

**The South Carolina State University
Center for NASA Research and Technology
Year 6 Annual Report and Year 7 Renewal Request**

January 14, 2002

**Dr. Donald K. Walter, Principal Investigator
South Carolina State University**

**Mr. Elbert Malone, Director of the Office of Sponsored Programs
South Carolina State University**

FORM D-7

**FY2000 INSTITUTIONAL RESEARCH AWARDS
(Minority Universities Information Network for Research and Education)**

BUDGET REQUEST SUMMARY

Institution Name South Carolina State University

Proposal Title The South Carolina State University Center for NASA Research and Technology

From February 1, 2002 to January 31, 2003 (Year 2 of 3)

	RECIPIENT'S COST	NASA USE ONLY		
	A	B		C
1. Direct Labor (salaries, wages, and fringe benefits)	55,873			
2. Other Direct Costs				
a. Subcontracts	114,000			
b. Consultants	69,815			
c. Equipment	10,000			
d. Supplies	2,872			
e. Travel	20,500			
f. Other	53,450			
3. Indirect Costs	23,490			
4. Other Applicable Costs	0			
5. SUBTOTAL - Estimated Costs	350,000			
6. Less Proposed Cost Sharing (if any)	0			
7. Carryover Funds (if any)	0			
8. TOTAL ESTIMATED COST	350,000			
APPROVED BUDGET				

BUDGET DETAIL INFORMATION

For the time period: February 1, 2002 through January 31, 2003

Year 2 Direct Labor: Total \$55,873

(AY=Academic Year, Sum=Summer, mo=months,wks=weeks)

PERSON	PERIOD	TIME	SALARY RATE	SALARY	BEN. RATE	BENEFITS
Walter	AY	25%	50466/9 mo	12617	29.05%	3666
Walter	Sum	2 wks	50,466/9mo	2804	20.15%	566
L. Payne	52 wks	9%	70303/12mo	6328	19.65%	1244
D. Smith	Sum	6 wks	46641/9mo	8179	20.15%	1648
K. Adziewski	Sum	4 wks	46433/9mo	5160	20.15%	1040
V. Kulkarni	Sum	3 wks	53039/9mo	4420	20.15%	891
Clerical	52 wks	20%	28320/12 mo	5664	29.05%	1646
TOTAL				45172		10701

Year 2 Subcontracts: Total \$114,000 [Includes \$100,000 for partner schools (see Appendix B for details); and, \$14,000 for Voorhees (within the SCSU budget)]

Year 2 Consultants: Total \$69,390 [\$2,265 to Dr. Patrick Shopbell, Caltech, for UNIX System Support, 5 days X \$453/day = \$2,265; \$55,000 to Computer Sciences Corp (CSC) to provide network administration, web publishing support, videoconference support and related technical support, student program management, workshop management, outreach coordination, public relations, press relations, record keeping and related activities. \$10,000 to Dr. Mark Everett, Tucson, for postdoctoral software support and RCT system upkeep; \$2,125 to Ms. Irene Scott for clerical support (\$8.50/hr x 5 hr/wk x 50 wk)]

Year 2 Equipment: Total \$10,000 for computer and peripheral equipment to be named later since it will require input from a new faculty hire in the fall of 2002.

Year 2 Supplies: Total \$2,872 [\$872 for miscellaneous computer and office and \$2,000 supplies for URIA students for books & software (10 students x \$200)]

Year 2 Travel: \$20,500 See table below for details

Year 2 Travel Details:

Person/Purpose	Air	#ni	Lodge	#day	Food	Confer. Fee	Taxi Bus	# people	TOTAL
Faculty travel for research & conf.	440	4	100/ni	5	32/day	200	50	8	10,000
Rd trip URIA – home to SCSU	550	1	100	2	25/day	0	50	8	6,000
Van for students (Whatley Toyota Orangeburg, SC)									1,000
Students to conference	589	3	100	4	32/day	100	50	3	3,500
TOTAL									20,500

Year 2 Other Direct Costs - Item 2f: Total \$53,875 Includes \$4,000 for membership in the Robotically Controlled Telescope (RCT) Consortium to obtain observing time for students; \$4,875 for videoconferencing maintenance and line charges; \$45,000 for student stipends.

Year 2 Indirect Costs: Total \$23,490 at 52% of salaries only = 0.52 X \$45,172.

**The South Carolina State University
Center for NASA Research and Technology
Year 6 Annual Report
January 14, 2002**

INTRODUCTION

The South Carolina State University (SCSU) Center for NASA Research and Technology (CNRT) has completed a successful first year under the continuation Institutional Research Award (IRA) to the original five-year Minority Universities Information Network for Research and Education IRA. Under the original IRA, CNRT was known as the Center for Network Resources and Training. This change in name during the sixth year of operation reflects the change in emphasis that took place during the final years under the original IRA. SCSU's CNRT has moved from a project whose main emphasis was on computer and network infrastructure and training to a strategic focus on NASA's Space Science Enterprise, specifically research, curriculum development and outreach in the field of astrophysics.

All of the objectives in our continuation proposal have been met, which is also true of most of the proposed milestones. A few of the milestones had to be modified and in one case eliminated (Academy II) because the project was funded in increments and all the necessary funds were not available when needed.

We have successfully enhanced our faculty research program in astrophysics at SCSU by increasing the number and depth of our collaborations, increasing the number of grants written and supporting the near completion of the refurbishment of the Robotically Controlled Telescope (RCT) in Arizona. We have also enhanced our student research program by including more students and reaching out to a greater number of minority institutions. Furthermore we have facilitated reform in the teaching of science and provided greater support for preservice and in-service teachers. Finally, we have implemented technical workshops that have increased the involvement of K-12 partners as well as college partners in NASA programs within the space science and earth science enterprises. Our partner school Florida International University (FIU) has implemented a new research program of interest to NASA in microgravity using this MU-SPIN grant. Partner schools Morris Brown and Allen University have enhanced existing NASA NOVA programs on their campuses as part of the CNRT follow-on.

THE IRA PROGRAM

The current SCSU CNRT is funded under the 3-year continuation of the IRA Minority Universities Information Network for Research and Education effective February 1, 2001 through January 31, 2004. The goal of this program is to "...strengthen the capacity of minority institutions to provide a quality learning and research environment for disadvantaged minority students and to increase opportunities for minority institutions to participate in and benefit from NASA and other Federal agencies' research and education programs." This goal is being achieved at SCSU under this IRA as summarized in the previous section and as described in detail in the sections that follow.

The specific objectives of the IRA are enumerated in the call for proposals and include: (1) perform scientific/engineering research; or (2) education projects; (3) facilitate technical assistance workshops; (4) contribute substantially to the NASA mission; and (5) the goals of the IRA; and, (6) move the institution toward gaining support outside the IRA. It will be shown that the CNRT has achieved all of these objectives in Year 6.

THE STRATEGIC FOCUS OF THE CNRT

The CNRT at SCSU supports that part of the NASA mission which "... will advance and communicate scientific knowledge of the universe" through our successful implementation of research, education and outreach in the field of astrophysics. Since we are working in the field of astrophysics, the CNRT project clearly relates to the goals and objectives of the Space Science Enterprise. The CNRT is at the core of SCSU's involvement in this field. Through the current and previous version of the IRA, we have taken a comprehensive approach to implementing astrophysics programs at SCSU for the K-16 community as well as our faculty. We have used MU-SPIN funding from the first five years to leverage several additional NASA programs, specifically a 4-year MURED PAIR award and a 3-year OSS/OEOP Minority Initiative award. Additionally, smaller grants from a subcontract under Tennessee State's MURED-URC, the Space Telescope Science Institute and the South Carolina Space Grant program have all contributed to building a program in astrophysics at SCSU which supports research, education and outreach.

THE ICRE MODEL AND PARTNER SCHOOLS

The SCSU CNRT is an example of a MU-SPIN-funded Institute for Collaborative Research and Education (ICRE). Graphics that demonstrate the CNRT model are found in Appendix A. Briefly stated, the ICRE at CNRT creates a virtual institute in which the lead school, SCSU, collaborates with its OMU, HBCU and K-12 partners as well as the NASA Centers, most frequently the Goddard Space Flight Center (GSFC), though the Internet. Communication among the partners and between partner schools and NASA also follows this route. The use of the Internet by the CNRT ICRE takes a variety of forms including webcasting, web-based access to data, resources and information, email, ISDN-based group videoconferencing and within the next year, remote control in real time of distant ground-based telescopes.

Each partner school has been encouraged to pursue development of its own ICRE, based on the expertise and resources available on their campus. Details of their success and their annual reports for Year 6 and budgets for Year 7 can be found in Appendix B. FIU has chosen to build upon previous research work with NASA in the field of microgravity. This experience includes work with NASA's flying laboratory on a KC-135 and the drop tower at the Glenn Research Center. Partner schools Allen University and Morris Brown College are NASA NOVA schools. They have expanded upon their previous NOVA funding to further enhance science education at their institutes. Allen University has used its Year 6 funding to modify two core mathematics courses. Morris Brown has developed a new course, "Chemistry in Society, (CHE 100)" based on the science content required of education and non-science majors at the college. Voorhees College has had to defer their NOVA-like curriculum project until

Year 7 because of a change in the president of the college and subsequent delays in approval at the administrative level. The CNRT K-12 partners have implemented a variety of earth and space science projects as described in the following sections.

OVERVIEW OF SCSU YEAR 6 ACTIVITIES

The SCSU proposal included four specific objectives and accompanying milestones and approaches. An overview of the SCSU activities in Year 6 is placed in the context of matching each major activity with one or more specific objective-milestone combination. Recognizing that a reviewer may not have the original proposal in-hand, the objectives and milestones are reproduced here. The approaches are not included in order to save space.

Objective #1: To support and enhance faculty research in astrophysics at SCSU.

