing instruction using current teaching practice. This next year is the third and final year of validation and testing of the real impact of the WELES on using NASA materials in their classroom to enhance instruction.

#### **2. Approach**

This year's research will consist of the following activities:

- Complete the Validation of the Web Enhanced Learning Environment Strategies (WELES).

The WELES are currently being sent to instructional design experts, and in the near future will be sent to NASA Education officers to validate the content of the model. This work will be concluded.

- Conduct a large group field study.

For the large group field study, at least 40 teachers from different sites and education levels (approximately 10 from each level) will be selected as beta test centers for the WELES materials. Reactions will be gathered in three areas: practicality, user-friendliness, and effectiveness.

- Conduct an impact study.

During this phase, teachers who participated in the pilot field trial, as well as any new users/participants (teachers), will be followed to determine the impact of the instruction on teaching practice, and diffusion of Web-based instruction in their schools. In addition, use of the NASA Web sites will be tracked, and users asked similar follow-up questions regarding teaching practices and school diffusion. The NASA Websites that are used by these teachers will be tracked to determine if any

new sites were used as a result of the WELES. We will also attempt to identify those teachers who visit the WELES Website to determine how useful the information on the site was to them, and if they were able to use any of the strategies presented there.

- Refine the WELES teacher training document and reflection tool.

The WELES teacher training document and reflection tool is in its fourth revision based on input from the ongoing evaluation. The WELES teacher training document and reflection tool will continue to be refined according to the data gathered from the field study and impact study.

- Refine and document an exportable teacher workshop.

This workshop will be developed such that it could be marketed for in-service training in schools. These materials will be tested for usability.

- Refine the WELES Website.

The Website that follows and reports the development of the WELES is for information purposes about the WELES, and will function as a tool to support the teacher workshop, however, it is not proposed as a substitute for this workshop. It is important to note that the WELES enhance in-class teaching. In order to demonstrate how the Web enhances teaching, the workshop must have an in-class instructional component.

- Write three journal articles reporting on the results of 1) the small group study, 2) the field trial and 3) the impact study.

Proposals to the NSTA and AECT national and INET international conference will also be written to report on these results.

- Develop an implementation plan.

This plan will consider strategies for using the WELES to diffuse NASA educational Websites into the school system.

### 3. Milestone Timeline

Activities	Milestone Timeline
1. Complete the validation of the Web Enhanced Learning Environment Strategies (WELES). Write Technical Report	9/1/98 - 2/28/99  3/1/99 - 4/15/99
2. Conduct a large group field study. Write Technical Report	9/1/98-12/30/98  1/2/99 - 2/15/98
3. Conduct an impact study. Write technical report	1/1/99-6/15/99  6/15/99 - 7/31/99
4. Refine the WELES teacher training manual and reflection tool.	10/1/98-6/30/99
5. Refine and document an exportable teacher workshop.	7/1/99-9/30/99
6. Refine the WELES Website.	10/1/98-9/30/99
7. Write three journal articles reporting on the results of 1) the small group study, 2) the field trial and 3) the impact study.  8. Proposals to the NSTA and AECT national and INET international conference will also be written to report on these results	10/1/98-1/31/99 2/1/99-5/31/99 6/1/99-9/30/99  2/99, 5/99, 6/99
9. Develop an implementation plan	6/1/99 -9/30/99

#### 4. Deliverables

Activities	Deliverable
1. Complete the validation of the Web Enhanced Learning Environment Strategies (WELES).	Technical report on the results of the WELES validation.
2. Conduct a large group field study.	Technical report summarizing the results of the field trial
3. Conduct an impact study.	Technical report summarizing the results of the impact study
4. Refine the WELES teacher training document and reflection tool.	WELES publication
5. Refine and document an exportable teacher workshop.	Teacher Workshop Manual
6. Refine the WELES Website.	Informational Website
7. Write three journal articles reporting on the results of 1) the small group study, 2) the field trial and 3) the impact study.	Three journal articles
8. Proposals to the NSTA and AECT national and INET international conference will also be written to report on these results	Three presentation proposals
9. Develop an implementation plan	Technical report documenting the implementation plan

#### 5. Evaluation

Evaluation is occurring throughout the development of the WELES and consists of review by experts, NASA education specialists, and classroom teachers. For the large group study, 40 teachers will use a variety of self-report instruments including weekly logs, attitude surveys, reflection tools, listserv discussions, and follow-up interviews. For the impact study, all teachers who participated in the multiyear WELES research will report about their use of NASA Web resources, WELES, and about changes in their teaching practices and school diffusion of Web-based instruction.

#### 6. Dissemination and Public Relations

## 7. Budget

Dryden requests \$150K in FY99 to implement its Learning Technologies Project: Teacher Training & Tools for Web-Based Science, Math and Technology Instruction and Learning

Pennsylvania State University Grant	\$75K
Support Service Contractor (50% FTE)	\$45K
Web Support (50% FTE)	\$45K
<i>SubTotal</i>	<i>\$165K</i>
Center Contribution	\$15K
<b>Total Request</b>	<b>\$150K</b>

## **25.12 A12 Goddard Space Flight Center Learning Technologies Regional Project**

### **The 1999 GSFC Earth System Science Education Project (GESSEP)**

#### **1. Goals**

The Goddard Space Flight Center (GSFC) Education Office, through its curriculum support component of the NASA and GSFC education frameworks, is charged with providing materials that support both national standards and state curricular frameworks, as well as incorporate the knowledge being generated through NASA enterprises. In addressing this mandate, the proposed FY99 LTP activity seeks to:

- Foster the implementation of NASA/Goddard Earth and space science resources available on the World Wide Web into viable classroom activities.
- Use the Internet as a major communication vehicle for the dissemination of Earth and space science curricular support materials to Earth and space science teachers primarily at the secondary level.
- Develop a resource bank of Earth and space science activities using Internet Web sites linked to the resources of the Earth and space science directorates at NASA/Goddard.
- Correlate the instructional resource bank with national standards for Earth and space sciences.

#### **2. Approach**

Twenty Earth and environmental science teachers will continue the work begun in FY97 and FY98 to develop Internet-based Earth system science instructional activities that incorporate NASA data. In FY97, a repository of 43 "Investigations" for grades 5-8 and 9-12 was developed during a four-week summer workshop at GSFC, converted to HTML format, and put through a content validation process with OES scientists. In FY98, content validation on those Investigations was completed, work began to put those Investigations in a standardized format and a pilot testing and evaluation framework was put in place. An additional 22 Investigations (with accompanying abstracts) were developed at a follow-on summer workshop, and those also entered the "finishing" process. All Investigations are appended with an evaluation form, and this feedback will be used to refine the Investigations and determine relative value of each Investigation in the classroom.

Dr. Gil Austin, former Executive Director of the Center for Educational Research and Development at the University of Maryland Baltimore County, will analyze the evaluation data for validity. In FY99, the piloting process will take place on the FY97 and FY98 Investigations during the 1998-1999 school year. Additionally, teachers will expand the repository with a new set of Investigations to be developed in an August, 1999 workshop. Participants in this workshop will be drawn from the full GSFC Educational region.

As in FY98, particular focus will be on developing Investigations directly related to NASA Earth and space science projects, and teachers will be paired with scientists representing various NASA projects. This project will be conducted in partnership with the GSFC Education Office, NASA Headquarters Code FE, Earth Science Enterprise Education Office, the Maryland State Department of Education, the MSFC LTP Project, and twenty local Maryland School Systems.

### *2.1 Implementation Strategies*

The following implementation strategies of LTP have been incorporated into this project: needs assessment, customer involvement, integration with NASA Center Education office, high level partners, and training. A needs assessment from the Maryland Earth and Environmental Science Teacher Ambassador Program led to the GESSEP concept from the beginning. Teachers trained in the use of the Internet complained of the lack of ready-to-use activities available on the Internet to integrate the Internet into the Earth science classroom. A subset of these same teachers (customer involvement) were consequently empowered to develop such activities, and will receive any feedback on the Investigations generated by pilot test teachers.

The GESSEP project is a multipartner effort, with LTP and the GSFC Education Office as prime contributors. The local school districts of Maryland are also partners, and participate in the Steering Committee. Finally, in addressing training, one requirement in the design of the Investigations was and continues to be that they are all self-explanatory—any teacher or learner can complete the Investigations without additional (external) training. This feature greatly increases the potential customer base and probability for successful use of the Investigations.

### *2.2 Collaboration with Other LTP Centers*

GSFC will partner with MSFC in the pilot testing of the FY97 and FY98 GESSEP Investigations. Also, while GSFC is focusing on the development of Investigations targeted at secondary schools, MSFC will complement this effort by developing similar Investigations, targeted at the K-4 level.

## **3. Milestone Timeline**

- Evaluation of '98 Investigations completed by scientists, aerospace specialists in workshops, Ambassadors and other Earth science teachers and students in their classrooms, WWW template developed, final revisions, approval, and available on the Internet for all —10/1/98
- Steering committee convened, preparation and planning of Summer '99 workshop and review of '97 and '98 program — 12/1/98
- Provide final report on Investigation evaluation process, submitted by Dr. Gil Austin —12/98
- Complete pilot testing of '97 and '98 Investigations and analyze evaluation data each semester —1/99 and 6/99
- Workshop held at GSFC —7/12/98-8/5/98

- Evaluation of '99 investigations, final revisions, approval, and availability on the Internet for all—8/8/99 - 9/30/99

#### 4. Deliverables

Internet-based interactive Earth System and Space Science Investigations will be available on a GSFC Web Site for all interested learners. These Investigations will meet identified National science, math, and geography standards, and electronically bring NASA science missions into the classroom. Project reports for the '97, '98 and '99 projects will be available to all interested parties.

#### 5. Evaluation

Pilot testing of the FY97 and FY98 Investigations will occur during the 1998-1999 school year. Classroom teachers will register to pilot individual Investigations in their classrooms. GESSEP staff will contact them for completed evaluations after the planned pilot dates. GESSEP strives to collect 25 to 30 evaluations per Investigation to determine usability and needed modifications for each Investigation. Dr. Gil Austin will deliver a final report on his validity study of the Investigation evaluation data. Also, number of accesses to Web site and geographical distribution of accesses will be monitored. Teacher evaluation of the GESSEP program itself will be conducted via EDCATS.

#### 6. Dissemination and Public Relations

Activities distributed via the Web. The educational community will be made aware of them through links to the GSFC Education, ERC and LTP Home Pages as well as those of NASA Headquarters, Spacelink, Earth Science Enterprise, EOS Home Pages and others, and by posting notices to all possible education newsgroups, mailing lists and bulletin boards. The GSFC Education Office will oversee dissemination of information.

#### 7. Budget

Labor: 0.2 civil servant FTEs, 1.3 contractor FTE

(Note: manpower from the Education Office is not included. Their support includes ~1 Aerospace Education Specialist and 1+ teachers on loan.)

Teacher stipend (\$3.5 K x 20)	\$ 70K
Teacher room and board and transportation	\$ 30K
Contractor Technical Support (1.3 FTE)	\$ 113K
Summer workshop equipment rental	\$ 10K
Internet accounts for GESSEP participants	\$ 5K
<u>Staff support/consultants</u>	<u>\$ 10K</u>
Total funds required	\$ 238K
<u>- Funding from other sources</u>	<u>\$ 78K</u>
<b>Total FY99 funds requested</b>	<b>\$ 160K</b>

## **25.13 A13 Jet Propulsion Laboratory Learning Technologies Regional Project**

### ***Telescopes In Education (TIE) Program***

#### ***Project SPACE Program—Sun, Planets, Asteroids, Comets, Exploration***

### **25.13.1 Telescopes In Education (TIE) Program**

FY99 Proposal

September 1998

Project Manager: Gilbert A. Clark

Education Outreach Coordinator: Lori L. Paul

#### ***Background***

The Telescopes In Education (TIE) project brings the opportunity to use remotely controlled telescopes and Charge Coupled Device (CCD) cameras in a real-time, hands-on, interactive environment to students around the world. The TIE project has successfully automated a science grade 24" reflecting telescope located at the Mount Wilson Observatory in Southern California. In 1998 a 14" telescope at Mount Wilson was successfully operated remotely via the Internet. TIE telescopes are being used by students in grades 1-14 to observe galaxies, nebula, variable stars, eclipsing binaries, and other celestial objects.

The TIE project enables students of all cultural backgrounds and economic status, including those with physical disabilities, to increase their knowledge of astronomy, astrophysics, and mathematics; improve their computer literacy; and strengthen their critical thinking skills. TIE makes it possible for young people to conduct actual research, make discoveries in the areas of astronomy and astrophysics, and even publish their independent discoveries in appropriate science journals or the popular press.

An Internet server and video link used in conjunction with live audio in the 24" telescope dome on Mount Wilson allows students and teachers to observe and hear the telescope in motion as they remotely control the telescope through The Sky software.

#### **1. Goals**

- Provide access to as many students and educators as possible.
- Provide online training for as many educators as possible.
- Provide on site training to as many educators as possible.
- Provide a science research component that will challenge and stimulate as many students and educators that wish to do research within the classroom as possible.

## 2. Approach

Since the approach of providing telescope time and training has been so successful in the past, we will continue to do as much of that as we can with a staff of 1.3 personnel at JPL.

### 2.1 Implementation Strategies

- Needs assessment

TIE is severely constrained by the number of personnel available to do needs assessment, and funding constraints. We rely on input from our customers to be able to respond to any needs that they might have. Over the last five years, they have only requested more time on telescopes, telescopes to be located on the other side of the world (so they may be used during the normal classroom hours), and more advanced training.

- Customer involvement:

In addition to the ongoing program of soliciting input from the educators and students using the TIE program, TIE has developed a working partnership with the Montebello School district MASTERS program. TIE is working with 30+ middle school educators that have just received their MS in Science Education under an Eisenhower grant. These educators are involved in many levels of science education throughout the state of California. Some are involved in mapping the State Framework into the classroom, while others are on various committees within the California Science Teachers Association. The Montebello School District has over 33,000 students, most of which are primarily Hispanic lower/middle income minority.

