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As Chief Engineer for the Wallops Launch Range, **Barton Bull** wears many hats: in the lab, on the launch pad, and at the negotiating table. Read inside about his many activities to support the orbital and suborbital missions at NASA's only dedicated flight range.

in this issue:

photo credit: Chris Gunn

Nona Cheeks

A Letter From the Chief

Thank you for picking up the spring issue of *Goddard Tech Transfer News.* We've chosen to highlight Wallops Flight Facility for this special issue, featuring exciting partnerships, SBIR contracts, and the unique capabilities Wallops has to offer.

In the Innovative Partnerships Program (IPP) Office, we're always looking for opportunities for collaboration and new relationships with both public and private sector partners. As NASA's only owned launch facility, Wallops has much to offer Goddard, NASA as a whole, and our partners. The unique combination of state-of-the-art labs and test flight opportunities, combined with industry-leading expertise, makes Wallops an ideal location for NASA innovators and partners alike to test fly technologies and embark on innovative spaceflight research.

We hope you'll enjoy reading more about these capabilities and opportunities inside.

Nona Cheeks
Chief, Innovative Partnerships Program Office (Code 504)
NASA Goddard Space Flight Center

A Special Issue About a Special Facility

Dr. John Campbell

Located on Virginia's Eastern Shore, Wallops Flight Facility was established in 1945 and continues to be NASA's only dedicated launch facility for orbital and suborbital missions. We are pleased that the IPP Office and the editor of *Goddard Tech Transfer News* have chosen this special issue to focus the magazine's content on this remarkable launch range.

Inside, you'll learn about some of the many capabilities and services offered at Wallops, as well as the many advantages to testing and space qualifying technologies here on the Eastern Shore. You'll also meet the Chief Engineer of the Launch Range, Barton Bull (featured on the cover) and learn about some of the exciting SBIR and funded projects ongoing at Wallops.

We hope that the information in this issue will bring the value of Wallops into clear focus for the Goddard research community and all NASA Centers and potential partners.

With thanks,

Dr. John Campbell, Director of Wallops Flight Facility
and Suborbital and Special Orbital Projects Directorate (Code 800)

Goddard Tech Transfer News **http://ipp.gsfc.nasa.gov**

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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. Also available online at http://ipp.gsfc.nasa.gov. Send suggestions to Enidia.Santiago-Arce@nasa.gov.

Wallops Offers a One-Stop Shop for Testing and Space-Qualifying Technologies

As the principal facility for NASA's suborbital research programs, Wallops Flight Facility offers both non-NASA organizations and other NASA centers unique opportunities for development and testing of new and existing technologies to prepare them for spaceflight or suborbital applications. Access to a wide range of vehicles, extensive payload and testing expertise, and end-to-end mission implementation capabilities, combined with the test range, make Wallops a true one-stop shop for technology maturation.

Take advantage of multiple craft for instrument testing and experimentation

As NASA's premier test-flight facility, Wallops offers the capability to test technologies and instruments on a wide range of craft, including sounding rockets, balloons (launched from Wallops as well as remote locations), manned aircraft, and unmanned aerial systems (UAS). With one UAS runway in use, Wallops currently is building a new control center, and proposals are being considered to build a second UAS runway—enabling Wallops to accommodate even more individual flights or tandem experiments.

Since each type of flight platform offers unique advantages, having a range of options available on site is a significant advantage for innovation, says Wallops technologist Wayne Powell. For example, a groundbreaking collaboration between NASA and the National Oceanic and Atmospheric Administration (NOAA) resulted in the first unmanned flight into a hurricane (Hurricane Noel) in November 2007. A UAS launched from Wallops flew into the eye wall of the hurricane, controlled remotely by scientists who made detailed observations in areas that would have been too dangerous for manned aircraft.

While this was a rather advanced example of flight-testing capabilities, other projects that are in initial testing stages may benefit from exposure to balloon or sounding rocket flight environments, said Powell. "And then some instruments will need to be tested on a combination of flight platforms in order to fly to different regions and conditions to evaluate how the instruments respond. And since we have all of these craft available, Wallops can provide exposure to most spaceflight environments." Ultimately, said Powell, this translates into innovation and testing being conducted in less time and at a lower cost.

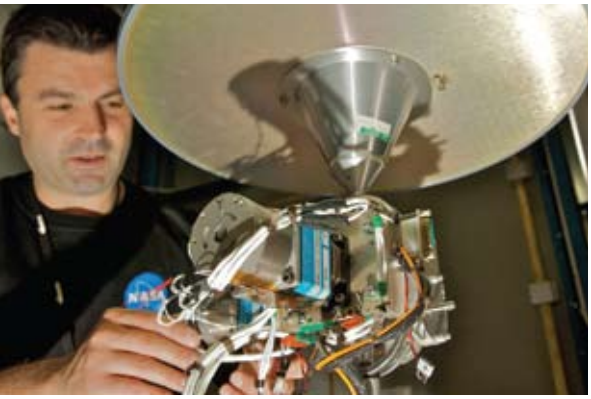
Several Small Business Innovation Research (SBIR) awards being carried out at Wallops are taking advantage of the opportunity to increase an instrument's technology readiness level (TRL) via experimentation on multiple craft. For example, Stratton Park Engineering Company (SPEC) and Anasphere will take advantage of both UAS and balloons at Wallops to test miniaturized cloud sensors in different conditions. Read more about these SBIR awards on page 12.