Milestones #1:

- A. Provide technical support to carry out astrophysical research at SCSU.
- B. Provide financial support for astrophysical research by faculty at SCSU.
- C. Support existing astrophysical research collaborations and/or establish new ones.

Objective #2: To support and enhance student astrophysical research by underrepresented minority students at SCSU and collaborating institutions.

Milestones #2:

- A. To maintain and/or expand existing research opportunities in astrophysics for underrepresented minority students at the college level.
- B. Develop a program of research in astrophysics for high school students who are underrepresented minorities.

Objective #3: To facilitate education reform in teaching of science and in pre-service teacher preparation at SCSU and collaborating institutions.

Milestones #3:

- A. Implement changes in teaching and research techniques used by faculty members and students to learn science and conduct research.
- B. Provide technical and financial support to pre-service teachers at SCSU and collaborating institutions to learn and practice modern learning techniques for the teaching of science

Objective #4: To increase opportunities for minority institutions to participate in NASA and other Federal agency research and education programs.

Milestone #4:

To provide technical assistance workshops and other facilitating activities for MU-SPIN and other organizations to increase minority involvement in NASA and other Federal agency programs related to research and/or education

Milestone 1A was achieved through the following activities:

- Remote UNIX system support was provided by Dr. Patrick Shopbell of the Astronomy Department at Caltech. His services were partially funded by MU-

SPIN. This support is critical to maintaining SCSU's involvement in HST and other space-based and ground-based research programs.

- Local LAN and Windows-based support was provided by a CNRT technical person who is partially funded by MU-SPIN. This support is critical to maintaining Internet access and ancillary supporting services such as printing.
- A new SUN Sunblade 1000 server was purchased with MU-SPIN funds. This server replaced the old SUN SPARC 20 server which has been in use for the past seven years. This server houses all the astrophysical research data and UNIX-based image processing software used by Dr. Walter, faculty collaborators and students to conduct research. Additionally, it is home to the CNRT website and serves as the on-line source for the University course catalog and physics courses.

Milestone 1B was achieved through the following activities:

- Dr. Walter received summer salary and academic-year release time from MU-SPIN to carryout his research.
- MU-SPIN provided \$20,000 for the purchase of narrow-band interference filters that will be installed on the RCT. These filters are essential to Walter's research to better understanding the physical diagnostics and chemical abundances of the galactic and extragalactic interstellar medium.
- Travel support from MU-SPIN allowed Walter to travel to research meetings, including the American Astronomical Society meeting in Washington, DC, in January 2002 during which he was able to interview nine potential candidates for a new faculty position at SCSU in astrophysics.
- Travel and related expenses to conduct a meeting of the RCT Consortium in Orangeburg, SC in April 2001. This included travel support for visiting astronomers as well as funds to hold the meeting. This was an important meeting at which the SCSU administration met with visiting scientists from Western Kentucky University, Francis Marion University and the Planetary Science Institute. This generated local press coverage and enhanced support among administrators at SCSU for their involvement in the RCT.

Milestone 1C was achieved through the following activities:

- Walter collaborated on a HST Cycle 11 proposal, which was not funded. However, this helped maintain existing research collaborations with colleagues at Arizona State University and Rice University
- Walter was coauthor on one published, referred paper and worked on two papers with colleagues at Arizona State and Rice related to his HST Cycle 7 PI project (the Bubble Nebula). The papers will be submitted to the *Astronomical Journal* for peer review in February 2002.
- CNRT funds from MU-SPIN supported a postdoctoral researcher for 2.5 months of salary. Dr. Mark Everett is located at the Planetary Science Institute in Tucson. He is providing software and other support to the RCT Consortium in preparation for the commencement of scientific operations. This represents a new research collaboration.

- Walter submitted a research proposal to the South Carolina Space Grant Consortium along with Co-I Dr. Richard Gelderman at Western Kentucky University. The status of the proposal is pending. While Walter and Gelderman have collaborated on the RCT refurbishment proposal, this is their first science research collaboration.
- Walter also began new collaborations with Dr. Kuzman Adziewski, a mathematician at SCSU, Dr. Varsha Kulkarni, an astronomer at the University of South Carolina, and Dr. John Mattox, an astronomer at Francis Marion University. All three of these collaborations occurred when each faculty member was funded by CNRT to serve as a mentor to a student research team under the URIA program. However, there is potential for faculty research collaborations between Walter and each of the three.
- Walter participated in a statewide 2-day meeting of South Carolina astronomers in December 2001. The group has decided to continue an annual meeting and to propose as a group for future NASA EPSCoR funding.

Milestone 2A was achieved through the following activities:

- The SCSU Undergraduate Research Institute in Astrophysics (URIA) was created under the original 5-year IRA for the CNRT. During the summer of 2001, ten undergraduate students attended this 8-week residential program for underrepresented minorities held at SCSU. The students studied a variety of astrophysical topics while gaining useful computer, web and multimedia experience. Each student was a member of a team that consisted of 2-3 students and one faculty mentor. Each team worked on a different research project, which ranged from processing images from the NICMOS camera on HST to calculating the probability of clustering of galaxies using Mathematica software.
- A *new* undergraduate research program in astrophysics for underrepresented minorities was created in 2001, the Undergraduate Research Program in Astrophysics (URPA). This new program was created under the SCSU Minority Initiative grant from the Office of Space Science (OSS), but MU-SPIN provided financial, logistical and technical support for its implementation. In this program, students with a previous space science research experience were placed at one of three national laboratories: the Goddard Space Flight Center (GSFC), Kitt Peak National Observatory (KPNO) or Lawrence Livermore National Laboratory (LLNL). A total of five students from four institutions were selected to attend (1 at GSFC, 2 each at KPNO and LLNL). The URPA was designed to be comparable to the popular NSF program Research Experiences for Undergraduates (REU) and similar NASA programs for summer undergraduate research.
- The URPA in conjunction with the URIA represents a two-tier system that accommodates various levels of student experience. URIA students from one summer can feed into URPA the next summer. That is what happened to students Nelvin Thomas (U. of Virgin Islands) and Vincent Davis (Elizabeth City State University) who attended URIA at SCSU in the summer of 2000 and went to KPNO in 2001. The five students carried out research on: field

testing a new camera system for wide-field asteroid searches, solar physics, classification of variable star light curves from data collected by the MACHO project and testing of materials to be used in a new generation of cryogenically cooled CCDs.

Milestone 2B was NOT achieved for the following reason:

- Incremental funding by the funding agency meant that insufficient funds were available when it was time to recruit high school teachers and students in the spring of 2001. In fact, the necessary funds were not available until August 2001. This was too late to begin a 10-month research project, so Academy II was cancelled. The Academy II program proposed to set up teams of high school students to conduct research under the guidance of a high school teacher and the science faculty at SCSU.

Milestone 3A was achieved through the following activities:

- A total of nine SCSU faculty members and two high school teachers attended a workshop at Tennessee State University NRTS in November 2000. During the workshop, they received training in the use of the “Explorers of the Universe” website as well as exposure to the metacognitive tools known as the Concept Map and the Vee Diagram. That trip was partially funded out of the first CNRT IRA.
 - o Under the new CNRT IRA, Walter and two other physics faculty members have applied these concepts to courses in the teaching of quantum mechanics, science for education majors, physics for education majors, physical science for non-science majors and a space science seminar course (a total of 5 courses and 53 students).
 - o The Concept Map was used on the CNRT URIA research students during the summer of 2001 and by the SCSU NASA PAIR students to improve their conceptual understanding of their research projects (a total of 22 students).
- CNRT funded travel for three SCSU faculty members to the NASA NOVA workshop in February 2001, and CNRT assisted in the writing of the SCSU NASA NOVA proposal that was submitted in June of 2001. The proposal received was rated a “very good” proposal, but was not funded by NOVA because the education Co-I was not from the Department of Education. The team intends to submit again using a new, science education faculty member on the team.
- CNRT funded travel for the CNRT Co-I for Education to the national NASA ERC meeting in Ohio including a visit to the Glenn Research Center.
- CNRT funded travel for the CNRT Co-I for Student Research to the American Association of Physics Teachers in Philadelphia in January 2002 where he presented a paper.

Milestone 3B was achieved through the following activities:

- The SCSU NRTS funded a total of two SCSU preservice teachers during the past year. Their projects included:

- o One student intern worked at the SCSU Math/Science Hub, an NSF-funded resource center for K-12 teachers. He was involved with the preparation for and the implementation of teacher workshops in the areas of science, mathematics and technology. He was also in charge of cataloging and organizing resource materials from NASA and other sources, including those materials inventoried as part of the SCSU NASA Educator Resource Center on campus. He was also trained in the operation of the StarLab Portable Planetarium and assisted teachers with its use.
- o One education major, who will graduate in May 2002, participated in the middle school science day camp known as Academy I (see below). She was in charge of a group of five students who were part of a larger group of 20 students. These students spent two weeks studying the solar system, learning about careers in science and engineering and developing computer skills such as learning how to prepare and present in PowerPoint.

Milestone 4 was achieved through the following activities:

The scheduling of a spring technical assistance workshop was not possible during Year 6 because of the delays in funding until more than half the award year was completed. Plans were underway for CNRT to conduct a fall, grant writing workshop in support of the NASA CIPA grants; however, a poll of potential attendees showed that most schools either would not attend or were not qualified for CIPA. Finally, the events of September 11, 2001, but a damper on travel. As a result, a series of smaller workshops and one-on-one assistance were provided by the CNRT.