- Integration with NASA Center Education Office

The TIE program is a part of the JPL (NASA Center) Education Office. Because of this, TIE has become a partner with several space projects.

- High-level partners

TIE has partnerships with several universities, planetaria, science centers, museums, colleges, school districts, and a number of partners within industry.

- Training

The TIE program has an active program of providing both local and remote training.

### 2.2 Collaboration with other LTP Centers

The Telescopes In Education (TIE) project will continue to collaborate with NASA Dryden Flight Research Facility, NASA Ames Research Center, and Goddard Space Flight Center (GSFC), and other NASA centers as opportunities for productive partnerships arise. Specifically, hands-on training, special astronomical events on Mount Wilson, and on-line Internet interviews and presentations.

Within the Jet Propulsion Laboratory (JPL), TIE is in the process of partnering with several active space exploration missions including: Cassini Program, Galileo

Extended Mission (GEM), Outer Planets/Solar Probe (OP/SP) consisting of the Europa Orbiter, Pluto, and Solar Probe missions, the Mars Programs, Stardust, ACRIM, and SIRTf.

### **3. Milestone Timeline**

- a. Monthly LTP reports will be submitted monthly as funding allows.
- b. Annual LTP report will be submitted in July.
- c. HPCC annual report will be submitted in August.
- d. LTP Annual proposal will be submitted in September.
- e. TIE will participate in 2 LTP required conferences - dates TBD.
- f. TIE training will be provided on Mount Wilson once per quarter as funding allows.
- g. TIE will provide hands on training twice during summer break as funding allows.
- h. TIE will attend at least three conferences - one per quarter as funding allows.
- i. TIE will update the Website monthly.

### **4. Deliverables**

Submit monthly reports as funding allows, and deliver an annual report in 1999 that summarizes TIE activities and accomplishments.

The TIE task will continue to provide K-12 schools with remote access to the automated 14" and 24" telescopes on Mount Wilson as funding allows.

TIE will continue to disseminate information (as funding allows) about the TIE system to the educational community in a way that encourages the widest possible participation of students, teachers, and schools in real-time, remote operation of telescopes. This includes information made available through the TIE Website.

TIE will conduct five comprehensive, on-site educator workshops (as funding allows). The training program will give educators the basic, intermediate, or advanced skills necessary to integrate hands-on astronomy into their established science curricula.

Wherever it is economically feasible, TIE will continue to offer an effective demonstration program which will bring information and examples of remote astronomy projects to educators and students. This includes TIE participation in appropriate conventions (such as NSTA and CSTA if allowed to go - last year there were NASA sanctions that prevented the TIE program from participating in NSTA), JPL project educator workshops, County Fair Education Expositions, and so forth.

### **5. Evaluation**

The Telescopes In Education (TIE) program will use the Learning Technologies Program (LTP) evaluation metrics. Last year the TIE program exceeded the metrics assigned many times over. The TIE program has a consistent level of success for

more than five years running, and receives more acclaim and stories of success within the class rooms as each month passes.

## 6. Dissemination and Public Relations

Due to the high profile of the TIE program, each year for the last four years TIE has been highlighted in national and international TV, cable, radio programs, news papers, magazines, referenced in science publications, and referred by national organizations. TIE information receives the widest dissemination, and is staffed by only 1.3 personnel at JPL, so there is no concerted plan to augment the natural dissemination and public relations that have evolved based on the popularity of the program.

## 7. Budget

### Fiscal Year 1999 Funding TIE for October through February, 1999

Item Description:	Estimated Costs:
<b>TIE Mount Wilson Costs :</b>	
Telescope engineer, part time scheduler, part time accountant, telescope site fees, hardware maintenance	50K
<b>Hands-on Research Module Development</b>	
Personnel, Materials	10K
<b>Travel:</b>	
LTP Conference and vendor travel.	10K
<b>Hardware/Software:</b>	
Modification and Improvement	5K
<b>JPL Personnel Costs:</b>	80K
<b>Sub-Total for Fiscal Year 1999</b>	<b>\$155K</b>

**Note:** TIE is only funded at \$155K which will only keep the program in operation from October through February 1999. TIE will produce monthly reports through February 1999, and attend two LTP conferences due to funding constraints. A final report will be generated at the end of February unless funding can be found through other sources. Currently the expectation is for ~\$50K support from Code S, and ~\$60K support from various space flight projects using the TIE program.

### **25.13.2 Project SPACE Program—Sun, Planets, Asteroids, Comets, Exploration**

Project Leader: Michael A. Garcia

Co-Investigator: Dr. Bruce C. Payne

Educational Affairs Office

Jet Propulsion Laboratory, California Institute of Technology

#### **Project Description**

The Project SPACE (Sun, Planets, Asteroids, Comets Exploration) Program is a NASA/Jet Propulsion Laboratory educational technology program which integrates advanced computer technology, complex scientific data sets and a variety of scientific technologies into educational curriculum resources, models, simulations and classroom activities that support the national reform efforts in science and mathematics education. Project SPACE educational curriculum resources are designed for Middle and Secondary School Educators and Students.

#### **1. Goals/Needs**

The goal of Project SPACE is to provide educational curriculum resources over the Internet that expose teachers and students to updated curriculum models, new teaching methodologies and technologies, and their application in the classroom.

Based on teacher feedback (Educator Conferences) and studies done by NASA's Learning Technology Project (LTP) educators have indicated that they have few such resources available to them, and few if any that are reviewed for appropriate content and alignment.

#### **2. Approach**

Project SPACE will accomplish its goals in the following ways:

- The extensive image, movie, classroom activity and animation library that has been produced as part of the Project SPACE Program will be repurposed into fresh interactive Website products. Additionally, we are taking into account recent LTP Website evaluation findings. These new curriculum products will be placed into a substantially updated and revised Project SPACE Website.
- Educator Inservices will be conducted that utilize LTP products, models, resources and educational methodologies.
- Dissemination of information and resource products will be coordinated with local school districts, and at regional and national educator conferences.
- Project SPACE will involve and work closely with our customers (educators and students) and our Educational, Industrial and Strategic partners. We will continue to form partnerships to leverage LTP resources.

## *2.1 Implementation Strategies*

Project SPACE Program will use the following implementation strategies as derived from the LTP Plan for Education. As follows:

- Needs assessment

The need for these types of curriculum resources are highlighted by the content contained within the National Education and Science Standards, Benchmarks, Frameworks, and the “Technology for All Americans” document. At a meeting attended by Southern California School District Superintendents and Educational Outreach staff from both JPL and NASA Headquarters, it was pointed out that there were no models of systemic change in a classroom that the districts could point to or use as examples or models for their districts. The clear need, that has been shown by these two examples, was the basis for the Project SPACE Program.

- Customer involvement

Project SPACE will involve and work closely with our primary customers, educators/students by: 1) Asking teachers what they really need for their classroom, 2) Involving teachers and students in the design/production process, 3) Partnering with Schools/School Districts, and 4) Employing teachers/students to evaluate curriculum resource products and test for classroom impact.

- Integration with NASA Center Education Office

Project SPACE originates out of JPL’s Educational Affairs Office. We will continue to work closely with JPL Project and Program Office Educational Outreach administrators.

- High-level partners

Project SPACE will continue to involve and work closely with our Educational (Pomona Educational Foundation), Industrial (Silicon Graphics, Inc.) and Strategic partners (California Community Colleges, Los Angeles Unified School District, California State Framework Committee). We will also continue to form partnerships that leverage LTP resources.

- Training

Educator Inservices will be conducted using JPL’s Applied Science and Technology Classroom. These inservices will utilize LTP products, models, resources and educational methodologies.

## *2.2 Collaboration With Other LTP Centers*

Project SPACE will collaborate with two LTP Centers in the coming year.

- Project SPACE will partner with the Ames Research Center, LTP’s Learning Technology Channel (LTC) to provide program content. We will be working with Karen Traicoff, ARC, Mark Siegel, ARC, and Dan Helfman ARC/UCLA. The plan is to: 1) Disseminate information and video (real-time and recorded) about NASA/JPL Missions, Projects and Special Events using on-line audio and video streams, and

2) Allow the audience to interact with the presenters by submitting questions and comments over the Internet, via a "Text Chat Room." The ground work for this collaboration began during FY '98. So that this unique partnership can occur, an office space, telephone and Mac workstation with Internet access will be provided for Dan Helfman at JPL (he will be sharing an office with Michael Garcia). Appropriate events will be coordinated with NASA Code FE, JPL EAO and PAO, and the ARC LTP/LTC Office.

- Project SPACE will also partner with Lewis Research Center. The plan is for Project SPACE to conduct educator inservices that utilize LeRC LTP products, models, and resources, including: 1) The "Beginner's Guide to Aerodynamics," 2) "FoilSim," 3) lesson plans and activities for grades 8-12 based on aeronautics missions, 4) "Aeronauts 2000" Web-based aeronautical problems, and 5) a wind tunnel scale model.

### 3. Milestone Timeline

Project SPACE Milestone Timeline FY '99

Item	Description	Timeline
1	Internet/Curriculum Support Products: Teacher Curriculum Support Products and Student Activities	Delivered monthly: October, '98 - September, '99
2	Teacher Inservices / Workshops	Conducted January, '99 - September, '99
3	National Educator Conferences: Four of Five of the following: NSTA, ASCD, ITEA, CCCF, NECC, and CUE; Presentation/Demonstration	Fiscal Year '99
4	Teacher/Student curriculum products Project SPACE Website Library	Fiscal Year '99

### 4. Deliverables

*Background:* The Project SPACE Program has developed educational resource products and models which benefit our nation's educators, students, and school administrators by promoting and supporting new methods of science and mathematics education, as identified by National Standards, Benchmarks, and State Frameworks. Project SPACE products demonstrate how data and information from NASA's Projects and Programs can be integrated into curriculum models and used in the classroom.

Project SPACE Deliverables for FY '99:

- Each month new interactive Resource and Activity Products will be delivered to the Project SPACE Website. These resources will include new science activities related to space exploration, astronomy, technology and the planets. These activities will be aligned to the educational themes of state frameworks, benchmarks and standards
- Teacher Inservices (workshops), that utilize LTP products, models, resources and educational methodologies, will be conducted January 1999 through September

1999 using the “Applied Science and Technology Classroom.” The purpose of the inservices will be to inform, educate, and demonstrate to teachers how curriculum support products, materials, resources and methodologies developed by NASA’s LTP Program in the Project SPACE Project, relate to and can be integrated into classroom environments, curricula, and disciplines. In these inservices, teachers will receive specific instruction in the use and access of Internet Websites, Project Space Program content (materials and products), and other LTP products such as Project TIE. Classroom teachers will demonstrate products and methods, that have been successfully used in classroom situations. Also, specific activities will be used to demonstrate science content areas, educational pedagogy and instructional methods and strategies.

- Project SPACE Presentations/Demonstrations will be conducted at four of the following regional/national educator conferences: NSTA, ASCD, ITEA, CCCF, NECC, and CUE. These presentations will provide product demonstrations and LTP Program information. We will utilize pamphlets, single page information sheets and sample materials on disks to distribute information.
- The creation of a Teacher/Student curriculum products library to be located on the Project SPACE Website.

## 5. Evaluation

To evaluate the effectiveness of the Project SPACE Program two evaluation strategies are to be employed. The first strategy will be to employ volunteer teachers and students in the initial design, delivery, and evaluation of the various educational curriculum components. The second strategy will be to develop a more comprehensive evaluation program to test classroom impact. This process will allow the project to more fully evaluate the metrics that have been developed for Project SPACE.

## 6. Dissemination

Local dissemination plan will focus on local School Districts. Regional dissemination will focus on the use of the Pomona/Los Angeles County Technology Center—Pomona Educational Foundation, Pomona, California. National dissemination will employ presentations and demonstrations at national educational conventions. Further the project will coordinate with and make use of NASA dissemination channels, such as: NASA HQ-Code FE, and Center Education Outreach Project Offices.

## 7. Budget

The Project SPACE budget for FY '99

Item	Category	Amount
Labor	Support Service Contractors	\$125K
Travel	Support Service Contractors	\$15K
Hardware / Software		\$15K
<b>Total:</b>		<b>\$155K</b>

## **25.14 A14 Johnson Space Center Learning Technologies Regional Project**

### **1. Goals**

- Provide affordable networking technology to a variety of school environments to enrich the K-12 education process.
- Develop and distribute unique network applications that promote the technology and use of the National Information Infrastructure.
- Disseminate NASA information, particularly math and science materials.

Wise use of information technology will prove essential to help students and educators keep pace with content in science, mathematics and technology that has undergone exponential increase in recent years. Internet-based education can be an effective tool to present new and rapidly changing frontiers of knowledge while giving educators and students alike hands-on experience with technology. Applications for gathering, processing and managing Internet information are driven by educators' needs for cost and time effective use of Internet resources.

The changes brought on by the information advances of the '80s swept through laboratories and businesses, while leaving most classrooms unchanged. As these changes come to schools, as they inevitably will, it is our goal to introduce our tools wisely and appropriately to best serve the needs of all involved.

### **2. Approach**

The first quarter of FY99 will be spent making refinements to the NASA Qwhiz and to SIMON, the School Internet Manager Over Networks. The remainder of the FY99 will be spent working on the ROVER Ranch, an on-line Remote Operating Vehicle simulation environment. Work on SIMON will incorporate teacher requests to provide maximum lesson building flexibility and Web page selection from any location. These changes will be invisible to the user but will improve the usability of the software greatly.

The new developmental focus for FY99 is the ROVER Ranch, an Internet outpost where virtual Remote Operating Vehicles (robots) are built, trained and sent out to perform missions in select physically remote environments. The ROVER Ranch will consist of a Workbench where very simple robot parts are combined to create task-specific ROVERs; a School where ROVERs are trained to respond to sets of conditions and the Proving Grounds, a set of dynamic environments where ROVERs perform their missions.

