National Aeronautics and Space Administration

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goddard tech transfer news

on the cover:

Dr. Stephanie Getty is Goddard's main point of contact with Lehigh University's nanotechnology facility, spearheading efforts to enable Goddard researchers to use the University's state-of-the-art transmission electron microscope remotely for advanced nanoscale imaging. Read more about this and her other nanotechnology transfer efforts inside.

in this issue:

photo credit: Chris Gunn

events

SBIR Entrepreneur and Private Astronaut to Speak at 15th Annual NTR Program

photo credit: Space Adventures

Each year, the Innovative Partnerships Program (IPP) Office hosts the New Technology Reporting (NTR) Program to recognize innovators who have filed NTRs, received patents, or made significant efforts to assist in establishing partnerships or transferring technology. The annual NTR Program also gives them a chance to learn about the latest IPP developments, partnership success stories, and trends in innovation. An entrepreneur and the third private citizen to orbit the Earth aboard the International Space Station, Greg Olsen will be the keynote speaker at this year's program to be held May 10.

During his illustrious career, Dr. Olsen has founded several businesses, including fiber-optic detector manufacturer EPITAXX, near-infrared camera manufacturer Sensors Unlimited, Inc. (SUI), and currently the "angel" investment company GHO Ventures—all of which have been involved in NASA's Small Business Innovative Research (SBIR) program.

"I think the SBIR program has tremendous value," Dr. Olsen said during a telephone interview. "It enables small business to do research so that they can then turn that research into a commercial product."

This was dramatically demonstrated by SUI, which developed technologies that have been used in such applications as night vision and covert surveillance, fiber optics networks, the food processing industry, and many others. Founded in 1992, the company was sold to Finisar Corp. for $600 million in 2000, repurchased by the management team in 2002 for $6 million, then sold again to Goodrich Corp. in 2005 for $60 million.

SUI's technologies also benefited NASA, including the Space Shuttle Discovery's Return to Flight mission.

Praising SBIR for its help in building the capabilities of small companies, Dr. Olsen noted that "SBIR helps companies make their technology better. The array we made in 2005 [and used on Discovery] was better than the array we made in 2000 which was better than the array we made in 1995 under SBIR. In a sense, the SBIR program helped us to develop all of those technologies."

Dr. Olsen earned a BS, a BSEE, and an MS in physics from Fairleigh Dickinson University, and he was awarded a Ph.D. in materials science from the University of Virginia. He holds 12 patents, has written more than 100 technical papers, and is an IEEE LEOS Fellow and the first recipient of the prestigious IEEE Aron Kressel Award.

Goddard Tech Transfer News
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Goddard Tech Transfer News is the quarterly magazine of the Innovative Partnerships Program Office (Code 504) at NASA Goddard Space Flight Center in Greenbelt, Maryland. This magazine seeks to inform and educate civil servant and contractor personnel at Goddard about actively participating in achieving NASA's technology transfer goals:

- Filing required New Technology Reports on eNTRe (http://entre.nasa.gov)
- Pursuing partnerships to accelerate R&D
- Finding new applications for space-program technology
- Identifying innovative funding sources
- Communicating partnership opportunities via conferences, workshops, papers, presentations, and other outreach efforts
- Seeking recognition by applying for technology-related awards

Please send suggestions or feedback about *Goddard Tech Transfer News* to the editor.

Register now for the **May 15th training session!**

Technology Transfer Overview Course

Tuesday, May 15 • 9:00 a.m. to noon • Bldg. 1, Room E100E

Civil servants can register online at https://satern.nasa.gov.

Contractors can register by sending an e-mail to Dale Hithon in the IPP Office at Dale.L.Hithon@nasa.gov

For more information visit: http://ipp.gsfc.nasa.gov/NWS-Tech-training.html

Questions? Contact Dale Hithon in the IPP Office (6-2691 or Dale.L.Hithon@nasa.gov).

register

NTR Corner

Technology title:
Multipurpose Fiber Injected Microspherical Lidar System
(GSC-15124-1)

Inventor:
Hossin Abdeldayem
(Code 554)

What it is: This microspherical laser system is a satellite-based lidar transmitter of broad laser lines. It is also referred to as a "white-light laser system" because its microspheres can be doped with various lasing materials that can emit broad laser lines.

