



PRAIRIE VIEW A&M UNIVERSITY

A Member of the Texas A&M University System

Center for Applied Radiation Research (CARR)

In Partnership with the National Aeronautics and Space Administration (NASA)

Radiation Research and Testing Since 1995

The NASA Center for Applied Radiation Research (CARR) was established in 1995 through a five-year cooperative agreement between Prairie View A&M University (PVAMU) and the National Aeronautics and Space Administration (NASA). Largely through the Center's record of successes and its unique abilities to pioneer human radiation protection and materials research, CARR's unified approach to radiation research for human space flight was continued by NASA through a second five-year agreement.

For the three year period starting with FY 2003 (beginning September 1, 2002) and ending with FY 2006 (August 31, 2006), CARR has served as a model Center in the university's research infrastructure, making significant contributions to the educational goals of Prairie View A&M University and the technical mission of NASA. Highlights include the following:

1. **Proposals Submitted** – CARR-supported research resulted in the submission of no fewer than fifty (50) research, infrastructure, curriculum and academic enhancement proposals totaling more than \$28.3 million during the three fiscal years involved in this report. All six CARR faculty members participated separately and together in quests for additional funding to carry on the Center's challenging new programs.
2. **Proposals Awarded** – CARR-supported principal investigators and faculty received more than \$12.9 million in research funding for the reporting period including:
 - *CARR Supplement*, Dr. Richard Wilkins, Dr. Kelvin K. Kirby, Dr. Jianren Zhou, Dr. Sukesh Aghara, Dr. Kevin Storr, Dr. Premkumar B. Saganti, \$360,000.
 - *Phase II Lightweight Shielding*, Richard Wilkins, \$119,462.
 - *Center for Applied Radiation Research*, Dr. Richard Wilkins, Dr. Kelvin Kirby, Dr. Jianren Zhou, Dr. Sukesh Aghara, Dr. Kevin Storr, Dr. Premkumar Saganti, \$3,600,000.
 - *Multifunctional CNT/Polyethylene Complex, Phase I*, Richard Wilkins, \$114,917
 - *Multifunctional CNT/Polyethylene Complex, Phase II*, Richard Wilkins, \$248,000.

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- *Microporous Carbon for Radiation Shield*, Richard Wilkins, \$13,500.
- *Multifunctional Polymer Composites*, Richard Wilkins, \$6000.
- *STEM Enhancement Program, 2nd 5-Year Program*, Dr. Kelvin K. Kirby, \$2,500,000
- *STEM Prep Institute*, Dr. Kelvin K. Kirby, \$300,000
- *Radiation Modeling at Mars for Martian Radiation Environment Experiment (MARIE) Project*, Dr. Prem B. Saganti - \$200,000
- *Radiation Modeling and Visualization*, Dr. Prem B. Saganti - \$400,000
- *Radiation Interuniversity Science and Engineering Program*, Dr. Prem B. Saganti - \$300,000
- *Radiation Assessment of Space Suit Proposed Material*, Dr. Prem B. Saganti - \$100,000
- *Marshall Spaceflight Center*, Dr. Brad B. Gersey, \$300,000
- *POSS Nanochemical Technology for Radiation*, Dr. Sukesh Aghara, \$20,882
- *Experimental and Computational Benchmarks in Medical Physics*, Dr. Sukesh Aghara, \$10,000
- *INIE Renewal 2006-07*, Dr. Sukesh Aghara, \$52,435
- *GEO Roamer Payload Systems Definition 2006*, Dr. Sukesh Aghara, \$25,709
- *RaISE Renewal 2006-07*, Dr. Sukesh Aghara, \$175,000
- *Innovations in Nuclear Education and Infrastructure*, Dr. Sukesh Aghara, \$45,000
- *RaISE 2005*, Dr. Sukesh Aghara, \$37,500
- *Minority/Majority University Partnership Program*, Dr. Sukesh Aghara, \$187,491
- *Faculty-Student Team for Summer Practicum 2005*, Dr. Sukesh Aghara, \$26,500
- *Thermal Neutron Shielding for Composite Materials*, Dr. Sukesh Aghara, \$2,500
- *Radiation Detectors and Sensors*, Dr. Sukesh Aghara, \$1,709,269
- *Thermal Neutron Shielding*, Dr. Sukesh Aghara, \$10,731
- *Research on the Actinides*, Dr. Kevin Storr - \$1,500,000
- *Research Foundation Project*, Dr. Kevin Storr - \$300,000
- *MRI: Acquisition of Dilution Refrigerant* Dr. Kevin Storr - \$322,000