Students will design their vehicle from a Workbench consisting of idealized body parts like thrusters, roller wheels, propellers or independent legs as locomotors; solar panels, generators, batteries or dilithium crystals as energy sources; and light, heat, chemical or tactile units as sensors. Students will train the ROVER in basic movement techniques (forward, back, etc.) and required conditions for decision-making. Appropriate and optimal combinations of ROVER parts and training are directly

correlated to task success. The Proving Grounds will be dynamic environments where different tasks like mining, exploration, and object location or retrieval take place. The ROVER Ranch will be a combination of intelligent software, Internet technology and NASA-based information resources.

### *2.1 Implementation Strategies.*

- Needs assessment

The enhancements to our SIMON and Qwhiz products are motivated directly by user evaluation and feed-back from beta testing and focus group presentations.

The ROVER Ranch is proposed as an innovative, engaging and scalable forum to support established education goals by introducing students to science pioneered by NASA researchers. The specific learning outcomes addressed include the explanation and proposed solution of a problem, the collection and analysis of information using tools, the ability to identify, predict, and replicate patterns in charts, extrapolation of information to make predictions, identification and description of position changes and object speeds and the documentation of motion and changes in motion of objects.

- Customer involvement

Our policy is to take advantage of every opportunity to solicit input from our customers. Historically, we have done this through participation in JSC education workshops, feed-back from presentations and demonstrations and on-line customer assessment surveys. In addition, this year we expect to enjoy a collaborative relationship with education specialists from the Teaching from Space Program and several NASA scientists who have offered to serve as domain experts for our activities. Although, strictly speaking, these people are more accurately described as consultants than as customers, they provide a synergistic link to the education and science communities which can help us better meet the needs of our customers.

- Integration with NASA Center Education Office

We are grateful to our colleagues in the JSC Education and Information Services organization for facilitating the partnerships described above.

- High-level partners

We maintain a relationship with the program at the Dana Center of the University of Texas, the Research, Rehabilitation and Training Center for Blindness and Low Vision at Mississippi State University, and our corporate partner, Knowledge Systems Incorporated.

- Training

Because scalability is a requirement for our projects, all of our products are designed for Internet distribution which includes information and examples illustrating the use of the product. We augment Web-based training by providing

hands-on instruction, particularly for groups such as technology coordinators that can serve as ambassadors and trainers for others.

## *2.2 Collaboration With Other LTP Centers.*

We will cooperate with the Langley and Lewis LTP teams on robotics issues related to software and simulations. We will work with Lewis LTP and their local Embedded Web Technology Project to investigate a software package called TEMPEST which allows robotic control functions over the Internet. We will work with Langley LTP on issues related to robotic simulation and control as it pertains to the FIRST competition and the PRC project. Additionally, we plan to cooperate with the Langley Education Office to add the interactive Qwhiz capability to their Web resources. We will also be working closely with the Ames Research Center Quest project and Learning Technologies Channel to distribute and promote the Qwhiz and ultimately the ROVer Ranch.

### **3. Milestone Timeline**

#### Quarter 1:

- Qwhiz construction, Internet tournaments and evaluation
- SIMON enhancements
- Initial consultation with scientists and educators for ROVer Ranch (R<sup>2</sup>)

#### Quarter 2:

- Roll-out of SIMON version 3.0
- More Qwhizzes and tournaments
- Initial object design and prototype implementation of R<sup>2</sup> components

#### Quarter 3:

- More Qwhizzes and tournaments
- R<sup>2</sup> implementation

#### Quarter 4:

- More Qwhizzes and tournaments
- R<sup>2</sup> Component and integration testing
- R<sup>2</sup> Teacher evaluation
- R<sup>2</sup> Beta release

### **4. Deliverables**

The software products delivered in FY99 benefit the educational community by providing affordable networked tools that can be integrated into the classroom. The software is Web-based and therefore available to all regardless of location.

Specifically, JSC LTP will deliver:

- 1/99 SIMON version 3.0

-- 9/99 A Qwhiz archive correlated to grade level, subject and the Texas Essential Knowledge Skills (TEKS) standards

-- 9/99 R<sup>2</sup> Beta

## **5. Evaluation**

The SIMON database details the quantity and location of SIMON applications as they are downloaded off the Web allowing us to periodically poll our users for comments and evaluations. The FY99 enhancements for Version 3 were gathered in this manner. SIMON was intended as a tool for teachers, thus the impact on learning at the student level is mediated by the way teachers use the product. We can get some of the picture by tracking the number of downloads and user comments, but as is true of all tools, the true impact on learning is a function of the use of the tool, and as such is not strictly measurable. Our strategy is to measure impact as it is measured for other software tools, specifically dissemination, user feed-back and the transfer of the product to a commercial line.

The interactive nature of the Qwhiz provides easy tracking of event participation and participant usage patterns. The learning outcomes for any given Qwhiz are developed by the teachers who create the Qwhiz content itself; however, since we have an input into Qwhiz construction and maintain the archive, it is theoretically possible to at least track the manner in which our product is being used. We plan to measure effectiveness by usage statistics, and assure proper learning outcomes by maintaining an archive of content aligned to recognized educational standards.

The ROVER Ranch is designed with specific learning objectives in mind. These are: the explanation and proposed solution of a problem; the collection and analysis of information using tools; the ability to identify, predict, and replicate patterns in charts; extrapolation of information to make predictions; identification and description of position changes and object speeds; and the documentation of motion and changes in motion of objects. We will maintain feed-back from customers, educators and NASA scientists to assure adherence to these objectives. Because content and interaction are known, designed and controlled to promote specific outcomes, we submit that the impact of the ROVER Ranch can be accurately assessed by usage statistics.

## **6. Dissemination and Public Relations**

We will use Web-based dissemination of all network software and provide user feedback capabilities to ensure products function and to log suggestions and/or improvements. JSC LTP team members are booked to give a paper at ACEE's WebNet '98, a presentation at TelEd '98 and a presentation at CAST '98. There will be additional presentations in calendar year 1999 as required by JSC staff. JSC maintains its collaborative efforts with the University of Texas Dana Center State Systemic Initiative for Education Reform by working with a teacher liaison to create Qwhiz material and evaluate JSC products. We also maintain a working relationship with the JSC Education Services Teaching From Space Visiting Teacher who will be working with us over the next year to disseminate our products to the educational community.

## 7. Budget.

### Labor:

CS	.50 FTE	
Contractor	2.25 FTE	\$195K

### Travel:

CS	2 Trips	
Contractor	10 Trips	ODC

<u>Hardware/Software</u>		\$20K
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<b>Total</b>		<b>\$215K</b>
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## **25.15 A15 Kennedy Space Center Learning Technologies Regional Project**

### ***Virtual Science Mentor Project Space Team Online***

#### ***Introduction***

Kennedy Space Center's portion of the LTP involves integrating local programs into a broader national context. Work will continue on existing programs—Virtual Science Mentor and Space Team Online. This year we will focus our effort to increase live events covering KSC activity and integrate them into these programs. In addition, the Partnership to Access Education Resources (PAER) and Information Technology for Education Policymakers (ITEP) are coming online which probably do have scalability and applicability to LTP as a whole. The PAER and ITEP programs are being developed and we will review the best method and determine the applicability for LTP to utilize them. Although these are not LTP-sponsored programs they do offer a very good opportunity for collaboration and dissemination for LTP.

#### **25.15.1 Virtual Science Mentor Project**

##### **1. Goals**

The Kennedy Space Center's Virtual Science Mentor (VSM) program is in its second year of operation and is continuing to expand due to the success of the 1997-98 school year. The goal of the this year's program is to increase the number of mentors at Kennedy Space Center by 28 mentors (43%) and making the expertise of scientists and engineers available to schools throughout the state of Florida. Using state-of-the-art desktop videoconferencing equipment, KSC scientists and engineers will integrate with 65 classrooms throughout the state and mentor students using Internet-based curriculum, provide support for the Sunshine State Standards of Education, judge science fairs, coordinate and evaluate science projects, introduce and reinforce the use of educational technologies and increase the awareness of NASA education programs and initiatives. This will enhance KSC's programs, serve the LTP objectives, and strongly support NASA's education framework.

##### **2. Approach**

Building on FY98's success, including the hiring of an Education Technology Specialist, KSC can begin to geographically broaden some local KSC unique programs. While VSM is a KSC unique program there are lessons from it that can be used for national such as a handbook on how to establish a VSM-like program, long distance mentoring handbook and specific KSC curriculum support.

This person has office space within the KSC University Programs Office in order to aid in learning about our programs and people. He will work 40 hours per week on these responsibilities. Specifically he will be responsible for:

- Increasing the number of KSC mentors from 37 to 65 (43% increase).
- Providing mentor support for curriculum, maintenance, special projects .
- Coordinating and providing logistic and technical support for Virtual Tours Launches and Interviews.
- Maintaining the Virtual Science Mentor Web site and continuing to develop the Virtual Science Mentor Web site.
- Coordinating with LTP for live events at KSC.

### *2.1 Implementation Strategies*

- Needs Assessment

The Virtual Science Mentor (VSM) program is in its second year of existence at KSC. In the past, it has been noted that the primary educational beneficiaries of the KSC effort have fallen within a 50-mile radius of the center. The VSM program extends that benefit to students throughout the state by matching scientists and engineers to classrooms for the entire school-year. This allows the students to interact with their assigned mentors at KSC using desktop video and Internet activities. Students are exposed to and utilize educational technologies and increase their awareness of NASA education programs and initiatives.

- Customer Involvement

The customers of the VSM program are the teachers and students in seven counties throughout the state, 68 total teams. The teachers are involved with all phases of the program development and are represented by Florida Gulf COAT University (FGCU) and the Technological Research and Development Authority (TRDA).

- Integration with NASA Center Education Office

The Education Technology Specialist representing the Kennedy Space Center Virtual Science Mentor program maintains office space with the University Programs office. All phases of the program are implemented through this office and are inclusive of hardware/software installation, training for KSC mentors, Web site development and maintenance, archiving biographical data, providing curriculum, coordinating T1 and ISDN access and coordinating with FGCU and TRDA.

- High-Level Partners

The Technological Research and Development Authority (TRDA) and the Florida Gulf COAT University (FGCU) are essential collaborative partners in this program.

- Training

Through a series of summer workshops, the teachers have direct involvement in the development of the product for the school year. This includes training in the use of technologies and tailoring training with their respective mentors. The goal of

the program is to reinforce the Sunshine State Standards of the state of Florida as well as integrating educational technologies and increasing their awareness of NASA education programs and initiatives.

## *2.2 Collaboration With Other LTP Centers*

The Virtual Science Mentor program offers many opportunities to share the LTP Internet initiatives of virtually every center through the application-sharing features of the Intel Pro Share videoconferencing equipment. Emphasis is placed on the distribution of LTP products to each mentor, and the mentors use the Web sites for interacting with their respective classrooms. Many of the KSC mentors are also actively involved with the Space Team Online project. These mentors participate in chats, answering specific questions that are submitted to the Q/A section of the Space Team Online project and submitting journals regarding their activities at Kennedy Space Center. The Virtual Science Mentor project also collaborates with the Learning Technology Channel to provide live broadcasts from KSC.

### **3. Milestones**

Broad milestones for this activity include:

September-November, 1998:	Integrate new mentors into the VSM program, provide startup assistance with hardware/software and materials.
November 1998:	Produce Virtual Science Handbook
November 1998-May 1999:	Integrate Internet Science Fair
December 1998 - September 1999:	Continue to develop products and place them on the Web site for access, as well as implement other methods of dissemination. Coordinate with LTC for live events at KSC. Provide technical and curricular support for KSC mentors.

### **4. Deliverables**

- A handbook using VSM as a basis for developing a program like the Virtual Science Mentor Program, including industry and academic involvement.
- Virtual Science Mentor handbook which should assist mentors in the application of the programs technology, philosophy and application.
- A lessons-learned report suggesting better, alternate, or new ways of developing large-scale curriculum.
- Final Report

### **5. Evaluation**

This activity, as with all other office activity, will be evaluated for its value. The metrics outlined in the LTP Management Plan are directly applicable to this activity: number

Website hits, number of teachers and schools using material developed, number of actual products developed, survey information from teachers and students indicating value of the material developed.

## **6. Dissemination and Public Relations**

This activity was highlighted at the 1998 Space Congress held in Florida during a panel session called "New Horizons in Education." A search for like opportunities will be pursued in FY 99. In addition, steps will be taken to disseminate the availability of material to the widest possible audience. It is anticipated in the fall of 1999, Florida will host a NASA-funded research and education conference for grantees to gather and discuss their similar activities.

In addition, our partners in the State of Florida, Florida's Education Commissioner and the Chancellor of the State University System of Florida, will be kept apprised of this activity and its products made available.

## **7. Budget**

(See budget in section 7 of Space Team Online below.)The Education Technology Specialist is a Raytheon employee. We will have coordinated the budget with the Space Team Online project. A limited amount is included for travel; more funds would mean a greater number of papers and poster sessions could be attended.

If funds are sent via a 506 to KSC, please earmark for "LTP Education Technology Specialist," and identify with Gregg Buckingham.

## **8. Conclusion**

KSC appreciates the opportunity to be part of the LTP project. We believe we already have several unique and valuable projects underway which can be translated to the LTP required objectives. We are open to suggested products which may be worked at KSC in conjunction with other centers and/or projects

## **25.15.2 Space Team Online**

### **1. Goals**

Space Team Online concentrates on the people of NASA involved in diverse careers who contribute to the space shuttle and space station programs. The project involves close collaboration with Kennedy Space Center and Johnson Space Center.

### **2. Approach**

An Education Technology Specialist with the necessary skills has been hired to achieve our goals. We have coordinated our overall LTP activity with the STO program. Specifically, KSC's goals are to:

- Provide support for Field Journals
- Keep Space Team Online members informed and apprised of the programs success
- Recruit volunteers in support of the project
- Complete and maintain biographies on each STO volunteer
- Identify and coordinate volunteers for STO chat rooms
- Identify and coordinate volunteers for Question and Answer portion of program
- Coordinate with Kennedy Space Center volunteers for support of special projects.