What makes it better: Unlike existing laser technologies, the system does not require a laser cavity, making it insensitive to the harsh environments and intense vibrations in space. The microspheres are excited for lasing using far less pump energy than conventional systems. In addition, the emission from the microspheres is guided along a fiber, making the system very compact and lightweight. Finally, the system is inexpensive and durable, and it offers the flexibility of controlling the lasing energy by controlling the number of microspheres being used.

How it might be used: The laser can be designed to lase fine single or multiple lines simultaneously. A multiline system makes it ideal to replace several conventional lasers for many space-exploration applications, such as surface-chemical analyses as well as detection of organic compounds and biomarker gases on other planets. It can also be used for remote measurements of atmospheric aerosols, clouds, ozone layer, water vapor, carbon, and methane as well as profiling wind measurements, performing surface topography, mapping vegetation, and measuring subsurface ocean layers. In addition, it can be used as a single optical source for dense optical communication and to activate multi-optical logic gates with various laser lines in future optical computers.

Tech transfer status: A provisional patent application has been filed. Goddard's Office of Patent Counsel will be following up the provisional patent application with a nonprovisional filing in the next few months. While no license agreements are in place as of press time, the IPP Office continues to engage with interested companies and universities to understand needs and requirements for potential technology transfer opportunities.

Test your TTQ*

*technology transfer quotient

When is the right time for filling out an NTR?

Decide whether the following technology development situations warrant completion of a New Technology Report (NTR).

1. ***I'm in the middle of R&D of a new method for system software analysis. R&D probably won't be completed for at least another six months.***

2. ***I've now completed R&D on the new method, but I don't think any commercial applications exist for it.***

3. ***I've come up with an idea for satellite attitude control. I'd like to research it to see if it might be feasible, but I haven't done anything yet.***

4. ***My team has built a prototype of a new mechanical grip, but it needs more work before it will operate properly.***

Answers:

1. **FILE THE NTR NOW**. As soon as you recognize that you have a new invention, you should file an NTR. In this case, a new method is a new invention. Even if R&D is ongoing, filing an NTR before it is completed will enable the IPP Office to begin researching potential applications and any intellectual property (IP) protection issues that may later arise.

2. **FILE THE NTR.** Even technologies that you think do not have commercial applications should be reported. The IPP Office has the expertise to determine the non-NASA potential of a new invention and may think of an application that you have not considered.

3. **DON'T FILE THE NTR YET**. If you have an idea, it is important to begin research as soon as possible in order to document the idea. Once any research work has begun, then file an NTR as soon as possible.

4. **FILE THE NTR NOW**. In this case, a new invention exists, regardless of whether or not it is fully operational, and therefore warrants an NTR.

Remember: If you are unsure about whether it is too early to file an NTR, contact the IPP Office for advice. It is better to file too early than too late.

File your New Technology Reports (NTRs) on eNTRe (http://entre.nasa.gov). For more information, contact Goddard's IPP Office (6-5810).

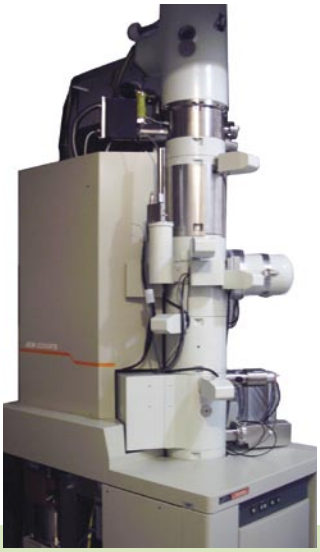

photo courtesy of: Lehigh University

Goddard Researchers Can Remotely Access Lehigh's Aberration Corrected TEM for Nanoscale Imaging and Nanoanalysis

As the liaison for the remote interface to Lehigh University's high-resolution transmission electron microscope (TEM), Dr. Getty can help Goddard researchers use Lehigh University's state-of-the-art electron microscopy capability remotely for advanced nanoscale imaging and elemental analyses. Interested researchers should contact Dr. Getty who will coordinate training, sending subject samples to Lehigh for loading into the TEM, and remote access scheduling.

Features of the Lehigh JEOL JEM-2200FS include:

- HREM imaging resolution of 1.8Å
- HAADF image resolution of 1Å
- STEM spherical aberration correction
- In-column omega filter for energy filtered imaging and diffraction
- EFTEM and STEM-EELS analysis capability
- EELS energy resolution of 0.7eV
- Thermo-Noran EDS detector for STEM-XEDS analysis
- 2k x 2k CCD camera
- 200kV Accelerating voltage
- Specialized Nanofactory TEM-SPM stage for *in-situ* transport measurements
- Remote control from Goddard

Contact Stephanie Getty for more information:
Stephanie.A.Getty@nasa.gov • 301-286-9760

Stephanie Getty

Tell us a bit about the research you've been doing for Goddard.

