NRC Research Associateship Programs Newsletter

Autumn 2005

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

…Thank you for making our 50th Anniversary celebration a huge success! On November 19, the National Research Council (NRC) celebrated the 50th anniversary of the Resident Research Associateship Programs. Over 200 Advisers, agency representatives, and current and past NRC Associates, representing many of the participating agencies, attended the half-day celebration, which included a welcoming lunch, talks by agency leaders and former-Associates, a poster session highlighting the accomplishments of over 80 current Associates, and a closing reception. The event was held at the National Academy of Sciences main building on Constitution Avenue location in Washington DC.

In opening remarks, Dr. Ray Gamble, Director of the NRC Fellowships Office gave a brief history of the program. Then, **Dr. John Montgomery**, Director of Research at the Naval Research Laboratory (NRL), **Dr. Hratch Semerjian**, Acting Director of the National Institute for Standards and Technology (NIST), and **Dr. Bill Farland**, the Environmental Protection Agency's (EPA) Acting Deputy Assistant Administrator for Science, each discussed the importance of the NRC Research Associateship Programs in their agencies, including the history of the program and it's impact on both research and the workforce.

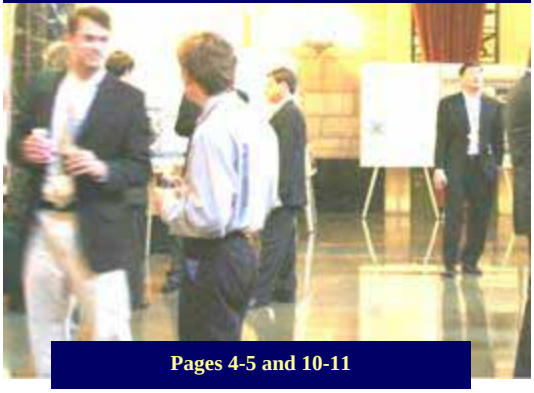
Six former NRC Associates discussed their NRC experiences and their subsequent careers. These speakers included: **Dr. Guenter Riegler**, NRC Associate at the NASA Jet Propulsion Laboratory, and currently Director of the NASA Astrobiology and Space Research; **Dr. Alison O'Brien**, NRC Associate at the Walter Reed Army Institute for Research (WRAIR), and currently Professor and Chair of the Department of Microbiology and Immunology, in the Uniformed Services University of the Health Sciences; **Dr. Barry Farmer**, NRC Associate at the National Bureau of Standards (NBS), and currently Chief Scientist in the Materials and Manufacturing Directorate of the Air Force Research Laboratory (AFRL); **Dr. Mary Lou Zoback**, member NAS; NRC Associate at the U.S. Geological Survey (USGS), and currently Senior Research Scientist at the U.S. Geologic Survey; **Dr. Melchor Antunano**, NRC Associate at the Air Force School of Aerospace Medicine, and currently Director of the Federal Aeronautics Administration (FAA) Civil Aerospace Medical Institute; and **Dr. Isaac Sanchez**, member NAE; NRC Associate at NBS, and currently the William J. Murray Endowed Chair in Engineering at the University of Texas at Austin.

The NRC Resident Research Associateship Program began in 1954, in partnership with the National Bureau of Standards, now the National Institute of Standards and Technology. NRL joined in 1955 and many other laboratories soon followed. In its 50 year history, over 11,400 NRC Associates have received awards to conduct research in the 40 participating agencies' laboratories. Many have remained at the agencies' laboratories as permanent or contract employees.

Thank you for making the NRC Research Associateship Programs a huge success! **Ray Gamble, Director**

Hundreds Showed!

NRC 50th Anniversary Poster Exhibition & Reception



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The NRC Research Associateship Programs are represented at approximately 32 professional meetings each year. Reflecting the goal of increased diversity of applicants to the programs, there are now more meetings that target unrepresented minorities.

NRC Exhibits - 2006 - Scientific Meetings	Dates	Place
American Institute of Aeronautics and Astronautics	Jan 9-12	Reno, NV
SPIE/Photonics West	Jan 21-26	San Jose, CA
American Meteorological Society	Jan 29-Feb 2	Atlanta, GA
National Council of Black Physicists and Physics Students	Feb 15-18	San Jose, CA
American Physical Society	March 13-17	Baltimore, MD
American Chemical Society	March 27-29	Atlanta, GA
National Society of Black Engineers	March 29-Apr 2	Pittsburgh, PA
Experimental Biology/American Society of Biochemistry and Molecular Biology	April 2-4	San Francisco, CA
National Organization of Black Chemists and Chemical Engineers	April 9-15	Los Angeles, CA
American Society for Microbiology	May 22-24	Orlando, FL
Conference on Lasers and Electro-optics	May 23-25	Long Beach, CA
Ecological Society of America	August 6-11	Memphis, TN
American Fisheries Society	Sept 10-14	Lake Placid, NY
American Chemical Society	Sept 11-13	San Francisco, CA
Human Factors and Ergonomics Society	Oct 16-20	San Francisco, CA
Society for Neuroscience	Oct 21-25	New Orleans, LA
Geological Society of America	Oct 22-25	Philadelphia, PA
Society for the Advancement of Chicanos and Native Americans in Science	Oct 27 & 28	Tampa, FL
Science and Engineering Alliance/Student Technical Conference	Oct 13-15	Washington, DC
Hispanic Association of Colleges and Universities	Oct 28-31	San Antonio, TX
Mexican American Engineers and Scientists	Nov 1-6	San Jose, CA
American Indian Science and Engineering Society	Nov 2-4	Detroit, MI
Society of Environmental Toxicology and Chemistry	Nov 5-9	Montreal, Quebec
Annual Biomedical Rsrch Conference for Minority Students	Nov 8-11	Anaheim, CA
Florida Education Fund/McKnight Fellows	Nov 11-13	Tampa, FL
American Society for Tropical Medicine and Hygiene	Nov 12-16	Atlanta, GA
Materials Research Society	Nov 27-Dec 1	Boston, MA
American Society for Cell Biology	Dec 9-13	San Diego, CA
American Geophysical Union	Dec 11-15	San Francisco, CA

Note to Advisers: **If you are interested in promoting a specific research opportunity at any of these meetings, please contact Jane Dell'Amore at least one month prior to the meeting date to request flyers for your opportunity to be distributed at the meeting. Another effective means of finding prospective applicants for a specific research opportunity is to place an announcement on a professional society web site; this is relatively inexpensive compared to the cost of display advertisements in printed publications. If you will be attending a meeting not on our list, you can request a supply of flyers.**

Jane Dell'Amore: (202) 334-2768 or jdellamo@nas.edu

Awards & Honors AFRRI

In February 2004, the Armed Forces Radiobiology Research Institute (AFRRI) was awarded the Joint Meritorious Unit Award by Secretary of Defense Donald Rumsfeld. The justification for the award reads in part:

"The Armed Forces Radiobiology Research Institute distinguished itself by exceptionally meritorious achievement from 11 September 2001 to 20 June 2003, in response to acts of terrorism and nuclear/radiological threats at home and abroad. The Institute's expert guidance and critical training and information services became especially evident with the September 11, 2001, terrorist attacks on the World Trade Center and the Pentagon, followed by the anthrax threat to the nation's mail system, all while nuclear/radiological dangers abroad demanded attention. The Institute's military and civilian employees provided expert advice and extensive training to the military services; to regional, state, and federal government organizations, including the White House staff; and to civilian first responders, including those in New York City and Washington, D.C. By their exemplary performance of duty, the members of the Armed Forces Radiobiology Research Institute have brought great credit upon themselves and to the Department of Defense."

Left to right (a/a = NRC Adviser / former NRC Associate): Dr. Pataje Prasanna (a/a); Dr. Alexandra Miller (a/a); Dr. William Blakely (a/a); Colonel David Jarrett , MD, AFRRI Director; Dr. Sree Kumar (a/a); Dr. Terry Pellmar, AFRRI Scientific Director, (former NRC Associate); Dr. Vijay Singh, former NRC Associate; Mr. James Pendergrass (Laboratory Program Representative); and Dr. Vasan Srinivasan (a/a). Current NRC Advisers not pictured: Marcy Grace, Michael Landauer, Joel Lowy, David McClain, and Mark Whitnall.

After receiving the award presented to the Institute in a ceremony in May 2004, the Institutes' Director, Col. David G. Jarrett, MD, acknowledged:

"This prestigious award belongs to all Institute employees, each of whom contributed to the organization's ability to respond immediately after the attacks on the World Trade Center and the Pentagon, and who continue to provide expert advice, training and research in support of national anti-terrorism programs."

Prior to and during the award period , AFRRI was fortunate to have numerous **NRC Research Associateship Program alumni** on staff. These include Dr. Terry Pellmar (1977), currently AFRRI Scientific Director; Dr. K. Sree Kumar (1978 & 1983), a member of the Institute's Radiation Casualty Management Team; Dr. William Blakely (1983), currently the Institute's Biodosimetry Team Leader; Dr. Vasan Srinivasan (1989), member of the Institute's Radiation Casualty Management Team; Dr. Pataje (Pat) Prasanna (1993), member of the Institute's Biodosimetry Team; and Dr. Vijay Singh (2001), member of the Institute's Radiation Casualty Management Team.

Awards & Honors NOAA

Dr. Kyle Shertzer, NRC Research Associate, on the NOAA (National Oceangraphic and Atmospheric Administration) Population Dynamics Team in Beaufort, North Carolina (**June 2001 through December 2002)**

Dr. Kyle Shertzer

was selected for a 2003 Presidential Early Career Award for Scientists and Engineers. This award is of five years' duration and includes $10,000 per year made available for the recipient's scientific work. The awards ceremony was September 9 at the White House. The citation follows:

"The Presidential Award embodies the high priority placed by the government on maintaining the leadership position of the United States in science by producing outstanding scientists and engineers and nurturing their continued development. The Awards will identify a cadre of outstanding scientists and engineers who will broadly advance science and the missions important to the participating agencies."

