Curriculum Enhancement Through Space Science Research

Progress Report

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Period of Performance: March 1, 2001 – February 28, 2002

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NCC 5 – 454

Progress Report for Year 2 and Renewal for Year 3 of the NASA PAIR Project at South Carolina State University (NCC 5-454)

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Progress Report for Year 2 and Renewal for Year 3 of the NASA PAIR Project at South Carolina State University (NCC 5-454)

March 1, 2002

The following report is submitted as a Progress Report for Year 2 and as a Renewal Request for Year 3 of the NASA PAIR project at South Carolina State University (SCSU) known as "Curriculum Enhancement Through Space Science Research" (CESSR). The format and content of this report follows that of the Year 1 annual report. The items listed below are taken from a template supplied by MURED to the PAIR Group 2 schools for their Year 1 annual report. More information about the SCSU PAIR program is available at: http://physics.scsu.edu/pair/.

RELEVANCE TO NASA

Item 1: Relation to MUREP, Strategic Enterprises and Center Core Area

The CESSR mission (see Item 2) contributed to the Minority University Research and Education Programs (MUREP) goal in Year 2 by facilitating activities at an MI (SCSU) that related to NASA's mission to " communicate scientific knowledge of the universe". The MUREP goal of systemic and sustainable change by incorporating current NASA research results and modern teaching strategies into the curriculum was also achieved as described in Item 2. These activities have better prepared SCSU faculty to participate in competitive research and education processes in the NASA Strategic Enterprises by familiarizing faculty with both the subject content and the methods employed by NASA in implementing such projects. In fact, during Year 2, two of the faculty members in CESSR successfully proposed to the South Carolina Space Grant Consortium for funding to carry out space science related projects at SCSU.

Underrepresented minority students at SCSU have become better prepared for graduate school or employment in fields of interest to NASA through various research and learning experiences supported by CESSR. Student research projects and curriculum development in Year 2 are clearly related to the goals and objectives of the Space Science Enterprise, in particular to "Contribute measurably to achieving the science, mathematics, and technology education goals of our Nation, and share widely the excitement and inspiration of our missions and discoveries." Training and use of the LabVIEW software package as well as applications related to radio astronomy, database management, robotics and remote control of instrumentation over the web are examples of the type of experiences these students have gained which make them more competitive.

The SCSU PAIR partnering center is the Goddard Space Flight Center (GSFC) which has been designated the NASA Center of Excellence in Scientific Research, and whose Mission Area includes Earth Science, Physics and Astronomy. The SCSU PAIR activities are based on NASA astrophysical research conducted by the PAIR PI. Some space science topics which were explored in Year 2 included radio astronomy, robotic control of a radio telescope, remote web management of a radio telescope and construction and management of a database of radio telescope observations.

Item 2: Mission of the Project and Specific Outcomes

The mission of CESSR is, "To enhance undergraduate faculty teaching and student education across mathematics, science and engineering technology (MSET) disciplines by

integrating the existing NASA research in space science at South Carolina State University into the MSET courses and curricula. Faculty training, undergraduate research and coursework development will be pursued through exposure to cutting-edge science and technology concepts, as well as introducing modern, innovative teaching techniques into the classroom and laboratory."

Year 2 project activities have supported this mission. During Year 2, as in Year 1, four teams of students conducted yearlong research projects under the direction of a faculty mentor. While in Year 1 those projects all had applications to space science, the individual faculty mentors chose the specific objective of their team's project. In Year 2, all four teams were integrated into one large project with each faculty-student team being responsible for one component of the large project. This change in the project was highly successful in getting the students and faculty members to work as one large group. Students and faculty members expressed far greater satisfaction with this arrangement than their counterparts in Year 1. Furthermore, this improved the efficiency of management of CESSR since similar training, supplies and materials could be shared among the groups.