- CNRT webcast the live NASA coverage of the total solar eclipse in Africa on June 21, 2001. A total of 2 college faculty members, 3 college staffers, 15 college students and 1 precollege student attended.
- Two high school teachers were funded by CNRT to attend the Elizabeth City State University NRTS workshop, Earth System Science Academy, which covered a variety of earth science topics related to environmental science and wetland ecosystems.
- The CNRT collaborated with the SCSU OSS Minority Initiative grant and the SCSU Math/Science Hub to hold a 1-week intensive space science workshop for teachers in grades 6-12 during July 2001. In order to include the required number of contact hours for a 3-credit course, the teachers met most days from 8:30 am to 9:30 pm. Each day of the week a different space science theme was covered (e.g. Sun-Earth Connection). A typical day included science content and web searches by Dr. Walter as well as hands-on activities lead by the CNRT Co-I for Education, Dr. Linda Payne, and a middle school teacher with previous experience in space science. The teachers were given a significant amount of NASA handouts, lithographs, CDs and other resources. The hands-on activities were chosen so that they both highlighted important astrophysical concepts and could be easily reproduced in the classroom. At a Saturday session in the fall of 2001, each teacher discussed how they implemented the concepts they learned into the classroom.

- o One of the teachers from the summer workshop was given a NASA Radio Jove Kit (funded by SCSU's NASA PAIR project) for her high school astronomy club, which they setup and acquired radio observations of Jupiter and the Sun,
- o Three teachers from the summer workshop and Dr. Linda Payne presented a workshop on space science at the South Carolina Science Council meeting in November 2001. Over 1,000 science educators attend this event each year. The space science workshop was filled beyond the limit of 25.
- In planning for a grant-writing workshop, we spoke with a number of our current and former partner schools and met with some of them one-on-one to assist in the writing and review process.
 - o Claflin University
 - Applied for a NASA CIPA grant with technical assistance in the writing and review phase provided by SCSU and Ms. Valerie Thomas, Education Consultant to the MU-SPIN office.
 - o Allen University
 - Already has a NASA CIPA grant, therefore not eligible in 2001.
 - SCSU held a one-on-one meeting with a science faculty member from Allen and Dr. Willease Sanders, a grant writer and Allen's NOVA Co-I. The two schools made plans to write an IDEAS grant with SCSU's Dr. Walter the Science Co-PI and Allen's faculty member the Education Co-PI. Allen was to be the lead institution. SCSU provided Allen with copies of a past SCSU NASA proposal and budget to serve as a starting point in their writing. Unfortunately, during a time of uncertainty due to a change in the presidency of Allen, the proposal did not receive administrative approval so it was not written.
 - o Edward Waters College
 - They were not eligible for the NASA CIPA.
 - We suggested they write and submit a NASA NOVA proposal but have not heard from them.
 - o Morris College
 - Since they were eligible for NASA CIPA, we traveled to Morris and met with two faculty members who seemed interested in writing a grant. We provided them with a copy of one of our successful NASA grants to serve as a starting point in their writing. However, several weeks later they informed us that they were not going to write a proposal since their Dean had recently passed away and they were encountering resistance to their ideas within the department.
 - o Voorhees College
 - Note eligible for NASA CIPA
 - With regard to a rewrite and submission of their previous attempt at a NOVA proposal, they were unable to do so in the fall of 2001 since they experienced turnover in the campus

- administration with the retirement of their president. We will work with them in the spring of 2002 to carry out this rewrite.
- SCSU
 - SCSU partnered with the College of Charleston in 2001 to win a 5-year Broker/Facilitator award from NASA's Office of Space Science. The College of Charleston is the lead institution for the SouthEastern Regional Clearing House (SERCH) and SCSU is funded under a subcontract for \$38,500 per year for each of five years. SCSU, with Dr. Walter as the Co-PI, will be responsible for conducting workshops and other activities which will increase minority participation in SERCH and OSS programs.
 - Dr. Dan Smith, CNRT Co-I for Student Research, submitted a curriculum enhancement proposal to the NSF for \$2.5 million. The "HBCU-UP" program is designed "...to enhance the quality of undergraduate science, mathematics, engineering and technology (SMET)." The status of his proposal is pending.
 - The first ever SCSU FAR proposal was submitted by a chemistry professor in July 2001. The status of the proposal is unclear at this time. The CNRT, with assistance from the MU-SPIN Office, established a contact at the Glenn Research Center with a research chemist who was interested in collaborating with the SCSU faculty member.
 - SCSU's first ever NASA NOVA proposal was submitted in June 2001 and, as discussed above, was judged to be a very good proposal, but was not approved because the Co-I for education was not a member of the SCSU Department of Education. SCSU was encouraged by the NOVA reviewers to submit again. A new science-education faculty member was recently hired and has expressed an interest in working with the physics faculty on their resubmission.
 - SCSU, with Dr. Walter as PI, submitted its first ever IDEAS grant to the Space Telescope Science Institute (STScI) in October 2001. The proposal is still pending. SCSU is asking for two years of funding from STScI to expand their MU-SPIN Academy I program for middle school students from a 2-week day camp to a residential program.
 - Dr. Walter has also submitted a grant to the South Carolina Space Grant Consortium (in collaboration with Dr. Richard Gelderman from Western Kentucky University) for funds to partially support a postdoctoral research assistant. The status of the proposal is pending.
 - Two other physics faculty members at SCSU submitted proposals to the South Carolina Space Grant Consortium. For one of the faculty members, this was the first proposal of any kind he had written. The status of these proposals is pending.

Other Activities

- The CNRT lab and staff provided technical and/or administrative support for all NASA programs housed in the science building including the following funded projects: MASTAP, PAIR, Space Grant, OSS Minority Initiative, a subcontract with the Tennessee State URC, OSS Broker/Facilitator, ERC, Space Telescope Science Institute research and the group attempting to obtain a NOVA grant.
- The CNRT Co-I for Student Research is working with a computer science major to develop a variety of web-based activities and exercises related to cosmology. The student is learning how to write in Java as well as being exposed to different opportunities not normally available to SCSU students in his field.
- An SCSU student majoring in nuclear engineering tested various PC-based and UNIX-based image processing packages. The results of his work will assist the CNRT in future workshops.
- A total of seven SCSU students were funded to serve as lab monitors. In addition to being concerned about the security of the lab, these students are exposed to multimedia and web based resources that they might not normally encounter.
- The CNRT provides ISDN group videoconferencing, multimedia and web support for science faculty members in Biology, Chemistry and Physics.
- The CNRT lab is open during normal working hours throughout most of the year. This means that both walk-ins and classes with reservations use the lab extensively. It is the only computer lab in the science building and is used extensively by science majors and students enrolled in science classes. A total of **more than 5,000** students use the lab as walk-ins during the year.
- Faculty members reserve the use of the CNRT lab for their classes. A partial list of courses which used the lab on a regular basis during the past year include Physical Chemistry, Genetics, General Physics, Quantitative Analysis Ecology, Introductory Biological Science, Mammalian Anatomy and Inorganic Chemistry. Not counting repeat use by the same class, annually **over 1,000 students and faculty** used the facility for in-class sessions.
- The CNRT videoconferencing equipment is currently used infrequently but is an important resource. The Dean of the School of Engineering Technology and Sciences uses it on a monthly basis for videoconferencing with the University of South Carolina and the Medical University of South Carolina as part of a collaborative NIH grant among the schools.
- A distance learning course in Art Appreciation used the CNRT videoconferencing lab this past year.
- Faculty members in Biology, Chemistry and Physics use the color printers and scanner as well as CD writers and other CNRT lab resources for their proposal writing, reports and coursework.
- The CNRT technical support staff member is partially funded by MU-SPIN. He provides extensive support for all the NASA projects at SCSU and limited technical support to other science projects and faculty.

IMPLEMENTATION OF THE TECHNICAL PLAN

The activities and their relationship to the objectives and milestones of the SCSU proposal listed above along with the metrics discussed below describe in detail the implementation of the CNRT technical plan in Year 6.

STUDENT INVOLVEMENT

Student programs are discussed in the Overview section under the appropriate milestones. In this section we provide demographic information.

Total number of students supported by CNRT in Year 6: 26

Breakdown by job classification, race and gender

Position	Black Female	Black Male	Hispanic Female
Lab Monitor	2	5	
Fall/Spr Research Assistant	2	3	
Summer URJA	6	4	
Summer URPA	1	3	1
Preservice Teachers	2		
Correction for double count**	-1	-2	
TOTAL	12	13	1

** This corrects for students who held more than one position over the past 12 months.

Breakdown by major

Major	Number of Students
Computer Science	10
Physics	5
Mathematics	3
Engineering Technology	3
Biology	2
Education	2
Non-MSET	1

Participation by School:

SCSU	18
Elizabeth City State University (ECSU)	5
University of the Virgin Islands (UVI)	3
California State University – Northridge (CSUN)	1

Supported Seniors who graduated:

E. Lamar, SCSU, physics	Grad School Clemson (Physics/Material Science)
Leyanna Lloyd, SCSU, edu.	Seeking teaching position
T. Hicks, SCSU, engineering tech.	Seeking permanent employment
M. Tovar, CSUN, mathematics	Status unknown
N. Thomas, UVI, mathematics	Seeking permanent employment

INSTITUTIONAL COMMITMENT

The commitments made in the SCSU continuation IRA proposal have all be met. The Vice President for Academic Affairs (VPAA) has provided \$50,000 per year for use by the CNRT PI, principally to partially fund the positions of CNRT Program Coordinator and Network Manager (the CNRT technical staff member). The Dean of the School of Engineering Technology and Sciences continues to provide \$6,100 per year for the PI to use toward membership in the RCT Consortium. Management of the CNRT is facilitated by special arrangement with the VPAA. Under both the previous IRA and the new IRA, the CNRT PI reports to the VPAA on CNRT matters, not to any chairperson or dean, thus streamlining paperwork and the approval process. Finally, the CNRT continues to have widespread support from the President of the university on down to the individual faculty members.

DISSEMINATION AND EVALUATION

The dissemination of information related to the CNRT has increased under the plan outlined in the CNRT continuation proposal. This was accomplished through a variety of activities.