I am working to incorporate nanomaterials, such as carbon nanotubes and silicon nanowires, into next-generation scientific instruments for manned and unmanned solar system exploration. I'm involved in an applied nanotechnology effort in the Materials Engineering Branch—we are responsible for growing high-quality nanomaterials on a substrate using a catalyst-assisted vapor-liquid-solid (or chemical vapor deposition) growth method, fabricating prototype devices, and testing the performance of these devices.

What kinds of technologies use these nanomaterials?

Right now, I am focusing on developing three technologies. The first is a nanoscale magnetometer that operates using the piezoresistive properties of single-walled carbon nanotubes. The magnetometer may have potential application in helping us to measure magnetic fields in space and on the surface of planets, and the strain-sensing mechanism may be generalized in the future for other sensor applications. I'm also working on high–aspect ratio electrodes using carbon nanotubes for application in field emission electron guns and field amplification. Finally, I'm developing a well-ordered array of silicon nanowire transistors for potential use as a biosensor for astronaut health monitoring on long spaceflight missions.

What have you been doing with the IPP Office?

I've been involved in various memoranda of understanding (MOUs) with organizations such as Lehigh University, and I'm working on upcoming agreements with the National Cancer Institute (NCI) and the University of Maryland, College Park.

What are you doing with Lehigh University?

Our work with Lehigh University has focused on making their world-class electron microscopy facilities available for use by Goddard researchers *(see the sidebar about the facility's capabilities).* In fact, we have established a remote interface to a state-of-the-art transmission electron microscope housed at Lehigh for advanced nanoscale imaging and elemental analysis. In the near future, we are planning to use the focused ion beam capability at Lehigh to fabricate suspended NEMS (nanoelectromechanical systems) structures, and I am planning to host a graduate student intern from Lehigh this summer to work on fabrication and modeling of carbon nanotubes for electron gun applications.

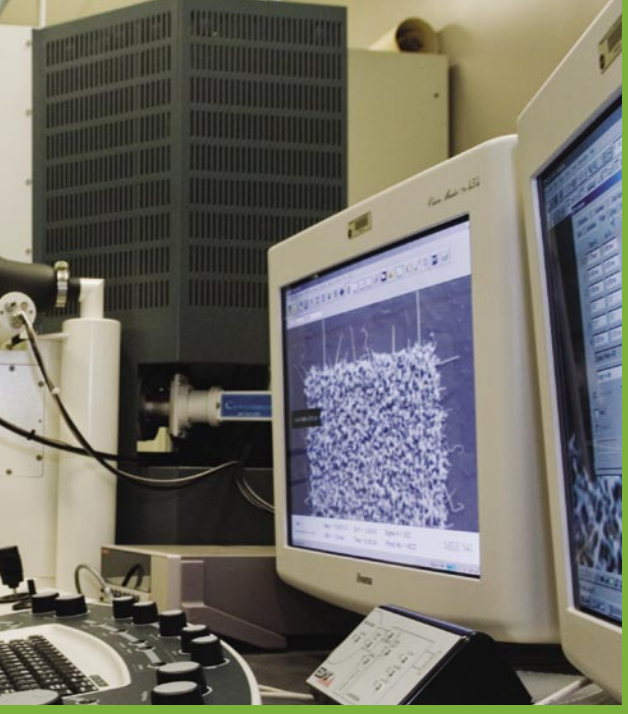

photo credit: Chris Gunn

And with NCI and the University of Maryland?

The National Cancer Institute, the University of Maryland, College Park, and our team at Goddard are partnering to develop an advanced nanobiosensor using silicon nanowires and carbon nanotubes as the sensor element. This new detection approach promises to replace the current time-intensive fluorescence technique of performing a DNA analysis with a fully electronic method. Using nanoelectronic materials will enable a miniaturized, simplified, low-power, and potentially handheld diagnostic device that we envision could be part of a medical toolkit in exploration missions. For example, we may be able to locate biomarkers in astronauts' genetic makeup to predict a susceptibility to cancer or to monitor their blood over a long period of time to detect radioactive damage on long spaceflight missions.

photo credit: Chris Gunn

Code: 541

Years at NASA: 2.5

Field of Research: Nanotechnology

Birthplace: Douglasville, Georgia

Education: Ph.D. and B.S., physics, University of Florida

Have you benefited from your work with the IPP Office?