The specific group project in Year 2 was the upgrade of a 4.6-meter radio telescope (a.k.a. Smiley) at the Pisgah Astronomical Research Institute (PARI) with the intention of making the telescope remotely accessible and manageable over the Internet in real time. PARI is now a close and very active partner with SCSU in implementing CESSR. PARI is the site of a former NASA satellite tracking facility near Rosman, North Carolina, and is a nonprofit organization which owns and operates the facility that includes two 26-meter radio telescopes, the 4.6-meter radio telescope and several other radio and microwave receivers as well as one 0.2-meter optical telescope. The four SCSU teams implemented the following projects which were components of the overall group project of upgrading Smiley: (1) develop a means of controlling the temperature of Smiley's receiver; (2) design and configure a database for installation on a server which will be a repository for Smiley's observations and will be accessible to the K-12 community; (3) design and implement the LabVIEW interface to remotely control (robotically) the telescope; and, (4) design and implement the LabVIEW-based telescope control user interface which will be accessible over the Internet.

Team #1 completed their work and PARI is ready to implement their results. Teams #2 and #3 have successfully demonstrated their results in the laboratory, and in Year 3 the new teams will complete the upgrade of Smiley. Team #4 has tested and partially configured the database and server software that will be used in Year 3 with actual data from Smiley.

The team that carried out project #1 also worked with a radio astronomer from the University of South Carolina, Dr. Christina Lacey. Lacey provided longslit, optical spectra of select positions in the spiral galaxy NGC 6946. The students on the team used the IRAF software package to measure emission lines in hydrogen-alpha (656.3 nanometers) and singly ionized sulfur lines (671.7 and 673.1 nanometers). The ratio of the fluxes of the sum of the sulfur lines and hydrogen-alpha line are used to determine if emission objects in the galaxy are supernova remnants (ratio > 0.4) or HII regions (ratio < 0.4). The optical results will be used to confirm the radio results from observations obtained by Lacey. One or more peer-reviewed papers will be submitted to the Astrophysical Journal during Year 3.

INTRINSIC MERIT

Objectives and Implementation

Item 3: Project alignment with original objectives

Our original proposal listed "Objectives and Assessment" under the Project Description. Those items are more accurately described as milestones rather than objectives. Therefore, a

set of objectives was created by the CESSAR Steering Committee (PI, Co-PI and Co-Is) that are in-line with the objectives stated in the original NRA. These objectives are as follows:

1. Integrate cutting-edge science and technology concepts, practices and teaching strategies into the MSET curriculum at SCSU.

2. Increase the number of SCSU MSET graduates who have been competitively trained, have discipline-related work experience and who will attain advanced degrees in fields of interest to NASA.

3. Foster cross-departmental collaborative research and curriculum activities among students and faculty members at SCSU.

4. Significantly improve undergraduate teaching and learning in the technical fields at SCSU including the use of modern teaching techniques and methodologies in introductory and advanced MSET coursework for majors and non-majors.

5. Promote faculty and student interest in NASA space science discoveries.

6. Create an advisory board to include individuals from a wide range of backgrounds and experiences who will provide insight, knowledge and professional contacts to further enhance the development of the various activities supported by this program.

The project has remained aligned with these objectives in Year 2 as evidenced by the examples given under Items 4 and 5.

Item 4: Impact on faculty and staff

Referred Publications resulting from the MURED PAIR project at SCSU:

Olden, P., Robinson, K., Tanner, K., Wilson, R, and Basher, A. M. H., "Open-Loop Motor Speed Control with LabVIEW," Proceedings IEEE SoutheastCon 2001, Clemson, SC, March 30-April 1, 2001, pp. 259-262.

Nikunja K. Swain, James A. Anderson, M. Swain, Raghu Korrapati “State Space Analysis of Linear Time Invariant Control Systems Using Virtual Instruments” , ASEE Annual Conference, Albuquerque, NM, June 2001.