The Co-I for Education has promoted the activities for K-12 throughout the state as part of her work as the Director of the Math/Science Teacher Resource Center (Hub). This increased visibility was demonstrated by the number of qualified candidates who applied for our summer teacher workshop as well as the large turnout at our teacher workshop at the statewide November meeting of the science educators.

The CNRT webpage (www.cnrt.scsu.edu) has been completely redesigned under the direction of the Program Coordinator and a student assistant webmaster. Additionally, an activities booklet describing all of the SCSU NASA summer 2001 projects was published and 75 copies were distributed to upper and middle level administrators at SCSU as well as numerous NASA project managers and SCSU's collaborators in NASA research, education and outreach programs. A four-fold color brochure describing the CNRT has also been produced in-house and distributed both on and off campus.

The number of MU-SPIN funded student and faculty talks and posters was rather limited this year because there was no MU-SPIN annual conference. Two referred papers with Walter as a listed author are currently in preparation for submission to the *Astronomical Journal* in February 2002. These articles will explicitly acknowledge the MU-SPIN IRA for providing support. Additionally, Walter has given a number of faculty seminar talks during the past year which publicly acknowledged MU-SPIN 's support, including talks at the PAIR PI meeting at NASA Headquarters, the PI meeting for the OSS Minority Initiative, the SCSU PAIR Advisory Board meeting, the Lawrence Livermore National Laboratory, Francis Marion University, Tennessee State University and at the statewide meeting of astronomers held at the University of South Carolina.

The CNRT has worked with the MU-SPIN Project Office to further publicize the success of the project at SCSU. This has included web postings on the MU-SPIN homepage as well as electronic journal articles about the solar eclipse webcast in June 2001, as well as one in preparation that describes the SCSU space science program.

The one part of the CNRT dissemination plan which has been a disappointment has been working with the SCSU Office of Public Relations. That office has

experienced a near 100% turnover during the past 12 months, including the departure of the Director of Public Relations. While that office provides adequate coverage of campus activities through campus publications, those publications are typically distributed 2-4 months after an event. Furthermore, the CNRT has had only limited success in getting that office to submit success stories to the media off campus. This is a widely recognized problem at SCSU and something the university administration is working to rectify.

One of the major changes proposed by CNRT in its continuation proposal was the monthly reporting by the Program Coordinator and the Network Administrator. This process has been implemented and has improved both the timeliness and accuracy of reporting. These two staff members are responsible for compiling statistics and writing a summary report each month regarding all relevant activities.

The means of evaluating the success of the CNRT were discussed in the original proposal and are centered on the level of achievement of the metrics discussed below, specifically the ten metrics identified in the CNRT continuation proposal.

COST

The budget has conformed to the requirements of the IRA document. Specifically this includes that a minimum of 25% be spent on students, a maximum of 15% on equipment and no more than 40% be spent on personnel and other administrative costs. For SCSU, the following was true in Year 6:

Students Stipends:	\$37,000	
Student Travel:	\$20,000	
Student Supplies	\$ 2,500	
Student Equipment (1 computer for student)	\$ 1,500	
Student Observing time on the RCT Telescope	\$ 3,900	
TOTAL STUDENT:	\$64,900	= 26% of SCSU's \$250,000

Imaging Filters:	\$20,000	
Computers & Peripherals	\$16,000	
TOTAL EQUIPMENT:	\$36,000	= 14% of SCSU's \$250,000

Salaries	\$43,000	
Benefits	\$ 8,300	
Indirect Costs	\$ 22,400	
TOTAL PERSONEL	\$73,700	= 29% of SCSU's \$250,000

Finally, no more than 25% of any one person's direct salary was charged to this grant.

SCSU METRICS

The continuation IRA lists a total of 31 metrics divided into three categories, research, education and technology. The IRA states that each NRTS will report on all 31 metrics even if some of them are not relevant to the institution. Additionally, the IRA

states that each NRTS will select a subset of metrics by which they wish to be judged. Listed below is our report on the SCSU metrics. Those shaded in gray are the 10 we chose in the SCSU proposal by which we wish to be evaluated. Note that the partner school metrics are incorporated into their reports that are in Appendix B.

Research Activity Metrics

Outcome: To increase the number of MI faculty and students in NASA related research that will contribute substantially to the NASA mission and move the IRA recipients increasingly toward gaining support from sources outside the IRA Program.

• Number and types of NRTS collaborating research activities relevant to the NASA Strategic Enterprises.

Conferences attended: **AAS, South Carolina astronomers research meeting**

Seminar talks presented: **Francis Marion U., South Carolina research astronomers' meeting, Lawrence Livermore National Lab, Tennessee State U.**

• Number and types of workshops held to support the NRTS collaboration research efforts.

1 student research workshop held March 23, 2001 at Tennessee State U. (TSU)

1 student summer institute (URIA) held at SCSU for 8 weeks.

• Number and types of attendees participating in the research oriented workshops.

1 faculty member and 3 students from SCSU participated at TSU

5 faculty and 10 students from 5 institutions participated in URIA

• Number and types of institutions participating in research oriented workshops.

The workshop at TSU included SCSU, TSU, ECSU and City College of New York.

The URIA participants included SCSU, ECSU, U. of the Virgin Islands, U. of South Carolina and Francis Marion U.

• Number and types of proposals submitted in response to a NASA research announcement.

1 to Hubble Space Telescope Cycle 11

1 to South Carolina Space Grant Consortium

• Number and types of institutions participating in NRTS research oriented collaborations.

Dr. Walter collaborates on faculty or student astrophysical research with:

Faculty: **Arizona State U., Rice U., Caltech, Western Kentucky U.**

Student: **Goddard Space Flight Center, Lawrence Livermore National Lab, Kitt Peak National Observatory, Tennessee State U., Elizabeth City State U., U. of the Virgin Islands, U of South Carolina, Francis Marion U.**

• Amount of leveraged funding received from NRTS research related activities.

None to date during Year 6 of the CNRT. The space grant proposal is still pending.

- **Number and types of facilitated research publications.**

1 referred publication, 2 in preparation

- Number and types of funded awards from NRTS research activities.

None to date during Year 6 of the CNRT. The space grant proposal is still pending.

- **Number of students participating in NRTS research activities.**

24 students

Education Activity Metrics

Outcome: To provide a quality learning and research environment to inspire an increase in the number and quality of students, including pre-service student teachers achieving degrees in NASA related SMET fields.

- **Number and types of NRTS collaborating education activities relevant to the NASA Strategic Enterprises.**

- **Three SCSU faculty members send to NOVA workshop in Feb 2001**
- **Two teachers sent to the ECSU Earth Science System Academy in June 2001 (earth science topics)**
- **A webcast of NASA's coverage of the solar eclipse in Africa in June 2001**
- **One-on-one grant writing assistance meetings and working sessions with Claflin U. to submit a NASA CIPA proposal**
- **One-on-one meeting with Morris College to plan a NASA CIPA proposal**
- **One-on-one meeting with Allen University to plan writing a STScl IDEAS grant**

- Number and types of workshops held to support the NRTS collaboration education efforts.

- **A 2-day preparation workshop on the solar system for Academy I teachers**
- **A 1-week, teacher workshop on astronomy & space science in the summer**
- **A 2-hour demonstration workshop at the statewide SC Science Council**

- **Number of pre-service teachers impacted by education activities.**

2

- **Number of in-service teachers impacted by education activities.**

- **6 teachers in the 2-day workshop for Academy I teachers**
- **8 teachers in the 1-week teacher workshop**
- **25 teachers in the 2-hour demonstration workshop at the statewide SC Science**

Total of 39 in-service teachers impacted

- Number and types of institutions participating in education oriented workshops.
 - **7 institutions (6 K-12, 1 Univ) participated in 2-day Academy I workshop**
 - **9 institutions (8 K-12, 1 Univ) participated in 1-week teacher workshop**
 - **24 institutions (23 K-12 and 1 Univ) in 2-hour demonstration workshop**
 - Total of 38 institutions (37 K-12 and 1 Univ. [SCSU])**
- Number and types of proposals submitted in response to a NASA education announcement.
 - **A proposal to the OSS Broker/Facilitator program which was awarded**
 - **A proposal to the STScI IDEAS program, which is still pending**
- Number and types of NASA Enterprise Education products systemically implemented by NRTS and partner institutions.
 - (all of the following at SCSU were Space Science materials)**
 - **NASA video “The Milky Way’s Invisible Light” to 1-week teacher workshop**
 - **5 different NASA CDs to teachers at 1-week and 2-day teacher workshops**
 - **Numerous NASA posters & lithographs to 1-week and 2-day teacher workshops**
 - **Numerous NASA resource handouts on select topics to 1-week and 2-day groups**
- Number and types of institutions participating in NRTS education oriented collaborations.
 - **4 Univ (SCSU, Claflin, Allen, Morris)**
 - **15 K-12 schools (ESSA, Academy I, 1-week teacher workshop)**
- Amount of leveraged funding received from NRTS education related activities.
The Broker/Facilitator award gives SCSU \$38,500 x 5 yrs = \$192,500
- Number and types of NRTS facilitated education publications.
N/A
- Number and types of funded awards from NRTS education activities.
A proposal to the OSS Broker/Facilitator program that was awarded for \$192,500
- **Number of students participating in NRTS education activities.**
 - **20 K-12 students in Academy I**
 - **1 K-12 (high school) student was funded to assist with Academy I**
 - **2 college preservice teachers**
 - **1 K-12 student impacted by webcast of solar eclipse**
 - **15 college students impacted by webcast of solar eclipse**
 - Total of 39 students**
 - (22 K-12 students, 2 preservice teachers, 15 other college students)**

Technology Activity Metrics

Outcome: To improve the capacity of MIs to provide a technology rich environment that promotes increased usage of technology for research and education for increasing the number and quality of students graduating with SMET degrees.