Yes, I've been lucky to have a close relationship with the IPP Office in the time I've been at Goddard. Through this relationship, the IPP Office has encouraged me to protect my new technologies through the eNTRe system, they work to introduce me to potential industrial partners, and they keep me informed about upcoming funding opportunities. The IPP Office also invited me to present my work at the National Nano Engineering Conference in Massachusetts last November. The conference was an interesting mix of research underway in universities, government labs, and industry, and it was a great way to interact with the larger technology community.

Do you think NASA has benefited from the work that the IPP Office has been doing? How?

The IPP Office plays a central role in maximizing the impact of technologies developed at Goddard. The engineers and innovators benefit from support in the areas of commercialization and partnerships that can be easy to neglect when focused on technical work. Spaceflight projects benefit from greater maturity and greater capability in instruments and systems made possible by leveraging these approaches. NASA as a whole benefits from lower costs of technology development and shared investment with outside partners that have common interests.

What do you see as the value of technology transfer and/or partnering with outside organizations in collaborative R&D?

In the current competitive funding climate, it's more important than ever to get the most out of small amounts of funding to keep innovative new technology development going. One way to make the most of limited resources is to develop relationships between organizations that have common goals, and the IPP Office is integral to identifying new partners and putting the framework in place so that we can work together.

Any advice for your colleagues?

I would say that it's important to take full advantage of the resources available to you in the IPP Office. Make sure they know about your innovations. They are great at identifying partnership and funding opportunities that you might not otherwise come across.

The IPP Office is pleased to announce the following new agreements:

partner	technology/focus	agreement	NASA goals/benefits
BAE Systems	SpaceWire link-and-switch implementation	Reimbursable SAA	BAE will build a new computer board with native SpaceWire functionality, allowing NASA to procure the boards at a lower cost than building similar technology in-house or retrofitting existing computers.
E-City NanoTechnologies	Manufacturing of single-walled carbon nanotubes (SWCNTs)	License	NASA will receive royalty revenue and access to lower cost SWCNTs.
Enduro Medical Technology	Cable-Compliant Joint (CCJ) technology	License	NASA will benefit from royalty revenue and public goodwill.
LogicNets	Artificially intelligent robotic test system	Nonreimbursable SAA	NASA will have the potential to define and test many important exploration scenarios using the proposed robotic test system, including exploration and monitoring of land and water surfaces as well as planetary exploration.

SAA = Space Act Agreement

BAE Systems Information and Electronic Systems Integration, Inc.

A new reimbursable SAA has been entered into between Goddard and BAE. Under the terms of the agreement, NASA will provide the company with technical support, consultation, and VHSIC Hardware Description Language (VHDL) code modifications, enabling BAE to integrate Goddard's SpaceWire link-and-switch technology into its new application-specific integrated circuit (ASIC) design. The new ASIC will make SpaceWire an embedded feature in the company's space computer, bringing greater standardization to the SpaceWire technology and providing SpaceWire functionality with fewer parts and at a lower cost to NASA and other aerospace organizations that may purchase the company's redesigned onboard computer.

E-City NanoTechnologies

This start-up in Pasadena, Maryland, is the second company to license Goddard's innovative process for manufacturing single-walled carbon nanotubes (SWCNTs). As discussed in the Fall 2006 issue of *Goddard Tech Transfer News,* retired Goddard researcher Jeannette Benavides developed an innovative process for manufacturing SWCNTs without using a metal catalyst. The absence of the metal catalyst dramatically reduces pre- and post-production costs: "The cost savings is staggering," said Tim Irwin of E-City NanoTechnologies. The company is passing those savings along to its customers—which could include NASA—while achieving its mission of producing the highest quality SWCNTs to meet the ever-growing needs of an expanding array of industries worldwide. Sales will generate royalty revenue for Goddard.