Nikunja K. Swain & James A. Anderson, Cristal Caroll, Priya Olden, James Parker, Maurice Robinson, & Allan Seedarsan “ Computer Based Virtual Engineering Laboratory and Undergraduate Engineering, Technology, and Science Research” ASEE Annual conference, Albuquerque, NM, June 2001.

Non-referred Publications resulting from the MURED PAIR project at SCSU:

Brown, James, “Easy Radio Astronomy For $125”, *Mercury Magazine*, in preparation with knowledge and encouragement of the editor of *Mercury*.

N*on-referred Conference Proceedings resulting from the MURED PAIR project at SCSU*:

Brown, James, “Small Radio Telescopes at South Carolina State University”, Small Radio Telescopes in Modern Astronomy; Workshop at Pisgah Astronomical Research Institute, Rosman, NC; August 9-11, 2001

Brown, James, ‘‘ An Inexpensive Computer Controlled Az-El Antenna Drive System”, Society of Amateur Radio Astronomers (SARA) 20th annual conference; Greenbank, WV; July 15-18, 2001.

Published Reference to SCSU Radio Astronomy Project at PARI

Goldman, Stuart J.; “Mission Possible: The Promise of Pisgah”, *Sky and Telescope Magazine*; October 2001, p. 42

Submitted Proposals resulting from the MURED PAIR project at SCSU in Year 2:

Lead Institution: Pisgah Astronomical Research Institute
SCSU PI/CoI: James Payne (PAIR Project Director)
Submitted to: NSF REU Program (NSF)
Amount Requested: $163,317 Project Duration: 3 years
Amount Funded: Not funded

Lead Institution: South Carolina State University
SCSU PI/CoI: James Payne (PAIR Project Director)
Submitted to: South Carolina Space Grant Consortium (NASA)
Amount Requested: $4,000 Project Duration: 1 year
Amount Funded: $4,000

Lead Institution: South Carolina State University
SCSU PI/CoI: James Brown (PAIR Faculty Mentor)
Submitted to: South Carolina Space Grant Consortium (NASA)
Amount Requested: $3,900 Project Duration: 1 year
Amount Funded: $3,900

Resource Development and Recognition by NASA Radio Jove

James Brown, SCSU Planetarium Director, has done an extraordinary job of implementing radio observations of the Sun and Jupiter since October of 2000. Through his own funds and those provided by SCSU PAIR, he has set up Radio Jove telescopes as well as Alt-Az mounted solar receivers and is near completion of installing a commercially available 1.4 GHz radio telescope to observe galactic and extragalactic sources of radio emission from hydrogen. He is currently monitoring the sun at two frequencies (20 MHz and 145 MHz) and has an extensive database of solar observations at http://www.draco.scsu.edu/radioastro.html. He has come to the attention of Dr. James Thieman, radio astronomer at the Goddard Spaceflight Center and the Radio Jove Project Leader. **Brown’s extensive database at his draco.scsu site is one of only 3 sites linked from the Radio Jove web pages**. Brown is one of only 13 national “Master Helpers” in the Radio Jove program and provides assistance to others in the use of their Jove equipment.

New Partnerships

Project Director, James Payne, is responsible for establishing three new partnerships for SCSU PAIR in Year 2. He facilitated the formation of the SCSU–PARI collaboration at the beginning of Year 2 and is now managing that partnership. He contacted Dr. Christina Lacey, a radio astronomer at the University of South Carolina, and brought her to the project as a professional consultant. She has provided valuable advice and information related to astronomy as well as optical spectroscopic data now being used by one of the PAIR teams. Finally, Payne has been responsible for establishing a new partnership with Orangeburg-Calhoun Technical College (OC Tec). During Year 3, SCSU PAIR and Payne’s grant from the South Carolina Space Grant Consortium will install a radio dish at OC Tec with the involvement of students and faculty

members from both institutions. The two schools will work together to implement remote control of the telescope over the Internet.