3. **Scholarly Publications** – CARR faculty has been extremely prolific in the generation of scientifically-significant journals, conference papers and presentations at national and international conferences, seminars and scientific gatherings. For the reporting period, a total of 173 publications, invited presentations, abstracts, and other relevant papers have been disseminated throughout the scientific community.
4. **Students Employed** – The Center has also contributed to the academic growth of scientifically-talented students through the employment of undergraduate and graduate students, who derive additional academic benefit from CARR research initiatives. During the 2003-2006 reporting period, CARR provided research-related employment to sixty-eight (68) undergraduate and graduate students. The breakdown shows:

- Forty-seven (47) undergraduate students
 - Nineteen (19) master's students, and
 - Two (2) Ph.D. students
5. **Professional Staff** – Two (2) professional staff members were employed by CARR during the period covered by the report. Helping to carry on the work of the Center were:
- Dr. Brad B. Gersey, Research Scientist
 - Mr. Ray Dwivedi, Research Assistant/Instructor
6. **Faculty Associated with CARR** – Six (6) Prairie View A&M University faculty members are responsible for overcoming the scientific challenges and growing the academic accomplishments of the CARR Center. They are:
- Dr. Richard T. Wilkins, Director
 - Dr. Kelvin K. Kirby, Deputy Director
 - Dr. Jianren Zhou, Department of Mechanical Engineering
 - Dr. Sukesh Aghara, Department of Chemical Engineering
 - Dr. Kevin Storr, Department of Physics, and
 - Dr. Premkumar B. Saganti, Department of Physics
7. **Future CARR Activities** – We plan to continue to use the expertise that NASA established at Prairie View A&M University to complete ongoing research and seek new opportunities from NASA as well as other funding sources to enhance and expand our research and provide students with opportunities to participate in our work.

Near term plans:

- Complete ongoing NASA related research, especially a set of three Phase II Small Business Innovative Research (SBIR) partnerships. These partnerships expose our researchers to innovators in nanotechnology and advanced materials.
- Many CARR investigators are part of an effort to bring a National Science Foundation sponsored Center for Research Excellence in Science and Technology (CREST). The main technical focus will be in the area of “nano-dosimetry”, the study of measuring energy deposition in nano-scale volumes from ionizing radiation. This research has wide ranging implications from the reliability of electronic devices to radiation therapy for cancer.
- Participate in a new competition for a NASA University Research Center as the opportunity comes available.
- Work with NASA, Department of Energy and PVAMU to enable education opportunities in nuclear engineering and radiation science and engineering.
- Completion of laboratories funded through leveraged grants from the National Nuclear Security Agency.

Long term plans:

- Perform research on radiation effects on nanotechnology and explore ways of using nanotechnology to detect and quantify radiation.

- Explore new methods for radiation detection and dosimetry, and use this knowledge to develop new instrumentation.
- Perform research that impacts radiation biology and radiation medicine.
- Study novel materials in radiation environment for structural and shielding application.
- Continue radiation effects studies on cutting-edge electronic materials and devices.
- Seek funding for these endeavors from a variety of funding sources including:
 - ◆ Department of Energy
 - ◆ National Science Foundation
 - ◆ Department of Defense
 - ◆ National Institute of Health
 - ◆ Department of Homeland Security
 - ◆ Private Industry including Aerospace and Health related companies.

8. **Advisory Boards** – The Center for Applied Radiation Research relies on the assessment and recommendations of its two advisory boards to assist and guide the CARR faculty in its efforts to focus the center's efforts on its responsibilities in the scientific community. Both internal and external advisory panels are used to fine-tune the goals and objectives of CARR.

External Technical Advisory Panel

- Dr. James Arnold, Motorola
- Dr. Thomas Borak, Colorado State University, Dept. of Health Science
- Dr. Leslie A. Braby, Texas A&M University, Dept. of Nuclear Physics
- Dr. Daniel Chesire, Agere Systems
- Dr. Kaulu Diogu, Motorola
- Dr. Kenneth Galloway, Vanderbilt University, School of Engineering
- Mr. Jim Lambert, Boeing Environmental Engineering
- Dr. Gary Maki, University of New Mexico, Dept. of Electrical Engineering
- Dr. Jack Miller, Lawrence Berkley Laboratory
- Dr. Larry Townsend, University of Tennessee, Dept. of Nuclear Engineering
- Dr. Stephen Wender, Los Alamos Neutron Science Center

Internal Technical Advisory Panel

- Dr. George Wright, President, Prairie View A&M University
- Dr. Willie F. Trotty, Chairman, Vice President for Research & Development
- Dr. E. Joahanne Thomas-Smith, Co-Chairman, Provost and Vice President for Student and Academic Affairs
- Dr. Milton R. Bryant, Dean, College of Engineering
- Dr. Danny Kelley, Dean, College of Arts and Sciences
- Mr. Larry Raab, Vice President of University Operations