

PROJECT PLAN

Introduction

The _____ Program is requesting \$60,000 per year for three years from the _____ for identified underserved high school students who will benefit from research experience in space science. The _____ is operated at _____. Over a three year period, a total of 90 high school Hispanic, Native American, African American, and non-Hispanic white students _____ will study daily changes of our nearest star – the Sun, and participate in a global research project. Students will learn to use state-of-the-art telescopes at both optical and radio wavelengths. Each student will spend a week on _____ and be invited to follow-up campus programs during the school year. To extend the benefits of the program, students will build and take ownership of their own radio telescope to use at home or school.

High school students who conduct research _____ learn how to conduct scientific investigations, use all they have learned in math, science, even writing classes, and complete their internships at _____ with a new sense of enthusiasm. Students begin a new phase in their thought processes – they question, they analyze, and begin a new journey of critical thought. _____ is a place where science excites the imagination. We give students the chance to experience a world of authentic scientific research that they might not otherwise have available. Their participation will sharpen the students' critical; thinking skills, inspire them, and promote their realization of their talents and skills. As one young lady in one of our high school summer research programs said "I didn't realize I could do this", after she completed a mechanical engineering project with our _____. That realization is what we want to accomplish.

_____ currently operates a similar program for high school students in the _____, who participate in a two week _____. Other high school students conduct research and are supported by scholarships funded by private donations. All programs use the resources at _____ – the radio and optical telescopes, labs, computers, and the astronomy staff. _____ employs two full-time professional astronomers who are committed to secondary and undergraduate education. The _____ students will also benefit from the same resources – and even reach out a step further by lending their results to worldwide studies of the Sun.

_____ is a not-for-profit public foundation located in _____. The facilities available are a truly unique set of telescopes and infrastructure that can be dedicated to the _____ observations, providing learning opportunities not available elsewhere.

1. Problem Statement and Needs Assessment

The science and technology education needs the population of talented Hispanic, African American, Native American, and other underserved high school students are addressed in this proposal. We use _____ as an indicator of the need for synergistic programs with opportunities to improve learning. We find that --% of Native American _____, --% of Hispanic (_____), and --% of African American (_____) high school students pass their _____. Although these statistics include many factors, we feel a research experience in _____ can contribute positively to improving the number of

students who will pass this exam by sharpening the students' critical thinking skills. The statistics are from the _____

Superintendents of Schools in _____ Counties are excited by opportunity _____ will have for their students. As indicated in their letters of support, these Superintendents will help manage the selection process to identify outstanding students to participate in the _____ at _____.

2. Goals

The specific goals of _____ include:

1. Improve science competence by developing skills in electronics, computer sciences, astronomy, physics and earth sciences.
2. Nurture enthusiasm for science by providing hands-on creative scientific investigations that will be fun and relevant to the students' understanding of the world around them.
3. Interest underserved young people in pursuing careers in research or other science-related areas. They will live and work with professional scientists on the _____ campus for one week, visit _____ several times during the school year, link with other scientists in a global research project, and develop the tools and means to continue their research after returning home.

Meeting _____ goals, students participating in research in the _____ will develop their competence in electronics technology, computer, astronomy, and physics competence as they operate the telescopes and learn to critically analyze their data. Specifically, the students will be monitoring the Sun in real-time and contributing to international efforts to understand the impact of the Sun's activity on earth. The instruments the students will be using will be accessible remotely via the Internet, so the students will take their research home following their summer residency and continue during the school year. With new knowledge and tools, the students will have a new appreciation for knowledge and learning in a way that is practical and meaningful in their daily lives. Our experience has shown that some may decide to pursue science related careers.

3. Objectives

Our first and foremost objective is to take the students out of the classroom and into an unprecedented opportunity to be a part of an authentic science research effort. In effect they will "learn science by doing science." Their _____ research experience complements the Earth/Environmental Science, Physical Science, and Physics Curriculum Goals from the _____ for grades 9-12. The _____ Goals and the alignment of _____ are given in Table 2

TABLE 2.