Participation in Regional/National Workshops/Conferences

The following faculty members have attended regional or national conferences or workshops with funding provided by SCSU PAIR:

Donald Walter (PI), James Anderson (Co-PI), James Payne (Project Director), Hasanul Basher (CoI), James Brown (Faculty Mentor) Nikunja Swain (CoI), and Kuzman Adzievski (Faculty).

Faculty members at SCSU who are not part of the CESSR project have also benefited from PAIR. A physics faculty member developed a solar and lunar laboratory exercise being used in the Earth/Space Science Foundations course for non-science majors. This extensive lab exercise is carried out over several weeks while the students are required to observe the sun and moon during the course of the semester. Additionally, the lab exposes these education and non-science majors to numerous NASA web sites such as the SOHO site as they carry out various parts of the exercise.

Item 5: Integration of NASA-related research into the MSET curriculum

The PAIR project is responsible for the creation of a new, two-semester, 1-credit course entitled **"**Interdisciplinary Research Seminar in Space Science" (ETS 468-469) which is now part of the curriculum. This course was first offered in Year 1 with an enrollment of 17 students each semester and in Year 2 with an enrollment of 12 each semester. Members of the interdisciplinary student research terms are required to enroll in the course and continue their research projects which were begun during the summer prior to the academic year. During the two semesters in which the course is offered, the cumulative requirements for each student team includes each student giving a presentation at some state, regional or national meeting.

A new laboratory experiment was developed under CESSR for non-MSET majors taking PSC 153, Foundations of Earth/Space Science. Details are provided above under Item 4.

LabVIEW has been integrated into several physics and electrical engineering technology courses including the physics Advanced Laboratory (P 407) course and electrical engineering technology courses (EET 475, Computer-Aided Design of Electrical Systems; EET 460, Senior Project; EET 443, PLC and Virtual Instrumentation; EET 392, Introduction to PLC and Virtual Instrumentation; EET 383, Digital and Microprocessor Laboratory). PAIR is directly responsible for this result, either for incorporating LabVIEW into the course for the first time, or for dramatically increasing its use where it already existed.

Astrophysical subject matter is now in use in physics courses where previously it was not. For example, a CCD lab is now an optional exercise in the Advanced Lab course (P 407). In Quantum Mechanics (P 410) students have been given writing assignments on astrophysical topics (e.g. Production of Optical and UV Emission Lines in Astrophysical Plasmas).

Program Evaluation

Item 6: Outline Implementation of the Program Evaluation Plan

The plan for evaluating the success of the program has been implemented in four separate stages corresponding to time periods that were defined by the academic calendar.

Stage 1: Occurred at the beginning of the summer term (May) and involved an overview by the Steering Committee of the various milestones and projections required in Year 2 and the cumulative milestones and projections for Years 1-4.

Stage 2: Occurred in the fall (October) by which time student and faculty training had been completed and the team and group projects were well underway.

Stage 3: Occurred at the end of the fall term (December) and addressed a number of issues related to the advisory board visit in November, the student research teams and their presentations during the spring term.

Stage 4: Occurred in the spring (March). At this time Year 2 issues were reviewed and plans were made for the Year 3 student teams.

It should be noted that while the funding period for the SCSU PAIR project is March 1 to February 28, the evaluation plan assumes a period beginning on May 15 of one year and ending on May 14 of the next year since student and faculty commitments and subsequent achievement of milestones are tied to the academic calendar. Therefore, the assessment and evaluation for Year 2 described below involves some projections to May 14, 2002.

Item 7: Formative Development of the Project in Response to the Program Evaluation Plan

The project, its goals, milestones and assessment have largely remained the same during Year 2. The most significant changes to the original proposal that occurred in Year 2 included: (1) a single, group project (Smiley) was implemented with separate components for each team. (2) the focus has shifted from optical to radio astronomy as the space science foundation on which the projects are based; and, (3) old partners (A Tech, and Western Kentucky University) were replaced with new ones (OC Tec, PARI, Dr. Christina Lacey at the University of South Carolina).