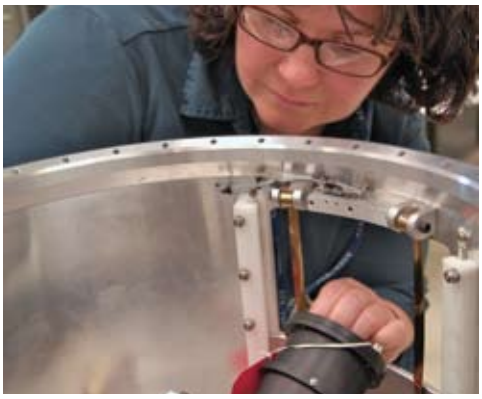
(continued on page 4)

Wayne Powell

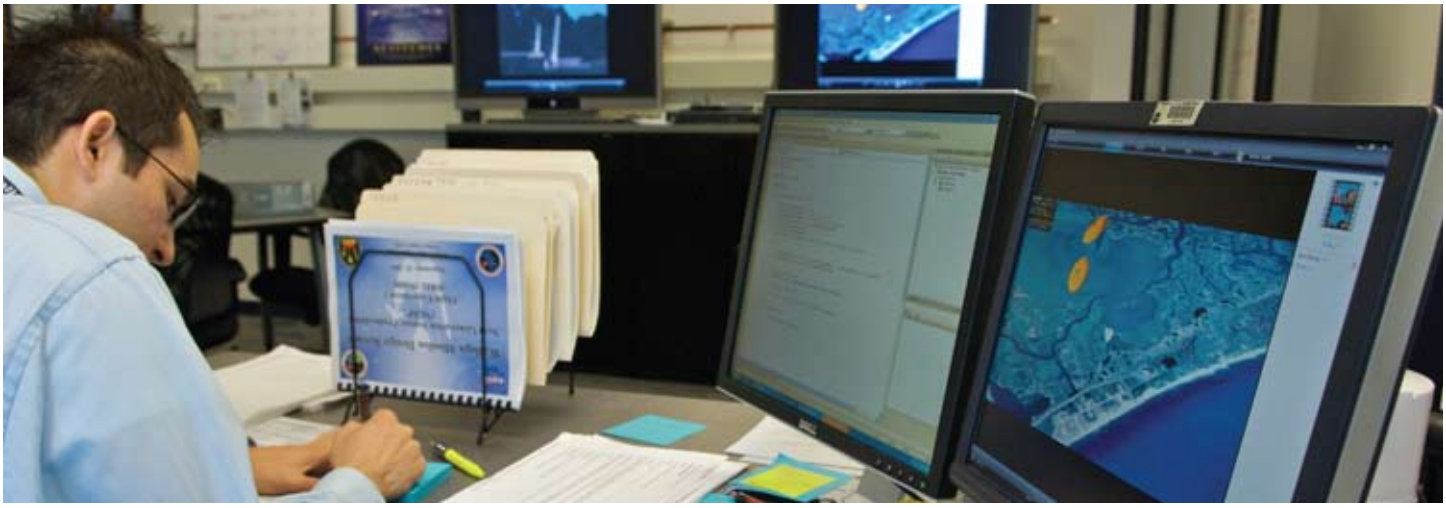
"For outside organizations and other NASA centers, one of the most attractive aspects of the work we do here is time frame. The duration of time between concept and implementation is very short. Satellite missions might take 10 years to collect data. Here, concept to fruition is sometimes just a few months—so you get to see your ideas and test results come together quickly.

— Wayne Powell, Wallops Flight Facility"





Wallops researchers work on a variety of payloads in facilities ranging from calibration to test and everything in between. From left to right: Kenny Hall works on a high-gain antenna for long duration balloon missions; an inertial attitude determination instrument developed for spinning launch vehicles; Valerie Gsell works on an attitude determination star field instrument.



Wallops' Mission Planning Lab features state-of-the-art equipment and expertise for all aspects of orbital and sub-orbital mission operations. Here, Ben Cervantes observes data on the real-time launch vehicle attitude display.

> "The people here are accustomed to wearing multiple hats. We have a broad range of knowledge and ability to get the job done and respond to a variety of needs."
>
> — Wayne Powell, Wallops Flight Facility

Experience the freedom of restricted airspace

"One of the unique advantages of Wallops' location is that we have access to a corridor of restricted airspace from the Wallops runways to the ocean and, therefore, lower flight restrictions," says Powell. In fact, Wallops is one of the few U.S. flight facilities offering this capability. The safety advantage of restricted airspace is that only authorized participants in the exercise are permitted entry. And unlike Wallops' restricted airspace, there are many limitations when flying in the national airspace (over the continental U.S.), including scheduling, duration, and other requirements. "When you're flying an experiment in national airspace, the FAA [Federal Aviation Administration] requires you to have a chase plane," explains Powell. "This makes it infeasible for UAS missions because the whole point is to test without a manned aircraft." It also adds time and research dollars to the mix because another aircraft and more personnel are required.

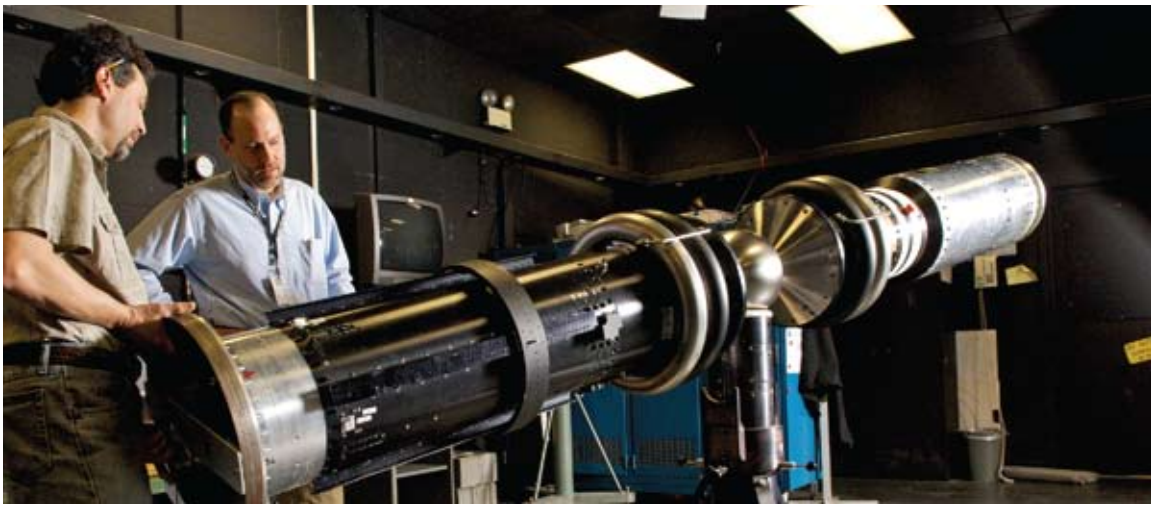
In contrast, Wallops' restricted airspace is free of these concerns because it is restricted to government use—so commercial aircraft schedules need not be a factor in planning. This unique advantage enables relatively unhindered experimentation of technologies and testing of the unique environmental and atmospheric properties over the ocean.