Awards & Honors USGS

Dr. Stephen Gray

The American Water Resources Association has named Dr. Stephen Gray, NRC Associate, and Dr. Julio Betancourt, his NRC Adviser, as recipients of the William R. Boggess Award. Drs. Gray and Betancourt are at the U.S. Geological Society (USGS) Desert Laboratory in Tucson, Arizona. The Boggess Award was established in 1973 to honor the author(s) of the best paper published in the *Journal of the American Water Resources Association* the previous year.

The award-winning paper entitled **"Tree-ring based reconstructions of interannual to decadal scale precipitation variability for Northeastern Utah since 1226 A.D."** can be found in the *Journal of the American Water Resources Association* 40 (4), 947-960, 2004

Dr. Tom Rozelle & Carol Picard
PGA

Postdocs at Reception

NRC Research Associateship Programs 50th Anniversary

Friday, November 19th, 2004

National Academy of Sciencess Building

12:00 PM Lunch & Poster Viewing

1:00 PM Welcoming Remarks
Rich Bissell, Ph.D., Executive Director, PGA

1:10 PM Brief History of the Research Programs
Ray Gamble, Ph.D., Dir., Associateship Programs

Agency Representatives

1:30 PM Hratch Semerjian, Ph.D., Acting Director
National Institute of Standards and Technology

1:45 PM John Montgomery, Ph.D., Director
Naval Research Laboratory

2:00 PM Bill Farland, Ph.D., Deputy Assistant Administrator
Ofc. of Research, Environmental Protection Agency

Former NRC Associates

2:10 PM Guenter Riegler, Ph.D., Director
NASA Astrobiology and Space Research

2:30 PM Alison O'Brien, Ph.D., Professor
Uniformed Services, U. of the Health Sci.

3:00 PM Barry Farmer, Ph.D., Chief Scientist
Materials and Manufacturing Directorate, AFRL

3:30 PM Break Poster Viewing

3:50 PM Mary Lou Zoback, Ph.D., Senior Research Scientist
U.S. Geological Survey

4:20 PM Melchor Antunano, M.D., M.S., Director
FAA, Civil Aerospace Medical Institute

4:50 PM Isaac Sanchez, Ph.D.
National Academy of Engineering Member
W.J. Murray Chair in Engineering, U-Texas-Austin

5:20 PM Closing Remarks

5:30 PM Reception & Poster Viewing

Corinne Gamble Dr. Judith Nyquist
Marguerite Bernheim

NRC Associate
AMRMC/ICD

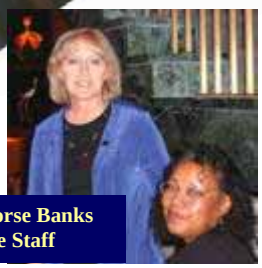
Carol Hix Steve Merrill Peggy Wilson
NASA/JPL PGA Associateship Programs

Adrienne Byrd Carol Hix Lavon Jennings
NASA/GSFC NASAJPL NASA/GSFC

Dr. Bob Bernheim Corinne Gamble Marguerite Bernheim
Chair, Chemistry Panel

Joan Rosenthal Nancy Diener Randy Higgins
Barbara Kneebone Pam Tyler
Fellowship Office Staff

Dr. Ray Gamble, Director
Fellowship Office



Nancy Diener & Delorse Banks
Fellowship Office Staff

NRC RAP 50th Anniversary Poster Exhibition

NASA
Glenn Research Center at Lewis Field

Chih-Hao Chang
Simulation of Compressible Multi-Fluid Flows with AUSM+ up Scheme and Stratified Flow Method
Adviser: Meng-Sing Liou

Aleksandr Nagorny
High Speed Permanent Magnet Motor Generator Design for FlyWheel Application
Adviser: M. D. KanKam

NASA
Kennedy Space Center

Cassondra R. Thomas
Evaluation of Management Effect Using Ecological Network Analysis
Adviser: Ross Hinkle

Hyeon-Hye Kim
A Comparison of Growth and Photosynthetic Characteristics of Lettuce Grown Under Red and Blue Light Emitting Diodes (LEDs) with and without Supplemental Green LEDs
Adviser: Ray Wheeler

Paul Hintze
Prgano-Silicon Polymers for Corrosion Control
Adviser: Luz Calle

Rosvel Bracho
Hurricane Frances Reduced Net Ecosystem Carbon Exchange by 30% in a scrub Oak Ecosystem in Central Florida
Adviser: Ross Hinkle

NASA
Goddard Space Flight Center

Ana C. T. Pinheiro
Near Real Time Land Surface Temperature in the MODIS Rapid Response System
Adviser: Paul Houser

Anna L. Watts
Surface Modes: A Viable Mechanism for Oscillation in the Tail of Type 1 X-Ray Bursts
Adviser: Tod E. Strohmayer

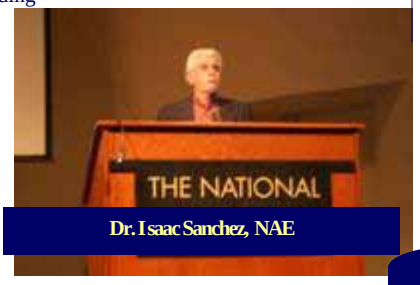
Anthony Remijan
High Resolution Observations of Methyl Cyanide (CH3CN) Toward the Hot Core Regions W51 e1/e2
Adviser: Jan Hollis

Emily Wilson
Ultra Precise Ground Based Column CO2 measurements using a Fabry-Perot Interferometer
Adviser: William H. Prosser

Natasha M. Johnson
Fischer-Tropsch Type Synthesis of Organics using Iron-Silicate Grains
Adviser: Joseph A. Nuth III

Thomas.H. Burbine
Theoretical Calculations of the X-Ray Fluorescence from Mercury due to High Energy Electrons
Adviser: Jacob I Trombka

Jordan Muller
Using LIDAR Topographic Data to Constrain Earthquake Hazards in Puget Sound, WA
Adviser: David Harding



NASA
Johnson Space Center

Sara Rathman-Zwart
The Ratio of Animal Protein to K Intake is Correlated with Markers of Bone Resorption in Ambulatory and Bed Rest Subjects
Adviser: Scott Smith

Keiko Nakamura
15N-rich Organic Globules in the Tagish Lake Meteorite: Sensitive Proves of the Nebular Thermal Environment
Adviser: Lindsay Keller

NASA
Langley Research Center

Derek Van Allen
Multifunctional Polymer-Based Nanocomposites for Photovoltaic Materials
Adviser: Dr. Catharine C. Fay

Matthew N. Herzog
Cross-Linking of Single-walled Carbon Nanotubes for the Modeling and Production of High Performance Materials
Adviser: Dr. Catharine C. Fay

Phillip Williams
Dispersion and Deposition of Individual Single-Walled Carbon Nanotubes for NDE Sensors
Adviser: Dr. William H. Prosser

NASA
Marshall Space Flight Center

Ken Nishikawa
Particle Accelerating Magnetic Field Generation and Emission in Relativistic Shocks
Adviser: Gerald Fishman

Jessica Gaskin
Evaluation of a Cadmium-Zinc-Telluride Focal Plane Detector for Hard X-Ray Astronomy
Adviser: Brian Ramsey

NRC RAP 50th Anniversary Poster Exhibition
continued

AIR FORCE RESEARCH LABORATORY

Kelly Anderson
Meso-Scale Simulations of Polymer-Layered Silicate Nanocomposites
Adviser: Barry Farmer

George Jefferson
Analytical and FEM Models for Integrated Design of Novel Hybrid Composite Materials/Components
Adviser: Ronald Kerans

Mark Pender
Controlled Carbon Nanotube Synthesis and a Peptide-Mediated Non-Covalent Functionalization Approach for Composite Materials
Adviser: Morley O. Stone

Adam Smith
An Investigation of Poly (thienylene vinylene) in Organic Photovoltaic Devices
Adviser: Richard Vaia

Dallas Trinkle
The Lattice Green Function for Photons Decoupling Short and Long Range Contributions
Adviser: Dennis Dimiduk

Research for the Soldier

Dr. Ben Nephew joined the Thermal and Mountain Medicine Division at the U. S. Army Research Institute of Environmental Medicine (USARIEM) in October of 2004. He completed his doctoral degree at Tufts University in 2003, and worked at the Tufts University School of Veterinary Medicine as a postdoctoral research associate prior to assuming his current position at USARIEM.

The purpose of the Thermal and Mountain Medicine Division is to maximize work capabilities and minimize medical problems associated with military operations in cold, hot, and mountainous environments.

Ben is working in the laboratory of NRC Adviser, Dr. Lisa Leon, which investigates the molecular and physiological etiologies of heat injury. Heat injury and stroke are important concerns for soldiers both during training and while deployed to warm climates. In order to develop effective strategies for reducing and treating heat injury/stroke, mechanistic studies regarding the pathophysiologic events are needed.

Dr. Ben Nephew, NRCAssociate
Dr. Lisa Leon, NRC Adviser

Recent thermoregulation research has suggested that transient receptor potential vanilloid (TRPV) cation channels have an important role in the inflammatory response to heat injury. Ben is currently studying the role of these channels in heat injury and the core temperature responses to various stressors. Preliminary evidence indicates that TRPV channels are involved in the control of core temperature during exposure to hot environments and certain types of stressors.

These recent findings have been presented at the Federation of American Societies for Experimental Biology meeting in San Diego, and will be submitted for publication upon completion of additional experiments. Future study includes investigating the role of TRPV channels on the metabolic changes both during and following heat injury.

USARIEM

Dr. James McClung joined the research team at the United States Army Research Institute for Environmental Medicine (USARIEM) after completing his Ph.D. at Cornell University in 2004. USARIEM is the Department of Defense's premier research laboratory for the study of exercise physiology and environmental medicine. Included in that mission are basic and applied biomedical research relevant to the formulation and development of combat rations for military personnel. James is working with the Military Nutrition Division and his NRC Adviser, Dr. Andrew Young, to study the effects of micronutrient nutrition on soldier health.

Soldiers face intense physiological, metabolic and cognitive demands when operationally deployed for combat missions or when they undergo field training to prepare for those missions. These types of intense operational stress factors have been shown to have a negative effect on human micronutrient status. Zinc status may be especially important, and recent studies demonstrate a role for dietary zinc in protection against diarrhea, malaria, and respiratory diseases. Furthermore, supplemental zinc is a potential treatment for cutaneous leishmaniasis, a disorder affecting many US Service members deployed to Afghanistan and Iraq.