Item 8: Dissemination of "best practices" information

The dissemination of such information within the project has been carried out through quarterly meetings of the Steering Committee and semi-monthly email exchanges. Unscheduled face-to-face discussions and phone conversations among members of the Steering Committee occur one or more times per week since the committee members interact with each other through various other committees and activities such as shared teaching responsibilities.

Dissemination of the information beyond the project has taken the form of a web site (physics.scsu.edu/pair/), a brochure, an activity booklet and as PAIR faculty mentors attend profession conferences and workshops. Student presentations at state and national meetings such as the IEEE regional meeting and the South Carolina Academy of Science were also a means of going beyond SCSU and the MURED community to include exposure at majority universities. The upcoming October 2002 PAIR meeting will be another place where the best practices will be presented.

Item 9: Tabular Representation of Outcomes/Milestones for Year 2

The original proposal by SCSU called for an assessment of the project (page 14) based on a number of criteria including specific annual milestones, annual and four year totals for enrollment in impacted classes, annual and four year totals for the number of individuals trained as well as the number of presentations given. In the following table, those outcomes and metrics are evaluated for Year 2 and its milestones.

Project Outcomes	Metric for Success	Actual Achievement
LabVIEW introduced in courses	2 new courses	EET 475
New Lab Exercises Created	2 new ones	Solar/Lunar, Radio Astron.
K-12 presentations & email		Yr 2 K-12 goals suspended to concentrate on university goals
Student professional presentations at conferences	3	8
Number of students trained	12	12
Number of faculty trained	5	2 (Year 1: 5 projected, 11 trained)
MSET Majors Impacted	140	126
Non-MSET Majors Impacted	365	62

Comments/Issues to Address in Item 9 Table

Most of the annual metrics included in the original SCSU proposal for Year 2 have been met or exceeded except for: the number of faculty trained and the enrollment in non-MSET classes which were impacted by the project. As to the faculty training, the Year 1 metric was exceeded so that the total Year 1 and 2 metric has been achieved and surpassed. The reason for the failure to achieve the impact on the non-MSET majors is due to a change in the curriculum at SCSU for non-MSET majors since the proposal was written. Many non-science majors at SCSU no longer require the PSC 152 and 153 courses. Furthermore, the general education requirement for science was reduced after the writing of the original proposal. The original goal for the non-MSET majors is no longer a valid one.

Partnering

Item 10: Partners and outcomes from formally established partnerships

Partnering in Year 2 of the SCSU project has been highly successful, but we do not expect to see its full impact until Year 3 or 4 as these relationships continue to evolve.

Our partnership with the Goddard Spaceflight Center through Dr. James Thieman has been helpful in establishing our NASA Radio Jove program. He has been very supportive of our efforts, in particular he has exposed the work of James Brown to a much wider community than would otherwise have known about it.

National Instruments develops and markets the LabVIEW software and they have provided SCSU with teaching materials for training workshops at no cost or significant (85% reduced) cost.

Three new partnerships were developed in Year 2. One new partnership developed with the PARI radio astronomy facility near Rosman, North Carolina. Another new partner is a local junior college, OC Tec. Finally, a collaboration has developed with Dr. Christina Lacey, a radio astronomer and faculty member at the University of South Carolina. More details on these partnerships can be found under Item 4.

MANAGEMENT APPROACH

Item 11: Implementation steps for achieving milestones.

Currently the PI, in consultation with the Co-PI and Co-Is, evaluates and enumerates the steps necessary for successful implementation of each milestone as discussed above in Stage

1 under Item 6. This group then monitors the progress toward achieving each milestone as described in Stages 2-4 under Item 6. Adjustments are made at any time to the course of action needed to achieve a milestone when it becomes apparent that such an adjustment is necessary (e.g. K-12 goals were suspended in Year 2 in order to more fully concentrate on university goals).