Enduro Medical Technology

Enduro Medical Technology has secured an expanded field of use for its license of Goddard's patented Cable-Compliant Joint (CCJ) technology, enabling further product development. The company's original license of the technology was used to successfully develop the Secure Ambulation Mode (SAM), a revolutionary rehabilitative walker enabling patients to stand and ambulate without the aid of a physical therapist. SAM is currently being used to help soldiers and other patients with a variety of injuries at Walter Reed Army Medical Center and at Kindred Hospital in Greensboro, NC. A youth version (SAM-Y) has also been developed and tested. With the newly revised and expanded license, Enduro plans to secure equity funding in order to develop an equine version of the walker to help rehabilitate injured horses. Interest from the equine and veterinary communities has been high, and the company plans to work to develop prototypes with researchers at the University of Georgia and an equine surgery and rehabilitation center in Lexington, Kentucky, once funding has been secured.

LogicNets, Inc.

A new nonreimbursable SAA between Goddard and LogicNets will enable collaborative development of an intelligence modeling and runtime environment for autonomous robotic systems. These intelligence models will have the capability to control real vehicles and to make the decisions for the interaction between the robotic vehicle systems and the environment. LogicNets will provide its expert system application modeling and runtime environments to be used as the basis for the project, while Goddard will provide domain knowledge and software procedures and rules to develop the robotic test system. Researchers at both organizations will work together to develop a robotic system that can be defined and tested in any exploration scenario. Potential applications for intelligent autonomous vehicles are vast, including mapping, exploration, and monitoring of land and water surfaces on Earth as well as unknown planetary surfaces.

A Partnership Primer

As noted previously in this magazine, NASA is working to leverage the resources of other organizations in pursuing exploration and science goals. These resources include outside organizations' technology and capabilities that can be "infused" into NASA missions, programs, and projects via a partnership arrangement.

Since partnerships are a new concept for some researchers, Goddard's Innovative Partnerships Program (IPP) Office has prepared the following summary information.

Partnership Basics

- ***What a Partnership Is:*** When NASA collaborates with an outside organization to develop the solution(s) to their respective technical challenges. Each party "brings to the table" something that the other needs, and thereby both parties benefit from working together.
- ***What a Partnership Is Not:*** An agreement where the outside technology comes into NASA relatively easily—without the need for extensive knowledge sharing—and/or where NASA's only contribution is as a "customer."
- ***Who Could Be a Partner:*** NASA can partner with U.S. companies, universities, not-for-profit R&D organizations, or even other government laboratories or programs. International organizations also can be partners, although the process for securing the partnership is different and involves HQ.

Why Partner

- Finding a match with an outside organizations' needs (problems) and technologies (solutions) allows NASA and the partner to achieve their goals faster while using fewer resources.
- A partnership can improve the chances of success in securing other federal funding through opportunities such as those listed below and online (http://ipp.gsfc.nasa.gov/funding-opps.html).
- Some funding opportunities, such as the Partnership Seed Fund (see the Fall 2006 issue of *Goddard Tech Transfer News)* and a current solicitation from the Air Force Office of Scientific Research , require partnerships or other teaming arrangements.

What Makes a Partnership Successful

- The problem(s) that NASA and the partner are working to solve is identifiable and can be clearly stated.
- Both NASA and the partner view the relationship as valuable and furthering their own interests.
- NASA and the partner are vested in the joint research and willing to share the risks and resources to achieve their mutually beneficial goals.

How to Get Started

Goddard's IPP Office can provide assistance as you start to consider partnering, including:

- Identifying potential partners
- Putting proper agreements in place to ensure that discussions can proceed without compromising sensitive information
- Developing a clear plan for working with the partner, including what the cost structuring might be, who the key personnel would be, what support levels would be required, and from where the resources might come
- Suggesting possible funding opportunities for the partnership to pursue
- Leveraging Goddard's relationships with current or previous partners in the federal government, academia, or industry

Contact the IPP Office at partnership@gsfc.nasa.gov to learn more about establishing partnerships to benefit NASA.

Federal Funding Solicitations

Federal agencies often issue notices for funding of research and development (R&D) projects that might overlap with NASA mission work. With some modifications, existing project/proposal summaries (e.g., for IRAD, IPP Seed Fund) might be submitted as white papers or executive summaries as a first step in pursuing funding from these agencies. Below is just one example.