- Number and types of institutions participating in technology oriented workshops.

N/A

- Number and types of electronic networks **funded** being leveraged to support research and education related activities.

- 1 lab, the CNRT computer & ISDN videoconference lab supports numerous NASA, science and other activities and is listed as a leveraged resource in proposals written to NASA, NSF, DOEnergy, NIH

- Number and types of proposals submitted in response to a NASA research announcement.

- N/A as relates to technology, for research see Research Metrics

- New technology deployed in region to support collaboration for research and education.

- CNRT has deployed 2 PCs and 1 printer to the RCT in Tucson to support its operation

- New technology deployed in region to support research.

- Purchase of new SUN Sunblade 1000 server for astronomical image processing

- Purchase of dual-sided, color laser printer for research reports, papers, etc

- One new 1.2 GHz PC for student webmaster

- New technology deployed in region to support education.

- Purchase of new SUN Sunblade 1000 server for on-line courses in science

- Purchase of dual-sided, color laser printer for teacher/student resources materials

- One new 1.2 GHz PC for CNRT Lab (in addition to 1 PC for student webmaster)

- Number and types of technology departments (i.e. Computer Science, Engineering, Information Systems, etc.) in the region participating in the support of NRTS regional research and/or education technology requirements.

- The SCSU Math & Computer Science Department

- Two SCSU Engineering Technology Departments (Industrial/Electrical and Civil/Mechanical)

- The SCSU Nuclear Engineering Program

- ECSU Comp. Sci (students attend URIA)

- UVI Comp Sci (student attends URIA)

- Number of students in technology departments participating in technology efforts.

- 13 funded students (10 CS, 3 Engineering Tech) see “Student Involvement” for details

- 1,000 (or more) CS & Engineer Tech students use the CNRT as walk-ins and/or through classes being held in the CNRT lab

• Amount of leveraged funding received for improving technology infrastructure from NRTS activities.

-\$50,000 per year SCSU cost share to CNRT for each of 3 years = \$150,000

-\$6,100 per year from SCSU Dean for each of 5 years to cover cost of participation in the RCT Consortium (5 x \$6,100 = \$30,500)

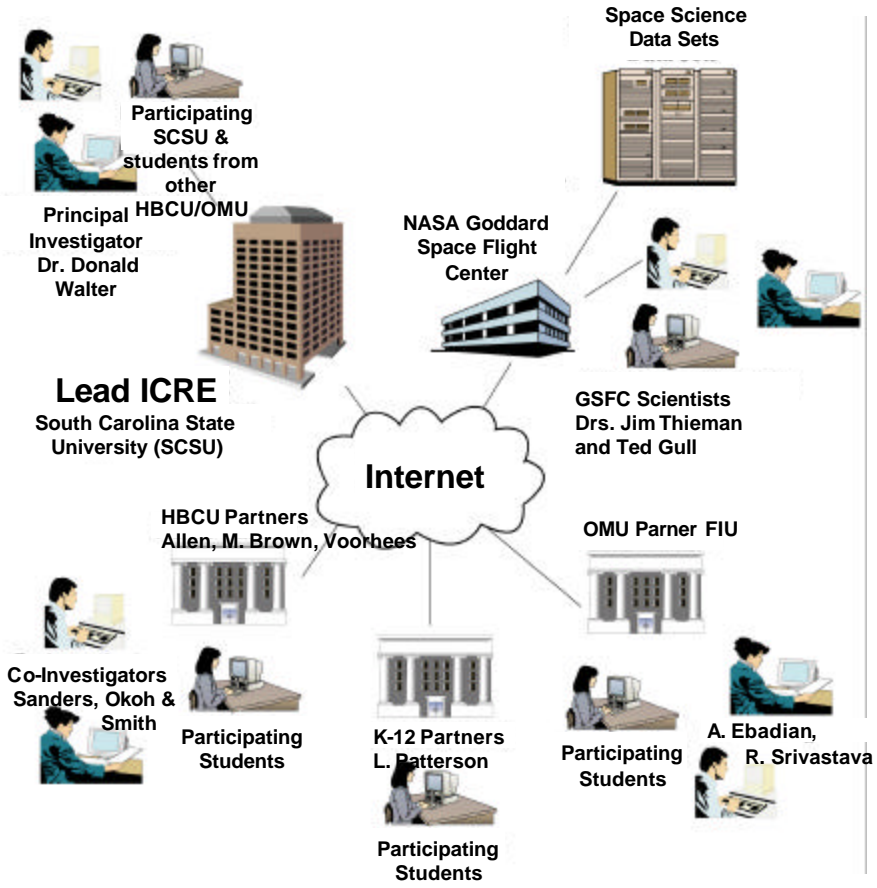
EQUIPMENT FORM

See the Budget form and Budget Narrative for this information

APPENDIX A

The ICRE Model for the SCSU CNRT

The ICRE Model for the SCSU CNRT



APPENDIX B

Partner School Year 6 Reports and Year 7 Budgets

Allen University

IRA Continuing Grant

Year II

During Year II of Allen University's NOVA grant, the syllabi for mathematics 111 and 112 are being revised and tested. Course modifications are being done in collaboration with a person from the Education Department and the English Department and with input from schools where education majors do their practicum, Burnside Elementary School and E. E. Taylor Elementary Schools in Richland County School District One. A manual for writing in mathematics is being prepared by the English Department, since proficiency in written and oral language are essential to the meeting the new mathematics standards.

Outcomes

The anticipated outcomes for this program are listed below, followed by the level of accomplishment.

1. 80% of students will demonstrate enhanced understanding of, and disposition to do mathematics, as indicated by performance on tests, projects, and other assessment measures. Level of Accomplishment: 60% of the students met this objective. This

may have been influences somewhat by an influx of student athletes, many of whom do not have a strong interest in academics.

2. 70% of faculty will demonstrate, as indicated by course syllabi and during observation of classes in session, a more student-centered and inquiry-based approach to teaching mathematics and will incorporate practices that reflect teaching reform initiatives and use of NASA products, including (a) integration of technology in teaching; (b) use of NASA product to enhance understanding of math concepts and applications; collaboration with faculty from other disciplines and with public school partners; and (d) emphasis on meaningful and meaning-defining talking and writing about mathematics. Level of Accomplishment: 100% of the faculty who teach freshman math in the General Studies Core revised course syllabi according to the standards expressed in this objective. All identified NASA products that can be useful in making the courses come alive. There were a few difficulties in implementation because expected facility renovations did not occur in a timely manner.
3. The college will emerge in a leadership role in innovative mathematics teaching and learning, as indicated by the involvement of college personnel and departments in sponsoring and participating in professional development workshops, seminars, and conferences designed to improve the pre-service and in-service development of mathematics teachers. **Level of accomplishment:** The leadership role of the college as an agent of innovation in the teaching and learning of mathematics is somewhat latent at this time because of changes in administrative organization and functions. A member of the Allen team served on the Statewide Systemic Initiative for

Mathematics Reform that looked at where the state of South Carolina is and where it needs to go in terms of math and science teaching.

Student Involvement

Students are involved in testing the new methods of learning in that periodically they provide feedback on the effectiveness of the methods as compared to others methods with which they have been taught. They also suggest other activities and techniques that might be incorporated. Although they initially were not enthusiastic about having to write in mathematics, some of them (60%) now say they found writing useful because it forced them to reflect on the processes they use in solving mathematics problems. Moreover, students assisted in identifying and creating a catalog of NASA products relevant to math. Upper-level math majors also assist in evaluating papers for the entry classes. By the end of Year I, \$4,000 will have been spent on students and student involvement. (Note: Student involvement did not begin until August because we do not have summer school.)

	Budget	
	Year II	
	<u>MU-Spin</u>	<u>Cost-Share</u>
Personnel Stipends for 3 Co-PIs @ (\$4,000 each: T. Crosby, W. Sanders & L.M. Weeks	\$6,000	\$6,000
Equipment:		\$3,000
Travel To MU-SPIN Conference and local conferences	\$2,000	\$2,000
Student interns (2 to assist in	\$4,000	-0-

identifying and accessing
NASA-related products and
assisting students in labs)

Internet Access		\$2,400
Materials	\$2,000	600
Printing (Handbooks, syllabi, reports, etc.)		500
	\$14,000	\$14,500

Proposed Activities for Year II

For Year II, Allen University would like to continue with curriculum reform but concentrating in the sciences, since the change should be systemic throughout the Division of Mathematics and Natural Sciences. The objectives will be the same for the students, the faculty, and the college. A change in one discipline, without simultaneous changes in each of the other areas, chemistry, physical science and biology, would defeat the purpose of the whole initiative. In this way, pre-service teachers will become accustomed to the “NOVA way” of doing things. They will be more inclined to use technology in all of the disciplines they teach as elementary school teachers. Also, having a central theme throughout all of the math and natural science courses will better ensure that students see interrelationships between not only science and math disciplines, but also other disciplines such as English language and literature, and business.

The courses to be revised are biology and teaching of science in the elementary school. As a result, teachers in these areas will work together to select teaching and assessment strategies that support the development of students at Allen University, many of whom have woefully weak backgrounds in and often an aversion to science. Instead of traditional lecture and laboratory activities, strategies will be incorporated to include more real world experiences, along with greater application of technology. This can be greatly facilitated by the use of NASA products. Furthermore, assessment will move away from mere pen and pencil tests that ask students to regurgitate textbook knowledge to inquiry-based activities where students are involved in the creation of their own knowledge. Not only will science topics be explored in science classes, but with cooperation from English teachers, such topics will become the basis for essays and research papers in composition.

In assisting with the revision of syllabi in the proposed areas, students will be engaged in data collection and analysis. Following the lead of teachers who model the skills of scientific inquiry, they will learn to better formulate and answer questions and to make generalizations based on the answers.