COMPETENCY GOALS FOR GRADES 9-12	DISCIPLINE	ALIGNMENT
The learner will acquire an understanding of the earth in the solar system and its position in the universe.	Earth/ Environmental Science	Students use radio and optical telescopes; examine the sources of stellar (solar) energies
The learner will construct an understanding of electricity and magnetism.	Physical Science	Practical applications of electromagnetism via radio waves and visible light
The learner will develop an understanding of wave motion and the wave nature of sound and light.	Physical Science	Analyze the characteristics of waves including wavelength and frequency
The learner will build an understanding of the structure and properties of matter	Physical Science	Study the nature of atomic structure including protons, neutrons, and electrons.
The learner will develop an understanding of wave motion and the wave nature of sound and light.	Physics	Study the mechanisms for producing radio waves and visible light

4. Methods





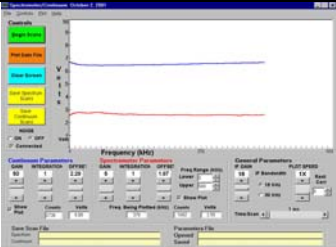
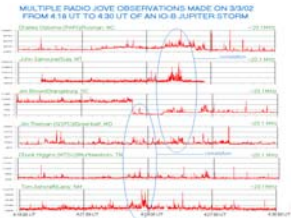

The _____ students will learn fundamental science concepts and use critical thinking skills to study daily variations in the Sun's activity. The students in _____ will observe and measure sunspots, visible solar flares; and the energy from flares at low and high radio frequencies. The study of the interrelationship of these observations provides important data for understanding the impact of energy of the Sun on our environment. The students will be immersed in a global research effort as part of the Radio JOVE Project sponsored by NASA. Briefly, Radio JOVE has more than 1,700 radio telescopes distributed throughout the world, and participating high schools, amateur and professional astronomers are interacting and sharing their data. Each of the experiments the students will conduct is summarized in Table 3 on the next page. All of the telescopes can be operated remotely.

The experience of the students will be greatly enhanced when they build radio telescope while at _____ that they will keep and take home for continued study. The radio telescope kit (\$_____) is part of Radio JOVE and will allow students to continue monitoring and sharing their measurements of 20 MHz solar activity. Not only can this become a lifelong experience, but also connects the students with professional scientists and their research.

5. Implementation

The first year of student involvement in the _____ begins in March 20. The Program Director and school superintendents from _____ counties will begin the process for identifying students. High school principals, teachers, and counselors will be notified and a website will be constructed to include _____ program details, the student opportunity and an on-line application form. By May of 20xx, students will have been selected and the curriculum and logistics (e.g. room and board, transportation, and cultural enrichment activities) will be in place.

Table 3. Student Research

What Students See	The Telescope	Observations
 <p>Sunspots</p>		<p>SUNSPOTS: The Sun will be imaged and sunspots will be counted and mapped. Sunspots numbers will be compared with predictions by the National geophysical Data Center of the NOAA. The daily changes in sunspot latitude and longitude will be used to calculate the rotation rate of the Sun. Large sunspots are indicative of forthcoming solar flares which will be detected at radio wavelengths.</p>
 <p>Solar Flares</p>		<p>SOLAR FLARES: Solar flares will be observed using a Coronado Solar Telescope. Students will image the progress of a flare using a camera operating at video rates. The amount of energy and physical size of the flares will be calculated by the students.</p>
 <p>Bursts of radio waves</p>	<p>Redacted photo</p>	<p>HIGH FREQUENCY RADIO: Radio observations of the sun at a radio frequency of _____Hz will be performed using with the _____. The students will measures the intensity of the solar radiation and correlated with the other observational experiments.</p>
 <p>Radio Flares</p>		<p>LOW FREQUENCY RADIO: Radio signals at a frequency of _____Hz from the Sun will be measured using the _____ radio antenna shown to the left. Students will use the antenna to detect intense solar activity, contributing to the worldwide campaign. Solar bursts are often observed at the same time as solar</p>