Work with teams small in size, but big in expertise

Another advantage of the Wallops environment is the team philosophy. "We tend to work in small teams, in close partnership with any contractors and outside organizations, with lots of support for ongoing innovation," explains Barton Bull, Chief Engineer of the Wallops Launch Range. "There's a lot of close work between the engineers and the scientists. We really roll our sleeves up and get our hands dirty."

The small-team, hands-on philosophy at Wallops results in concepting, building, and implementing operations that are very agile and flexible to respond to changing needs and technological requirements. Communication tends to be conducted in real time, face-to-face or over the phone, rather than pushing documents back and forth—making teams more responsive and maintaining the integrity of schedules.

But just because the teams are small, they are certainly not lacking in skill set. "The people here are accustomed to wearing multiple hats. We have a broad range of knowledge and ability to get the job done and respond to a variety of needs," says Powell. Indeed, with more than 50 years' experience with suborbital projects, the staff at Wallops provides expertise in all engineering disciplines, flight structures, flight and ground instrumentation, project management, mobile campaigns, and much more. The staff includes scientists, pilots, project managers, engineers, photographers, and safety specialists—as well as technicians of multiple trades.



Gerry Doyon (left) and Doug Voss (right) work on the development of a high data-rate telemetry system that will be test flown on a sounding rocket launched from Wallops.

"When you work on a small team, you're allowed—and even required—to understand more about what the people around you are doing, and you're encouraged to step up to new skills and develop further expertise," says Bull. "This breadth of knowledge and skills certainly adds to the value and responsiveness of our work."

Whether operating on-site instrumentation or traveling the world with Wallops' unique mobile facilities, the researchers, contractors, and partners are offered full support. "Launches conducted at remote sites are common, and the remote teams support each other just as they would here at Wallops," says Bull. "The team is given the authority to solve problems as they arise, find innovative solutions, and feel satisfied that they've contributed to getting the job done."

Be assured of end-to-end implementation for lower costs and faster turnaround

With on-site facilities and labs for safety, control, calibration, fabrication, and launch, Wallops offers a one-stop shop to meet the needs of nearly any mission, end-to-end, with reliability. This self-sufficient nature makes Wallops a very cost-effective flight facility capable of turning around projects with tight schedules, says Powell. "For outside organizations and other NASA centers, one of the most attractive aspects of the work we do here is time frame. The duration of time between concept and implementation is very short. Satellite missions

(continued on page 14)

Coming Soon: The Wallops Research Park

Currently in final planning and approval stages, the Wallops Research Park (WRP) is an initiative by Accomack County, Virginia, NASA Goddard Space Flight Center's Wallops Flight Facility (WFF), and the Marine Sciences Consortium. These three groups have joined forces to establish a 240-acre area adjacent to Wallops that will offer space for the growth of aerospace, research, education, recreation, and commercial activities.

"As part of NASA's master planning process, we recognized that we needed to create an environment where academia, technology, and commercial enterprise can collaborate for activities related to NASA WFF and their partners' work," said Caroline Massey, NASA's project manager for the Park. NASA will be entering into a long-term lease, while Accomack County manages the Park, enabling NASA missions to take advantage of the collaboration that takes place in the Park without bearing a management and institutional burden.

According to Massey, the Park will offer an ideal location for workforce training and development (for NASA, the Navy, and other organizations), as well economic development by hosting commercial businesses that support NASA and other WFF partner missions. Construction is currently planned for late 2008 for the Park's first two commercial tenants, both aerospace companies.

"The Park will enable the region to grow as the nation's preeminent commercial space and launch test facility," said Massey. "One of NASA's strategic goals is to form partnerships with the emerging commercial space sector, enabling them to make use of our unique facilities and capabilities. And the Park will do just that—create the opportunities for this sector to cluster, collaborate, and thrive."

The Park is expected to open for business in late 2008. ■

James "Barton"

As Chief Engineer for the Wallops Launch Range, Barton Bull wears many hats: in the lab, on the launch pad, and at the negotiating table. In this interview, Bull shares a close look at his work supporting many facets of the missions at Wallops, and the exciting work being done at the test range.

> "There always seems to be collaboration happening in one form or another at Wallops. That's our very nature. The facilities are test beds for other companies and other NASA centers to space-qualify their technologies, so we're involved with those collaborations on an ongoing basis."
>
> — Barton Bull

As Chief Engineer for the Launch Range, you must stay quite busy. Can you give readers some background about what your role entails?

I wear some distinctly different hats. As Chief Engineer of the research range, I'm responsible for engineering upgrades to equipment, procuring new equipment, trouble-shooting mission support issues. I help arrange engineering support for missions, and I conduct design reviews and make sure payload requirements are satisfied. Our goal here is to be a "test range for test ranges." That is, to be a flexible proving ground for new launch technologies that can later be deployed on larger, less flexible ranges.

My second hat is worn for leading efforts for the Advanced Range Technologies Initiative [ARTI]. Here at Wallops, we support a broad range of missions. The research range is responsible for successfully launching orbital and suborbital rockets, UAS [unmanned aircraft systems] and aircraft—so it's a complex operation requiring integration, testing, data displays, command transmitters, end-to-end facilities. We have a constant drive to improve and build new systems. My job is to support innovators in their efforts. We work in small teams driven by their own initiative. And I support the work of these teams by nurturing contacts with other NASA centers and outside organizations. I am constantly on the prowl for funding. I act as a liaison between AETD contractors and Wallops, and I help offload the administration, configuration, control, reporting, and other functions that would otherwise drain a small team. We try to keep the designers busy with the designing instead of all these extraneous things. I help provide the machinery to keep these teams going.

It does keep me busy and it's to support the people really doing the innovation. I go to a lot of range safety group meetings to brief them on what we're doing, show them design decisions we're making, and get their input. I spend a lot of time with Air Force groups interested in operational readiness and responsiveness, looking for opportunities where we can work together, and trying to understand their needs that might be fulfilled with our systems. I work with contractors to make sure we have the optimal mix of people on projects. All of this is aimed at letting the designers do their design work. If I can respond to questions and keep them up to date then it saves them from having to stop the important work they are doing.