James's current research project, in association with Dr. Angus Scrimgeour, is aimed at determining the role of zinc nutrition in regulating body composition and bone health. The major findings of one their recent projects suggest that an intervention to increase dietary bioavailability of zinc leads to greater lean body mass and increased bone strength in animal models, even without increasing dietary zinc content. Another ongoing study at the laboratory is aimed at determining the molecular mechanism by which dietary zinc seems to improve body composition.

Dr. James McClung, NRCAssociate
Dr. Andrew Young, NRC Adviser

James's recent findings will be presented at the Federation of American Societies for Experimental Biology meetings in San Diego, and have been submitted for publication in peer reviewed journals. His Associateship at USARIEM has been renewed for a second year, and his current research plans include further investigation of the role of zinc and other micronutrients in the molecular regulation of protein synthesis.

Awards & Honors
Air Force

Featured Speaker at Florida Science Fair

Dr. Howard Hamilton, an NRC Research Associate at the Air Force Research Laboratory on Eglin Air Force Base, was the featured speaker at the 50th Florida State Science and Engineering Fair (SSEF) in Orlando last April. The fair is a three-day exhibition of science and engineering projects by junior and senior high school students who were winners at their respective regional fairs in the state of Florida. This year, over 900 finalists competed for awards ranging from college scholarships to an expense-paid trip to the International Science and Engineering Fair in Phoenix, Arizona.

For Dr. Hamilton, this opportunity to speak at the Florida SSEF was special because his own career in scientific research began with his involvement in the science fairs while he was in junior high school in southeast Florida. "I started out doing a botany project, but just before the school science fair my little brother ripped the leaves off my plants so the project ended up being a disaster," he said. "So after that I decided to work on an engineering project that he couldn't destroy! I was always interested in airplanes and how they worked, so I followed my interests and things went from there." In 1990, his project on airfoil design won a 4th place award in the Senior-level Engineering category at the Florida SSEF. Two years later, his project on flapping wing aircraft won Best-in-Fair at Palm Beach Regional Science and Engineering Fair, a 2nd place award in Engineering at the Florida SSEF, and a Semifinalist award in the Westinghouse Science Talent Search.

This time, Howard participated in the Florida SSEF from the other side of the display board – a science fair judge. "I was a judge before at the 2001 International Science and Engineering Fair in San Jose and I really liked the experience, so when I returned to Florida I knew that I would want to participate", he said. At the Fair he worked at Judging Captain for the Senior level (high school) Engineering category, which meant that he assigned 14 judges to 38 projects, certified the final results, and assisted with the other Judging Captains in the selection of the Best-In-Fair projects. In addition Dr. Hamilton was the featured speaker at the annual judges' luncheon, and spoke from the perspective of a former state finalist now serving as a science fair judge. "For those of you who are judging at this fair for the first time, a question is certain to have popped into your head: Is this worth it?" Hamilton told the audience. "I am here today as a former participant to tell you that the answer to that question is an emphatic 'Yes!' "

Dr. Howard Hamilton

Now that Howard has been involved on both sides, what is his overall impression of the science fair experience? "I think it is just as nerve-wracking being a judge as it is a finalist," he said. "There are a lot of fantastic projects, a lot of very bright potential scientists and engineers and you want to be fair to everybody. At the same time, it is a fantastic opportunity to be a mentor to these students and help refine their research skills."

Dr. Hamilton has kept in contact with the science fair directors and teachers since high school, and he is invited on a regular basis to give talks to students throughout the state of Florida on different aspects of scientific research. "I really enjoy talking to the students, sharing my insights with them, and showing them that these high school projects can be the entryway to your career. I owe everything in my career to my involvement in the science fairs, and I'll always be willing to share my time and knowledge with those who are coming up after me."

Dr. Howard Hamilton is an NRC Research Associate at the Air Force Research Laboratory, Munitions Directorate on Eglin Air Force Base in Florida. His research, under the direction of Dr. David Jeffcoat, involves the development of optimal control strategies to operate air vehicles that either change their wing shape during flight or employ a distributed array of sensors and actuators on the body. Dr. Hamilton received his undergraduate and graduate degrees from the Georgia Institute of Technology and Stanford University, respectively.

Awards & Honors
EPA

Congratulations, Dr. Mottaleb

for being selected as one of this year's recipients of the Environmental Protection Agency (EPA) Science Achievement Award in Chemistry! The award was presented by EPA during the Agency's annual Awards Ceremony in Washington, D.C. on April 27, 2005. The Science Achievement Awards are an Agency honors award, developed by the Scientific and Technical Careers Advisory Committee, to recognize Agency scientists for outstanding contributions in specific technical fields. Each award is established in conjunction with a professional society. For the Chemistry Award, the selection was made by a peer panel selected from EPA and the American Chemistry Society. Your selection as the recipients of this award recognizes your impressive achievements in the development and application of analytical tools for the measurement of biomarkers of exposure (hemoglobin adducts of nitromusks) in ecologically sentinel species of fish.

Dr. Mohammad Mottaleb, NRC Research Associate

From Predoc to Postdoc

When Jamie Elsila began her NRC Associateship in the Astrochemistry Lab at NASA Ames Research Center in November, 2004, it was something of a homecoming. Nearly nine years previously, she had been an undergraduate researcher there, investigating the chemistry of icy interstellar environments. In the intervening time, she had many adventures and experiences around the globe, but that first astrochemistry experience was always in the background, eventually calling her back to NASA.

As a senior chemistry major at Kalamazoo College (Michigan), Jamie had to design and perform a 10-week Senior Individualized Project. When her professor suggested an internship at NASA Ames, Jamie at first had no clue what the field of astrochemistry was all about, but was intrigued enough to move to California for three months and learn. While there, she learned to create laboratory analogs of interstellar ices and analyze them with infrared spectroscopy, producing laboratory data to compare with the infrared data collected by astronomers. This work led to a paper in the Astrophysical Journal and a poster presentation, but more importantly it introduced Jamie to the world of astrochemistry and the interesting questions being investigated in that field.

Jamie Elsila, undergrad

After the internship was over, Jamie returned to Michigan and college graduation. Rather than continuing directly to graduate school, she instead packed her bags for a 27-month stint in the Peace Corps. As an Education Volunteer in the East African country of Tanzania, Jamie taught chemistry and math to teenagers at a secondary school located in a small town. This was an intriguing experience; as Jamie puts it, "When your lab is a big, empty concrete room, and your chemical supplies consist of a few bottles with labels of dubious accuracy, you quickly learn how to improvise and look for locally available materials." Battery acid from the local gas station, zinc and carbon taken from an old "D" battery, pH indicator made from local flowers – all of these allowed Jamie to give her students their first "hands-on" chemistry experience.

"Serving as a Peace Corps Volunteer was a great opportunity for me; I loved it, and I learned and experienced so many new things," says Jamie. "But throughout it, I was feeling a longing to do some 'real science' and to get back into a research lab to delve deeper into chemistry." So while finishing up her second year of teaching in the Peace Corps, Jamie applied to graduate schools back in the U.S. In the back of her mind was the knowledge if she returned to San Francisco Bay Area, she could resume her collaborations with Ames Astrochemistry Lab and continue to explore space chemistry.

Thus, after returning from Tanzania, Jamie entered the Ph.D. program in the Chemistry Department at Stanford University. Working with advisor Richard Zare, she began to investigate a class of molecules known as polycyclic aromatic hydrocarbons (PAHs). PAHs are prevalent throughout the universe, appearing in a multitude of extraterrestrial environments. Jamie measured the abundance and distribution of PAHs in a variety of samples, including carbonaceous meteorites. She became part of an ongoing collaboration between Professor Zare's lab and the Ames Astrochemistry Lab. As an undergraduate, Jamie had created interstellar ice analogs at Ames; now, she took the residues of similar ices and analyzed them for evidence of chemical reactions that might explain the types of compounds and processes to expect in interstellar space.

Other collaborations developed as well; one project led Jamie to analyze products formed in simulations of the atmospheric chemistry of Saturn's moon, Titan. In another project, Jamie worked with Professor David Deamer from the University of California at Santa Cruz to consider the possibility that PAHs could form non-biologically in hydrothermal environments. Understanding the chemistry occurring in hydrothermal vents and hot springs provides more information about the possible inventory of compounds that could have existed on the early Earth and could have contributed to the origin of life. In order to obtain samples of hydrothermal waters, Jamie joined an expedition led by Professor Deamer to the Kamchatka Peninsula in far eastern Russia. There, Jamie and the other team members climbed a volcano, donned gas masks, and collected water samples from hot pools and steaming vents. These samples were brought back to the U.S. and analyzed for PAHs and other molecules of potential biological interest.

Dr. Jamie Elsila, postgrad

With this project, Jamie concluded her Ph.D. work and obtained her degree in August, 2004. Throughout her graduate career, she kept a focus on astrochemistry. With the encouragement of her collaborators/mentors at the Ames Astrochemistry Lab, Dr. Elsila successfully applied for a NRC Postdoctoral Research Associateship in the NASA Astrobiology Institute. Jamie's research proposal focused on studying the chemistry of nitrogen-containing compounds in interstellar ices and other potential chemical precursors to life. She also included a strong education and public outreach component, and as part of her Associateship, she is working with the Education offices of the SETI Institute and the California Academy of Sciences, helping to educate the general public about new research in astrochemistry. Most of the time, though, she's back in the lab where she worked as an undergraduate, again trying to understand the chemical mysteries that take place in the deep freeze of outer space.