*If you are interested in submitting a white paper, please contact **Nannette Stangle-Castor** of Goddard's IPP Office at 919-873-1457 or nsc@fuentek.com.*

Agency: **Sensors Directorate, Air Force Research Laboratory (AFRL)**

Solicitation: Advanced Component Technology for Sensor Systems (ACTSS) (BAA-07-01 PKD)

Relevant areas of interest: Radio frequency, electro-optical, and mixed-signal devices and subsystems; electronic sensing devices; MEMS; intelligent sensor component processing; sensor data compression; and avionic component architectures

Closing date: September 30, 2009, white papers only, no full proposals accepted

More information: **http://www.fbo.gov/spg/USAF/AFMC/AFRLWRS/BAA07-01-PKD/SynopsisP.html**

Find other federal funding opportunities online at: **http://ipp.gsfc.nasa.gov/funding-opps.html**

training

Tech Transfer Training a Success

Register now for the May 15th session!

In February, the IPP Office presented "An Introduction to NASA Goddard Technology Transfer" — a very successful overview course designed to familiarize NASA civil servants and contractors with policies and procedures related to technology transfer. Special emphasis on Goddard-specific practices provides participants with the knowledge and tools they need to work with the IPP Office on many different technology transfer and partnership activities.

Why attend technology transfer training?

Technology transfer training is vital to helping you understand key concepts that can benefit both you and Goddard. In the training, you will learn:

- When and how to file a New Technology Report (NTR), and how filing NTRs can make you eligible for recognition and monetary awards.
- How the IPP Office can help you secure intellectual property protection for your reported technologies.
- How you may be able to win new work through collaborations with other NASA Centers or non-NASA organizations.
- The in's and out's of various agreements, including licenses, Space Act Agreements, Memoranda of Understanding, and more.

The next Tech Transfer Overview Course is scheduled for May 15. Civil servants can register online at https://satern.nasa.gov. Contractors can register by e-mailing Dale.L.Hithon@nasa.gov

What Attendees Are Saying about the Training

"I was very satisfied with the level of detail presented. Not too general, not too specific. A very good overview."

"It was a great course! I learned a lot of new information."

"Excellent overview!"

metrics

Tech Transfer Metrics

January 1, 2007 to March 31, 2007

New Technology Reports: 11

**Software*

Applications of Virtual Planetarium Software Technology* by Indiana University

Enhanced Graphics for Extended Scale Range by Indiana University

Goddard Dynamic Simulator* by Stephen Leake (Code 582)

Goddard Space Flight Center—IP Address Management System (GSFC–IPAMS)* by Indus Corporation

Integrated Lunar Information Architecture for Decision Support (ILIADS)* by Julie Loftis (Code 580), Stephen Talabac (Code 586), James Garvin (Code 600), Karin Blank (Code 586), Carl Hostetter (Code 588), Peyush Jain (Code 588), Richard Mullinix (Code 586), Jeffrey Hosler (Code 588), and Ryan Boller (Code 587)

Low Conductance Silicon Micro-leak for Mass Spectrometer Inlet by MEI Technologies, Inc.

Method for Non-Destructive Evaluation of Thermal Protection System Materials and other Materials via Ultraviolet Spectroscopy by Diane Pugel (Code 553)

Modular Integrated Solution Toolkit (MIST)* by Computer Science Corporation, Inc.

Solar Journey* by Indiana University

Ultra-Lightweight Hybrid Structured Mirror by Metal Matrix Cast Composites

Volumetric and Optical Studies of Phase Equilibria in Hydrated Salts from 0.1–400 MPa with Applications to Europa's Ocean by Lafayette College

Patent Applications Filed: 5

Conformal Gripping Device by John Vranish (Code 544)

Method and Associated Apparatus for Capturing, Servicing, and De-Orbiting Earth Satellites Using Robotics (4 applications) by Frank Cepollina (Code 442), Richard Burns (Code 591), Jill Holz (Code 442), James Corbo (Code 599), and Nicholas Jedrich (Code 599)

Provisional Patents Filed: 3

Analog Radio Interference Suppression System by Jeffrey Piepmeier (Code 555), Joseph Knuble (Code 555)

Field Reactive Amplification Controlling Total Adhesion Loading (FRACTAL) by Steven Curtis (Code 695)

Low Conductance Silicon Micro-leak for Mass Spectrometer Inlet by Dan Harpold (Code 699), Hasso Niemann (Code 699), Brian Jamieson (Scientific and Biomedical Microsystems), and Bernard Lynch (MEI Technologies, Inc.)

Get the 2006 Accomplishments Report

Read up on the significant technology transfer achievements of 2006. Download your copy of the 2006 Accomplishments Report online at:

http://ipp.gsfc.nasa.gov/2006-accomplishments-report/