It sounds like you find the work rewarding. What excites you most about the work happening at Wallops?

My work with ARTI is especially rewarding because we get tremendously good support from the range and mission management offices. They give me a lot of latitude to use the talented people here as I see fit—so we're able to be flexible in assigning people to teams they are excited about, or even have people work with more than one group at a time. We are constantly working on new innovations to support the orbital and suborbital missions here, which is very exciting to be a part of. For example, we're looking into new and integrated surveillance systems—range displays to show where a rocket or UAS is traveling, its health, and its status. We're also looking at many different functions that may be handled by onboard navigation systems to make flight determination more autonomous. This would result in a range free of the expense and constraints

photo credit: Chris Gunn

Bull

of the present infrastructure. The mission planning lab [MPL] is an important part of the effort. The Autonomous Flight Safety System [AFSS] (which we're working on with the Air Force and DARPA) and the Low Cost Tracking and Data Relay Satellite System [TDRSS] Transceiver will also be a part of this tool. So it's very rewarding to work on these types of initiatives that are trying to leverage space-based assets to make our operations less costly, more flexible, and safer. Ultimately, we want to be able to launch from different sites and track more than one missile at a time and to ready missions for flight even faster than we do now. Wallops is being recognized throughout the launch community as a leader in these efforts.

You mentioned the AFSS work with DARPA. You were recently awarded Technology Excellence Initiative funding for this work, correct?

Yes, we're really excited about the TEI funding. We initially received funding from DARPA for the initiative, and then Goddard's IPP Office also encouraged us to apply for HQ's TEI funding. (Editor's Note: Read more about the TEI funding awards on page 12.) The combined funding will make it possible for us to fly our next AFSS test on a sounding rocket here at Wallops (tentatively planned for summer 2008) rather than having to piggyback on another mission's schedule to test it out.

And once testing is complete, what will AFSS help NASA achieve? Why is it ultimately such an important initiative for Wallops?

Well, it's a big step forward from where we are now with flight termination, which is currently done the same way it was 50 years ago. We track the rocket with radar and process telemetry. If there's a problem, a person pushes a button, sending a signal from a powerful transmitter to the rocket. All of these systems have to be extremely reliable, redundant, manned, and maintained—even between missions. Obviously, this is very expensive. With AFSS, we won't need these redundant telemetry and command systems. The modern flight technology that's being developed will autonomously know where the rocket is, whether it has enough energy to make its intended orbit, how long it would take to get to a protected area if there is a problem, and so on. There simply is no other technology—that we know of—that holds as much promise for lowering the cost of safe access to space as AFSS.

So AFSS is part of a larger flight termination system?

Yes, AFSS will be part of the larger space-based range. The elements of this initiative are in various stages of development, and AFSS will require the most time and the most funding—which is another reason why the TEI funding was so crucial. Also, we operate as a safety function, plain and simple. We have requirements for .999 reliability. As you might imagine, this is very difficult to achieve. This will be ARTI's longest initiative, so we really need to have our ducks in a row.

How did you get to where you are now with the initiative?

One of the initial steps was the building of a GPS/IMU simulation facility and development of range-safety decision algorithms. The AFSS effort includes NASA's Low-Cost TDRSS Transceiver [LCT2], which we needed so we wouldn't be limited to line-of-sight on our sounding rockets. A small team from Wallops launched it on an Air Force rocket (the Cosmic Mission), and it was so successful that we were deluged for

(continued on page 15)

photo credit: Chris Gunn

James "Barton" Bull

code: **598**

years at NASA: **16**

education: **B.S., Aerospace and Oceanic Engineering, Virginia Technology Institute**

Wallops Flight Facility announces several recently funded partnerships and offers facilities for use by potential partners.

GSFC Partners with Iridium to Benefit From Iridium's "NEXT"-Generation Communication Capabilities

Under a Goddard IPP-funded agreement, Iridium Satellite Corporation will work with researchers at NASA Goddard to establish application needs and requirements for increasing the data rates available to suborbital missions and to provide the Telemetry, Tracking, and Control (TT&C) function to NASA's low Earth orbiting (LEO) satellites via Iridium's NEXT—the company's next-generation constellation satellite program to be launched beginning in 2013. Iridium's second-generation NEXT commercial communications systems are currently in planning and development. Iridium expects NEXT to provide low-cost, continuous, global Internet protocol data paths in real time without the need for pointable antennas or pre-scheduled access times.

Through the agreement, NASA will be able to influence the NEXT system capabilities to meet NASA mission needs. Researchers expect that the lower costs and continuous access will enable many more small experiments as well as two-way emergency communication services or contingency voice services for manned exploration missions. The results also are expected to benefit space and Earth science missions including sounding rockets, unmanned aerial systems (UAS), and balloons.

A joint NASA/Iridium team led by Wayne Powell at Wallops will be assembled to develop and analyze concepts, document NASA mission requirements, and establish cost versus benefit analyses.

> "The communications work with Iridium has the potential to give NASA flight platforms higher data rates, access on demand, and global availability. These would mean potential cost savings for NASA, and enable a new approach to science by permitting the flight platforms to initiate communications without advanced scheduling."
>
> — Wayne Powell, Wallops Flight Facility

SBIR Funding Yields Sensor to Better Understand Cloud Characteristics

Through a Phase 2 Small Business Innovation Research (SBIR) contract funded by NASA, researchers at Stratton Park Engineering Company (SPEC) have developed prototypes of miniaturized cloud sensors for use on small, unmanned aerial systems (UAS) and balloons at Wallops Flight Facility. Pending testing of the sensors, SPEC expects the technology to provide critical *in situ* cloud data that will help environmental scientists better understand the impact that clouds have on climate. The *in situ* cloud data can be compared with data from ground-based and satellite-borne remote sensors, thereby improving the retrievals that the remote sensors use to characterize clouds. In turn, improving satellite retrievals of cloud properties is critical for refining and validating numerical models that predict global climate change.