SATURN'S BULL'S-EYE MARKS ITS HOT SPOT

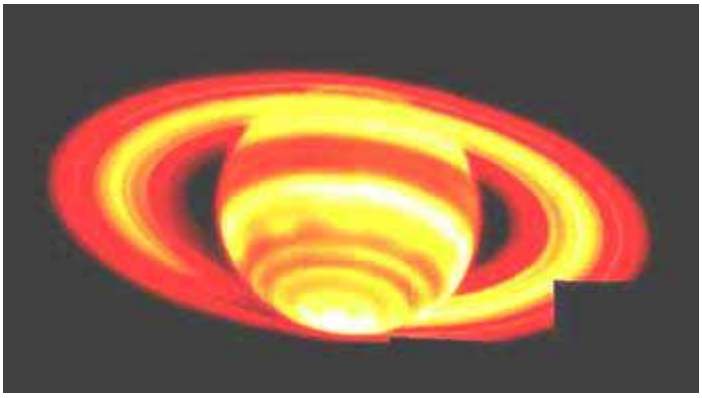
"There is nothing like this compact warm 'cap' in the Earth's atmosphere," said **Dr. Glenn S. Orton, former NRC Associate, and current NRC Senior Research Adviser/ Scientist at NASA's Jet Propulsion Laboratory in Pasadena, California, and lead author of the paper.**

"Meteorologists have detected sudden warming of the pole, but on Earth this effect is very short-term. This phenomenon on Saturn is longer-lived because we've been seeing hints of it in our data for at least two years."

Data for these observations were taken in the imaging mode of the Keck facility instrument, the Long Wavelength Spectrometer, on February 4, 2004, by Orton and **Dr. Padma Yanamandra-Fisher, the paper's co-author, also a former NRC Associate and current research scientist at the Jet Propulsion Laboratory.**

NASA astronomers using the Keck I telescope in Hawaii are learning much more about a strange, thermal "hot spot" on Saturn that is located at the tip of the planet's south pole.

In the sharpest view of Saturn's temperatures ever taken from the ground, a new set of infrared images suggests a warm "polar vortex" at Saturn's south pole - the first warm polar cap to ever be discovered in the solar system. The vortex is punctuated by a compact spot that is the warmest place on the planet. The researchers report their findings in the February 4 issue of the journal Science.



A polar vortex is a persistent, large-scale weather pattern, likened to a jet stream on Earth in the upper atmosphere. On Earth, the Arctic Polar Vortex is typically located over eastern Canada and plunges arctic air to the northern plains in the United States. Earth's cold Antarctic Polar Vortex, centered over Antarctica, is responsible for trapping air and creating unusual chemistry, such as effects that create the "ozone hole".

Polar vortices on Earth, Jupiter, Mars and Venus are colder than their surroundings. But new images from the W. M. Keck Observatory show the first evidence of such a polar vortex at much warmer temperatures. And the warmer, compact region at the pole itself is quite unusual.

It was no surprise to astronomers that the southern region of Saturn was home to warmer temperatures. Saturn's south pole has been exposed to 15 years of continuous sunlight, having just reached its summer solstice late in 2002. But both the distinct boundary of a warm polar vortex some 30 degrees latitude from the southern pole and a very hot "tip" right at the pole were completely unexpected. If the increased southern temperatures are the result of the seasonal variations of sunlight, then temperature should increase gradually with increasing latitude. But it doesn't-- the temperature increases abruptly near latitudes of 70 degrees and again at 87 degrees south.

The abrupt temperature changes may be caused by a concentration of sunlight-absorbing particulates trapping heat in Saturn's upper atmosphere. This theory would explain why the hot spot appears dark in visible light and contains the highest measured temperatures on Saturn. However, this alone would not explain why the particles themselves are constrained to a compact area at Saturn's south pole. One possible explanation would be downwelling of dry air, which is also consistent with deeper clouds observed at the southern pole. Researchers plan more observations to check that possibility.

More detail about the temperatures and possible chemical changes in these regions may be available from an infrared spectrometer on the Cassini spacecraft, in orbit around Saturn. The discovery of the hot spot at Saturn's south pole has prompted Cassini's composite infrared spectrometer science team, one of whom is Orton, to redirect some future observations to this area. Said Orton:

"One of the obvious questions is whether Saturn's north pole is abnormally cold and whether a cold polar vortex has been established there. That's something we can't see from Earth, and Cassini's instruments will be in a unique position to observe it."

PRESS RELEASE:
February 3, 2005
NASA/JPL
Laura Kraft , Keck Telescope
Hawaii

Drs. Orton & Yanamandra-Fisher

Funding for this research was provided by NASA's Office of Space Sciences and Applications, Planetary Astronomy Discipline, and the NASA Cassini project. The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the Cassini-Huygens mission for NASA's Science Mission Directorate, Washington, D.C. The W.M. Keck Observatory is operated by the California Association for Research in Astronomy, a non-profit scientific partnership of the California Institute of Technology, the University of California, and NASA.

Melchor Antunano, M.D., M.S.
Director, FAA Civil Aerospace Medical Institute

ARMY RESEARCH LABORATORY

Michael Greenfield
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Adviser: T.W. Wright

Scott Kerick
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Adviser: Laurel Allender

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NAVAL POSTGRADUATE SCHOOL

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Adviser: Gregory C. Johnson

Jessica L. Neu
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Elizabeth T. Methratta
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Defects in Cardiac Function Precede Morphological Abnormalities in Fish Embryos Exposed to Polycyclic Aromatic Hydrocarbons
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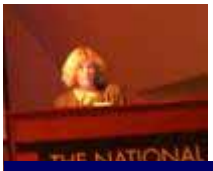
Connectivity Between Fish Populations Using Otolith Chemistry To Track Sardine Stocks
Adviser: Russell D. Vetter



Dr. MaryLou Zoback, USGS

Dr. Laura Tonduli, NRC Research Associate
Walter Reed Army Institute of Research

U.S. ARMY MED RSRCH INSTI OF INFECTIOUS DISEASES

Katherine Brittingham
Dendritic Cell Uptake of Bacillus Anthracis Spores: Implications for Anthrax Pathogenesis
Adviser: Sina Bavari

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Daniel Bain
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Deborah Bergfeld
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James Gray
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Jinxun Liu
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Michele Walvoord
Modeling CO_2 and Carbon-isotope Dynamics in a Deep Unsaturated Zone near Beatty Nevada
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WALTER REED ARMY INSTITUTE OF RESEARCH

Laura S. Tonduli
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Dr. Melchior Antunano, FAA

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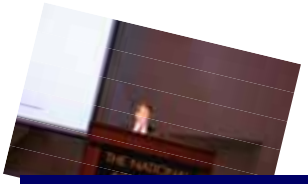
Adviser: Ainsley Weston

NAVAL RESEARCH LABORATORY

Alexis Lewis
Three-Dimensional Analysis of a Superaustenitic Stainless Steel
Adviser: Andrew Geltmacher



John Montgomery, Ph.D.
Director of Research, NRL

Benjamin Ruston
Microwave Satellite Data Assimilation over Land
Adviser: Nancy Baker

Carrie Rowland and Stephen Nelson
Gamma Ray Imaging and Polarization Measurements with Position-sensitive Silicon Detectors
Adviser: James Kurfess

Craig Benson
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Adviser: Eric Shettle

David Ponce-Marquez
Interferometric Measurements of Current Carrying Plasmas on Pulsed Power X-Ray Sources
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Drs. Anthony Malanoski Chris Spillmann
NRC Associates, NRL

Anthony Malanoski and Chris Spillmann
Novel Applications of Liquid Crystals
Advisers: J. Selinger and B. Ratna

Donna Ebenstein
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Duane Simonson
Hydrogen-Bond Acidic Poly (carbosilanes) for Chemical Sensor Applications
Adviser: Robert McGill

Ewa Jarosz and Chris Massey
Modeling Internal Tides And The Need for Conservative Schemes
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H. Tetsuo Uyeda, Igor Medintz and Aaron Clapp
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Ilya Alexeev
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NRC 50th Anniversary Poster Exhibition
continued

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Jeffrey Bellotti
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Michael Doescher, Jeremy Pietron, and Jeffrey Long
Using an Oxide Nanoarchitecture to Make or Break a Proton Wire
Adviser: Debra Rolison

Mason A. Wolak
Tailoring the Optical Properties of Pentacene Derivatives for Use in Organic Light-Emitting Diodes Adviser: Zakya Kafafi

Dr. Alison O'Brien, USUHS

Susan O'Reilly
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Adviser: Yoko Furukawa

Susan Trickett
Spatial Transformations as a Strategy for Managing Uncertainty
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Yanina Vekhter
Improving Experimental Phasing: The Role of Strongest Reflections
Adviser: Jerome Karle

Yen Vu
Elastomer Blends with Heterogeneous Network Structure

Awards & Honors
Air Force

AFRL Visiting Professor Honored by SUNY Foundation

ROME, N.Y., June 3, 2005 --- Dr. Monisha Kamala Mahanta, a visiting professor at the Air Force Research Laboratory, was honored May 4 at an Albany dinner honoring recipients of the 2005 State University of New York Chancellor's Research Recognition Award.

Dr. Mahanta is one of three faculty members at the State University College at Oneonta, and among 52 from 26 SUNY campuses across the state, to be recognized based on their research activities, grants, publications and presentations; involvement of students in research; teaching; community activities; and reputations in their fields.

An associate professor of physics at Oneonta, Dr. Mahanta is conducting research in quantum information at the AFRL Information Directorate, with support from the National Research Council and the Air Force Office of Scientific Research.

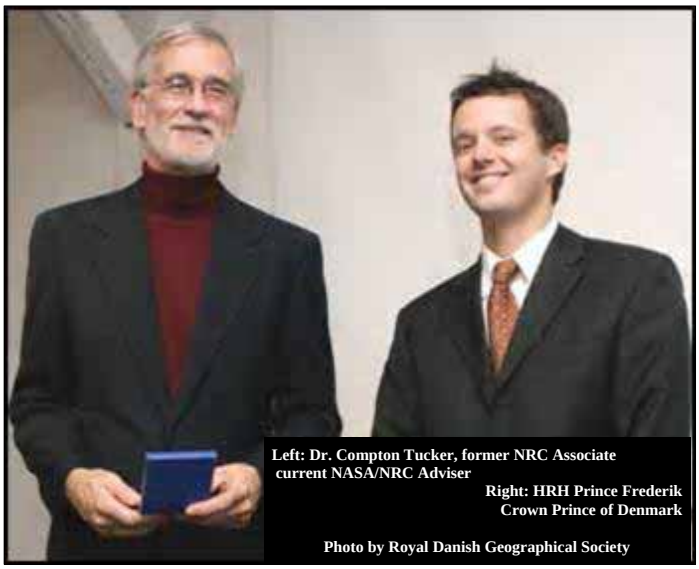
Dr. Mahanta in her laboratory

She began her research at the facility in 2002 through a fellowship from AFRL and later received a fellowship from the National Research Council and an extension grant from the laboratory.