CESSR received important feedback from its PAIR Advisory Board in Year 2. The Board pointed to the need to increase the number of faculty and students impacted by the project. In response to their recommendations, CESSR will almost double the number of impacted faculty members in Year 3 by adding a co-mentor to each of the four student research teams. In response to their recommendation for wider dissemination on campus regarding the project, in Year 3 a campus-wide event will be cosponsored with the SCSU NSF AMP students. During this event, student presentations will be given to the student body at large.

Item 12: Evidence of competence in achieving the objects

The table given under Item 9 clearly shows that that project personnel and the partners are capable of achieving the objectives of the project by reaching or exceeding most annual milestones. Additionally, comments under Item 13 show the success of the program from the student perspective.

Item 13: Significance/impact on host institution, NASA and/or state's math/science standards

The NASA PAIR project has achieved a high level of respect and attention from MSET majors at SCSU during its two years of operation. Beyond the obvious appeal of the stipend and required course credit (ETS 468 and 469), the students are aware of the excitement of the subject matter and the unique opportunity to work as a team on a project for a full year.

To quote a junior chemistry major, Dezra Hinkson, "The PAIR Program allows the integration of students from different disciplines to integrate their strengths to complete an assigned research-oriented task and therefore provides an opportunity for me to learn about topics within these other disciplines, e.g. LabVIEW, without the confinement of a classroom setting."

Junior Guy Mentor who's major is Electrical Engineering Technology said this: "What I liked most about the PAIR program was the Astronomy aspect because I've always had a curiosity about it and this made it fun for me to learn. I also liked the way four teams of three members were broken up to accomplish one main task. This was a great experience of engineering and teamwork at its best."

Tia Sweat is a graduating senior who majored in Computer Science. Her feelings about the program echoed a number of her colleagues: "The PAIR Program was a very challenging yet rewarding experience. It gave me a chance to excel in different aspects of the sciences. The highlight of the program was integrating with peers of different educational backgrounds to accomplish common objectives."

Kimberly Burns is a graduating senior in Biology who has already been accepted into the MS program in Public Health at UCLA. Her comments on PAIR and its impact on her career were, "The PAIR Program has given me an opportunity to learn something completely different from my major. Even though I have always considered myself a team player, I have learned how to share ideas with others and put them to use."

HUMAN RESOURCE DEVELOPMENT

Item 14: Project involvement of underrepresented students

Course abbreviations include: P (Physics), PSC (Physical Science), EET (Electrical Engineering Technology), ETS (Engineering Technology & Science)

Non-MSET Majors

PAIR course	Semester	Black Male	Black Female	White Male	White Female	Hispanic Male	Hispanic Female
PSC 151	Fall 01	10	13		1		
PSC 152	Spr 02	6	12				
PSC 153	Spr 02	6	12				
P 507	Spr 02		2				
TOTAL	**Year 2**	**22**	**39**		**1**		

MSET Majors

PAIR course	Semester	Black Male	Black Female	White Male	White Female	Hispanic Male	Hispanic Female
EET 392	Fall 01	19	4				
EET 392	Spr 02	25	6				
EET 443	Fall 01	13	3				
EET 443	Spr 02	13	4				
EET 460	Fall 01	2	1				
EET 475	Spr 02	10	2				
ETS 468	Fall 01	6	6				
ETS 469	Spr 02	6	6				
TOTAL	**Year 2**	**94**	**32**				

Item 15: Measuring MSET student retention

A total of 29 students, 17 from Year 1 and 12 from Year 2, have participated as members of the student research teams. The retention rate stands at 100% to date. All 29 students have either graduated as MSET majors or are still students in an MSET field.