SBIR Advances Our Understanding of Clouds and the Carbon Cycle

Two NASA-funded Small Business Innovation Research (SBIR) contracts with Anasphere may enable researchers to better understand the water content of clouds and the carbon dioxide in Earth's atmosphere—helping to meet NASA mission needs while supporting this new business. One of the Phase 2 contracts has resulted in a set of miniaturized cloud-water sensors to be test flown on balloons from Wallops Flight Facility in the summer of 2008, helping scientists determine how the sensor performs for measuring the water content in clouds and potentially the distribution of rain in a storm. The other SBIR Phase 2 contract is enabling Anasphere to develop a miniaturized carbon dioxide (CO_2) sensor for use on unmanned missions. If validation is favorable, NASA and Anasphere expect the sensor to be revolutionary in enabling highly sensitive measurements of CO_2 sources and sinks in the atmosphere, leading to critical understanding of the carbon cycle and climate change. ■

Wallops Sounding Rockets Provide an Ideal Test Bed for NASA Innovators

NASA's Sounding Rocket Program Office (SRPO), located at Wallops, provides suborbital launch vehicles, payload development, and field operations support to NASA and other government agencies through various partnership agreements. For scientific investigators interested in flying an instrument or experiment on a rocket, the SRPO offers a unique opportunity, removing the logistical burdens of these missions and enabling the scientist to focus on the science. The SRPO provides everything needed for most sounding rocket experiments, including:

- Electrical power
- Attitude determination and control
- Payload control
- Telemetry to transmit data back to the ground
- Capability to capture and format data on board
- Positional and trajectory data during flight via radar and GPS
- Planning and implementation of the launch vehicle

The SRPO has integrated as many as 18 different experiments on one payload. This allows the investigator to focus on research and testing while Wallops provides the logistics. In addition, most missions can be completed in about one year from concept to flight, for a fraction of the cost of a typical satellite mission. This provides an ideal training ground for principal investigators looking toward future missions on satellites, as well as graduate students conducting field research.

For more information about submitting a proposal to the SRPO, contact John Hickman at extension 757 824-2374. ■

At left, John Hickman (left) and Karl Haugh (right) work on technology development for sounding rocket missions at Wallops.

Other Goddard Partnership News

Goddard's IPP Office is also pleased to announce the signing of several new agreements.

Partner	Technology/Focus	Agreement	NASA Benefits/Goals
Northrop Grumman*	Development of space-based remote sensing instruments	Space Act Agreement	Scientists will be able to better understand the history and habitability of Mars and other planets, as well as carbon cycles and global climate change.
ITT Space Industries	Mirror technologies for next-generation space telescopes	Space Act Agreement	NASA will save tens of millions of dollars and ultimately shorten mirror fabrication time from two years to about eight weeks.
Microcosm	Exploration of ultra-lightweight mirrors, off-axis telescope design, advanced controls, and nano-materials	Space Act Agreement	NASA's science and exploration missions are likely to benefit through access to new and improved space telescope architectures.

Public Gains Insight Into Goddard Technology and Value at Maryland Space Day

Maryland Space Day attendees learned about valuable partnerships with Maryland-based organizations through a variety of materials and displays.

Representatives from Goddard were on hand to demonstrate how GSFC technologies have benefitted the state of Maryland.

Legislators, members of state departments, media, school groups, and business representatives were among the attendees of Maryland Space Day, held February 21 at the Presidential Conference Center in Annapolis, MD. Sponsored by Goddard's Government and Community Relations Office, the event featured displays of Goddard missions along with innovators on hand to answer questions. Notable presentations included an appearance by Nobel Laureate and physicist Dr. John Mather. Educational materials as well as models of the Hubble and James Webb Space Telescopes were also available.

The event also offered an ideal opportunity to highlight the ways in which technology transfer and partnerships have benefited the state of Maryland and the Maryland economy, said IPP Office Chief Nona Cheeks. "The work of the Innovative Partnerships Program at Goddard helps transfer technologies out of the space program into businesses in Maryland and across the U.S., finding new uses for the technologies here on Earth—and benefiting their business and the state economies as a whole," said Cheeks. "We also look to a growing number of technology-based organizations within the state to form partnerships that will help meet NASA needs. Working synergistically with businesses in the state of Maryland is a win-win opportunity."

The IPP Office presented examples of significant technology transfer partnerships in Maryland that have resulted in advanced materials for instruments and electronics such as medical imaging devices, intelligent highway systems, and others. And the day concluded with a public signing of a very promising new agreement between Goddard and Northrop Grumman's Maryland-based Electronics Systems Sector, the aim of which is to develop advanced remote sensing capabilities to better understand the history and habitability of Mars and other planets, as well as the role of carbon cycles on Earth. (Editor's Note: The Northrop Grumman agreement will be covered in detail in the Summer 2008 issue of *Goddard Tech Transfer News.)* ■

The large turnout at Maryland Space Day included legislators, media, school groups, and local business representatives.

Goddard's IPP Office also attended several other events during Q2 2008:

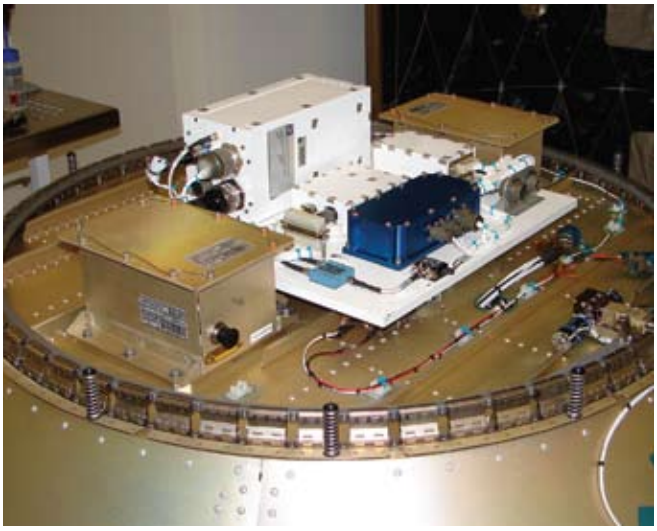
Event/Dates/Location	About the Event	Benefits to NASA GSFC
Game Developers Conference San Francisco, CA Feb. 20–22, 2008	The GDC hosted more than 250 companies, providing networking opportunities and education sessions.	Goddard was able to promote NASA's new massively multi-player online (MMO) gaming initiative, and promote the upcoming MMO workshop. Read more about the MMO initiative in the Winter issue of *Tech Transfer News*.
Project Management (PM) Challenge Daytona Beach, FL Feb. 26–27, 2008	Hosted by NASA, the theme for this year's challenge was "Reach Higher." The event provided opportunities to learn about PM successes, global perspectives, best practices, building effective teams, and more.	IPP Office Chief Nona Cheeks offered insight and partnership best practices in her presentation, "Forming Innovative Partnerships to Enhance Future Mission-Enabling Capabilities."
Missouri Regional SBIR Conference St. Louis, MO Jan. 24–28, 2008	This event hosted SBIR program managers from many government agencies to provide small businesses with the information they need to compete for SBIR/STTR contracts.	The IPP Office's Jim Chern attended the event to provide attendees with insight into NASA's SBIR/STTR program.
Association of University Technology Managers (AUTM) Annual Meeting San Diego, CA Feb. 28—March 1, 2008	About 1,900 participants attended this year's meeting, which was themed "Changing Horizons." Education sessions, workshops, and special-interest meetings explored all facets of technology transfer.	IPP staff were able to gain perspectives on technology transfer activities from the academic community as well as network with other professionals in the technology transfer field.
46th Goddard Memorial Symposium Greenbelt, MD March 5–6, 2008	Sponsored by the American Astronautical Society, this year's theme was "Exploration to Commercialization; Going to Work in Space."	IPP Office staff attended the meeting to ascertain new partnering strategies as well as identify partnering opportunities.
Korea Foundation for International Cooperation of Science and Technology (KICOS) Training Workshop Arlington, VA Feb. 18–29, 2008	This training session hosted managers of Korean government research institutes, universities, and research funding agencies. The workshop was designed to help attendees improve international collaboration by learning from their U.S. counterparts.	IPP Office Chief Nona Cheeks was invited to present to the Korean delegates to share technology transfer partnership negotiation tips, trends, protocols, and best practices. Her presentation also offered examples of spinoff successes.
GSFC Sciences and Exploration Directorate (SED) Poster Session Goddard Building 28 Jan. 16, 2008	This session offered SED innovators an opportunity to highlight current data collection and scientific work, and to network with representatives from various Goddard offices, including the IPP Office.	The session provided IPP Office staff the opportunity to network with the science community in SED about IPP functions and partnering opportunities.

TEI Funding Awarded to Goddard/Wallops Projects for 2008

NASA Headquarters' Office of the Chief Engineer's Technical Excellence Initiative (TEI) provides funding for research and development projects that offer solutions to technical challenges affecting multiple Mission Directorates. Goddard submitted proposals for the two funded projects described below. The IPP Office coordinated Goddard's activity for the TEI Call. The IPP Office congratulates the winners of TEI funding:

Autonomous Flight Safety System

Made possible through TEI and Defense Advanced Research Projects Agency (DARPA) funding, a collaborative arrangement between NASA, the Air Force, and DARPA will enable Wallops Flight Facility and their partners at Kennedy Space Center to help hasten the certification process for NASA's Autonomous Flight Safety System (AFSS). A nontraditional Flight Termination System, AFSS provides trajectory information for flight-termination decisions by incorporating rule-based algorithms coded onto redundant flight processors. The system augments or replaces the functions of traditional ground-based tracking and safety systems and provides for range safety beyond the radar horizon, in the presence of Radio Frequency Interference and in situations requiring minimal response time. The system represents leaps forward in traditional flight safety. This NASA- and DARPA-sponsored effort will enable testing of the merger of AFSS with NASA's Low-Cost TDRSS Transceiver (LCT2), which provides tracking data and other telemetry, including that needed for AFSS verification. The proof-of-concept will be flown on a sounding rocket test flight from Wallops in 2008, led by principal investigator Barton Bull *(read more about Bull's work on pages 6-7).*



The TEI- and DARPA-funded AFSS project (pictured above) is comprised of a team of researchers from Wallops, the Air Force, DARPA, and Kennedy Space Center. The team plans to test fly the technology on a Wallops sounding rocket this year.

Integrated Space Weather Analysis System

From robotic missions to human exploration, space weather has an impact on nearly all NASA endeavors. Principal investigators Michael Hesse (Code 674) and Marlo Maddox (Code 587) have received TEI funding to develop an Integrated Space Weather Analysis System to help better understand and predict space weather conditions as they relate to NASA mission operations. The proposed turnkey, Web-based dissemination system for NASA-relevant space weather information will combine forecasts based on the most advanced space weather models with concurrent space environment information. Customer configurable and highly adaptable, the proposed system is expected to enable retrieval of environmental data and model outputs from a large and evolving list of sources, and then sort and characterize the nature of the data. The output can then be processed into "mission decision supporting" outputs in response to specific user queries and displayed in user-friendly formats. ■

NASA Inventions and Contributions Board Awards

The following awards were issued by ICB during the second quarter of FY08.

Tech Briefs Awards

High-Resolution X-Ray Collimators by Michael Appleby, James Atkinson, Iain Fraser, and Jill Klinger (all Code 682)

Null Assembly with Aspheric Element by John Hannon (Code 440)

Software Release Awards

Core Flight Executive (cFE) Application Program Interface (API) by Nicholas Yanchik (Code 582)

JWST Wavefront Sensing Software by Jeffrey Smith, David Aronstein, and Bruce Dean (all Code 551)

Space Act Awards

Integrated Lunar Information Architecture for Decision Support (ILIADS) by Richard Mullinix (Code 541), Julia Loftis (Code 588), Karin Blank (Code 586), Carl Hostetter (Code 588), Peyush Jain (Code 588), Jeffrey Hosler (Code 588), Stephen Talabac (Code 586), Ryan Boller (Code 586), and James Garvin (Code 586)

Core Flight Executive (cFE) Application Program Interface (API) by Robert McGraw, Alan Cudmore, David Kobe, Lonnie Walling, Jonathan Wilmot, Michael Blau, David McComas, Nicholas Yanchik, Maureen Bartholomew, Susanne Strege, Jane Marquart (all Code 582) ■

Sign Up Now for Tech Transfer Training!

The IPP Office's successful "Introduction to NASA Goddard Technology Transfer" is an 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.