Upon completion of student selection for the first year, the program staff will contact parents of students. The first summer group of students will begin in July 20xx. Thirty students per year for three years (a total of 90 _____ in the _____) will participate in the program. The core learning experience will take place during two one-week summer sessions (with 15 students per session) each year. The fifteen students per session will be grouped into sections of 5 students each, with one mentor per section. A Program Coordinator, hired in March 20xx, will coordinate and organize the one week summer sessions, and mentor one section. Mentors for the other two sections will be high school teachers who have participated in the _____. Each section of students and mentors will concentrate on one of the solar research experiments. When not using the telescopes, but during regular research hours, the students will use their time to interpret and compare data, and to construct their own radio telescopes with guidance from the mentors. The students will write papers and make presentations to participants in all summer programs at _____. Each week includes 48 instructional and research hours per student, as well as time for cultural enrichment activities and recreation. The students will continue their research throughout the school year. The thirty students for the two programs will be brought back to _____ on the same weekend. Four weekends are planned; two in the Fall Term and two in the Spring Term. Students' parents/guardians, teachers, school superintendents and the media will attend the fourth meeting where we plan a banquet and the students will be recognized. Students will also present their research results.

6. Student Recruitment

Participation in the _____ is for underserved and underrepresented students who show outstanding science skills and interest, especially for those who have potential but have not had the opportunity to demonstrate their potential. Guideline qualifications for participation the _____ include: a GPA greater than 2.7, 10th or 11th grade, expressed interest in being a part of a student academic group, and teacher recommendation. The criteria will be clearly stated in all communications with parents, guidance counselors, and school faculty.

We will e-mail and send letters to Superintendents, Principals and Counselors in Jackson, Henderson, and Transylvania counties. In addition, we will attempt to reach parents through e-mail, phone calls, and letters the Parent/Teacher Associations for each school.

Selection will be based on recommendations, essays, grades in Math and Science, and interviews. The superintendents from all three school systems have agreed to help with selection of students for the program (see letters of support). The _____ Director, Program Coordinator and school superintendents will make the final selection. Should a student who was selected decide not to participate, a runner-up will be notified.

7. _____ Alumni Follow-up

The _____ Program Coordinator and Director will follow-up with _____ after they complete their year of research in the _____. These scholars are ambassadors for future participants, so they will be invited to future banquets to support those who are just completing their year of research. Also, the alumni will be encouraged to share notice of their achievements to the _____ website. On a

personal level, the Program Coordinator and Director will keep contact with alumni through phone calls and e-mails, and be willing to write letters of reference for academic and employment opportunities.

STAFF RESPONSIBILITIES

The Director is responsible for administrative aspects of the program. This includes dissemination of information between the program and students/parents/teachers/mentors. Information includes the organization of application forms, keeping the electronic newsletter and website up-to-date, housing and transportation logistics, and cultural enrichment activities. The Program Director will have final approval of all student activities, budgetary concerns, student experience and conduct, curriculum, and staffing decisions. The Director will also be responsible for collecting, processing, and distributing application forms, and directing evaluation.

PROGRAM DIRECTOR

Qualifications for the Program Coordinator requires at least a Master's Degree or equivalent in a field of Science, at least two years experience in coordinating education programs, and experience as a faculty member at a college or university. The Program Coordinator will be hired by March 31 of each year and will be selected from _____. The performance of the program coordinator will be evaluated annually.

The Program Coordinator will organize the students and mentors into their groups and their research activities, be responsible for use instruction of use of the instrumentation, provide guidance for the research observation and data analysis phase, and direct the daily activities. Mentors will report directly to the Program Coordinator. The Program Coordinator will organize after-hours cultural enrichment activities. These may include attendance of musical performances at the nationally recognized _____, horseback riding, swimming, and hiking.

MENTORS

The _____ will hire two mentors who are high school teachers from _____ counties, and who have participated in the _____. The mentors will be hired for each summer session. The mentors will provide basic instruction and instructions on use of the telescopes. The mentors will live at _____ during the Summer Sessions and will help the Program Coordinator organize cultural enrichment activities. The mentors will continue their involvement during the school year, providing continuity between _____ and the participating students.

STAFF SCIENTISTS

_____, staff astronomer at _____, will work with the students and their mentors as a consultant and provide guidance on their research. As a professional astronomer, _____ has extensive experience with telescopes and observation techniques. _____ curriculum vita are given in the section of this proposal.

Also, please note that _____, _____ Program Director is a professional astronomer and will be available as needed for consultation the research efforts.