PROPOSED COST

Item 16: Explain any significant budget changes

Two significant budget changes took place in Year 2. The original proposal included a $15,000 Spectrum Analyzer. By the time of the beginning of Year 2, this item had increased in cost such that the budget could no longer accommodate it. Furthermore, a less expensive but reasonable substitute was found as part of the purchase of a radio telescope. Therefore, a number of lower-priced items were substituted for this single item. Specifically, $14,400 worth of National Instruments data acquisition cards, interface modules and related supplies were purchased for existing computers in our NASA training lab. Thus, we are now able to conduct LabVIEW training for up to 12 people at a time using multipurpose PCs rather than a lab full of dedicated National Instruments PXI workstations.

The second major budget change was to remove the $14,000 Questar long-range microscope/telescope and substitute a research-grade sputtering unit for physics and material science use. The sputtering unit will be used by students and faculty for PAIR research projects in material science and advanced physics laboratory courses enhanced by PAIR. The loss of an optical telescope is in keeping with the shift in emphasis from optical to radio astronomy.

Item 17: Ways the budget structure has adequately supported the project implementation

Funds for equipment purchases, faculty salaries and fridge benefits as well as student stipend money have all been adequate to address the needs of implementing the project. Specifically, this budget structure has allowed the University to pursue long-term (12 month) research projects for teams of students, something that has never been done at SCSU and rarely accomplished at other universities.

Item 18: Impact of the largest expenditures other than personnel

If one includes student stipends as a personnel cost, then the largest expenditures, which have had a significant impact on the project, are those for equipment and consultants. While other grants typically provide funding for items of equipment that cost a few thousands of dollars, the PAIR grant has allowed SCSU to purchase more costly pieces of equipment. Such items as the $14,000 sputtering unit would normally be out of the price range of a typical grant. These and other equipment items will have a significant impact on SCSU's MSET department's ability to carry out student and faculty research projects. The approximately $33,000 for consulting is a bit misleading since about 25% of it is for standard services such as equipment setup and installation.

Item 19: Commitment of Resources by the Institution

A total of $14,116 in salaries, benefits and indirect costs is being provided as a voluntary cost share by the University in Year 3. An additional $43,700 in various budget categories are being leveraged by the PAIR PI. These will cover such items as student stipends, communication costs and travel.

Two computer labs in the science building and the computer science building have been used extensively by the student research teams. Lab space has been set aside for the student research teams in the science building and the engineering technology building.

Item 20: Long-term evidence the project has been institutionalized

The SCSU PAIR project is in the process of implementing the following items that will institutionalize the project after the end of funding.

1. An astronomy minor or concentration is being developed as an option in the physics area. During Year 3 it will be presented to the Educational Policies committee for consideration.
2. New courses or new sections of courses which focus on PAIR-related topics
    a. A new, two-semester course "Interdisciplinary Research Seminar in Space Science" was accepted by the University during Year 1 and has been taught for two full years. This is required of all PAIR students.
    b. A general education requirement for all SCSU students is a 1-semester course in computer science. Since the course is required of all majors, it generally does not meet the needs of the math, science and engineering technology (MSET) majors. We will develop specialized sections of this course that will use LabVIEW as a foundation on which computer topics and techniques will be developed. Furthermore, this will be a way for most MSET students to gain exposure to LabVIEW so that they will be better prepared to use it in advanced coursework.

3. Development of a series of new or revised laboratory exercises for physical science courses for non-majors as well as advanced courses for majors. This is an ongoing project. Numerous laboratory exercises have been developed and will be further tested in the classroom in Year 3.

4. Institutionalization of undergraduate research. We have attended a workshop conducted by the Council on Undergraduate Research (CUR) entitled “Institutionalization of Undergraduate Research”. This national organization promotes undergraduate research as an important component to MSET curricula. In Year 3 we will fund a CUR advisory team to visit SCSU and make recommendations on how to develop such a program. We intend to first implement this in the MSET school and then attempt to do so campus-wide, including non-technical fields. Institutionalization of undergraduate research addresses the foundation on which this project is built.