#### **2.1 Implementation Strategies**

- Needs Assessment

The effort at Kennedy Space Center is to enhance the needs of the K-12 audience associated with the Space Team Online Project. Kennedy Space Center offers the audience insight and involvement in the processing, launch operations and activities that take place at KSC. At present there are 68 members involved with the Space Team Online that interact with students via email, question and answer, field journals, chat-room and special activities (Virtual Launches, interviews etc.).

- Customer Involvement

The Education Technology Specialist at Kennedy Space Center is the collaborating individual with the Space Team Online project. This individual is responsible for coordinating, organizing and assisting the scientists and engineers with producing the product in all phases of production as outlined in section 2 (Approach).

- Integration with NASA Center Education Office

The Education Technology Specialist representing the Space Team Online maintains office space with the KSC University Programs office. The University Programs manager (Gregg Buckingham) has involvement in the program and collaborates with the Space Team Online personnel at NASA Ames to ensure that

the project meets all principals and goals specified in NASA's Education Program and Evaluation Framework.

- **High Level Partners**

The Technological Research and Development Authority (TRDA) will be a continuing partner in this year's program to support and disseminate the Space Team Online effort. This will be accomplished through several of its training programs involving the training of educators throughout the state of Florida.

- **Training**

As new members are acquired for the project, the Educational Technology Specialist is involved in training and supporting the member for chat room activity, journals processing and directing forum questions to the appropriate member at KSC.

## *2.2 Collaboration With Other LTP Centers*

The Space Team Online effort at KSC collaborates primarily with Johnson Space Center (JSC) and Ames Research Center (ARC) for the submission of biographies, journals, electronic question and answer efforts and chat room participation.

## **3. Milestones**

Activity for the project is clearly defined and will continue throughout the school year and will continue to support the items specified in the project's Approach.

## **4. Deliverables**

- Monthly journals
- Keep Space Team Online members informed and apprised of the programs success
- Recruit volunteers in support of the project
- Complete and maintain biographies on each STO volunteer
- Identify and coordinate volunteers for STO chat rooms
- Identify and coordinate volunteers for Question and Answer portion of program
- Coordinate with Kennedy Space Center volunteers for support of special projects. Several special projects are being considered at this point. Examples of these are:
  - International Space Station discussions with ISS engineers and scientists at KSC. Discussions would be broadcast via the LTC.
  - Virtual Launches for the ISS assembly flights. Events will include interviews with astronauts and presentations by experts at KSC.

## **5. Evaluation**

Lead evaluation for Space Team Online will be the responsibility of the Space Team Online office. KSC will provide input for evaluation purposes.

## 6. Dissemination and Public Relations

Dissemination and Public Relations will remain a primary function of the Space Team Online office. KSC will enthusiastically assist in this effort.

## 7. Budget

KSC has coordinated with the Space Team Online and KSC's overall LTP effort.

Technology Specialist	Factors	Subtotals	Funds to be sent to Raytheon STX Corp.
Labor hours	\$2,080		
Labor rate (incl. FICA, MED.)	\$15		
Labor dollars		\$31,200	
Travel			Raytheon STX Corp.
One trip to Ames	\$1,575		
Travel dollars		\$1,575	
Awards	\$500	\$625	Raytheon STX Corp.
<b>Subtotal</b>		<b>\$33,400</b>	
Raytheon O/H*	\$13,360	\$33,400	
<i>*This \$13.3 K to be funded by Space Team Online per K. Traicoff</i>			
\$0			
Materials communications hardware	\$16,600		Sent to KSC, Linda Euell Mail Code GG-C1-C, KSC Phone 407-867-3305
<b>Materials cost</b>		<b>\$16,600</b>	
<b>Total</b>		<b>\$50,000</b>	

## 8. Conclusion

KSC appreciates the opportunity to be part of this LTP project. Guidance on desired products or activities is welcome so that the greatest number of needs can be served.

The contacts for this activity at KSC are:

Gregg Buckingham  
KSC University Programs Manager  
Mail Code AB-G2  
Kennedy Space Center, FL 32899  
Ph 407-867-2627  
Fx 407-867-2977  
email: [Gregg.Buckingham-1@ksc.nasa.gov](mailto:Gregg.Buckingham-1@ksc.nasa.gov)

Brandt Secosh  
Education Technology Specialist  
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## **25.16 A16 Langley Research Center Learning Technologies Regional Project**

### ***Distance Learning Interactive Projects***

The Learning Technologies Project at NASA Langley is involved in a number of different projects utilizing computer and networking technology to communicate NASA information to K-12 education and lifelong learning communities. For the purposes of this proposal, these projects have been grouped into two larger areas: Distance Learning and Interactive Projects. The proposed work in each of these two areas is outlined in the following pages.

#### **25.16.1 Distance Learning**

##### **1. Goal**

In FY 99 the LaRC LTP will continue to develop the distance learning approaches begun in FY98. With the goal of making LTP training and NASA content easily accessible to educators, students, and the general public at any time of the day, regardless of their location, this project promises to address several critical issues. Common topics for discussion at many LTP meetings are the issues of scalability, dissemination, and training related to LTP projects. This element addresses all three of these concerns and the results of this project are anticipated to be of benefit to LTP projects at other NASA centers, in addition to the primary K-12 audience. The decision was made at the conclusion of FY98 to cease development of the contracted interactive instruction/feedback software, based upon reviews of the product, and comparison to other approaches being evaluated by LaRC LTP. Development of instructional modules will proceed, focusing on RealMedia, IChat, and HTML delivery mechanisms.

##### **2. Approach**

###### **2.1 Implementation Strategies**

- **Needs Assessment**

While the LaRC LTP has not conducted a formal needs assessment related to this project, LTP and NASA Education management consistently flag the issues of scalability, training, and dissemination as areas which need to be improved upon in many LTP projects. The K-12 community will be involved in assisting to identify NASA topics that will be covered in the online learning sessions.

- **Customer Involvement**

Partnerships with local educators, school systems, and educational associations will be used to identify areas of NASA content and training expertise that fit weak areas in current curricula, as well as meet state and national standards.

- Integration with NASA Center Education Office

Collaboration with the LaRC OEd will help to identify content areas which will be of benefit to ongoing educational programs at the center. NASA researchers will provide content for educational modules that will be used to expose students and the general public to current work and missions underway at NASA LaRC.

- Training

The results of this project will provide a new mechanism for providing training related to other LTP projects. Materials will accompany each module to train new participants on the effective use of the various delivery mechanisms.

## *2.2 Collaboration With Other NASA Centers*

Another part of this element includes Langley's ongoing participation in the Digital Audio Testbed project (possibly renamed the Digital Multimedia Testbed). Collaboration with other participating centers will continue as the system is debugged and expanded. This testbed will serve as one of the primary delivery mechanisms for content developed under this element. Langley anticipates increasing the number of streams available from its server by at least 400% in FY99 as negotiations with the Langley network support group continue and funding becomes available for system upgrades.

### **3. Milestone Timeline**

November 1998: Module 1 Complete (technology training emphasis)  
 March 1999: Module 2 Complete (NASA content emphasis)  
 August 1999: Paper documenting initial findings completed

### **4. Deliverables**

Deliverables associated with this element include a paper documenting the distance learning models developed, along with an initial study of their effectiveness as compared to more traditional delivery mechanisms and techniques. The modules themselves will also be available via the Web for access at any time.

### **5. Evaluation**

Support will be provided for one full-time Ph.D. candidate pursuing a degree in the area of instructional technology. Part of this support will include study and research into the effectiveness of the distance learning methods developed. At least one comparative study will be conducted and documented, to determine the effectiveness of these distance learning models. Pre- and post-tests will be given to those who use the modules, in order to assess the effectiveness of the various strategies.

### **6. Dissemination**

Informing the K-12 community of these resources will be achieved through posting to educational listserves, registering with the major Web search engines, and by working with the LTP Project Office to support conference presentations, although it is

anticipated that few conferences will be attended during FY99 due to budget constraints.

## 7. Budget

### Labor:

1 Civil Servant	\$0 (Not funded via LTP)
0 Support Service Contractors	\$0 (LaRC guidelines limit the use of SSCs)
1 Ph.D. candidate	\$35K
1 IPA (half-time)	\$20K
K-12 teacher support	\$15K
Hardware & software	\$50K

### Travel:

Civil Servant: \$0 (Not funded via LTP)

**TOTAL: \$120K**

## **25.16.2 Interactive Projects**

### **1. Goal**

The LaRC LTP will continue to develop strategic collaborations with NASA researchers and the educational community in a variety of areas to develop self-sustaining online projects, learning resources, and communications methods which support NASA's educational outreach efforts and expose students to unique NASA information and research. Some of the proposed activities are outlined below:

- **Aero Design Team Online**

In partnership with various NASA LaRC researchers, biographical information and Web pages will be provided to Aero Design Team Online (ADTO) coordinators in order to represent NASA LaRC more fully as part this project. Tools used by Langley researchers as part of the aircraft design process will be evaluated and, if appropriate, developed into online projects of interest to ADTO.

- **EarthKAM**

In partnership with Langley's Office of Education, the EarthKAM project will be developed and expanded so that it is accessible to schools across Langley's five-state service region. This will include the development of a variety of online resources, materials, and programs to provide student and teacher support, as well as foster online collaboration. If successful, this approach will serve as a model for other regions to follow as they look for effective ways to scale their EarthKAM outreach efforts.

- **Atmospheric Sciences**

As a partner in the Student Cloud Observations OnLine (S'COOL) project (a Langley-based international project where students collect ground-based data which is then used to validate satellite-based Earth observations), the LaRC LTP will assist S'COOL in developing effective mechanisms for global collaboration and data collection. The communication strategies employed will enable students to not only share their insights and questions with one another, but also with S'COOL coordinators and NASA researchers.

- **Robotics**

With support from NASA's Telerobotics program, the LaRC LTP will once again coordinate Langley's participation in the FIRST robotics competition where high school students design and construct a remotely operated robot, competing against teams from across the country. An extension of this effort in FY99 is the development of a middle school robotics challenge, based upon the latest LEGO programmable brick, using software developed by Tufts University as part of their recently completed, NASA-funded Cooperative Agreement. Currently, a working group comprised of LaRC LTP, major educational associations, and corporate partners has been formed and is making plans for a K-8 national competition in 2000, based upon the LaRC FY99 pilot.

This robotics element also includes the development of Internet-based haptic interfaces and educational modules. Haptic interfaces allow remote users to obtain a virtual sense of touch (in this case via an electronic joystick) through the use of force sensors in a physical environment or through software control in virtual, online environments. While NASA uses such interfaces in the control of remote robots, astronaut training, and design simulations, this project will investigate the application of haptic interfaces to K-12 math/science education as well, including a literature search of the current state of VR technology in K-12 education.

- **CON<sup>2</sup>ECT video series**

The LaRC LTP will be partnering with the Office of Education in FY99 on the development of the CON<sup>2</sup>ECT video series. LTP will serve as technical consultants, develop online activities to accompany the broadcasts, and coordinate interactive chat sessions with NASA researchers.

- **Kids' Corner**

As part of NASA Langley's focus on aeronautics, the Office of Education, Learning Technologies Project, and Media Concepts Team will develop a student-centered segment of NASA Langley's main Website. This project will provide K-12 online visitors to Langley with age-appropriate activities helping them to better understand NASA's role in aeronautics research. Opportunities for online interaction with NASA researchers will be provided in conjunction with the various learning modules. If successful, the theme of Kids' Corner will shift from year to year, focusing on a different thrust of NASA Langley's overall mission.

- **NASA/CNES**

In partnership with other NASA Langley researchers and the Office of Education, Langley's LTP will provide technology support to the developing partnership between the US and French space agencies in the area of educational outreach.

## **2. Approach**

### *2.1 Implementation Strategies*

- **Needs Assessment**

Ongoing collaboration with practicing K-12 educators consistently reveals the need for practical examples of math and science in use in the real world. Teachers state that they are in need of projects which can anchor the math and science that they are teaching to relevant problems and interesting NASA missions. The LTP Review Panel also mentioned the need for LTP to be doing leading edge work in areas such as VR and 3-D modeling, which will be partially addressed by the robotics element of this proposal. Continued interaction with our K-12 customers throughout the development of these projects will provide refinement in project direction.

- **Customer Involvement**

Partnerships with local educators, school systems, and educational associations will be used to identify areas of relevant NASA content that also meet state and national standards. Practicing educators will be used in the development, pilot testing, and assessment of projects where appropriate.

- Integration with NASA Center Education Office

Collaboration with the Langley Office of Education is the norm rather than the exception for the LaRC LTP. All seven of the identified projects listed in this section involve collaboration with Langley's Office of Education at some level. Some of the projects require a direct, side-by-side working relationship, while others will involve periodic discussions between the two groups

- High-level Partners

Where appropriate, the NASA LaRC LTP will form partnerships with industry, educational associations, and universities to accomplish the objectives of these interactive projects. The robotics effort as well as the NASA/CNES program are two programs where these types of partnerships are anticipated.

- Training

Where appropriate, training will be provided to enable classroom teachers and parents to quickly make use of these online resources. To the largest extent possible, training will be developed that is entirely Internet-based, making these resources self-sufficient in their online form. This training element integrates with the Distance Learning initiative outlined in the first half of this proposal.

## 2.2 Collaboration With Other NASA Centers

Several of the proposed projects lend themselves to collaboration with other NASA LTP activities. LaRC LTP anticipates working closely with ARC LTP as part of the Aero Design Team online project. JSC, LeRC, and ARC have robotics-related activities, so partnering on the various robotics initiatives which have been proposed for FY99 is a logical connection. The NASA/CNES program will most likely involve multiple NASA centers, so as this program becomes more defined we anticipate partnering with other LTP projects as well.

## 3. Milestone Timeline

Several of the projects entail multiple smaller milestones. Major milestones include:

- December 1998: Kids Corner fully functional
- February 1999: Middle school robotics challenge complete  
Rough draft of paper documenting challenge complete
- September 1999: Prototype Internet-based haptics unit complete  
Virtual reality in K-12 education literature survey complete

## 4. Deliverables

Deliverables associated with this element include a paper documenting the middle school robotics challenge, and several Web-based instructional projects tied to national education frameworks that will be easily integrated into K-12 classrooms.