FACILITIES

An aerial view of _____, and home of the _____, is shown below. _____, founded in _____, is a not-for-profit foundation dedicated to providing research, study, and educational access to optical and radio astronomy for a broad cross section of users. Pre-college through post-graduate students have the opportunity to work and learn with full time and visiting astronomers while performing research using a variety of advanced astronomical techniques. Additional access is provided to grades K-12 and the public.

_____ is located on _____ in _____. The site is relatively free of light and radio interference. Students will use the _____ two fully operational _____ m radio telescopes, a _____ m radio telescope, a _____ Hz log periodic antenna dedicated to the study of the Sun, and the _____ Solar telescope. Housing and a cafeteria for students and visitors are available at the facility.

The _____ office will be located at _____. _____ is the main observatory control center and administrative center. The _____ office will be furnished and equipped with a high speed Internet line. A large classroom area furnished with Internet access and desk space is available for the students.

The Expertise at _____ includes assistance of student/mentor teams by _____ staff on use of telescopes and other research instrumentation, interpretation of data, and daily interaction amounting to twenty hours/week per _____ staff member during the summer. The interaction of student/mentor teams with _____ staff is critical for the success of the program.

EVALUATION PLAN

Immediately following the summer program, the Program Director, Program Coordinator, and mentors will have a debriefing. The debriefing will focus on review of evaluations, student written and oral reports, and student logbooks. Identification of common themes of change from the review will be implemented by the _____ staff. With changes implemented, application forms, letters, newsletter and website will be adjusted. The sequence of contacts, visits, applications, processing of applications, hiring of mentors, preparation of _____ and development of curriculum will proceed for the next summer. The next year follows a similar path.

Students will keep logbooks to view their progress. We will ask the students to record brief daily comments of their accomplishments and data related to their research. Also, scientists keep logbooks of their research activities, so this is a good habit for students to begin. Once a week the logbooks will be reviewed and progress noted, providing a real-time evaluation. At the end of the three week session, each team of students will prepare an oral presentation to the other teams. The presentations will be shared in a Symposium so that the sense of achievement and contribution will help to provides closure through accomplishment to the summer's program. The Director and Assistant Director will assess the effectiveness of the program from the logbooks and presentations. Changes and enhancements to the program for the following summer will in part be based on these reports.

Students will evaluate the program at the end of their one week program. The students' evaluation form will encourage students to make comments and suggestions on the following topics: How they learned about the _____; deadline and application process and forms; stipend; travel support; host institution living accommodations; local activities; work environment; faculty mentor; research project; overall experience; local host personnel; observing trips; e-mail list server; and additional comments.

Mentors will also evaluate the program. The mentors' evaluation form will ask for comments and suggestions on the following topics: application process; observing trips; travel support; workshops; management of the program; improvements and changes, and additional comments. We want to keep an open atmosphere where positive changes can be made. Evaluations will be taken seriously, and we will make both immediate and annual improvements in the program based on their feedback.

To assess the impact of the _____ experience on the students, we will ask the students to fill in a questionnaire about astronomy and science education and the beginning and end of their research participation. Comparison of the two questionnaires provides a measure of impact of the program on the students. Specifically, we plan to ask questions about the following:

- Astronomy and radio astronomy basics;
- Using telescope
- Knowledge of solar monitoring programs
- Solar Flares
- Sunspots
- Radio emission from the Sun

REPLICATION AND DISSEMINATION

_____ will publish and disseminate the program results. Dissemination will focus on implementation, results of evaluations, suggestions and comments for improvement, and recommendations. We plan to disseminate program results to both professional organizations and to the public, and will travel to and present results at national meetings of the American Astronomical Society and the _____ Science Teachers Association. We will also contribute to the Teachers' Newsletter: The Universe in the Classroom, a free quarterly educational newsletter published by the Astronomical Society of the Pacific for educators. We also will submit our program results to the publications of the National Science Teachers Association: NTSA Reports! (a newspaper of science education), Science Scope (a journal for middle school science teachers), and The Science Teacher (a journal for high school science teachers). Publicly, we will seek interviews with local newspapers, radio, and TV stations.

During the third year of the program, but the _____ staff will prepare and submit a proposal for continuing the program and seek funding from several sources including private foundations, the National Science Foundation, and NASA. Upon positive notification awards, the program will be in place and continue with the possibility of expansion of services to a larger population and/or area.