Dr. Mahanta has also worked as a contractor and research fellow with NASA and is a co-recipient of a $250,000 federal grant used to set up a DNA computing and genomics laboratory at Oneonta, where she has been a staff member since in 1988. Her professional interests include fluid mechanics, solid mechanics, heat transfer, stress analysis, finite element analysis, lasers, thin-film technology, and thermal spray techniques.

At Rome, Dr. Mahanta is conducting research in quantum information processes using orbital angular momentum of light. Her research, in collaboration with the Quantum Communication group in the directorate's Information Grid Division, played a key role in the SUNY Research Foundation's award process.

Goddard Researcher Receives Medal from Crown Prince



Left: Dr. Compton Tucker, former NRC Associate
current NASA/NRC Adviser
Right: HRH Prince Frederik
Crown Prince of Denmark
Photo by Royal Danish Geographical Society

"In spite of all the dangers encountered during my many adventures, I enjoy traveling to these remote areas to study the environment and learn about the people and their culture," remarked Tucker. "My research for NASA allows me the freedom to pursue many interests at the same time."

Dr. Compton J. Tucker was awarded the Galathea Medal of the Royal Danish Geographical Society on November 2 in Copenhagen, Denmark. His Royal Highness (HRH) Prince Frederik, the Crown Prince of Denmark, presented the award to Tucker in the presence of 120 invited guests.

The Galathea Medal is given to scientists that have contributed significantly to the development of geography, and Danish geography specifically. The use of Earth observation from space plays an ever-increasing role in geography all over the world. "NASA has played a leading role in the development of Earth observation and Dr. Tucker has had a key position in this development," stated the HRH Prince Frederik, President of the Royal Danish Geographical Society. "Dr. Tucker and his co-workers have made great contributions to our understanding of environmental change in many parts of the world, including the study of tropical deforestation using satellite images from Landsat and other satellites. Some of the major Danish geographical research activities in the Sahel-zone of Africa directly build on and continue his work from some 20 years ago."

Tucker is a senior Earth scientist at NASA Goddard's Laboratory for Terrestrial Physics and has been a pioneer in the use of satellite data to study the Earth. He has been internationally recognized for developing the use of spectral vegetation indices to study green vegetation and primary production through time. This work was first developed from ground-based experiments and subsequently applied by Earth- orbiting satellites to the entire terrestrial surface. Spectral vegetation indices are the most widely used type of Earth science data about vegetation on land. Tucker has also used Landsat data to study tropical deforestation and habitat fragmentation, to establish accurate information for understanding the carbon cycle and preventing further loss of terrestrial biological diversity. He and his co-workers were among the first to use Landsat data to study habitat fragmentation of tropical forests.

"The gratitude expressed towards Professor Tucker and to NASA for a significant contribution to science, specifically the geographical sciences, was warmly sustained by all Danish participants at the awards ceremony," stated Sofus Christiansen, Vice President of the Royal Danish Geographical Society. "This well deserved medal is also a recognition of the American generosity that has allowed our little nation to benefit from NASA's tremendous technical achievements."

Tucker began his career at Goddard in 1975 as a National Research Council post-doctoral fellow and subsequently joined NASA in 1977. He has specialization in using satellite observations to study the Earth's vegetation, including questions about the carbon cycle, tropical deforestation and desertification. Some areas of recent and continuing work include quantifying the expansion and contraction of the major deserts of Africa and Asia; studying terrestrial vegetation from space including tropical deforestation, studying global photosynthesis and how it varies with climate; studying ecologically linked diseases and using satellite data to reduce human suffering as in the Famine Early Warning System for Africa and Central America.

Tucker has traveled extensively during his career as a NASA Goddard research scientist. Some of his more unusual trips have been to the Amazon Basin of South America, in Brazil and Bolivia, all associated with studying tropical deforestation there.

In 1998 and again in 2002, Tucker was involved in the Iturralde Crater Expeditions and spent weeks in Bolivia hiking in a very remote portion of the Amazon rainforest studying a possible meteorite crater. The Amazon is a salt-limited area since the rain leaches most of the salt away. In the rain forest, the team was deluged with many insects, including bees and wasps, looking for a source of salt. Because bees and wasps are social insects, they communicate the location of salt to their fellow insects causing them to swarm and sting humans. The scientists received as many as 10 to 20 stings a day as the insects converged, feeding off of them like walking salt licks. Bathing in the rivers to wash the salt off their bodies and clothes was necessary on a daily basis but it posed many other risks. The murky water hides many dangers, such as manta rays and electric eels, and the former can deliver deadly stings.

"People have lost their legs from being stung by manta rays. If you step on an electric eel, you are in for a big shock — about 600 volts," says Tucker. "That discharge will paralyze you and you could drown if you aren't with a friend. "Electric eels are the most dangerous animal you can encounter, much more so than piranhas, snakes, or jaguars."

As for piranhas, Tucker says that they are over-rated as far as being really dangerous. "I've only been nibbled on once or twice by piranhas, but they are good to eat, although pretty bony," remarked Tucker. While on their first expedition to the meteor crater, Tucker and Peter Wasilewski, also of Goddard, along with their friend from Bolivia, Tim Killeen, had nothing to eat but piranhas for three days. "They were pretty tasty especially since we didn't have a choice," laughed Tucker.

Drs. Henry Tucker and Tim Killeen in motorized canoe on the Rio Manupare in Bolivia, returning to Puerto Araona after the first expedition to the crater in 1998. Photo by: P. Wasilewski

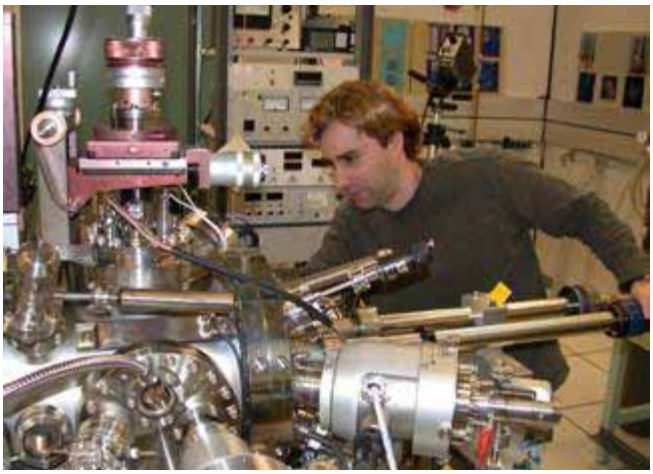
Another risk of these adventures is the possibility of contracting an unusual disease. On his second expedition to the meteor crater, Tucker's good friend, Tim Killeen, came down with a strange tropical virus, and had to be flown for treatment to Brazil to the best hospital in South America. "He lapsed into a coma on the hospital ambulance plane and had to be kept alive in flight with periodic shots of adrenalin. He was unconscious for five weeks in the Einstein Hospital in Sao Paulo Brazil. We thought he was gone for good, but he recovered," remarked Tucker. Why Tucker and Wasilewski did not come down with the same disease is anyone's guess.

The only time Tucker was in serious physical trouble was in 1996 in tropical Bolivia where his team ran out of water under the hot tropical sun in Noel Kempff National Park. Tucker and another re-searcher began to suffer severe heat stroke, and headed to a seasonal small stream that was dry. "We were lucky to find one pool of stagnant water, completely surrounded by animal droppings from tapirs, anteaters, monkeys, jaguars, you name it—it was there. What do you think we did? We jumped in and drank as much of the water as we could. Best water I've ever tasted," Tucker said.

Two Araona native guides, travel with Tucker to the edge of the Iturralde crater in Bolivia.
Photo by Cynthia O'Carroll, NASA/GSFC Public Affairs

Another of Tucker's research activities concerns documenting the expansion and contraction of the major deserts in Africa and Asia using the NOAA Advanced Very High Resolution Radiometer. In 1993 a trip to the Gobi Desert in Mongolia was plagued by tremendous rains, terrible roads and washed out bridges that forced the researchers to return to the area later that year. What should have been a 10-day trip became a trip of more than three weeks. The Mongolian people are traditionally very generous with visitors and often fed the team meals of boiled sheep meat and khomis, fermented mare's milk. As honored guests at one Mongolian feast, the men were required to eat first from the main dish of boiled sheep stomach and intestines, both stuffed with blood, before anyone else could partake.

End States in One-Dimensional Chains



Jason making one of the many delicate maneuvers required to transfer samples and tips in and out of the scanning tunneling microscope.

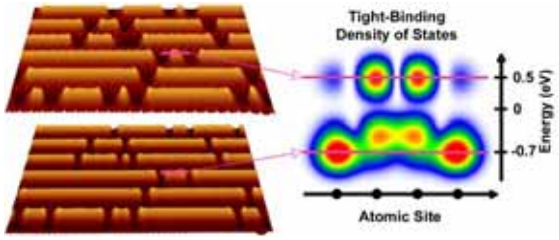
Dr. Jason Crain has worked as an NRC Postdoc with Dr. Daniel Pierce in the Electron Physics Group at NIST since October 2003. In the course of his work, Jason discovered a new kind of electronic state at the ends of a one-dimensional nanostructure. This "end state" is a direct consequence of the lower dimensionality of the structure. Such end states can be thought of as zero-dimensional analogs to two-dimensional states that occur at the surface of a crystal. In fabricating these structures, he exploited the self assembly of atom chains that occurs when gold is deposited on stepped silicon surfaces at elevated temperatures.

Jason received Bachelors degrees in physics and music from the University of Connecticut, and a Masters in music from the University of Texas.