## 5. Evaluation

Follow-up surveys will be conducted with project participants and developers to determine both the strong and weak areas in the project development cycle and in classroom effectiveness. Professional education organizations such as NSTA will assist in the evaluation and refinement of the middle school robotics project.

## 6. Dissemination

These projects will be made available via the LaRC LTP Website. Informing the K-12 community of these resources will be achieved through posting to educational listserves, registering with the major Web search engines, partnering with professional educational associations, and by working with the LTP Project Office to support conference presentations. Few conferences will be attended during FY99 due to budget constraints, although a presentation at the NSTA conference describing activities in the robotics area is anticipated.

## 7. Budget

### Labor:

1 Civil Servant	\$0 (Not funded via LTP)
0 Support Service Contractors	\$0 (LaRC guidelines limit the use of SSCs)
1 IPA (half-time)	\$25K
K-12 teacher support	\$20K
Grad/undergrad interns	\$15K
Hardware & software	\$50K

### Travel:

Civil Servant:	\$0 (Not funded via LTP)
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**TOTAL: \$110K**

## **25.17 A17 Lewis Research Center Learning Technologies Regional Project**

Submitted by: \_\_\_\_\_

Date: \_\_\_\_\_

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Project Manager, NASA LeRC LTP

Approved by: \_\_\_\_\_

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Education Director

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# NASA Lewis Research Center's Learning Technologies Program FY99 Proposal

## 1. Goals

The goals of the NASA Lewis Research Center's Learning Technologies Project (LeLTP) are to:

- Increase student's interest in and proficiency of math and science through the use of computing and communications technology and by using NASA's mission in aeronautics as a theme.

The article, "Skills Gap Threatens U. S. Competitiveness," from the American Society of Mechanical Engineers' November 26, 1997, International Capitol Update, is one of many articles that is reporting the lack of qualified workers in the United States. The article reports the results of a survey of 4,500 manufacturers and states that "more than half of the companies surveyed reported that current workers lack skills in basic math and writing."

The NASA Lewis Research Center's Learning Technologies Project is working towards addressing this skill gap in its Educational Technology Applications Projects by using the excitement of airplanes and flight to create a spark in students to take an interest in their math and science studies. If students have an enticement to use math and science skills, such as to make predictions before they are able to fly paper airplanes during a lesson on rate problems, they will be more willing to use those skills and thus learn them.

- Assist in creating cutting-edge and efficient network solutions that will enable schools to gain access to the Internet for educational resources.

The February 1998 issue brief, "Internet Access in Public Schools," from the National Center for Education Statistics reports that although the percentage of schools that are connected to the Internet continues to rise, "schools with 50 percent or more minority students" and "schools with 71 percent or more poor students (that is, students eligible for free or reduced-price lunch)" are lagging in Internet capabilities. Additionally the report states, while 78 percent of all public schools have Internet access, only 43 percent of those schools have Internet access in five or more instructional rooms, clearly indicating that more work needs to be done to increase students' access to the Internet during classroom time.

The NASA Lewis Research Center's Learning Technologies Project begins to address these issues through its Internet Access Research Projects. The NASA LeLTP is developing networking solutions for schools in non-traditional settings to ease the ability for these schools to get connected. Also, these solutions can be used as a model for duplication in other schools. Additionally, the NASA LeLTP is addressing the need for Internet access during classroom time by researching local area network solutions that will provide teachers with

more flexibility when they want to incorporate the use of the Internet into a lesson.

## **2. Approach**

The NASA LeLTP has taken a three-point approach towards achieving the goals stated above. The three aspects of the program are:

*Educational Technology Applications* – Students and teachers need educational applications that utilize computer and communications technology and that provide them with tools to enhance their educational experiences.

*Internet Access Research* – Schools need to be connected to the Internet in order to access the wealth of educational applications available.

*Wide Spread Dissemination* (Covered in item 6.) – This is the LeLTP's effort to let teachers know about the educational material available to them and basic instructions on how to incorporate it into the classroom.

Further information follows on the first two aspects:

### **Educational Technology Applications:**

The educational technology applications, or content, developed by the NASA LeLTP, focuses on software simulations and Web-based information and activities. Simulations of aeronautics related concepts are created, along with grade appropriate lessons that prompt students to discover basic scientific principles or to engage in problem solving activities. All of the content developed will be reviewed for technical accuracy and for compliance with the national science and math standards. The NASA LeRC Office of Educational Programs (OEP) will be asked to provide national standards expertise during the creation of the LeLTP products, along with any other input from an educational expert standpoint. OEP will be asked to participate in the review process of the educational products. OEP will be asked to review the evaluation feedback form created for the products. OEP will be asked to identify schools that would be good candidates for field testing the software. Following are the content development goals of the LeLTP in FY99.

- **Beginner's Guide to Aerodynamics**

The Beginner's Guide to Aerodynamics (BGA) is a series of Web pages located on the LeLTP Web site that serve as a source of background information for the software simulation packages, FoilSim and EngineSim. Currently, the BGA contains information on lift, which corresponds to the principles taught within the FoilSim software package. During FY99, information on thrust will be added to the BGA, which will correspond to the principles that EngineSim covers. During the 1998 Summer Professional Development Workshops, problem sets for grades 9-12 were created for the Lift portion of the BGA. These problem sets, along with the current information within the BGA will be field tested in the fall of 1998. In FY99 problem sets for grades 6-8 will be created. The problem sets will be created in collaboration with the Ohio Space Grant Consortium (OSGC). LeLTP and OSGC will work with a college or university's education department to identify an

education professor who is willing to make the creation of the problem sets be a project that the pre-service teachers must complete as a part of a class.

- FoilSim

FoilSim is a package that simulates the air flowing over an airfoil and over a baseball. Contained within the package are slider bar controls, graphical outputs and ready-made lessons. During the FY98 Summer Professional Development Workshops, problem sets for FoilSim were created. These problem sets will be field tested, along with the problem sets from the Basic Guide to Aerodynamics, in the fall of 1998. The goal for FY99 for FoilSim is to continue the dissemination of the product through various methods, including video-conference workshops, educational conferences and public events. LeLTP will continue to collect feedback from the users of FoilSim and begin to plan for changes that will be incorporated into FoilSim Version 2.0, including the possibility of including stall. The release date of Version 2.0 is TBD.

- EngineSim

EngineSim is a software package that simulates a working aircraft engine. This package also contains slider bar controls and graphical outputs. EngineSim contains lessons within the package such as rate and distance problems. At the end of the fiscal year Version 1.0 of EngineSim will be available. EngineSim will be available on a CD ROM and for downloading from the LeLTP Web site. An instructional manual will accompany EngineSim, along with background information and problem sets. All of this information will be available from the EngineSim Web site. The problem sets will be created in collaboration with the Ohio Space Grant Consortium (OSGC). LeLTP and OSGC will jointly conduct one summer teacher workshop with the purpose of creating problem sets for EngineSim.

- Lesson Plans and Activities for grades 8-12 based on Aeronautics Missions

The NASA Lewis Science Lessons that were created during the 1998 Summer Professional Development workshops will be field tested in the fall of 1998. The lessons will be available online at the LeLTP Web site in October of 1998. The NASA Lewis Science Lessons are a series of Web pages containing lessons and activities that blend research conducted at the NASA Lewis Research Center with scientific principles that must be taught in K-12 schools.

- Aeronauts 2000

Aeronauts 2000 is a series of Web pages which takes the user through an aeronautical and space adventure. Contained within the Web pages are a series of math and science problems to be solved. A second round of field testing of the Aeronauts 2000 activities will be conducted in the fall of 1998. A revision of the activities will be completed, by the end of the calendar year, which will incorporate the feedback from the field tests and then the revised activities will be available online.

- Educational Wind Tunnel Project

Franklin D. Roosevelt Middle School, a Cleveland Public School, has been chosen to receive the Educational Wind Tunnel created at General B. O. Davis Jr. Aviation High School, also a Cleveland Public School, in 1995. Due to the school closing at the end of the '95/'96 school year, a new location needed to be identified for the tunnel. Ownership of the NASA Educational Tunnel will be transferred to the Cleveland Public School District through a donation from NASA LeRC, through the Stevenson-Wylder Technology Innovation Act amendment of January 28, 1992 (Public Law 102-45). The tunnel has been moved to FDR Middle School and will be operational by 12/31/98. FDR middle school will be using the tunnel in conjunction with their vision to become a Discovery Magnet School. The wind tunnel will be a step towards helping Franklin D. Roosevelt Middle School realize their vision by providing them with the ability to set up a discovery based opportunity with the use of the wind tunnel as the focus of the activity. The wind tunnel can be used to test objects for their aerodynamic characteristics, allowing students to discover the physics behind basic aerodynamics.

### **Internet Access Research:**

The NASA Lewis Learning Technologies Program is committed to researching, prototyping and testing emerging networking technologies that can be used in an educational setting to connect schools to the Internet economically and efficiently. Access to the Internet will allow the schools to use the educational content available on the World Wide Web at the NASA LeRC LTP Web site as well as other educational Web sites.

- Over the Horizon Networking Technology

The Over the Horizon (OtH) Networking Technology project will be a collaborative effort between NASA, Signatron Corp., Eros Data Center and Flandreau Boarding School. Signatron Corp. is the vendor of OtH networking equipment. Eros Data Center is an Internet Service Provider in South Dakota. Flandreau Boarding School is a Native American school in South Dakota. Over the Horizon networking technology is a wireless network solution. The OtH equipment works by transmitting a data signal from an antenna and bouncing the signal off of the troposphere to the receiving antenna. This method allows for a longer distance between the receiving point and the point of presence than does line of sight radio frequency networking technologies. An OtH networking prototype will be implemented in Flandreau Boarding School and Eros Data Center will serve as the Internet Service Provider for the school. The grant to Flandreau Boarding School will be in place by 12/31/98. Equipment installation will begin in the spring of 1999 and will be complete by the beginning of the '99/'00 school year. During the '99/'00 school year, the prototype will be monitored for its ease of use, reliability, bandwidth capabilities, cost effectiveness and other parameters to determine its effectiveness in providing connectivity to rural schools. Data collected on these parameters will be summarized in a report of findings. The NASA LeRC Office of

Educational Programs (OEP) will be asked to review the type of data that will be collected during this research project for any input they may have.

- AIRNet

Typically computer resources are scarce within schools and teachers are forced to share equipment. The NASA Lewis Learning Technologies Program is working with the NASA Lewis Computer Services Division to research and implement a prototype of a wireless local area network within Whitney Young Middle School, a Cleveland public school. This wireless local area network allows teachers to share the equipment used to access the Internet. The prototype will be used to determine the benefits of a wireless network solution within an educational setting. Examples of the benefits include increase usage of the Internet within classes, decreased disruptions due to having to have the class move to a computer lab and increased flexibility for the teachers.

The wireless local area network prototype consists of strategically located access points within the school and client antennas for desktop computers. The computers are on carts and are equipped with LCD panels and local printers. The wireless LAN is connected to a T1 wide area network. The network was installed during FY98 and in FY99 the prototype will be monitored for its ease of use, reliability, bandwidth capabilities, cost effectiveness and other parameters. Data collected on these parameters during the '98/'99 school year will be summarized in a report of findings. OEP will also be asked to review the type of data that will be collected during this research project for any input they may have.

- INMARSAT Satellite Terminal Project

The LeLTP has purchased an INMARSAT Satellite portable terminal and has constructed a setup to allow for a remote laptop or desktop computer to have a 64kbs connection to the Internet. The equipment needed to make the connection consists of the computer, a 2514 Cisco Router at the remote location, the INMARSAT portable terminal, and a 4500 Cisco router at the NASA Lewis Research Center. All of the equipment was purchased in FY98. In early FY99 NASA LeLTP will test the purchased equipment and configure the equipment for the setup described above. NASA LeRC serves as the Internet service provider for the remote terminal.

The setup allows for two-way data communication through the use of a satellite link between the remote terminal and a ground station and through the use of an ISDN link between the ground station and the NASA Lewis Research Center. The NASA LeLTP will support the NASA Learning Technologies Project by continuing to provide Internet service when the unit is being used for various educational and NASA sponsored events by lending the INMARSAT terminal to the NASA Ames Research Center project working with the Ukraine to clean up Chernobyl.

- Digital Audio Test Bed

The LeLTP will continue to support the Digital Audio Test Bed project, led by the Learning Technologies Project Office. During FY98, LeLTP installed a real media

server and is helping with the dissemination of real media broadcast over the Learning Technologies Channel. LeLTP will participate in the test plan during FY99.

## *2.1 Implementation Plan*

The NASA LeLTP will use the following implementation strategies from the LTP Plan for Education:

- Needs Assessment

The NASA LeLTP conducted a needs assessment for its distance learning program (see Section 6.) through a survey sent to 500 schools identified to have compatible video conferencing equipment. The results of this survey will be used to shape the direction of the distance learning program.

- Customer Involvement

The NASA LeLTP will be using the results of field testing surveys when developing new software simulations and new Web based educational material. Additionally, all of the educational material is developed jointly by a team of NASA personnel and teachers.

- Integration with NASA Center Education Office

The NASA LeRC Office of Educational Programs (OEP) will be asked to provide national standards expertise during the creation of the LeLTP products, along with any other input from an educational expert standpoint. OEP will be asked to participate in the review process of the educational products. OEP will be asked to review the evaluation feedback form created for the products. OEP will be asked to identify schools that would be good candidates for field testing the software. OEP will also be asked to review the type of data that will be collected during the Internet Access Research projects for any input they may have.

- High Leverage Partners

The NASA LeLTP will work with the following high leverage partners:

### *Ohio Space Grant Consortium*

The Ohio Space Grant Consortium and the NASA LeLTP will work together to create problem sets to accompany the Beginner's Guide to Aerodynamics and FoilSim for grades 6-8 and to accompany EngineSim for grades 9-12.