At the end of the year, the instructors and students will evaluate the courses and reflect on the findings to improve instruction in future semesters.

CNRT - ZERO GRAVITY EXPERIMENTS

A Detail Study of Fluoropolymer Degradation in a Zero Gravity Environment

**M. A. Ebadian, Ph.D.
Rajiv Srivastava, Ph.D.**

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Executive Summary

Introduction

Research is underway at the Florida International University (FIU) to study the chemical and physical mechanisms associated with the thermodegradation of fluoropolymers. Of specific interest to this work is the effect of gravity on the particle and gas formation mechanisms. In a zero-gravity (0-g) environment the forces of buoyancy are removed. This changes the time-temperature-concentration history to which the nucleating and growing particles are exposed. Previous research had shown that besides gravity, pigmentation has an overbearing effect on the ultrafine particle generation (Srivastava, 1999). Some of the other factors besides gravity and pigmentation that affect the size and morphology of the particles are the fluoropolymer type, heating rate and the surrounding environment (oxygen rich-depleted). The proposed study aims to incorporate the gas phase and also include a comparative study of the gaseous products from fluoropolymer degradation in 0-g *versus* 1-g (terrestrial) gravity. During FY01, FIU successfully completed the fabrication of the drop tower

Background

Fluoropolymers such as Polytetrafluoroethylene (PTFE, also known as Teflon), Perfluoroalkoxy (PFA), Fluorinated Ethylene-Propylene copolymer (FEP), and Ethylene-Tetrafluoroethylene (ETFE) are widely used on board spacecraft due to their excellent mechanical, electrical, and chemical-resistance properties. One widespread use of fluoropolymers is for wire insulation. Wires are particularly prone to overheating causing combustion of the insulation. Fires aboard spacecraft have been reported in the past. Four fires aboard the U.S. Shuttle program have been reported, all of which were due to overheated wires or electrical components (Ross, 1993). In all four of these cases the fires were stopped by removing power to the instruments without the use of a fire extinguisher. A more serious event occurred on the Soviet Soyuz 7 in which a fire extinguisher was used. The cabin was vented to space vacuum and breathing air restored with a later re-supply flight.

As the International Space Station is assembled and space missions become longer and more involved, it is inevitable that these types of incidents will increase. Thus, the ability to predict the types and severity of health hazards associated with fluoropolymer combustion becomes more valuable. In the arena of hazard avoidance, the fundamental chemical and physical information obtained in this study could aid in the development of inherently safer polymers. For example, the chemical molecular weight growth process is believed to be through free radical-molecule reactions. Formulation of a fluoropolymer that is mostly PTFE but with a small amount of a radical scavenger, could "short-circuit" the chemical growth process and reduce the formation rate of ultrafine particles. Another strategy to make polymer fires less injurious is to coax the particles to grow rapidly to sizes greater than one micron where the adverse health effects are reduced. Particle coagulation in hydrocarbon sooting flames is known to be influenced greatly by the degree of ionization. Thus, the results of the experiments in this project on particle dynamics can be used to guide the formulation of polymers in which ion-producing additives are included.

Summary of the Objective and Value of the Research

The objective of this work is to obtain an understanding of the fundamental chemical and physical mechanisms involved in the formation of ultrafine particles from fluoropolymer combustion and thermodegradation. The motivation for the project is to provide a basic foundation for policy on spacecraft health and safety with regard to fire safety and spacecraft polymers.

Project Technical Description

In this project we combine laboratory experiments, both at 0-g and 1-g to gain a predictive understanding of ultrafine particle generation and gaseous products release from fluoropolymer degradation under intense ohmic heating in a 0-g and 1-g environment. The overall project is organized into four easily manageable tasks shown in Table 1.

Table 1. Major tasks' timeline

Task Description	Start Date	Finish Date
1 Assembly of 2 s drop tower at FIU	Sep. 2000	Aug. 2001
2 1-g fluoropolymer degradation experiments	Sep. 2001	Feb. 2002
3 0-g fluoropolymer degradation experiments in the 2 s drop tower	Dec. 2001	Aug. 2002
4 Prolonged 0-g fluoropolymer degradation experiments in KC-135	Sep. 2002	Aug. 2003

Task 1. Assembly of 2 s drop tower at FIU (FY 01)

Technical Achievement

A drop tower facility was designed and developed at FIU, and drop hardware was designed such that easy integration into the NASA Glenn Research Center 2.2 s drop tower could take place at a later date, if so desired. The drop tower facility is located in the hoist shaft area of the Center for Engineering and Applied Sciences building. The practical working height is 60 feet with a catwalk access at 3 levels. The drop tower allows free fall duration of about 1.85 s factoring in the 5 feet of foam padding on the ground used to catch the experiment. The free fall achieves a reduced gravity of the order of 10^{-2} g. The experiment assembly is hoisted to the ceiling by a 3-ton crane as shown in Fig 2. A 3-ton crane lifts the drop frame. A release mechanism is activated to initiate the free fall. The drop frame was fabricated out of welded 6061-T6 aluminum to mimic the frame used by NASA.

Figure 1. Schematic

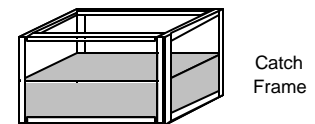
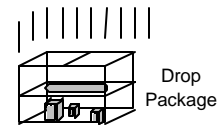
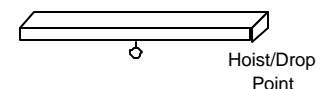


Figure 2. Elevator shaft area and the 3-ton crane for the drop box experiments

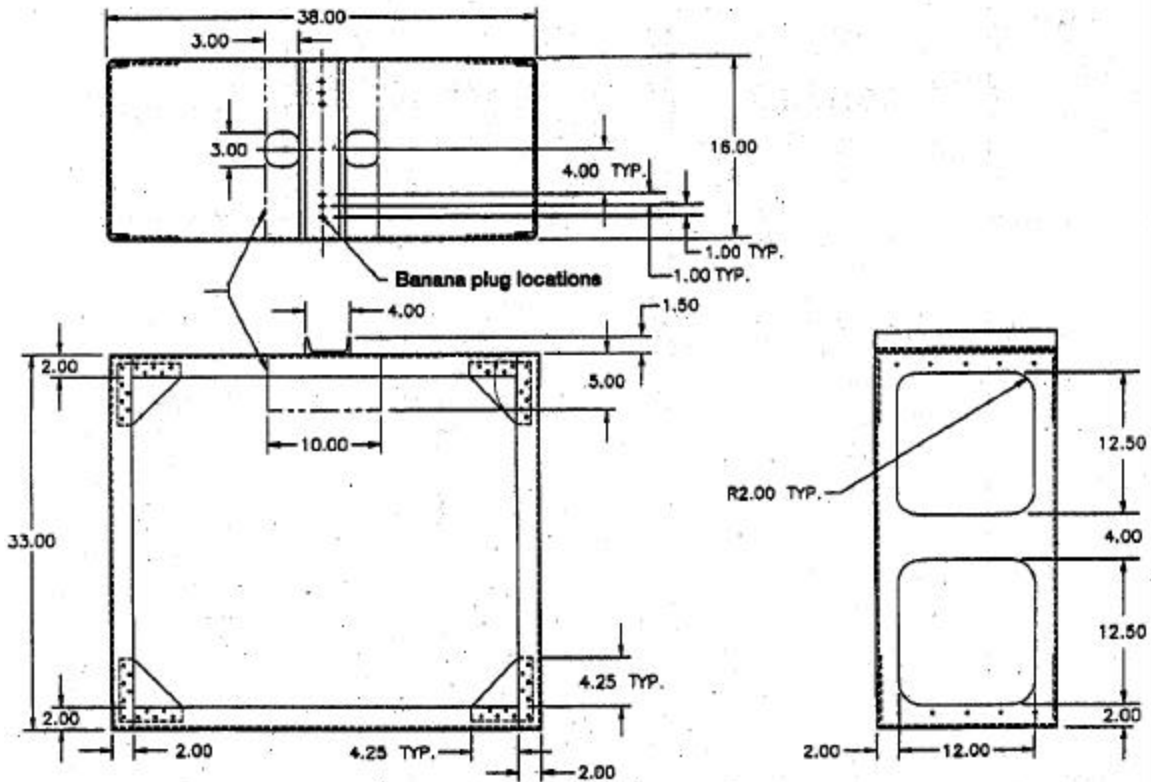


Figure 3. Drop box schematics for the microgravity experiments

Project Status

The project is behind schedule by 3 months. Task 1 was completed in November 2001 instead of August 2001 as per the original proposed schedule. The delay in funding did impact the program and affected the procurement and fabrication of the drop frame. However, if FY 02 funding is obtained without delay, the project's task 2 and task 3 can be accelerated sufficient enough to stage a complete recovery by the end of FY02.

Response to Education Activity Metrics

Outcome: To provide a quality learning and research environment to inspire an increase in the number and quality of students, including pre-service student teachers achieving degrees in NASA related SMET fields.

• Number and types of NRTS collaborating education activities relevant to the NASA Strategic Enterprises.	1
• Number and types of workshops held to support the NRTS collaboration education efforts.	NA
• Number of pre-service teachers impacted by education activities.	NA
• Number of in-service teachers impacted by education activities.	NA
• Number and types of institutions participating in education oriented workshops.	NA
• Number and types of proposals submitted in response to a NASA education announcement.	NA
• Number and types of NASA Enterprise Education products systemically implemented by NRTS and partner institutions.	NA
• Number and types of institutions participating in NRTS education oriented collaborations.	NA
• Amount of leveraged funding received from NRTS education related activities.	NA
• Number and types of NRTS facilitated education publications.	1
• Number and types of funded awards from NRTS education activities.	NA
• Number of students participating in NRTS education activities.	2

Technology Activity Metrics

Outcome: To improve the capacity of MIs to provide a technology rich environment which promotes increased usage of technology for research and education for increasing the number and quality of students graduating with SMET degrees.

