South Carolina State University
NASA PAIR Program

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Principal Investigator

Dr. James Anderson, Dean
Co-Principal Investigator

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Relevance to NASA

SCSU PAIR Mission Statement

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 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.
Relevance to NASA

- Astrophysical Research
  - HST PI & Co-I projects
  - Studies of Galactic ISM & Starburst Galaxies
  - Themes: Origins & Structure and Evolution of Universe
- Incorporate Space Science into the curriculum
- Collaborating Departments
  - Physical Science
  - Math & Computer Science
  - Electrical Engineering Technology
Relevance to NASA

- GSFC is the SCSU Partnering Center
- Center of Excellence in Scientific Research
- Mission Area includes Physics & Astronomy
- Contact: Dr. James Thieman
  - Radio Astronomer
Relevance to NASA

• PAIR facilitates activities at a Minority University (SCSU) that are related to NASA’s mission
• PAIR achieving sustainable change using current NASA research results
• PAIR better preparing SCSU faculty to participate in competitive NASA research and education processes
• PAIR better preparing SCSU students for graduate school and careers in fields of interest to NASA
Overview

• Faculty Development & Training
  – Astrophysics, Software, Teaching Methods

• LabView Implementation
  – Widespread use in industry & government labs
  – Gives student valuable experience

• Curriculum Enhancement
  – New equipment & laboratory exercises in majors courses
  – New laboratory exercises & lecture material in non-majors courses, including preservice teachers
Overview

• **Student Research Teams**
  – Team of 3-4 student, 1 faculty mentor
  – Work on single project for 1 year
  – Experience working on team with others from different fields
  – Profession presentation(s)
  – Cross-disciplinary
    • 1 major each from science, engineering technology and math/computer science

• **Recruitment & Outreach**
  – Undergrads interact 3 times per year with K-12
Intrinsic Merit
Statement of Objectives

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.
Impact of the Project

• Training
  – LabView
  – UNIX
  – Astrophysics
  – Teaching Methods

• Student Research
  – Radio Astronomy
  – Robotics
  – Database Management
  – Virtual web instrument management
Impact of the Project

• Student Presentations
  – Professional meeting experience
  – Talking & Working with K-12 students
  – Presenting to peers

• Curriculum
  – New Seminar Course in Space Science
  – New CCD camera lab in advanced physics
  – LabView in physics & EET courses
  – New Physical Science Lab Exercises for non-majors
Impact of the Project

• NASA Research in the Curriculum
  – Physics, Science Ed
    • NASA web resources
    • Explorers of the Univ.
    • Hubble & JPL Imagery
  – Computer Science
    • Hubble Imagery
  – Non-majors course
    • Radio Jove
    • SOHO imagery
    • NASA web sites searches
<table>
<thead>
<tr>
<th>Project Outcomes</th>
<th>Metric for Success</th>
<th>Actual Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAIR Advisory Board created, review of project provided</td>
<td>13-15 members from varied backgrounds</td>
<td>100 %</td>
</tr>
<tr>
<td>Student research teams formed, projects completed</td>
<td>3 teams, 3 completed projects</td>
<td>4 teams, 4 completed projects</td>
</tr>
<tr>
<td>New advanced research course tied to space science</td>
<td>ETS 468-469 approved by Board of Trustees and offered</td>
<td>100%</td>
</tr>
<tr>
<td>New lab exercises created</td>
<td>2 in MSET courses</td>
<td>1 in physics, 4 in physical science</td>
</tr>
<tr>
<td>Incorporates NASA resources in non-MSET course</td>
<td>PSC 152 (lecture)</td>
<td>Deferred to PSC 153 (lab course)</td>
</tr>
<tr>
<td>A-Tech low-light video system</td>
<td>Purchase &amp; begin observing</td>
<td>100%</td>
</tr>
<tr>
<td>Project Outcomes</td>
<td>Metric for Success</td>
<td>Actual Achievement</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>--------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Impacted MSET class enrollment</td>
<td>154</td>
<td>151</td>
</tr>
<tr>
<td>Impacted non-MSET class enrollment</td>
<td>365</td>
<td>39</td>
</tr>
<tr>
<td>Faculty members trained</td>
<td>5</td>
<td>11</td>
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<tr>
<td>Students trained</td>
<td>12</td>
<td>17</td>
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<tr>
<td>Presentations to K-16</td>
<td>12</td>
<td>12</td>
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<tr>
<td>K-12 students view PAIR undergrad presentations</td>
<td>225</td>
<td>343</td>
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<tr>
<td>Student professional presentations</td>
<td>3</td>
<td>4</td>
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Program Evaluation

• **Stage 1: First Quarter Year 1**
  – Steering Committee Overview of milestones and plans for implementation of project
  – Implement training & student research teams

• **Stage 2: Second Quarter Year 1**
  – Steering Committee Evaluation of progress
  – Adjustments to Outreach Plans
  – Begin curriculum development
Program Evaluation