### *EROS Data Center*

The Earth Resources Observation Systems (EROS) Data Center is a part of the U. S. Geological Survey Organization. The main function of the EROS Data Center is to collect and distribute data from satellites and high altitude aircraft. The EROS Data Center, located in Sioux Falls, SD, will serve as the Internet Service Provider for the Over the Horizon project.

### *Rockwell Automation, Inc.*

Rockwell Automation, Inc., is Whitney Young Middle School's corporate sponsor. Rockwell Automation, Inc., has agreed to supply additional computer equipment to Whitney Young Middle School in conjunction with the AIRNet Project.

#### *WVIZ-TV*

WVIZ-TV, Cleveland's Public Television Station and NASA Lewis Research Center have signed a Space Act Agreement that outlines each organization's responsibilities towards the creation of a NASA Education Channel. (See Section 6.)

- Training

The NASA LeLTP holds various professional development workshops for teachers. The workshops provide teachers with basic instruction on the use of LeLTP products and suggestions on how to use the products in the classroom. Workshops are delivered via video conferencing, the Learning Technologies Channel and at educational conferences (see Section 6).

#### *2.2 Collaboration with Other LTP Centers*

- Ames Research Center

In partnership with various NASA LeRC researchers, LeLTP will provide information and Web pages to Aero Design Team Online coordinators in order to represent NASA LeRC more fully as part of the Aero Design Team Online project.

LeLTP will facilitate Franklin D. Roosevelt Middle School's involvement in the Wright Flyer Online project.

- Johnson Space Center & Langley Research Center

LeLTP will facilitate the coordination between the LTP projects at JSC and LaRC and the Embedded Web Technology Project at LeRC. The Embedded Web Technology project utilizes a software package called TEMPEST, which allows for remote control over the Internet. LeLTP will help explore with JSC and LaRC the possibility of using the TEMPEST software within their robotics projects.

- Stennis Space Center

LeLTP would like to acquire a mailing list of the schools that are a part of the Mississippi Interactive Video Network in order to send advertisements about the LeLTP's video conferences. Additionally, LeLTP is interested in learning about the methods and techniques that are taught at SSC's workshops for educators who use distance learning.

3. Milestone Timeline												
	10/31	11/30	12/31	1/31	2/28	3/31	4/30	5/31	6/30	7/31	8/31	9/30
<b>Beginner's Guide to Aerodynamics</b>												
Problem sets field tested								x				
Thrust added to the BGA			x									
<b>Foil Sim</b>												
FoilSim Problem Sets field tested								x				
<b>Engine Sim</b>												
Beta Version of Engine Sim available	x											
Instructional Manual complete			x									
Background information complete (BGA-thrust)			x									
Problem sets complete										x		
Web Site complete												x
Available on CD ROM												x
Version 1.0 available												x
<b>Lesson Plans and Activities for grades 8-12 based on Aeronautics Missions</b>												
Lessons field tested								x				
NASA Lewis Science Lessons on-line	x											
<b>Aeronauts 2000</b>												
Second round of field testing complete		x										
Aeronauts 2000 on-line				x								
<b>Educational Wind Tunnel Project</b>												
Wind tunnel set up and operational at FDR MS			x									
FDR Staff trained on how to use tunnel				x								
FDR Staff has activities developed						x						
100 FDR Students have participated in WT act.									x			
<b>Over the Horizon Networking Technology</b>												
Grant in place			x									
Purchase OtH equipment					x							
Equipment installed in schools									x			
Data collection system in place											x	

3. Milestone Timeline (Con't)												
	10/31	11/30	12/31	1/31	2/28	3/31	4/30	5/31	6/30	7/31	8/31	9/30
<b>AIRNet</b>												
Data collection system in place	x											
Training for teachers complete		x										
Data collection complete							x					
Report of findings complete									x			
<b>IMARSAT Satellite Terminal Project</b>												
Equipment tested and configured	x											
Equipment given to ARC for Chernobyl project			x									
<b>Digital Audio Test Bed</b>												
Purchase PC	x											
<b>Learning Technologies Channel</b>												
FoilSim Presentation	x			x			x					
BGA Presentation	x			x			x					
EngineSim Presentation												x
<b>Video Conferencing Workshops</b>												
FoilSim Presentation	x	x		x	x	x	x					
BGA Presentation	x	x		x	x	x	x					
NASA Educational Web Sites Presentation	x	x		x	x	x	x					
EngineSim Presentation												x
<b>NASA Educational Channel</b>												
Live Presentations Broadcast	x											
Survey of viewers complete									x			
<b>Conferences and Papers</b>												
Teled Conference	x											
Supercomputing '98		x										
NSTA							x					
ITEA							x					
NECC										x		
Paper on AIRNet Project											x	

#### **4. Deliverables**

The following will be the deliverables of the NASA LeLTP for FY99:

- Version 1.0 of EngineSim

EngineSim will be available on the Internet for students' and teachers' use across the country. Background information and problem sets will accompany the software code. EngineSim will be available to teachers to use as a curriculum supplement within their classes. The activities within the package will encourage students to use problem-solving skills and prompt discovery based learning. EngineSim will also be available on CD ROM for distribution at educational conferences.

- Problem Sets for the Beginner's Guide to Aerodynamics and FoilSim for grades 6-8

Problem sets will be available for Middle School Teachers that accompany the Beginner's Guide to Aerodynamics and FoilSim. These problems will be available via the Internet.

- AIRNet Project: Report of Findings

A study of the use of a wireless local area network as a networking solution for schools will be completed. The network solution study will evaluate new wireless networking solutions and their use within an educational setting. Results of the study will allow schools to make a more informed decision regarding the networking solutions they choose for their schools. The result of the study will be made available on the NASA Lewis LTP Web site, through presentations at educational technologies conferences and through publications.

- Over the Horizon Network Prototype Installed

The Over the Horizon Network Prototype will be installed in an educational setting and a data collection system will be in place.

- INMARSAT Satellite Terminal Configured for Remote Internet Access

The INMARSAT Satellite Terminal will be configured for remote Internet access and tested to verify its operation.

- Professional Development Workshops

Workshops that provide training and awareness for teachers on LeLTP products will be conducted on the Learning Technologies Channel, through video conferencing, programs on the NASA Education Channel and presentations at national educational conferences.

#### **5. Evaluation**

- EDCATS

EDCATS will be used to evaluate all of the video conferencing programs. A method will be devised to identify which program is being reported on. The short event feedback form will be used to collect the data. An EDCATS program

inventory will be developed for the NASA Education Channel. Again, a method will be devised to identify which program is being reported on. The short event feedback form will be used to collect the data. When teachers do not have access to the Internet to complete their evaluations on line, a hard copy of the evaluation form will be sent to the teacher's school. They will be asked to fill it out and return it to NASA Lewis, where it will be entered online by one of the LTP staff.

- Customer Feedback

Customer feedback will be gathered on the EngineSim program. Information such as ease of use, usefulness as a science supplement, effectiveness in teaching concepts and other feedback will be sought. The feedback forms will both be in hard copy format, distributed with the software package, and online at the Web site.

An online customer feedback form will be placed on the NASA Lewis LTP Web site. Information on quality of information available, ability to find information, content, presentation of material and other feedback will be sought.

A customer feedback form will be sent to all of the schools that have the capability to receive the NASA Education Channel. Information on how much the channel is viewed, what programs are viewed the most, other content the teachers would like to have broadcast and other feedback will be sought.

- Data Collection

The Wireless Local Area Networking solution, installed within Whitney Young Middle School, will be monitored for reliability, bandwidth capability, cost effectiveness and other parameters. This data will be collected and a report of findings will be compiled. A data collection system for the Over the Horizon Technology Project will be developed and put in place before the start of the '99/'00 school year.

## **6. Dissemination**

Various methods will be used to disseminate the content produced.

- Learning Technologies Channel

The NASA LeLTP will present programs on the Learning Technologies Channel, a collaborative effort of the NASA Learning Technologies Program, lead by NASA Ames Research Center. The programs will consist of workshops for teachers on FoilSim, EngineSim and the Beginner's Guide to Aerodynamics (background information on aerodynamics in an electronic format).

- Video Conferencing Workshops

The NASA LeRC Learning Technologies Program will use the NASA LeRC Video Conferencing facility to conduct video conferences with schools with compatible video conferencing equipment. A distribution list of over 500 schools was developed in FY98 of schools that have video conferencing equipment in their schools. This list will be used to advertise the workshops available through video conferencing. The conferences will consist of workshops for teachers on FoilSim,

EngineSim, the Beginner's Guide to Aerodynamics (background information on aerodynamics in an electronic format) and NASA Educational Web sites. LeLTP will work with NASA LeRC OEP to create a joint program description booklet of the programs available to schools with distance learning capabilities. NASA LeRC OEP will be asked to review the evaluation form used to obtain feedback from the video conferencing programs.

- NASA Education Channel

The NASA LeRC Learning Technologies Program is partnering with WVIZ-TV, the public broadcasting station in Cleveland, OH, to create a NASA Education Channel. The NASA Education Channel will use one of WVIZ-TV's Instructional Television Fixed Services Channels to re-broadcast NASA TV and NASA educational content. Together with other organizations at NASA LeRC, the LeLTP will supply educational content in the form of existing video tapes, tapes of the above video conferences and live presentations. NASA LeLTP will work with NASA LeRC OEP to identify existing content that can be broadcast on the NASA Education Channel. During the '98/'99 school year, the viewers of the NASA Education Channel will be surveyed for their feedback which will be used to determine future planning for the channel. NASA LeRC OEP will be asked to review the survey created.

- Conferences and Papers

The NASA LeLTP staff has submitted presentation proposals at the following educational conferences: Teled Conference, SuperComputing '98, NSTA, ITEA and NECC. The presentations include delivering hands on workshops or demonstrations of the educational software. Copies of the software will be distributed at the conferences as well. Technical papers about the educational software will be prepared and submitted for publishing. Technical papers on the networking research will also be prepared and submitted for publishing. When NASA LeLTP is solely representing educational projects, at the NASA Lewis Research Center, at conferences, NASA LeLTP will distribute hand out material on projects managed by the NASA Lewis Office of Educational Programs.

## 7. Budget

### Project Budget

<b>Labor</b>	
Support Service Contractors	
Java development task	8,000
Distance learning task	
Labor (SSC)	65,000
Travel (SSC)	3,000
Web site development task	
Labor (SSC)	60,000
Travel (SSC)	5,000
Summer Intern	10,000
INMARSAT set up task	
Labor (SSC)	6,000
Disk duplication	3,000
Video footage (for the NASA Ed Chan.)	5,000
<i>Sub Total</i>	<i>165,000</i>
<b>Grants</b>	
Flandreau Boarding School (OtH)	42,500
Ohio Space Grant Consortium	7,500
<i>Sub Total</i>	<i>50,000</i>
<b>Equipment</b>	
PC Computer for DAT	3,000
Data Acquisition Program for WT	2,000
<i>Sub Total</i>	<i>5,000</i>
<b>Total</b>	<b>220,000</b>

### Civil Servant Travel

Project	Place	Amount
Over the Horizon	Sioux Falls, SD	4,500
LTP Conference	KSC	1,000
LTP Project Review	TBD	1,000
NSTA	Boston, MA	1,000
<b>Total</b>		<b>7,500</b>

### Civil Servant FTEs by Month

Month	Oct	Nov	Dec	Jan	Feb	Mar	May	Jun	Jul	Aug	Sep
<b>FTE</b>	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5

## **25.18 A18 Marshall Space Flight Center Learning Technologies Regional Project**

### **Earth System Science Education Pilot Testing and Dissemination Project**

#### **1. Goals**

- To pilot test a set of Earth and space science resources developed in support of NASA's Earth Science Program and being made available on the World Wide Web as part of the FY99 Goddard Space Flight Center LTP Proposal.
- To develop a new set of K-4 Earth and space science resources in support of goals and objectives of the NASA Earth Science Enterprise and to be made available on the World Wide Web in support of the FY99 Goddard Space Flight Center LTP Proposal.
- To utilize a network of teacher training sites established as part of the Alabama Research and Education Network (AREN) (see Approach).
- To use the Internet as a major communication vehicle for the dissemination of Earth and space science curricular support materials to Earth and space science teachers at the middle and secondary level.
- To assist in the development of a resource bank of Earth and space science activities using Internet Web sites linked to the resources of the Earth and space science directorates at NASA/Goddard and at the NASA/MSFC Global Hydrology and Climate Center (GHCC).
- To correlate these new Earth and space science resources with the Alabama Course of Study - Science and the objectives of the Stanford Achievement Test, 10th edition.

#### **2. Approach**

The MSFC Education Programs Office FY99 LTP proposal will be to coordinate the pilot testing of a set of existing Web based Earth and space science investigations for grades 5-8 and 9-12. These Web investigations were developed by Maryland teachers during summer workshops held at the Goddard Space Flight Center as part of their LPT project. GSFC developed 43 Investigations in FY97 and developed 22 more in FY98. These new resources will be placed in a standardized format and made available electronically as part of GSFC FY99 LTP proposal. In addition, the MSFC Education Programs Office will facilitate the development of several new K-4 Earth and space science investigations and will also conduct the pilot testing of these new modules with Alabama teachers.

MSFC will also work in cooperation with the Alabama Supercomputer Authority (ASA), which is a state-funded corporation founded in 1989 to operate the Alabama Supercomputer Center (ASC) and the Alabama Research and Education Network (AREN). ASA provides supercomputing time and related resources to Alabama's academic researchers and industry, facilitating research in advanced scientific and

engineering disciplines. The ASA data network, AREN, provides Internet connectivity to state government, industry, higher education and K-12 systems within the State of Alabama. MSFC will conduct introductory workshops for pilot teachers at AREN Teacher Training Sites located across Alabama. MSFC will also coordinate videoconference feedback sessions with the NASA and university scientists and curriculum designers at the conclusion of the pilot testing period. These sessions will utilize the AREN Teacher Training Sites as well.

Pilot testing and investigation development teachers in Alabama will be previous participants in *Project EarthSense*, a week-long teacher workshop focusing on the concepts of remote sensing and hydrology conducted at the GHCC and funded by the Alabama State Department of Education over the past five years. Alabama teachers who have been trained in the GLOBE Program will also be eligible as pilot testers for this effort. Pilot testing teachers will be asked to conduct several Web-based Earth science investigations and complete an appended evaluation form. MSFC will collect and provide this feedback to be used to further refine the Web investigations.