Tech Transfer Training:

dates: **June 26**
September 18
December 2

location: The course is held in Goddard Building 1, Room E100D

to register: Civil servants can register online at https://satern.nasa.gov. Contractors can register by contacting Dale Hithon (301-286-2691), who can also provide further information about the training.

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

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 ins and outs of various agreements, including licenses, Space Act Agreements, Memoranda of Understanding, and more

2008 Tech Transfer Overview Course dates have been scheduled—giving you plenty of time to sign up well in advance. You need attend only one of the scheduled dates. ■

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

"Great overview!"

File Your NTRs on eNTRe

Innovators: Remember to report your new technologies through the online eNTRe system. eNTRe makes it convenient to file your New Technology Reports (NTRs) quickly, easily, and securely. Filing your NTRs enables the Innovative Partnerships Program (IPP) Office to support you by:

- Obtaining appropriate intellectual property (IP) protection for the technology
- Protecting the rights of NASA and of you, the innovator
- Assessing the potential commercial applications for your technology
- Developing a marketing plan in order to facilitate appropriate agreements with non-NASA organizations that may benefit your technology
- Helping you secure awards and additional funding for the development of your technology ■

To get started, visit eNTRe online: http://entre.nasa.gov/

Wallops *(continued from page 5)*

might take 10 years to collect data from the time of concept definition. Here, concept to fruition is sometimes just a few months—so you get to see your ideas and test results come together quickly."

Powell credits the short time frames and cost savings not only to the stocked library of standard components from which extremely flexible flight-support systems are configured but also to the tight-knit Wallops organization. "We have a safety group that works side-by-side with the launch teams. If a safety issue is recognized, it is addressed in real time rather than waiting until the next review." Powell says having the in-house capabilities can save both NASA and its partners research dollars and time. "We can simply do it faster and for less because we can take care of everything in house," says Powell. "We have a machine shop to address and correct mechanical problems. We have calibration labs to take measurements. Without these facilities, we'd have to send things back to the factory when problems arise. It's because we have these end-to-end, in-house capabilities that we are able to achieve these short-duration missions with safety, reliability, and success."

For more information

The Wallops Web site offers a wealth of information about its location, facilities, capabilities, and much more. Visit Wallops online at: www.nasa.gov/centers/wallops ■

Bruce Smith (right) and Con Duer (left) work on a team to develop a beam-steering phased array at Wallops Flight Facility.

The AFSS effort began with NASA's Low-Cost TDRSS Tranceiver, a communication signal relay system that provides tracking and data acquisition services between low earth orbiting spacecraft and NASA/customer control and/or data processing facilities. Bull is principal investigator of a NASA- and DARPA-funded effort that will enable testing of the merger of AFSS and TDRSS systems.

a while. We started producing them for the Missile Defense Agency, for NASA, and for other areas of the military. We originally thought it would just be a TDRSS transceiver to work with NASA's TDRSS satellite at a given wattage—but it turned out that the transmitter found a niche for itself with many of these other groups who were excited about the technology. So we built six of them, but then it was time for someone else to handle the manufacturing.

So this is where technology transfer played a role?

Yes, the IPP Office helped us transfer the technology to an outside company to handle manufacturing: They handle the production of the transmitter, and we can focus our efforts on engineering the transceiver work. So we've discovered the value of tech transfer here at Wallops. In fact, several of the technologies that go into AFSS will most likely be ultimately manufactured outside NASA—so those will involve tech transfer agreements of some kind. It's great that the IPP Office has the infrastructure to handle these agreements for us—because Wallops simply is not a manufacturing group, and we don't want to be. We want to focus on what we're good at. We're glad the IPP Office can put the partnerships in place to make that possible.

Have you found collaboration to be key to this initiative?

Oh, yes. All of our work is collaborative in nature. With AFSS, we're partnering with Kennedy, the Air Force, and DARPA. And the work the IPP Office did to help us get TEI funding—that was a collaboration in itself. And what we're doing with that award lets us augment money that we got from Kennedy, DARPA, and the Wallops range itself. This is very much a collaborative effort as far as the funding is concerned.

Are you working on any other collaborative initiatives?

There always seems to be collaboration happening in one form or another at Wallops. That's our very nature. The facilities are test beds for other companies and other NASA centers to space-qualify their technologies, so we're involved with those collaborations on an ongoing basis. As for some of the larger initiatives, like the autonomous space-based navigation, we're collaborating with the Air Force to port over a new modulation technique they've developed for LCT2. They collaborated with JPL on the technology and are now coming to Wallops for our hardware and facilities.

Along those lines, the Missile Defense Agency will soon be launching a rocket at Wallops that will use the LCT2 box, programmed to increase the frequency to a certain level and sending output to a commercial power amplifier. We'll be collaborating on that effort to test higher data rates for the LCT2. All of these smaller collaborative efforts are making up the picture of a very exciting larger effort.

What do you think is the benefit of these collaborative efforts?

We go all over the world launching payloads, and the needs of these other organizations are often very much in line with ours. We're all in the same business and using the taxpayers' dollars. So if we can work together to make it cheaper to launch a rocket, everyone wins. Also, the expertise and facilities we provide our partners put Wallops in a state-of-the-art position. We also help save taxpayer dollars by leveraging the customer's paid projects. The know-how we gain through these projects can then be transferred to our own NASA missions. So in the end, the customer benefits, the taxpayer benefits, and NASA benefits. Clearly, this is advantageous. ■

metrics

Tech Transfer Metrics January 1, 2008 to March 31, 2008

New Technology Reports: 35

**Software approved for release*

Retractable Tool Tethers by Michael Wilks (Code 597)

Perl Module for Streaming Tar Generation* by Curt Tilmes (Code 614)

Radiation-Tolerant Pulse Width Modulated Motor Controller by David Sheppard, George Winkert, James Odom (all Code 564), and Tom Nolan (Nolan Engineering, LLC)

Superior Piezoresistive Sensor Designs for Rotation or Torque Sensing in Silicon MEMS Devices by Sateesh Bajikar (LW Microsystems, Inc.), Michael Scott, and Edward Adcock (both Langley)

Kameleon Software Suite—Access/Interpolation Library* by Marlo Maddox (Code 587)

Digital Beamforming Synthetic Aperture Radar (DBSAR) by Rafael Rincon (Code 550)

Design and Development of a Radiometer Active Test Sours (RATS) by Jeffrey Piepmeier and Shannon Rodriguez (both Code 555)

Goddard's Opportunity Bulletin Board (GOBBS)—Web Application* by Chris Durachka, Valerie Ward, and Steve Naus (all Code 585)

Superthin/Supersmooth Ultralightweight Composite Optic by Peter Chen (Computer Sciences Corp.) and Gareth Knowles (QorTek, Inc.)