• **Stage 3: Third Quarter Year 1**
  – Steering Committee Evaluation of Fall 2000
  – Adjustments to team organization
  – Planning for professional presentations
  – Changes to Year 2 student teams
  – New Year 2 partnerships & directions

• **Stage 4: Fourth Quarter Year 1**
  – Final adjustments to Year 1 implementation
  – Chose Year 2 student teams
  – Begin implementation of Year 2
Formative Development

- Increase by 40% number of student researchers
- Student Outreach shift to large on-campus visits
- Faculty teaching methods training changed to “Explorers of the Universe”
- Shift of emphasis to radio astronomy
Dissemination Plans

- Campus publications
- Outreach presentations
- On campus team talks
- Off campus presentations
  - IEEE Clemson Univ.
  - SC Academy of Science
  - Black Physics Students
  - Voorhees Diversity Meeting
- MURED/MUSPIN Meeting
- Radio Astronomy Meeting
Dissemination Plans

• Web page being developed
  – Year 2 will include K-12 email questions posed to student teams
• Brochure printed
• Posters to Outreach groups
• Year 2 & 3 introductory space science lab book
• Years 2-4 partner A Tech to develop astrophysical videos for lab & outreach
Partnerships

• NASA Goddard
  – Dr. James Thieman & Radio Jove
  – Mr. James Jackson assists other programs

• National Instruments
  – Provided free instructional manuals
  – Serving on Advisory Board

• Western Kentucky University
  – Overview of their LabView implementation
Partnerships

• **University of the Virgin Islands**
  – Purchase of new telescope & observatory work

• **A Tech**
  – Purchase & training on low light video imager
  – Serving on our Advisory Board
New Partnerships

• NASA’s Radio Jove
• Pisgah Astronomical Research Institute (PARI)
• Explorers of the Universe (Tennessee State Univ.)
• Planetarium Director
• SCSU School of Education
Management Approach

Implementation Strategies

• Management Team: PI, Co-PI, 5 Co-Is
• Management Team includes:
  – Dean, Chair, Area Coordinator
  – Director of K-12 Resource Center
  – Investigators on other NASA, DOE & related grants
• Ensures implementation of curriculum changes
• Leverages other funds & resources
• Management team meets quarterly to evaluate & modify as needed (see Program Evaluation)
• Additional weekly communication
• Year 2 input from Advisory Board and reviewers
Management Approach
Competence of Project Personnel

- Success of Project Outcomes
- Ability to modify process
- Addition of new partners
- Strong campus support from students & administration
Management Approach

Impact

• High Visibility
  – Presidential recognition
  – 2 front page campus articles & local press coverage
  – Cross-departmental support
• Strong Student & Faculty Interest
• Non-majors positive reaction to use of NASA web resources
• Non-traditional partnering with School of Education
• Positive feedback on Outreach
## Non-MSET Majors

<table>
<thead>
<tr>
<th>PAIR course</th>
<th>Semester</th>
<th>Black Male</th>
<th>Black Female</th>
<th>White Male</th>
<th>White Female</th>
<th>Hispanic Male</th>
<th>Hispanic Female</th>
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<tr>
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<td>TOTAL</td>
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<td>19</td>
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# MSET Majors

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<th>PAIR course</th>
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<th>Black Male</th>
<th>Black Female</th>
<th>White Male</th>
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<td>CS 201</td>
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<td><strong>TOTAL</strong></td>
<td>Year 1</td>
<td>105</td>
<td>44</td>
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Human Resource Development
Retention Plan

- Carryover one student on each team to Year 2
- Place team members in other SCSU programs with NASA, DOE etc.
- Support outside internships, exchanges, etc
  - Univ. Wisconsin Nuclear Engineering Program
  - Industrial Internships (utilities, telecommunications)
- Liaison with industrial & grad school recruiters
Project Cost

Budget Impact

• Faculty salaries & student stipends critical to pursue long term (1-year) student research projects
• Funds for training & travel essential for faculty development
• Funds for equipment in the $5,000 to $20,000 range make it possible to engage in research projects normally not available to SCSU faculty & students
  – Low light video imaging system
  – Questar microscope/telescope
  – Spectrum analyzer
Project Cost

Institutional Support

• Cost share portion of PI salary
• Lab tech staff support
• Computer labs in 3 buildings
• Robotics lab
• Separate student research lab
• Travel money for 2 faculty
• Existing LabView hardware & software for training & research
• Astrophysical equipment
• Servers for training & web resources
Looking Ahead to Year 2

• 4 new student research teams
• Radio astronomy applications by all 4 teams
• Planetarium Director funded to begin to develop a space science lab book for non-majors and more Radio Jove support
• LabView incorporated into more courses
• Increased student involvement in CCD and video observations of celestial phenomena