• Number and types of institutions participating in technology oriented workshops.	NA
• Number and types of electronic networks funded being leveraged to support research and education related activities.	NA
• Number and types of proposals submitted in response to a NASA research announcement.	2 R&D
• New technology deployed in region to support collaboration for research and education.	1
• New technology deployed in region to support research.	1
• New technology deployed in region to support education.	1
• Number and types of technology departments (i.e. Computer Science, Engineering, Information Systems, etc.) in the region participating in the support of NRTS regional research and/or education technology requirements.	2
• Number of students in technology departments participating in technology efforts.	2
• Amount of leveraged funding received for improving technology infrastructure from NRTS activities.	NA

Student Participation

During FY01, 2 graduate students from FIU were involved with the development activity described earlier. These students are Sameer Mehta and John Acquah. Sameer was involved with the procurement of Aluminum, AutoCAD drawings of the drop frame, and the fabrication (including welding). John was involved with the procurement of the foam, fabrication of the log cabin and the detachment mechanism. Both the students worked in tandem under the supervision of Dr. Rajiv Srivastava, the team leader. They will continue to work on the second phase of the project during FY02.

The total amount spent on the students was \$11,403. This accounted for tuition and stipends for the students assistants.

FY02 Statement of Work

Task Description

FY02 tasks are delineated in Table 1. To degrade and pyrolyze the fluoropolymer insulation and obtain images for smoke particulates and gas samples for chemical analysis, the same methodology will be used for comparative 1-g and the 0-g study.

Table 1. FY02 Tasks' timeline

Task Description	Start Date	End Date
1 1-g fluoropolymer degradation experiments	Jan. 2002	Apr. 2002
2 0-g fluoropolymer degradation experiments in the 1.85 s drop tower	Mar. 2002	Jun. 2002
3 Draft report on the comparative 1-g and 0-g fluoropolymer study	Jun. 2002	Aug. 2002

Methodology

A 7 cm long 20 AWG fluoropolymer insulated wire will be used as the test specimen. The conductor is stranded, silver-plated copper with an insulation thickness of 0.25 mm. As shown in Fig. 4, the fluoropolymer (e.g. PTFE) insulated wire will be bent in an upside down "U" shape to facilitate imaging using a sheet of laser light from an argon ion laser. A video camcorder will be used as the imager and recorder. The laser light sheet will be aimed over the apex of the wire bend. The wire will be housed in a clear 20 cm X 25 cm acrylic containment box. Copper ignition posts will be attached to the wire and 10 AWG aluminum wire was used in the balance of the circuit. A robust set of two 2 Volt rechargeable lead acid batteries (Hawker 25 amp-hr) will be used for the current source. These are a reliable and reproducible current source capable of producing as much as 150 Amps.

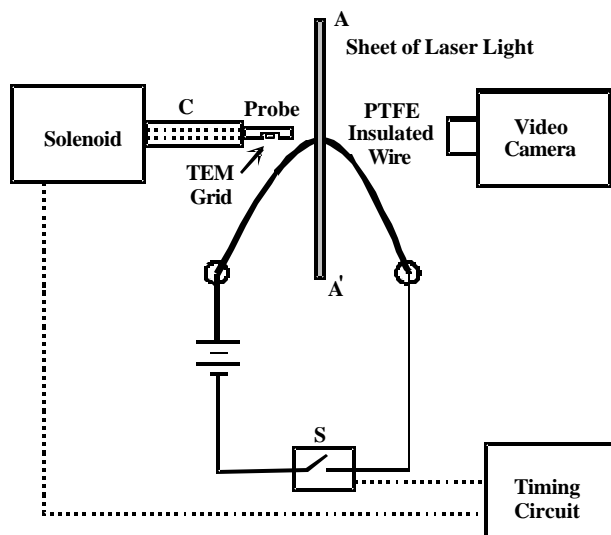


Figure 4. Schematic for the 0-g and 1-g experiments

The apparatus described above will be mounted on to the drop frame for the 0-g experiments. For the 1-g experiments, the experimental apparatus will not be dropped. For the 0-g experiments the experimental assembly will be dropped. At the start of the experiment the insulated wire will melt via current overload from the power supply. For imaging, an argon ion laser operating in the blue and green (460 nm to 532 nm) will be used as the light source for the video camera. A standard telecommunications 100 mm core diameter fiber optic will be dropped with the experiment as the laser will be mounted at the top of the tower. The fiber coupler will aim the laser beam into a 5X microscope objective, and then through a cylindrical optic. The resulting sheet of blue light will be collimated vertically and horizontally and focused over the test wire inside the acrylic containment box. The images will be transferred from the camcorder on to a SVHS video-tape and converted into standard movie and picture formats using a standard off the shelf frame grabber. Particles will be collected using the thermophoretic sampling technique. A TEM microgrid will be placed on a probe that will be held 2 cm above the tip of “U” shaped wire. This will be connected to a solenoid valve and a timer for precise timing of the probe pull. The probe will be designed in a manner so that when the solenoid pulled back, the copper grid retracts into a cylindrical enclosure, shielding it from further particle deposition.

For the experiments, PTFE insulated copper wire (5856, 20 AWG, MIL -W-16878D) will be used extensively. These hook up wires are used extensively in Spacecraft. Four different colors of PTFE insulation viz. white, black, and red and yellow will be used for the study. All experiments were performed in ambient atmosphere. A Philips EM 400 transmission electron microscope will be used for observing the particles captured on the TEM microgrid.

Project Management

Dr. M. A. Ebadian will be the Co-PI of this task. Dr. R. Srivastava will be the team leader and responsible for day-to-day activities. Dr. Srivastava has prior experience in assembly of a drop tower and is a veteran in performing microgravity experiments using the 2.2 s drop tower at NASA Glenn Research Center and the KC-135 aircraft.

Project Benefits

At FIU, the assembly of a 2 s drop tower is playing an important role in developing the microgravity science program. During the coming year we plan to pursue additional funding opportunities from NASA Strategic Enterprises. The project funds will be used for supporting 2 graduate student towards master thesis and providing stipends to 2 undergraduate students. Prospective students working on the project will gain hands-on industry-relevant skills. The skill training will broaden opportunities for students in the job market. Better job placement will ultimately lead to increased enrollment of students in math, engineering, and science disciplines at the University. Most importantly, the grant will increase awareness about NASA and its activities in the predominantly minority student community (50% Hispanic, 14.5 % African-American, 3.5 % Asian, 24.8 % White, and 0.1% Native-Indian) of the HBCU/OMI University. The Government funds will be directly utilized for hands-on training for the next generation of minority engineers and scientists.

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NASA CP-10113.

FY 2002 Budget

Labor Costs	
M. A. Ebadian	\$ 382
R. Srivastava	\$ 3,831
QA Manager	\$ 926
Administrative Staff	\$ 1,985
Total Salaries	\$ 7,124
Fringe Benefits for Full-time Personnel @ 27.5%	\$ 1,959
Other Personnel Services	
Graduate Students	\$ 6,000
Fringe Benefits for Students @7.65%	\$ 459
Total Labor Costs	\$ 15,542
Other Direct Costs	
Equipment	\$ 8,000
Travel	\$ -
Materials and Supplies	\$ 115
Total Other Direct Costs	\$ 8,115
Total Direct Costs	\$ 23,657
Indirect Costs	\$ 6,341
Grand Total	\$ 29,998

Budget Explanation

- A.1 Dr. M. A. Ebadian will be the co-investigator for the program, and will be responsible for managing the progress of the proposed project, producing reports, allocating financial resources, and communicating with funding agency.
- A.2 Dr. R. Srivastava will be the team leader and will be responsible for day-to-day activities.
- A.3 The Quality Assurance Manager is responsible for monitoring the quality of work performed and the quality affecting records and documentation.
- A.4 Administrative staff is responsible for gathering financial information and developing reports for the project, and other general office functions.
- B. One student will be recruited for the research project. He/she will be working with the team leader to assist with research experiments and coordinating project activities.
- C. The Fringe benefits rate for the University is 27.5% for full- time personnel and 7.65% for Students and part-time Other Personnel Services (OPS). The fringe benefit breakdown is as follows:

State retirement	10.30%
Social security	7.65%
Life Matching	0.25%
Health Insurance	6.90%
Sick and annual leave	2.00%
Workers Compensation	.20%
Unemployment Taxes	.20%
Total	27.50%

*Health and life insurance rates may vary depending on the plan selected by the employee; therefore, an average is used.

- C. The equipment to be purchased is as follows:
- Laser (Argon) - 5K
 - Fiber Optics - 2K
 - Video Camera - 1K
- E. Material and lab supplies funds will be to cover long distance telephone communication costs, office supplies, copying and duplication, etc. as it pertains to this project.
- F. Indirect costs for the University are 40.5% of modified total direct costs (MTDC).

MORRIS BROWN COLLEGE

Year 6 Report and Year 7 Renewal

Executive Summary of Year 2001 Activities

As proposed in the funded proposal, the department of chemistry at Morris Brown College developed a new course, "Chemistry in Society, (CHE 100) based on the science content required of Education and non science majors at the college. Three chemistry faculty and one education faculty worked collaboratively in developing this course. In addition, three in-service teachers and two undergraduate science majors participated in course review.

The course was taught during the Spring 2000 and Fall 2001 semesters respectively. The enrollment distribution for these semesters is shown in table 1 below. All students are African Americans except during Spring 2000 when there was one female Spanish student and one Arab male student.