To characterize this new kind of electronic state, Jason made spatially resolved scanning tunneling spectroscopy measurements along finite chains to map the density of states. These measurements reveal quantized states that form in isolated chain segments. Furthermore, a transfer of spectral weight from the filled to the empty states over the atoms at the ends of the chains is directly attributable to the formation of end states. These end states lead to a breakdown of the simple particle in a box model for states along the chains. Jason performed a tight binding calculation that revealed how the formation of end electronic states transforms the density of states and the quantized levels within the chains.

Rows of atom chains of varying length can be seen in the scanning tunneling microscopy images at the left of the figure, which are of the same area but measured at opposite polarity. The chains in the upper panel measured at a positive sample voltage appear shorter than the chains in the lower panel measured at a negative sample voltage. Such a polarity contrast in STM suggests an underlying difference in the density of states for the empty and filled states near the ends of the chains indicating the presence of end states.

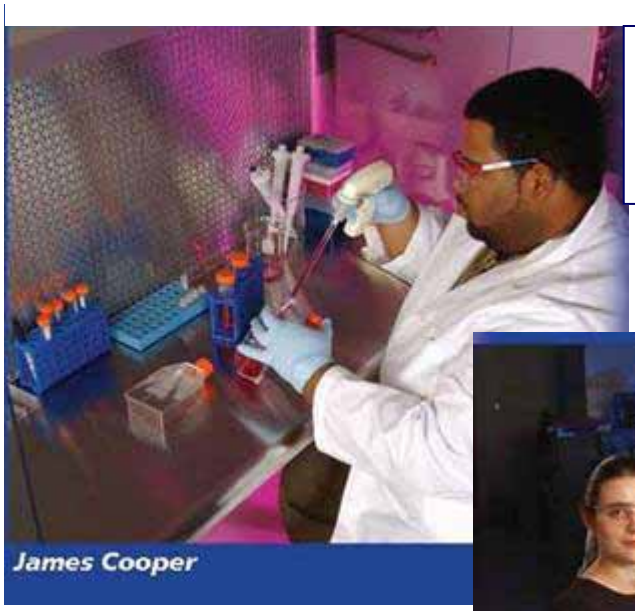
The density of states for a four atom chain calculated in the tight binding model is shown on the right of the figure. The end states effectively lower the energy levels of the filled states within the chains, suggesting a possible driving force for their formation. This work was published in Science Magazine, Vol 307, p. 703, February 4, 2005.



Jason received a Ph.D. in physics from University of Wisconsin where he worked with Prof. Franz Himpsel. In addition to his talent for physics, Jason is an accomplished pianist and swimmer.

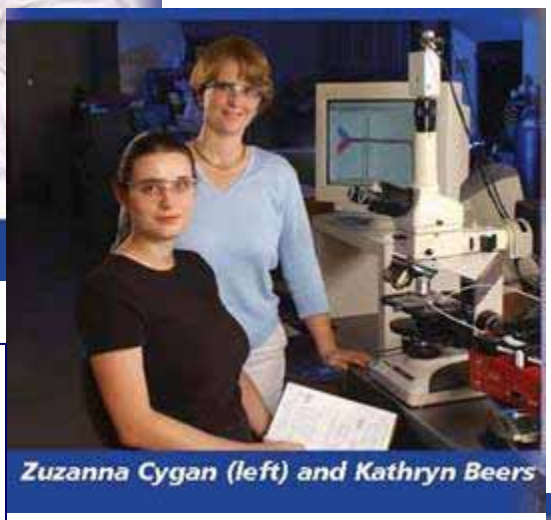
NIST Associate Profiles NRC

James Cooper (NRC postdoc, 2002-2004) received his Ph.D. in Biomedical Sciences from Drexel University. He has received a Calhoun Fellowship from Drexel's Biomedical Engineering Department and awards from NIH and the GE fund. At NIST, he has designed a bioreactor that allows the precise control and measurement of fluid stresses acting on a tissue-engineered construct. Initial work has quantified the differentiation of cartilage cells embedded in a hydrogel as a function of the magnitude and frequency of fluid stresses using real-time reverse transcriptase polymerase chain reaction (RT-PCR).



James Cooper

"…the flexibility to branch off and perform relevant experiments in my field was an unforeseen positive experience. The NRC Associateship has given me the ability to develop a broader knowledge base in tissue engineering.…the NIST mission of focusing on basic measurements and standards has given me a deeper appreciation of the fundamental research problems an investigator must face in the development of standard data interpretation." - James Cooper



Zuzanna Cygan (left) and Kathryn Beers

Zuzanna Cygan (NRC postdoc, 2004-2006) received her Ph.D. in Chemistry from the University of Michigan, where she was awarded NSF and Regents fellowships. Dr. Cygan is currently working on a polymer formulations project, using microfluidic technology for high-throughput synthesis of polymer colloidal particles and integrating spectroscopic detection methods for on-chip analysis of polymer properties.

"As an NRC postdoc at NIST, I have the opportunity to work on multidisciplinary projects and collaborations in a world-class research facility. The Polymers Division at NIST comprises a diverse, international team of scientists from a wide array of scientific backgrounds. Our research serves U.S. industries and the scientific community as a whole, generating a unique balance of basic and applied science." – Zuzanna Cygan

NIST Profiles NRC

Dean DeLongchamp (NRC postdoc, 2003-2005) received a Ph.D. in Chemical Engineering from the Massachusetts Institute of Technology with Prof. Paula Hammond. His graduate work focused on developing solution-assembled polymer thin films exhibiting electroactive behavior for applications in displays and power. Currently, his research interests include measurements of film architecture and electronic properties in organic electronics materials and devices. He has received honors including the MRS Graduate Student award, the Department of Defense NDSEG graduate fellowship, the NSF/KOSEF Korea Summer Institute travel fellowship, and first prize at the NIST Sigma Xi Postdoctoral Poster Session.

Dean DeLongchamp

Planetary X-rays—New Findings

Anil Bhardwaj
Senior NRC Associate
"Working with Ron at MSFC has been a wonderful and exciting experience for me. Ron is quite energetic and analytical in his work. He provides useful ideas and fruitful suggestions."

Senior planetary scientist, Dr. Anil Bhardwaj, began tenure as a NRC Research Associate at Marshall Space Flight Center in Huntsville, Alabama at the end of January 2004. In less than two years, Bhardwaj and his **Adviser, Marshall astrophysicist Dr. Ron Elsner**, have led the way to fascinating and significant new findings in planetary x-ray astronomy.

Bhardwaj is a planetary scientist from India, where he is a senior research scientist at Space Physics Laboratory of the Vikram Sarabhai Space Center in Trivandrum. He received his Ph.D. in Physics (planetary and space physics) in 1992 from Institute of Technology of the Banaras Hindu University, Varanasi, India. His research at MSFC is focused on studying Planetary X-rays, with particular emphasis on the soft (0.1-2.0 keV) X-ray emissions from Jupiter and Saturn systems and the Earth. Highlights of the exciting research done by Bhardwaj and Elsner follow.

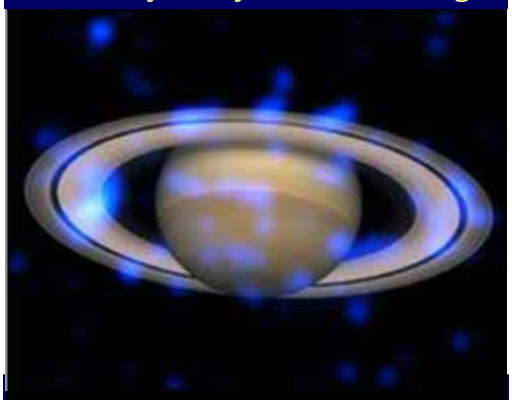
JUPITER: X-ray emission from Jupiter is the brightest among planetary bodies in the solar system. Jovian X rays are basically of two types: 1) the "auroral" emissions, which are confined to high-latitudes (~>60º) in both polar regions, and 2) the "dayglow" emissions, which are from the low-latitude (~<50º) regions of the disk. X-ray emission from the low-latitude (non-auroral) regions of the planet is generally referred as "disk" emission.

Working on disk X-ray emission from Jupiter, using 59 hours (~6 Jupiter rotations) of XMM-Newton observations, Bhardwaj, Elsner and co-workers found that the day-to-day variability in the low-latitude "disk" X-rays from Jupiter are possibly synchronized with the solar X-ray emission measured by the Earth-orbiting TIMED and GOES satellites. Moreover, a moderate solar X-ray flare occurring on the Jupiter-facing side of the Sun was found to have a corresponding time-matching feature in the Jovian disk X-ray emission.

This is the *first* direct evidence that the Sun controls the X-ray emission from Jupiter's disk.

This study was published in *Geophysical Research Letters* **(vol. 32, L03S08, doi: 10. 1029 / 2004 GL021497, 2005)**, and this article was selected for "AGU Journal Highlights". On March 7, 2005, European Space Agency (ESA) did a press release on this important finding entitled "Jupiter: A cloudy mirror for the Sun?"

For the X-ray emission from Jupiter's auroral region, their study, using the Chandra X-ray Observatory, suggests that particles producing Jovian auroral X-rays have to be accelerated to high energies of several MeVs in a multi-million-volt environment above the planet's poles. The presence of these energetic ions indicates that the cause of Jupiter's aurora is different from aurora produced on Earth or Saturn. This study is reported in *Journal of Geophysical Research* (**vol. 110, A01207, doi: 10. 1029/2004JA010717, pp.1-16, 2005**). On March 2, 2005, NASA and the Chandra X-ray Observatory Center (CXC) did a joint press release on this study entitled "Chandra Probes High-Voltage Auroras on Jupiter".



Saturn's Rings Sparkle with X-rays

SATURN AND ITS RINGS: Using the Chandra X-ray Observatory, Bhardwaj, Elsner and co-workers made the first observation of an "X-ray flare" from the disk of Saturn. This X-ray flare from Saturn was seen in direct response to an M6-class solar flare emanating from a sunspot that was clearly visible from both Saturn and Earth. They also found that X-rays from the disk of Saturn vary in tandem with the solar activity giving a clear indication that Saturn-ian disk X-rays, as well as Jupiter's disk X-rays, are controlled by the Sun. However, unlike Jupiter, no clear indication of auroral X-rays was seen on Saturn, suggesting that any X-ray aurora on Saturn is either weak or absent. These results are reported in *Astrophysical Journal Letters* (**vol. 624, pp. L121-L124, 2005**).