### **3. Milestone Timeline**

- MSFC will assist with the evaluation of '98 GSFC Investigations which is to be completed by Earth science teachers and students in their classrooms; a WWW template will be developed, approved, and made available on the Internet—12/31/98
- Selection of investigation development and pilot testing teachers to participate in introductory workshops—10/1/97 - 12/31/98
- Conduct five regional workshops in cooperation with AREN sites— 1/1/99 - 4/30/99
- Collect pilot testing evaluation materials and submit to GSFC —5/1/99 - 5/31/99
- Assist GSFC staff with the evaluation of '98 investigations, final revisions, approval, and availability on the Internet for all —8/1/99 - 9/30/99

### **4. Deliverables**

MSFC selected Alabama teachers will provide new K-4 Earth and space science investigation for pilot testing. MSFC Education Programs Office staff will coordinate the submittal of pilot testing evaluations of Internet interactive Earth System Science investigations to GSFC LTP. A project report for the MSFC LTP FY99 project will be available to all interested parties.

### **5. Evaluation**

Electronic evaluations will be solicited from each of the Alabama pilot testing teachers. The evaluation tool will be designed in cooperation with GSFC and MSFC staff. Summaries of these completed evaluation tools will be made available as a deliverable.

### **6. Dissemination**

Internet dissemination of final forms of the Earth and space science investigations will be the responsibility of the GSFC Education Office.

## 7. Budget

<b>Budget Item</b>		<b>Cost Estimate</b>
Regional Workshops (5 @ \$2K)		\$10K
Grants to Schools for pilot testing ( 10 @ \$1K)		\$10K
Teacher Grants for Module Development (10 @ \$1K)		\$10K
Pilot Teacher Stipends (10 @ \$1.0K)		\$10K
Travel	<i>Civil Service</i>	—
(related to workshop and other administrative activities)	<i>Contractor Support</i>	\$10K
<b>Total FY 99 Funds Requested</b>		<b>\$50K</b>

## **25.19 A19 Stennis Space Center Learning Technologies Regional Project**

### ***Introduction***

In the next ten years, the commercial remote sensing and spatial information industry has the potential to grow from a market value of \$1 billion to over \$10 billion. With this growth, the application of remote sensing to such concerns as the environment, agriculture, land use management, and infrastructure development will diversify and multiply. New technologies and applications consequently bring the need for new skills and techniques, which translates to additional jobs.

The Commercial Remote Sensing Program at Stennis Space Center (SSC) foresees a critical need developing within the spatial information industry. In the upcoming decade ten to fifteen commercial satellites are planned for launch, but little is being done to produce and prepare a workforce capable of managing the resulting data and data products. The potential candidates for these jobs are in grade school today!

### **1. Goals**

We propose the development and implementation of a one Carnegie unit, Web-delivered, high school science course called Spatial Information Sciences. The recognition of the need for a high-school level science course in the spatial information sciences is an outgrowth of the directives of the business plan referenced below. Stennis Space Center is the Lead Center for Commercial Remote Sensing and is responsible for implementing the NASA HQ directed Workforce Development Education and Training Initiative. This initiative “will establish world-class remote sensing academic and research centers of excellence in Mississippi, and will thereby address the critical remote sensing workforce shortage, enabling the growth of the industry in Mississippi, and removing one of the major roadblocks for industry growth across the nation.

A key to the successful implementation of this approach is systematic identification of the competencies required at all levels within remote sensing companies. These industry-identified requirements will be translated into integrated curricula targeted and implemented at graduate and undergraduate; community and junior college; high school and vocational-technical; and kindergarten through eighth grade.” (NASA Commercial Remote Sensing Workforce Development Education & Training Initiative, Business Plan, June 23, 1998.)

### **2. Approach**

#### ***2.1 Implementation Strategies***

- Needs Assessment

The Commercial Remote Sensing Program Workforce Development Education and Training Initiative has worked closely with leadership in the Mississippi State Department of Education and the Social Science Research Unit at Mississippi State University to determine education and training needs of businesses and

industries who are current or potential users of spatial information technologies. The Social Science Research Center has produced two documents (*1998 National Spatial Information Technology Survey Results*, and *Remote Sensing and Geographic Information Systems Course Availability in Mississippi's Public Universities and Community Colleges*) that have been instrumental in understanding the need for the proposed course at the high school level. These documents can be found on the Web at <http://www.ssrc.msstate.edu/>.

- Customer Involvement

In August of 1998 a curriculum writing team was formed led by the Mississippi State Department of Education to determine the core competencies and learning objectives for the course. This writing team involved members from the Office of Instruction Development at the Mississippi State Department of Education, teachers and administrators from several school districts throughout the state, NASA Commercial Remote Sensing Program Workforce Development Education and Training Initiative representatives, and representatives from the GLOBE program.

- Integration with NASA Center Education Office

This effort is fully integrated with the Center Education Office at Stennis. The Workforce Development Education and Training Initiative of the Commercial Remote Sensing Program as well as SSC's involvement in the Learning Technologies Project are both under the management of the Chief, Education and University Affairs Office, Dr. David Powe.

- High-level partners

This effort would not be possible without the buy-in and involvement of several key partners. As explained above the NASA Commercial Remote Sensing Program Workforce Development Education and Training Initiative is the prime "behind the scenes" mover for this effort. This group has solidly convinced the Mississippi State Department of Education of the need for a Spatial Information Sciences course and the practicality and power of the course being Web-delivered, so therefore, the Mississippi SDE is now the most visible proponent for this effort.

Preliminary meetings have been held with principals at the U. S. Department of Labor and the U. S. Department of Education as they have expressed interest in the NASA Commercial Remote Sensing Program Workforce Development Education and Training Initiative. We expect more involvement with these groups as we ramp the initiative to outreach on a national and international scale (FY2001 and beyond). Our NASA HQ mandate is to begin first in the state of Mississippi.

Another high-level partner is the Mississippi Space Commerce Initiative. The Initiative is a collaboration among the State of Mississippi, NASA, private space-related business, and four research universities (through the Mississippi Research Consortium). The objective of the MSCI partnership is to bring together all the forces necessary to make Mississippi an ideal location for businesses engaged in selling information products derived from satellites in space.

The GLOBE Program has been an invaluable partner in this effort. Students taking the Spatial Information Sciences course will utilize the rich data sets accumulating in the GLOBE Data Archives as they seek to acquire, integrate, and understand Earth as a system that can be examined by various spatial information gathering tools. GLOBE has supplied personnel in the curriculum writing effort and will continue to assist in the Web design of the course interface.

The Workforce Development Education and Training Initiative has employed three basic principles for carrying out its mandate. The process must be customer driven, it must utilize existing infrastructure and must result in systemic change. We believe that solid high-level partners are evidence that these three basic principles drive the effort.

- Training

The NASA Educator Resource Center at SSC under the direction of the Education and University Affairs Office will work in concert with the Mississippi State Department of Education to conduct teacher and/or classroom facilitator training in use and navigation of the Web-site.

## *2.2 Collaboration with Other LTP Centers*

We are exploring the possibility of collaborating with the Learning Technologies Channel component of the Quest project team. Although the proposed course is not “event” based, SSC will be offering other types of programming throughout the school year via two-way interactive video that can serve as enrichment to the course and perhaps LTC might be an appropriate venue for wider dissemination of that programming.

Although the following does not speak to collaboration with another Center this project is a nice fit with the LTP Project SSC developed in FY98. SSC’s FY98 project is a Web-site called “From A Distance”—a Web-site that is designed to serve as one’s first gentle immersion into remote sensing. This Web-site will often be referenced in the “supplementary resources” section of the Web-delivered Spatial Information Sciences course. The “From A Distance” site will be maintained and updated by the Engineering Research Consortium at Mississippi State University through a contract with the Commercial Remote Sensing Workforce Development Education and Training Initiative.

### 3. Milestone Timeline

Task	Date
Implement Content Development Contract (Non-LTP funding source)	<b>25.19.1.1 No v 98</b>
Curriculum Writing Team Finalizes Course Structure	Nov 98
Design Basic Web Structure	Dec-Feb 98
<b>25.19.1.2 Create/Test Quiz/Test Item Generating Engine</b>	Jan-Feb 99
Create/Test Participant Password, Log-on, General Server Security	Feb-Mar 99
Port Content to Web Structure	Mar-Jun 99
Develop Help Desk Protocols/Scenarios	May-July 99
Field Test w/ "Summer School" Students	July-Aug 99
Conduct "Summer School" Formative Evaluation	Aug 99
Incorporate Changes From "Summer School" Experience	Aug 99
Full Implementation Mississippi Student Version (Restricted Access)	Sep-Dec 99
Launch Unrestricted Access Version (Freely Available on the Web)	Sep 99
Conduct Summative Evaluation	Jan 00

### 4. Deliverables

The deliverable is a Web-delivered, one Carnegie unit, high school level science course. Students who will be taking the course for credit in Mississippi will go to a secure server that is capable of delivering the course content as well as generating random quiz and test questions that measure student mastery of the material. Since this capability implies a secure server this version of the course will only be available via a password by officially registered students. We envision another version of the Web-site that will have limited quiz-generating ability but will serve all the content of the course and will be freely available to the public.

### 5. Evaluation

The Commercial Remote Sensing Program Workforce Development Education and Training Initiative has a contract in place with the Social Science Research Center at Mississippi State University to conduct a complete evaluation of this project. They will

work in concert with the Mississippi State Department of Education to design and conduct an evaluation that will measure the extent to which this project fulfilled its goals and more importantly the extent to which students were effectively served.

## 6. Dissemination and Public Relations

The Commercial Remote Sensing Program Workforce Development Education and Training Initiative has built into its budget a robust Education Awareness Campaign that aims to: “use professional advertising and public relations tools and techniques to include video, radio and print media campaigns, exhibits, displays, and special events to present a message to the widest possible audience that increases public awareness about career-paths in the spatial information industry and call to action that will result in an increased percentage of students enrolling in remote sensing and spatial information training.”

A variety of vehicles, messages, and messengers will be used throughout the year to reach the primary target audience of potential students pursuing careers in the spatial information industry. Efforts will also be made to reach a secondary audience of influencers of these potential students to include parents, teachers, employers, etc. Media gatekeepers are identified as a tertiary audience since they control the play of the public service messages. Members of the Commercial Remote Sensing Program Workforce Development Education and Training Initiative Team regularly present at state and national conferences.

## 7. Budget

Category	Description	Amount
Labor	Support Services Contractor	<b>25.19.1.3 \$ 43K</b>
Travel	Support Services Contractor	\$7K
Equipment		N/A
<b>TOTAL</b>		<b>\$50K</b>

**1. Goals**

The Remote Sensing Public Access Center (RSPAC) is one of more than forty (40) projects funded by NASA's Learning Technologies Project (LTP). The two major areas of RSPAC activity are LTP support, particularly technical support to the LTP, and outreach activities, support, and materials for the dissemination of information to the public about NASA, LTP projects and activities, and Earth and space sciences via the Internet, RSPAC Web sites, CD-ROMs, and conferences.

Our goals are tied to the support needs and requirements of the other members of the LTP community.

**2. Approach**

RSPAC will continue to provide high-level technical services and support to the other teams in the LTP. We will strive to give rapid response to requests for assistance in Web page design and critique, site metrics and analysis, programming, graphics arts, databases, content editing, and production as needed.

We will also continue to provide support to the LT projects in outreach activities on a national and regional scale. RSPAC will continue to design and produce materials such as bookmarks, brochures, and other items that promote the LTP and the individual component projects.

**2.1 Implementation Strategies**

We plan to achieve the goals set forth above in the areas of technical support and outreach activities for LTP.

**2.1.1 Technical Support**

To accomplish the goals set forth above, with RSPAC as an LTP help desk, and as a focal point for technical project support, RSPAC will:

Support the individual Cooperative Agreement Teams (CATs) in meeting their project needs during 1999. To do this, each LTP will be contacted on a regular basis to determine needs in graphics, programming, and systems support.

In a secure area under the publicly accessible LTP site is the LTP management site (<http://learn.ivv.nasa.gov/ltpmgmt>). LTP participants go to this site for LTP information, contacts, monthly report submission forms, and the LTP calendar. We will continue to maintain this site with up-to-date and secure information for the LTP community. This site will continue to be updated and maintained.

LTP informational support will continue to be found in the Developer's Workshop site (<http://developers.ivv.nasa.gov/>). This information includes conference information, LTP contact information, technical information/support, educational resources, and a copy of the current LTP Bulletin, as well as an archive of previous LTP Bulletins.

The RSPAC team will continue to meet the needs of the individual LTP projects, especially in the areas of graphics and programming. Mirroring, testing and evaluation (T&E), and metrics will continue to be offered to the LT projects upon request. We will establish a regular T&E schedule for those who want these services.

#### 2.1.2 Outreach Support

RSPAC will continue to provide high-level outreach support to the LTP community. These activities include the following:

RSPAC will work with the CATs to continue placing NASA's educational materials on the Observatorium. The Observatorium will continue to be used for outreach activities, and to make NASA educational information readily available to the public. We will give more emphasis to the individual projects through Observatorium articles and features.

RSPAC will use the LTP Web site (<http://learn.ivv.nasa.gov/>) to ramp up promotion of LT projects. To do this we will increase the site's profile by directing more of our marketing and public relations activities, conference support and materials, especially for educators, toward this and other LTP sites. Consequently, we will be drawing more attention to it, especially among educators, thus directing more educators to the individual LT projects. We will roughly measure the success of this campaign through monitoring of hits and comparing them to past performance.

Bookmarks, stickers, brochures, postcards, and other promotional materials will be created for use at regional and national conferences.

RSPAC will provide LTP outreach at 1999 regional and national conferences. The conferences that RSPAC plans to support are listed under item 6, below. The list may be modified as other factors may dictate, and as more detailed information becomes available.