Table 1. Course Enrollment Distribution

SPRING 2000	FEMALE	MALE	TOTAL	FALL 2001	FEMALE	MALE	TOTAL
Section 1	13	8	21	Section 1	20	18	38
Section 2	9	12	21	Section 2	10	13	23
Section 3	19	9	28	Section 3	10	12	22

Table 2 shows the faculty or program staff who derived direct financial compensation from the funded grant.

Table 2. Faculty and Program Staff

PERSONNEL	POSITION	BENEFIT
Fred I. Okoh	Project Director/Course Instructor	Travel, Summer Stipend
Vincent Nwogu	Course Developer/Instructor	Travel, Summer Stipend
Peter Roessle	Course Developer/ Instructor	Travel, Summer Stipend
Terrie Byrd	In-Service Teacher	Stipend
Mashawn Duncan	In-Service Teacher	Stipend
Brandie Carolina	Lab Assistant, Summer	Stipend
Michelle A. Williams	Peer Tutor, Academic Year	Stipend
Ige Oluwatosin	Peer Tutor, Academic Year	Stipend

This course is largely based on a unifying theme – a science/technology related issue such as global warming and water quality that focuses on the global, as well as the personal

implications of the issue. Concepts were introduced and applied on a need-to-know basis. Through the teaching of this course, the faculty is:

1. Developing a distinctive approach to meet student outcomes
2. Finding new approach to present chemical phenomena, methodology, and theory in context of social, political and economic issues.
3. Making new and important interdisciplinary connections to the social sciences.
4. Integrating laboratory, library, Internet usage, and class work.

Preliminary oral student assessment of this course is very encouraging. Many students have expressed interest in the content and the quality of instruction. These students seem to imply that they are learning how chemistry applies and affect their daily lives. A short student course evaluation was conducted during the last week of the fall semester. The result will be published and discussed in subsequent reports.

Some preliminary observations have been made during the last two semesters. It is apparent to the instructors that our students are very under-prepared for science. They have very poor understand of mathematics (arithmetic) to perform very elementary tasks normally expected from sixth grade students. This problem is compounded with their lack of desire and interest to learn. They have very poor writing skills that make it terribly difficult to assign them materials that require out of the classroom written responses. Plagiarized work from the Internet is often presented for assignments and research reports.

Education Activity Metrics

Outcome: To provide a quality learning and research environment to inspire an increase in the number and quality of students, including pre-service student teachers achieving degrees in NASA related SMET fields.

- Number and types of NRTS collaborating education activities relevant to the NASA Strategic Enterprises. **(3) Space Science Education Library, Earth Science, The Sun and Space Research materials**
- Number and types of workshops held to support the NRTS collaboration education efforts. **NA**
- Number of pre-service teachers impacted by education activities. **22**
- Number of in-service teachers impacted by education activities. **4**
- Number and types of institutions participating in education oriented workshops. **NA**
- Number and types of proposals submitted in response to a NASA education announcement. **0**
- Number and types of NASA Enterprise Education products systemically implemented by NRTS and partner institutions. **NASA's Space Science, Earth Science, Solar System Exploration, Human Exploration and the Sun and Space Enterprises.**

- Number and types of institutions participating in NRTS education oriented collaborations. NA
- Amount of leveraged funding received from NRTS education related activities. \$55,000 for pre-college summer science program (Starlab, CDC)
- Number and types of NRTS facilitated education publications. NA
- Number and types of funded awards from NRTS education activities. NA
- Number of students participating in NRTS education activities.
3 course sections/semester x 2 semesters x 35 students/section = 210 students

PROPOSED YEAR 7 (2001-02) ACTIVITIES

The purpose of the MUSPIN funds is to assist Morris Brown College to fully implement and achieve the objectives described in the NOVA proposal. During the coming project year, Morris Brown College will continue to carry out the activities designed to aid in achieving these objectives. Specifically, the department of chemistry would teach two sections of Chemistry in Society during the 2002 Spring semester. Other activities in conjunction with teaching this course would include:

1. Faculty travel to NRTS workshops.
2. Internal campus team evaluation of project.
3. Student course instruction evaluation.
4. Campus visit and Project Evaluation by NOVA Team.
5. Campus NOVA Team Summer session to incorporate findings from 1-4 above.
6. Preparation for Fall 2002 course offering.

In order to support the above activities, the funds described in the budget table below are requested.

**MORRIS BROWN COLLEGE
MUSPIN
YEAR 7 BUDGET REQUEST**

BUDGET ITEM	ACAD MOS	SUMR MOS	AMOUNT
<u>I. Personnel</u>			
1. Project Director (Fred I. Okoh) and Course Instructor		1.5	\$7,000.00
2. Course Instructor (Vincent Nwogu)		1.0	\$3,000.00
c. Education Faculty			\$0.00
d. Fringe Benefits @ 25% (a+b+c)			\$2,500.00
e. Undergraduate Teaching Assistants (3) @ \$8/hr x 10 hrs/ week x 26 weeks			\$4,000.00
f. Collaborating K-12 Teachers (2)		1	\$2,100.00
g. Pre-Service (MBC) Student Teachers (5)		0.25	\$1,925.00
h. Secretarial/Clerical: 2 mos @ \$26,000/yr			\$0.00
<u>II. Permanent Equipment</u>			
<u>III. Laboratory/Activity Kits</u>			
<u>IV. Travel</u>			
<u>V. Materials and Supplies</u>			
TOTAL DIRECT COSTS			\$25,275.00
INDIRECT COSTS @ 18%			\$4,550
TOTAL DIRECT AND INDIRECT COSTS			\$29,825.00

BUDGET EXPLANATION AND JUSTIFICATION

I. PERSONNEL

a. Dr. Fred I. Okoh serves as Principal Investigator/Project Director. Dr. Okoh is involved in developing the course curriculum and in teaching two sections of the course. He will be involved in the preparation and selection of experimental/Activity kits. Dr. Okoh will serve as the primary college contact and will be responsible for preparing and submitting reports to SCSU and MU-SPIN. Dr. Okoh's compensation of \$7,000 (MU-SPIN Funds) is based on an academic year salary of \$50,000.

Morris Brown College will contribute one month's salary (\$5,000) through released time. Dr. Okoh's cash compensation will be limited to the \$7,000 request.

3. Dr. Daa'iyah Saleem will serve as the Education Faculty. She will be involved in the course design and delivery to ensure that relevant pedagogy and educational standards are incorporated. Morris Brown College will compensate her by a reduced course load. Dr. Saleem serves as the liaison between the education pre-service majors/education department and the science faculty/project director.

4. Dr. Vincent Nwogu will serve as course instructor. He will be involved in designing and implementing the course. He will be involved in the preparation of experimental/Activity Kits. Dr. Nwogu will teach one section of the course. His compensation is based on an academic year salary of \$36,000. Dr. Nwogu's cash compensation will be limited to the \$3,000 request.

5. Three undergraduate teaching assistants will be involved in the assembly of Activity Kits and provide assistance during laboratory sessions. Their compensation is calculated at \$8/hr for ten hours per week. Morris Brown College will provide 47% of their wage through the college work Aid program.

6. Two K-12 (Terrie Byrd and Mashawn Duncan) teachers will serve as Collaborating public school teachers. They have worked with the project director in the pre-college program for three years. Their compensation is calculated on current summer salary of \$1,100 for 4 weeks.

7. During the summer months, 5 pre-service Morris Brown College students will attend a week workshop which will serve as practice during the pre-college summer program. The pre-service students will receive \$385/week. Total proposed stipend cost is \$1,925.

8. Secretarial/Clerical. No MU-SPIN funds are requested. The college will provide this service to the project and the time is estimated to be 2 months (\$4,333) at an annual salary of \$26,000.

II. PERMANENT EQUIPMENT

No permanent equipment is being requested.

III. LABORATORY/ACTIVITY KITS.

Activity kits will be constructed and or purchased for these laboratory exercises. The cost is estimated at \$5000. The college will share 50% of this cost through the instructional budget in the department of chemistry.

IV. TRAVEL

One thousand five hundred dollars (\$1,500) is being requested for travel. This will allow project staff to attend annual Partnership Workshops and MUSPIN Conference.

V. MATERIALS AND SUPPLIES

Materials and supplies are estimated to cost \$850. This includes laboratory and instructional supplies not covered under laboratory/activity kits. Papers, print cartridges, copying, perishable supplies and photo films are included in this category.

Additional Budget Items for College and K-12 Partners

The following items are for college and K-12 partners who have been identified as collaborators but not explicitly included in the original proposal.

University of the Virgin Islands: **\$5,000** for repair/refurbishment of their observatory to be paid to the appropriate account at the UVI for this purpose. This will provide SCSU with access to an observatory at a latitude of 11 degrees north, further south than the continental United States and therefore gain access to a portion of the Southern Hemisphere sky.

URIA Student Research Positions for qualified URIA students from qualified minority institutions:

Item	Cost	# students	Total Cost
8-week stipend	\$3,800	2	\$7,600
Rd trip air home to Obrg, SC	550	2	1,100
Lodging	100 x 1 night	2	200
Food	\$25 x 2 days	2	100
Ground transport	50	2	100
TOTAL			\$9,100

K-12 Teacher and CNRT staff funded for participation in the Academy I Program

Item	# days	Daily Rate	# people	Total Cost
K-12 teachers	13	50	5	3,250
Lead teacher	20	72.40	1	1,448
Program Coordinator**	35			5,900
TOTAL				10,598

** Program Coordinator – Computer Sciences Corporation (CSC) will provide the planning, coordination and implementation of the workshop including ordering materials and establishing an agenda several months prior to the workshop dates and followup after the conference. Estimated time over the course of 1-year including the 13 days of the workshop is 35 full-time days of work

K-12 Teacher Travel to ECSU Earth System Science Academy

Fee:	\$200
Lodging (2x 100)	\$200
Food (3x32)	\$ 96
Mileage	\$251
Subtotal	\$747
# teachers	2
TOTAL	\$1,494