The recent work of Bhardwaj, Elsner, and coworkers on disk X-rays of Jupiter and Saturn suggests **the atmospheres of these planets acts like "diffuse mirrors"** for solar X-rays reflecting back about 1 in every few thousand photons in the ~0.1-2.0 keV band. These studies imply that, in principle, Jovian and Saturnian disk X-ray emission can be used to monitor solar X-ray flare activity on portions of the Sun's surface visible to these planets but is not visible to near-Earth space weather satellites.

On May 25, 2005, NASA and CXC did a press release on this study entitled "NASA's Chandra Finds Saturn Reflects X-Rays From Sun" (http://Chandra.harvard.edu/press/05_release/press_052505.html)

Continuing further work on the Saturn system, this team discovered X-rays from the rings of Saturn. X-rays from the rings was found to be produced in a very narrow energy band at the 0.53 keV Oxygen Kα fluorescence line. Fluorescent scattering of solar X-rays from the oxygen atoms in the H_2O icy ring material is suggested as the main source of rings X-rays. This discovery is reported in *Astrophysical Journal Letters* **(vol. 627, pp.L73-L76, 2005)**. On June 27, 2005, CXC released a story on this discovery entitled "Saturn's Rings Sparkle with X-rays"

EARTH: This team also directed Chandra Observatory to look at X-rays from the northern auroral region of the Earth. This was a series of 10 short duration (20 min) observations conducted in the winter of 2003-2004 so as to avoid bright emission from the Earth's dayside. This is the *first* observation in soft X-rays (<2.0 keV) of Earth's auroral regions. The results suggest that auroral soft X-ray emission shows high variability and that the bright X-rays arcs sometimes seen are most likely due to electron bremsstrahlung.

"Anil's time at MSFC has been a delight for me. He is a very knowledgeable and energetic researcher with many useful ideas. Working with our team of planetary X-ray observers, he has greatly multiplied our productivity and broadly disseminated our work in the science community. In my opinion, Anil's tenure at MSFC is an excellent example of how the NRC program benefits everyone."

Ron Elsner
NRC Research Adviser

Figure 1. **Picture of a mother-calf dolphin pair swimming in echelon position**

NOAA
Southwest Fisheries Science Center

Dolphins are born directly into the ocean and must swim immediately at birth. Yet recent research indicates that dolphin calves have low aerobic muscular capacity and a relatively small proportion of locomotor muscle compared to adults, even though the musculoskeletal system must function at birth to provide ample force for swimming. Dolphin calves may compensate by "free-riding" off their mothers. This behavior has been documented in captive and free-ranging populations. During "free-riding" behavior the neonatal dolphin moves very close to the lateral flank of its mother (echelon position, Figure 1). While swimming in echelon position, calves likely have reduced locomotor costs; the infant's cost of transport may be reduced as it is carried in a pressure wave created by its mother's relatively large body as she moves through the water. Empirical evidence for enhanced swimming efficiency and decreased locomotor costs for calves swimming in echelon position has yet to be provided.

The current impacts of the tuna purse-seine fisheries on depleted dolphin populations in the Eastern Tropical Pacific (ETP) makes the study of the swimming kinematics of dolphin calves a priority. Purse-seine fishing for yellow fin tuna in the ETP is conducted by setting the purse-seine on a pod of dolphins that has a school of tuna swimming underneath them. During this activity the pod of dolphins is chased, and throughout the chase the pod breaks up into smaller pods in an effort to avoid capture. Calves are likely to be vulnerable to the effects of chase and encirclements because they may be incapable of maintaining position with their mothers, given the speed and level of maneuvering that occurs. Without the theoretical locomotor boost provided by echelon swimming, calves may fall behind and become separated from the pod, ultimately resulting in the death of the calves if they are not reunited with their mothers. Although the reported dolphin by catch has been drastically decreased due to improved fishing procedures, the populations are not recovering at expected rates. One possible factor in the lack of recovery may be additional unobserved kills of dolphins; a potential source of the unobserved kills is permanent separation of dependent nursing calves from their mothers during purse-seine fishing.

Currently **Dr. Shawn Noren, a National Research Council Associate with the Protected Resources Division at Southwest Fisheries Science Center in La Jolla, CA**, is collecting data from four mom-calf dolphin pairs at Dolphin Quest Hawaii to determine empirically whether echelon swimming enhances swimming efficiency and reduces locomotor costs of calves. Shawn collected videos of swimming mom-calf dolphin pairs at parturition and when the calves were 3, 6, 9, and 12 months-old. She will also collect data from the calves when they are 1.5 and 2 years-old. This longitudinal sampling regime enables Shawn to determine the effect of physiological development and growth on calf swimming kinematics.

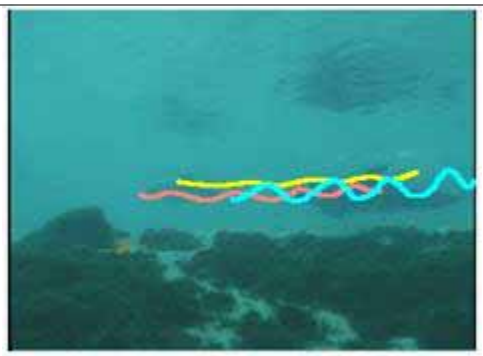


Figure 2. **Picture from a video clip of a swimming dolphin that has been digitized at the rostrum (pink), dorsal fin (yellow), and fluke (blue).**

Below: **Shawn, Poli, and Nani beached!**

In order to understand the swimming kinematics of the dolphins, Shawn must digitize the videos (Figure 2); this is a time consuming process so her results are preliminary. Thus far she has demonstrated that small body size constrains the calves' stroke amplitude, limiting their propulsive force. As a result, calves must stroke 2-3 times faster than their mothers in order to maintain proximity with their mothers. However, when the calves are in echelon position it appears that they are able to conserve energy by alternating periods of stroke and glide. This energy conservation technique is similar to that which has been observed for adult diving dolphins and seals.

NRC Senior Associate
A. P. Zhilyaev, PhD, Dr.Sci.

Friction Stir Processing

"From Russia with Love ..."

Taking of advantage of National Academies opportunity Dr. Alexander Zhilyaev from the Institute of Mechanics (Ufa Scientific Center of Russian Academy of Science) has joined Professor Terry R. McNelley at Naval Postgraduate School (Department of Mechanical and Astronautical Engineering). They enjoy working in an international team (third party is a Postdoctoral Fellow, Dr. Keiichiro Oishi from Japan) on different projects including one they talk about below and have made significant progress.

Professor T. R. McNelley

Contemporary industrial and military systems require new materials with improved properties to achieve increasing performance goals. One approach to property improvements is to modify phase composition or/and to alter microstructure of existing materials in order to achieve the desired properties. It is generally thought that ambient strength and ductility are inversely related, and simultaneous improvements in both strength and ductility are difficult to achieve. In this communication we present results from investigations using Friction Stir Processing (FSP) for microstructure modification of NiAl bronze (NAB) materials wherein ultimate tensile strength (usually used for estimation of materials strength) is *doubled* and room temperature ductility (ability of material to sustain deformation) is *tripled*. NAB materials are widely used in various marine applications. Employing multi-pass and rastering operations during FSP it is possible to achieve homogeneous microstructures with superior properties in bulk materials, or in deep layers near surfaces of large cast components. Advantages of FSP include computer control for microstructure modification in all types of materials.

FSP is a solid-state deformation process that employs a cylindrical, wear-resistant tool consisting of a smaller diameter pin with a concentric, larger-diameter shoulder. The rotating tool is brought into contact with a material surface under high applied pressure to generate frictional heating. Softening with adiabatic heating due to deformation of the material allows the tool to penetrate until its shoulder comes in contact with the surface. The tool shoulder acts to constrain upward metal flow caused by insertion of the pin and metal flow in the work piece may include vertical (parallel to the tool axis) as well as horizontal (in the plane of tool rotation) components. Horizontal displacement of the tool in a linear or raster pattern results in local thermo-mechanical cycles during which the rotating pin induces a stirring effect involving transient high strain rates and temperatures. Figure 1 shows a schematic of the process and a general view of an FSP machine (M. Mahoney, RSC). This technology represents an adaptation of the principles of friction stir welding, a solid-state joining process originally developed at The Welding Institute; in FSP, the process involves processing of a single piece of material.

As soon as the pin tool has passed a location, the resulting stir zone experiences cooling that "freezes in" the beneficial effects of the severe thermo-mechanical effects on microstructure. The FSP system involves sophisticated control of all parameters of the process including pin shape and size, applied loads, traversing speed, rotation rate, penetration depth, etc. The applied downward force can be as much as 15 tons; rotation rates are up to 20 revolutions per second (rps) and traversing speed as high as 0.5 centimeters per second (cps). The heat generation rate and deformation processes can also be manipulated by use of different pin geometries.

The axis of the pin tool is not an axis of symmetry in FSP: the linear velocity is different on advancing and retreating sides. Thus the effects on microstructure differ from the advancing to the retreating side of the stir zone as well as along the bottom of the stir zone. By devising raster pattern geometries for traversing of the tool, the problem of advancing and retreating differences in microstructure can be minimized.

Figure 2 (not shown here) is a linear raster and pin tool used to achieve modification of microstructure in an as-cast NAB material. The tool has spiral threads, and tool designs involving stepped or fluted pins have also been employed.