Budget Request Summary

From: March 1, 2002 to: February 28, 2003

	Project Total	Request to NASA	Contributions from Institution	Others
I . Direct Labor				
a. Salaries, wages	105,539	97,742	7,797	0
b. Fringe Benefits	24,239	21,974	2,265	0
2. Other Direct Costs				
a. Subcontracts	0	0	0	0
b. Consultants	32,565	32,565	0	0
c. Equipment	31,233	31,233	0	0
d. Supplies	11,978	11,978	0	0
e. Travel	20,582	16,582	0	4,000
f. Communication Costs (telephone, postage, printing)	4,000	2,500	0	1,500
g. Other (Student stipends, etc)	72,800	34,600	0	38,200
3. Indirect Costs (52%)	54,880	50,826	4,054	0
4. Other Applicable Costs	0	0	0	0
5. Total Estimated Costs	357,816	300,000	14,116	43,700
6. Deduct Carryover Funds	XXXXX	0	XXXXX	XXXXX
7. Cost to NASA	XXXXX	300,000	XXXXX	XXXXX

SCSU Year 3 Budget Narrative

Year 3 Direct Labor: $119,716:(AY-Academic Year, Sum-Summer, stu-students)

Person	Period	Time	Rate	Salary	Ben. Rate	Benefits
Walter	AY	10%	$51,980 /9mo	5,198	29.05%	1,510
Walter	Sum	3 wks	50,466/9mo	4,206	20.15%	848
Payne	AY	25%	58990/9mo	14,748	29.05%	4,284
Payne	Sum	8 wks	57272/9mo	12,727	20.15%	2,564
Basher	Sum	6 wks + $800	60,905/9mo	10,951	20.15%	2,207
Sadighi	Sum	6 wks + $800	39,445/9mo	7,374	20.15%	1,486
Swain	Sum	6 wks + $800	54,347/9mo	9,858	20.15%	1,986
J. Brown	12 mo	misc	7,000	7000	19.65%	1,376
C. Lacey	12 mo	misc	4,200	4,200	19.65%	826
Clerical	52 wks	25%	28,320/12mo	7,080	29.05%	2,057
6 Fac Mentor	AY	misc	2400/mentor	14,400	19.65%	2,830
TOTAL				**97,742**		**21,974**

Walter & Payne salary rate in AY 2002/03 assumes 3% salary increase from previous year. Note total of 25% time commitment by Walter each semester, 15% each semester will be cost shared by SCSU during AY (see below)

Fringe Benefits Detailed by element:

Percentage Rate	29.05%	20.15%	19.65%
Social Security	6.20%	6.20%	6.20%
Medicare	1.45%	1.45%	1.45%
State Retirement	9.95%	9.95%	9.95%
Pre-retire Death Ben.	0.15%	0.15%	0.15%
Workman's Comp.	1.90%	1.90%	1.90%
Unemployment Comp.	0.50%	0.50%	-0-
Health & Dental Ins.	8.90%	-0-	-0-

Year 3 Equipment: $31,233: Includes ($1,864 for receiver and antenna from Ham Radio Outlet, Atlanta); ($3,177 for weather station + software + interface from Weather Information Systems, Amity OR); ($3,798 for Cyber spectrometer and dish drive from Radio Astronomy Supplies, Plantation, FL); (3 PCs = $6,435); ($5,000 for Apple Macintosh server for Radio Jove archives); ($2,937 for 3 temperature controllers from Omega Engineering, Stamford, CT); ($8,022 from National Instruments, Austin, TX for the following items: CD drive for PXI ($237),4 Breakout boxes for LabVIEW ($1,721), 2 DAQ cards for training ($1,297), 4 DAQ cards for telescope ($4,265) and 6 cables ($502)).

Year 3 Other: $34,600: Student stipends (Note below, an additional $38,200 in student stipends for PAIR from other sources – leveraged funds.)

Year 3 IDC: $50,826: Rate of 52% on salaries only. U.S. Dept Health & Human Services, June Talbert, (202) 401-2808. Period: After July 1999 until amended.