#### 2.2 Collaboration With Other LTP Centers

RSPAC, which may be considered a help desk, or job shop for the LTP anticipates working with the Centers and CATS in providing support in as many ways as we can. We can relieve some of the technical burdens that projects may encounter in programming, graphics, T&E, systems questions, and other areas. We have a team of highly experienced Web programmers, systems personnel, graphics artists, and content specialists, especially in Earth and space sciences. Several of these have been teachers or are pursuing advanced degrees in education. As noted above we will be communicating with the LT projects about providing support services.

### 3. Milestone Timeline

All RSPAC support, and most outreach, activities are determined by the needs of our LTP customers. RSPAC will have all project work finalized by mid-July 1999 because the project ends 31 July, 1999.

### 4. Deliverables



- **West Virginia University Academic Computing Technology Fair**  
 April, 1999; Morgantown, WV; Booth Exhibit and Workshop \$44
- **AACE ED-Media ED-Telecom – World Conference on Educational  
 Multimedia, Hypermedia & Telecommunications**  
 June 1999; Seattle, WA; Booth Exhibit and Workshop \$3,212
- **LTP PI Conference**  
 Late Spring 1999; Place TBD.
- **Bell Atlantic World School,**  
 Date TBD; Charleston, WV; Booth Exhibit and Workshop \$312

**7. Budget**

**Total: \$587,999**

## **25.21 A21 University of North Dakota Volcano World**

### **1. Goals**

Maintain the online presence of VolcanoWorld. Add Landsat 7 and EOS AM1 data as they become available. Install a kiosk at Hawaii Volcanoes National Park.

### **2. Approach**

A no-cost extension will be given on the original RSD grant to University of North Dakota to allow the expenditure of carry-over funds. A new grant will be given for FY99 funds.

### **3. Milestone Timeline**

Monthly      New materials online

July 1999    Kiosk at Hawaii Volcanoes National Park

### **4. Deliverables**

Online VolcanoWorld presence

New data on the VolcanoWorld Website

Kiosk in Hawaii Volcanoes National Park

### **5. Evaluation**

Monthly progress reports will be submitted by the VolcanoWorld project.

### **6. Dissemination and Public Relations**

As currently conceived, this effort will be completely dissemination and public relations.

### **7. Budget**

University Grant	\$100K
<b>Total</b>	<b>\$100K</b>

## **25.22 A22 University of North Dakota Distance Learning**

### **1. Goals**

To provide university courses over the Internet-based on NASA technology. We propose to use funding from this grant for four purposes:

- 1) Teaching one or more short courses similar to TeleRobotics
- 2) Developing new technologies and methodologies for teaching SPACE.EDU courses
- 3) Developing a potential software product for teaching via the Internet
- 4) Informing a broad educational community of our progress via publications and presentations at national and international meetings

### **2. Approach**

The Department of Space Studies has developed SPACE.EDU (<http://www.space.edu>), an innovative M.S. program in Space Studies using the Internet and videotapes as the main media for instruction. In the first 18 months of operation approximately 255 students from 30 states and 10 countries have enrolled in SPACE.EDU courses. The highlight of SPACE.EDU thus far has been the eight-part short course, "Live from NASA Ames: TeleRobotics," which explored many different educational technologies using the Internet (Leon, McCurdy and Wood, 1997). Now we propose, in conjunction with NASA Ames, to continue to develop new models of Internet-based distant education programs. An additional goal is to develop the capability and experience to teach short courses similar to TeleRobotics, but to host all of the servers and software here at UND.

### **3. Milestone Timeline**

Annual report 9/98

### **4. Deliverables**

#### *4.1 Task 1*

We will prepare and teach a course, tentatively titled: "Live from NASA Johnson Space Center: Astronaut Training for the Space Station Era." We will work in association with scientists, astronauts, administrators and engineers at Johnson Space Center in developing this project. This course (to be provisionally offered in March 1998) will use those techniques which worked best in the previous TeleRobotics course: audio streaming, Web-pages for images, chat software for student questions and online exams. Additionally, we will monitor the improvements in voice-to-text recognition software and, when appropriate, integrate it into the course to compile a reference transcript. Similarly, other commercial software innovations will be tracked and used whenever they would improve the educational experience. We point out, however, that we do not wish to develop educational methodologies which can only be successful in unique circumstances. Rather our goal is to be early adopters of new technologies that can be utilized by students with computer capabilities only slightly more advanced

than the average. In other words, our technologies won't be cutting edge, but we will strive for our applications to education to be.

Other short courses are being considered. One is "Live from Moscow: The Russian Space Program" which may be offered in fall 1998. We are coordinating with the Baumann Institute (the MIT of Russia) in Moscow the exploration of possibilities for this course. We would need to send two Space Studies faculty and staff members to Moscow to coordinate this challenging offering. Additional course for development in future years include "Live from . . . Eros Data Center," ". . . Aerospace Industry," ". . . Research Organizations," and ". . . DOD." This capability can be used for many different types of courses and at various grade levels.

#### *4.2 Task 2*

SPACE.EDU is currently a very successful set of methodologies and technologies for teaching over the Internet. But as we learn from our experiences, and as new hardware and software capabilities become available, we will evaluate new ways to improve our courses. One important improvement will be to migrate our existing site into one based on a database. We envision that whenever a student logs on to SPACE.EDU the host server will present a menu of options and recommendations personalized to each student's status in the program. For example, if a student has completed nine credits but has not yet officially applied for admission to UND, the server will remind the student of the requirement to register and lead her/him to the online form for application. Such a database will provide a more personal interaction for the student.

Another important innovation is the development of simulations that improve student scientific understanding by performing interactive experiments. We have already developed such Internet-based lab exercises for impact cratering and volcanic eruptions. In each case a realistic modeling of a geologic process is rendered according to input parameters selected by the student. Comparison of simulation with real volcanoes or cratered surfaces allows inference about the actual parameters. We will also investigate other lab exercises using multi-media experiments delivered over the Internet. This is an effective and fun way to learn.

#### *4.3 Task 3*

Presentations about SPACE.EDU at meetings in Malaysia, Wyoming, North Dakota and Manitoba, Canada, have been very favorably received with many requests for our software. We intend to closely evaluate if our SPACE.EDU software can be generalized as a commercial product. Because the software has to be hosted on a server, it is more complicated to install and implement than most software which simply is loaded onto a desktop PC. We intend to develop a prototype of the various software components and instructions necessary to teach a single course on the Internet: i.e., building class Web pages, establishing class list serves, signup forms for enrolling in chat sessions, online testing and grading, etc. NASA funding will be used to test if a feasible product can be developed (can we do it and is there an adequate market); if the answers are yes, other funding will be used to actually develop and market the product.

#### *4.4 Task 4*

Internet education is inevitable for K-20 education, just-in-time job training and recreational education. We intend to present our experiences, lessons learned and recommendations to the educational community through published papers and presentations at national and international meetings.

#### *4.5 Technical Considerations*

Inappropriate use of any educational technology can stifle student interest. We intend to capitalize on the multi-media capability of the Web to use color, video, audio, live interactions and simulations to capture student interest. Because we teach the same courses to UND campus and distant students we will be able to quantitatively compare grade distributions and completion rates for the two groups.

We have found that as faculty members experience Internet teaching, they re-cast their teaching styles to encourage more interaction and minds-on and hands-on student projects. Additionally, the faculty members learn new tools that can be used to improve on campus teaching. And by assigning students to prepare homepages, rather than traditional research papers, the students learn valuable skills for use in their professional lives. While SPACE.EDU is specifically aimed at graduate level education, it is applicable to all educational levels. And its reliance upon computers and individual learning is consistent with goals of various national education reform movements.

The development of a complete pedagogical approach incorporating new technology and teaching methodologies provides a tested model for use by other teachers at all grade levels. The proposed commercial product and presentations at meetings will disseminate our innovations to a wide audience.

### **5. Evaluation**

The technical work provided by this resource will be evaluated by the grant COTR.

### **6. Dissemination and Public Relations**

These courses will be made available to at least 150 non-credit students with audio and thousands of participants via the World Wide Web.

## 7. Budget

### NASA Ames Budget for FY98 and FY 99 (in \$K)

<b>Category</b>	<b>1998</b>	<b>1999</b>
Personnel:		
Faculty	--	5000
Staff/Student*	8700	28500
Fringe Benefits (27%)	2349	9045
<i>Total Personnel</i>	<i>11049</i>	<i>42545</i>
Operating:		
Travel (see note 1)	2600	4800
Communications	55	500
Data Processing**	2000	14000
Office Supplies	--	--
Supplies	--	748
<i>Total Operating</i>	<i>4655</i>	<i>20048</i>
<i>Equipment***</i>	<i>7800</i>	<i>15500</i>
<i>Indirect Cost/35%</i>	<i>5496</i>	<i>21907</i>
<b>Total</b>	<b>\$29000</b>	<b>\$100000</b>

\* Yr 1: Staff 2 mm (\$5000); student (15hr/wk = \$3700)

Yr 2: Faculty 1.5 mm (\$5000), Staff 12mm (\$24,800), Student 15 hr/wk(\$3,700)

\*\* Web software: database, middleware, etc.

\*\*\* Equipment: Web workstation, laptop, RAM and hard drive upgrades

Note 1: Travel Breakdown

<b>Category</b>	<b>1998</b>	<b>1999</b>
Travel:		
Airfare	1300	2400
Hotel	450	1100
Food	350	600
Registration	100	100
Miscellaneous	100	200
Car Rental	300	400
<b>Total Travel</b>	<b>\$2600</b>	<b>\$4800</b>

## **25.23 A23 COMSAT Project**

### **1. Goals**

Provide a resource for demonstrating Learning Technologies.

### **2. Approach**

Fund appropriate contract to implement COMSAT satellite time for LeRC INMARSAT Portable B Station. Acquire an NT portable workstation that can encode video via real media.

### **3. Milestone Timeline**

December 1998	Implement INMARSAT account
January 1999	Procure NT portable workstation
February 1999	Integrate systems

### **4. Deliverables**

INMARSAT account

### **5. Evaluation**

Technical success will be logged and evaluated by LeRC.

### **6. Dissemination and Public Relations**

This resource will provide access for special events and technology demonstrations.

### **7. Budget**

Comsat Minutes	\$15K
NT Portable Workstation	\$5K
<b>Total</b>	<b>\$20K</b>

## **25.24 A24 Learning Technologies Project Office Local Projects**

### ***Minority Student Programs***

#### **1. Goals**

The Goal of the LTP Office Minority Student Programs is to provide challenged youth and minorities opportunities in Internet-based learning.

#### **2. Approach**

This program contains three specific elements towards these goals. The Hispanic Essay Contest, the Bay Area Minority Student Program, and the Santa Clara County Robotics Competition.

##### ***2.1 Implementation Strategies***

- Hispanic Essay Contest

The strategy is to solicit an essay contest to Bay Area schools for Hispanic organizations. Two high school essays on science and the Internet will be selected by the Center Director. The two awardees will be granted a trip to space camp and a two-week internship at NASA ARC. Wang, Inc., will be used as the operational mechanism.

- Bay Area Minority Student Program

The strategy is to employ qualifying challenged youth from minority backgrounds to support LT. These individuals are expected to undergo technical training and to provide technical support for the project office. Currently 75 percent of the youth pool is employed at ARC. A 25-percent increase is planned by the PO during the 2nd quarter of the fiscal year. Hiring practices and employment will be implemented through Wang, Inc.

- Santa Clara County Robotics Competition

One challenged youth school will be selected to enter in the US First Robotics Competition. This team will also attend the Western Regional Competition to be held at ARC in February 1999. The selection of this school is based on botball tournament placing held earlier in 1998.

##### ***2.2 Collaboration With Other LTP Centers***

This particular proposal includes no partnering.

#### **3. Milestone Timeline**

- Hispanic Essay Contest
  - Essay Contest Announced 3/99
  - Essay Contest Awarded 5/99
  - Summer Interns to Space Camp 7/99

- Bay Area Minority Student Program
  - Interviews and Selections 4/99
- Santa Clara County Robotics Competition
  - Prep School for Competition 10/98
  - US First Western Regional Competition 2/99
  - US First National Competition 5/99

#### **4. Deliverables**

The Hispanic Essay contest will benefit the Hispanic community through empowering young Hispanics in careers involving aerospace and Internet-based learning. Admittedly it is a local program and has no national impact.

The Bay Area Minority Student Program benefits the project office by supplying inexpensive technical labor. A cost savings of approximately \$110,000 can be realized for hiring fully certified technicians. Their labor is proficient and competent.

The Santa Clara Robotics Competition is designed to give the project manager greater insight into the US First Process so that LTP may play a larger role in the future of Code S-related activities. This will have a national impact as LT is preparing to take on the lead role for robotics education for the agency.

#### **5. Evaluation**

- The Hispanic Essay is reviewed by the Center Director for its value to the project.
- The technicians in the Bay Area Minority Student Program are reviewed annually by Wang, Inc.
- The Santa Clara Robotics Competition is reviewed by the Project Manager.

#### **6. Dissemination and Public Relations**

This Hispanic Essay Contest will be publicized in the ARC Astrogram and local newspapers. The winning essays will be placed on the Hispanic Advisory Group's Web page.

The Bay Area Minority Student Program selections will not be publicized as they are primarily a source of affordable labor for the project office. The fruits of their labor will, however, affect countless projects.

The results of the US First Robotics competition will be publicized at a national and regional level. Any success in placing will be revealed at that level.

## 7. Budget

• <b>Hispanic Essay Contest</b>	<b>\$5,000</b>
-- Travel for two @ \$1,500 per student	
-- Labor for two @ \$1,000 per student	
• <b>Bay Area Minority Student Program</b>	<b>\$32,000</b>
-- Labor for Four Technicians @ \$8,000 per year for full and part time	
• <b>Santa Clara Robotics Competition</b>	<b>\$10,000</b>
-- Hardware for Western Regional entry fee \$4,000	
-- Hardware for National entry fee \$4,000	
-- Travel \$2,000	
<b>Total</b>	<b>\$47,000</b>