A processed zone, or stir zone, is produced by severe plastic deformation with movement of material about the pin. The combination of very large deformations and adiabatic heating causes microstructure refinement and homogenization, leading to improved

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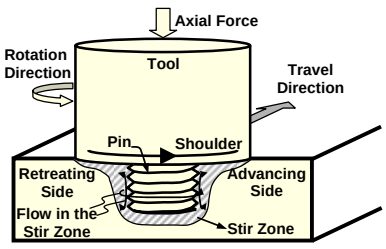
(a)



(b)

Figure 1. General view of FSP machine (a) and schematic of FSP geometry (b)

NOAA at Woods Hole

Fishing Research Vessel (FRV) Albatross IV, Woods Hole, MA

Dr. Elizabeth Methratta, NRC Associate at NOAA

Dr. Methratta, NRC Associate, & the FRV Delaware II

Dr. Elizabeth Methratta began her NRC Research Associateship at NOAA's Northeast Fisheries Science Center (NEFSC) in Woods Hole, MA in August 2003 after completing her Ph.D. at the University of Pennsylvania. In collaboration with Dr. Jason Link, her NRC Adviser, Dr. Methratta is exploring how species distributions and vital population rates are associated with habitat characteristics for demersal fish **(a slow moving and dorso-ventrally flattened fish, either carnivores or detritus feeders, marine fish production largely depends on presence of demersal fishes).** During her tenure as a NRC Associate, Dr. Methratta has been able to discern the relative importance of several habitat factors and how these relationships change across spatio-temporal scales. The information produced from her research should enhance our ability to manage living marine resources, particularly as we move toward implementing spatial management options.

Winter Flounder in sea-floor habitat

To conduct her work, Dr. Methratta has employed geographic information system (GIS) methods to integrate several complex and synoptic data sets on fish biomass, vital population rates, and environmental variables in a spatially explicit manner. Using a suite of geostatistical, multivariate ordination, and generalized additive modeling approaches, Dr. Methratta has evaluated multiple population and assemblage level relationships. In many respects her work represents the cutting edge of how geospatial-statistical tools can be applied to essential fish habitat issues.

In addition to her habitat related research, Dr. Methratta has participated in interactions and collaborations with other scientists at NEFSC. These projects included multi-disciplinary work on marine fish community indicators, network modeling, and marine food web theory. About her tenure as a NRC Associate, Dr. Methratta commented, ***"I have gained invaluable knowledge and insights about marine fish and habitat ecology that I will continue to draw on throughout my career."***

NPS- continued

strength and ductility of material in the stir zone. An FSP stir zone, or nugget, has an "inverted cap" profile when viewed along the axis of tool travel; this is shown in the montage of micrographs in Figure 3a. The nugget is not symmetric and there are gradients in microstructure that accompany the gradients in strain, strain rate and temperature associated with FSP. In order to examine this problem miniature tensile test specimens were designed and employed to explore the mechanical properties of processed

NAB materials at the Naval Postgraduate School. The distribution of mechanical test specimens in the stir zone are illustrated in the schematic of Figure 3b and machined specimens are depicted in Figure 3c.

Using these specimens, mechanical property data, such as ultimate tensile strength (UTS) and ductility (measured as engineering strain to failure), were measured with high resolution throughout stir zones. One such experiment is summarized in the results shown in Figure 4 as three-dimensional plots of distributions of longitudinal UTS and ductility as a function of location in the stir zone. These data show a unique effect in that both strength and ductility are increased along the centerline of the stir zone. UTS values approach 800MPa with corresponding ductility values of 20 – 30 pct. engineering strain to failure at such locations. In contrast, unprocessed NAB may exhibit a UTS value of 350MPa and ductility of 11 pct. engineering strain to failure.

Ongoing investigation of the microstructure – mechanical property relationships achieved by FSP will enable further improvements of this processing method and enable implementation of the technology in industrial and military systems.

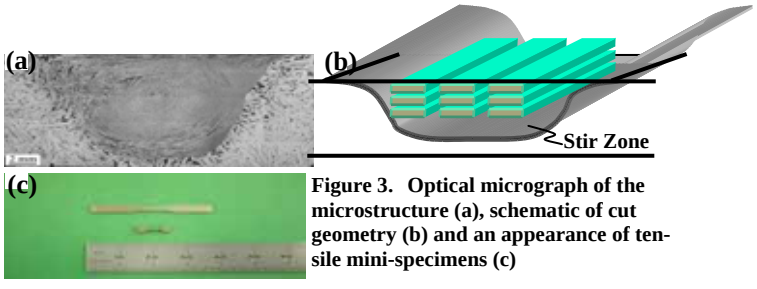
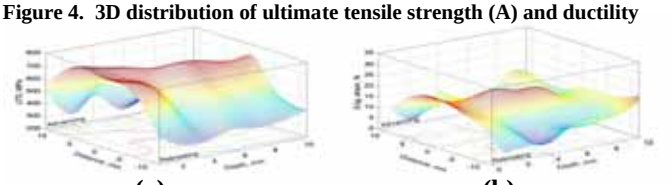


Figure 3. Optical micrograph of the microstructure (a), schematic of cut geometry (b) and an appearance of tensile mini-specimens (c)

Figure 4. 3D distribution of ultimate tensile strength (A) and ductility



(a) (b)

(b) across the stir zone in FSP nickel aluminum bronze.

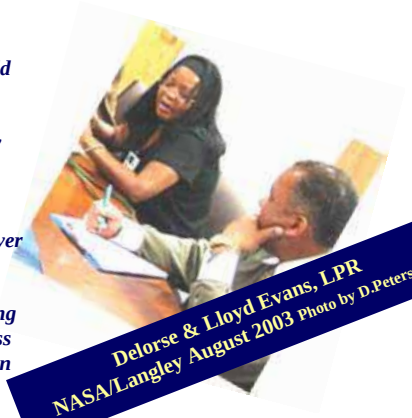
Delorse visits with Dr. Sean O'Byrne, NRC Associate NASA/Langley August 2002 Photo by D.Peterson

"Dee was...extremely helpful to our NRC Associates as well as to the LPR here at Ames--a very detailed oriented person who truly knew the program inside and out. She went above and beyond the call of duty throughout the 15 years I was associated with her on the NRC program. She … ... will be sorely missed."

Meredith Moore
NASA/Ames

"I am so sorry to hear about Dee. Sometimes, when I would call Dee with an issue, she would welcome my call with "well, hello Sweetie"...I knew then that I had a friend and a partner on the other end, and we were going to find a way to work through whatever issue in a win-win way … She had a way of always making you feel like everything was going to work out. I guess it's our chance to say to her in this tribute one last time, 'goodbye, Sweetie!'"

Ramona Travis, NASA/SSC



Delorse & Lloyd Evans, LPR NASA/Langley August 2003 Photo by D.Peterson

Delorse Thompson Lancaster February 12, 1950 - May 30, 2005

Delorse (Dee) was employed by the NRC Research Associateship Programs for over 25 years. She began as part of the Operations Unit, and immediately became an important player as the group constantly brainstormed about streamlining, expediting, and improving the efficiency of the application process. Many times, Dee went that extra mile to ensure and assure the candidates' applications were complete enough for review; the agencies, labs and postdocs always appreciated her personal 'hand holding'.
After 13 years, Delorse moved on and up to the responsibilities of the Coordinator of 1300-1500 NRC Research Associates (over the ensuing 13 years) of many Programs, such as NASA/Ames Research Center, NASA/Stennis Space Center, EPA, NASA/Langley Research Center, and Army Research Laboratory, where the agencies, LPRs, Advisers, and postdocs appreciated Dee's personal touch.

Loyal to her first 'home' in Operations, Dee always volunteered to help process the thousands of support documents received annually during review times.

We all knew and loved Dee as feisty, hardworking, smart, candid, religious, and stylish--purple being her omnipresent trademark, except when she deferred to the colors of her other love, the Redskins. We miss Delorse.

Delorse & Frank Flemisch, NRC Associate NASA/Langley August 2004 Photo by D.Peterson

"...Delorse always replied to my messages in a timely and complete fashion. I always felt…'the system works'. There was no worry about 'unpredictable bureaucratic pathways'... for legal matters related to my position as Associate. ...People like Delorse make the Associate experience more enjoyable and productive, and...break down...cultural barriers."

Marcelo J. Wolansky, EPA Associate

"Delorse was the person, to whom I could always bring my concerns as LPR for the EPA in Las Vegas. She would invariably get me an answer to fix the problem... With her loss there is a void in the program."

Don Betowski, EPA/ORD/NERL

Delorse & company visit Dr. Tatiana Semenova, NRC Associate NASA/Langley August 2004 Photo by D.Peterson

"I worked with Dee for many years as the LPR for the EPA Athens Laboratory. I have since retired, but remember Dee as a very caring and special person. She did everything possible to make things go smoothly when processing paperwork to bring on a new post doc or to help and existing one. Whenever I needed help, I knew I could depend on Dee to help fix the problem. Sometimes, it would be a rush job and Dee would fuss, but I would just say "Dee I love you too." This would bring about laughter from both of us. I know Dee will be missed at NRC and by her family. Although Dee is physically gone from this earth, she will live on in our hearts forever."

Annie J. Smith, EPA

"Delorse was a huge help to me as I was learning the ropes of EPA's NRC Associates Program. She was very kind, clear and thoughtful whenever I had questions. She understood my questions immediately and always, always returned my calls and provided me with more and better information than I thought I needed! She was also very kind and helpful to our Associates, some of whom are foreign nationals who do not understand American hiring customs. We will all miss her terribly. ...she was loved and admired by her family and friends. ...please let them know that we, at EPA's Mid-Continent Ecology Division in Duluth, MN, benefited greatly from our association with her."

Janet R. Keough, Acting Director, EPA, NHEERL

Delorse & Dr. Zielinski visit Dr. Phillip Williams, NRC Associate NASA/Langley August 2004 Photo by D.Peterson

2006 SCHEDULE

February Review

February 1	application deadline
February 13	rosters to agencies
Mid February	booklet revisions sent to agencies
February 27	LCR forms due
March 9-10	panel review / board meeting

May Review

April	booklet revisions begin arriving
May 1	application deadline
TBD	LPR meeting
May 12	rosters to agencies
May 26	LCR forms due
June 23	panel review / board meeting

August Review

August 1	application deadline
August 11	rosters to agencies
August 25	LCR forms due
Sept 25	panel review / board meeting

November Review

November 1	application deadline
November 10	rosters to agencies
November 27	LCR forms due
January 8, 2007	panel review / board meeting

www.NRC-RAP.org

Pilot site : web-based communication tool through which NRC Associates communicate with each other about social events, scientific meetings, employment, taxes, citizenship issues, networking, etc. Look at it, test it, use it as often as you can. We need your feedback for improving it to suit your communication needs. Contact Suzanne White with your comments (swhite@nas.edu)

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