Distributed Transpose for a 2-D FFT on a Cluster of DSPs by Jeffrey Scott Smith (Code 551)

Land Information Sensor Web Service-Oriented Architecture (LISW-SOA), Version 1.0 by Yudong Tian, Sujay Kumar (both University of Maryland—Baltimore County), James Geiger (Code 587), Paul Houser (Code 974), and Hongbo Su (Institute of Global Environment and Society, Inc.)

Lunar Reconnaissance Orbiter (LRO) High Gain Antenna (HGA) by Mahnad Ali (Code 560)

Non-Scanning Laser 3D Imager by Michael Krainak (Code 554)

Ultra Compact Cloud Physics Lidar by Christopher Field (Sigma)

Nano-Structure Mirrors for Diffraction Suppression by John Hagopian (Code 551)

Monoblock Laser for Atmospheric Lidar by Christopher Field (Sigma)

Programmable Digital Controller by Gregory Wassick (Michigan Aerospace Corporation)

Radiation Tolerant Non-Volatile Memory with Hard by Design Techniques by Don Hayashigawa (NXGEN Electronics, Inc.)

Sensor Complete Requirements Algorithm for Autonomous Mobility by Steven Curtis (Code 695)

Earth System Modeling Framework Software by V. Balaji (NOAA), Chris Hill (MIT), Max Suarez (Code 610), and Cecelia DeLuca (UCAR)

Goddard Mission Services Evolution Center (GMSEC) GMSEC Environmental Diagnostic Analysis Tool (GEDAT)* by Brian Gregory (ICs), Ezinne Uzo-Okoro (Code 587), John Bristow (Code 581), Allison Greene (Code 583), and Christopher Shuler (Code 584)

GREAT (Goddard Mission Services Evolution Center (GMSEC) Reusable Events Analysis Toolkit)* by Sheila Ritter (Code 583), Tina Tsui (Code 585), Ryan Turner (Code 581), Lamont Ruley (Code 583), Robert Wiegand (Code 583), Jim Fessler, Zhenping Li, and Cetin Savkli (all Lockheed Martin)

Goddard Mission Services Evolution Center (GMSEC) Criteria Action Table (CAT)* by John Bristow (Code 581), Dan Smith (Code 580), Sheila Ritter (Code 583), Lori Jones (Code 588), Chiu Yeung (Code 585), Robert Wiegand (Code 583), LaMont Ruley (Code 583), Jim Fessler, Cetin Savkli, and Zhenping Li (all Lockheed Martin)

Integrated Trending and Plotting System (ITPS)* by Danford Smith (Code 580), John Bristow (Code 581), Sheila Ritter (Code 583), Haim Brumer, and Denise Reitan (both Honeywell Technology Solutions, Inc.)

Multi Radius Tube Bender by Michael Wilks (Code 590)

Supervisory Survey—Supervisory Feedback Tool* by Leanne Phillips (INDUS Corp.)

Sensor Web 2.0* by Daniel Mandl Code 581), Patrice Cappelaere (Vightel Corp.), Stuart Frye (Noblis), Stefan Falke (Northrop Grumman), Peisheng Zhao, Liping Di, Nengcheng Chen (all George Mason University), David Smithbauer (West Virginia High Technology Consortium Foundation), Robert Sohlberg (University of Maryland), Lawrence Ong (Science Systems and Applications, Inc.), Stephan Kolitz (Draper Laboratory), Stephen Ungar (Code 614), Linda Derezinski (Innovative Solutions), Steve Chien, Daniel Tran, and Mark Johnston (all Jet Propulsion Laboratory)

Electrical and thermal conduction in an interface by use of a copper picture frame and NuSil CV-2946 interface material by Matthew Garrison, Charles Baker, Gilbert Ousley, Juan Rodriguez-Ruiz (all Code 545), and Thomas Ajluni (Code 540)

Real-Time Object Modeling Executive (ROME)* by Kenneth Witt, Jason Stanley, David Smithbauer (all West Virginia High Technology Consortium Foundation), and Daniel Mandl (Code 581)

Compact Planar Microwave Blocking Filter by Kongpop U-yen (Code 555) and Edward Wollack (Code 665)

Goddard Trajectory Determination System (GTDS) Release 2008.01 by Mark Nicholson (A.I. Solutions)

***In Situ* Radiometers: Smaller, Faster, and Scalable to Hyperspectral** by Charles Booth, John Morrow, and Randy Lind (all Biospherical Instruments, Inc.)

Low stress, low profile mount for thin walled glass or ceramic tubes and components capable of large thermal and vibration loads by Michael Amato (Code 101), Steven Smith (Code 544), James Marsh (Code 543), and Kevin Dahya (Code 543)

The Halo & Tardy Response Self-Managing Tagging System by Roy Sterritt, Catherine Mulholland, Patricia O-Hagen, and Edward Hanna (all University of Ulster Northern Ireland)

Loosely Coupled GPS Aided INS for Range Safety* by Scott Heatwole (Code 598) and Jim Lanzi (Code 803)

Patent Applications: 8

Systems and Methods for Transferring Cargo Containers in Space by Frank Cepollina, Mark Brumfield, Jason Budinoff, James Cooper, and Ralph Green (all Code 442)

Method for Non-Destructive Evaluation of Thermal Protection System Materials and other Materials via Ultraviolet Spectroscopy by Betsy Pugel (Code 584)

Systems, Methods, and Apparatus of a Space Communication File by Timothy Ray (Code 584)

A Compact Magic-T Using Microstrip-Slotline Transitions by Kongpop U-Yen, Edward Wollack, Terence Doiron, and Samuel Moseley (all Code 665)

Three-Dimensional Range Imaging Apparatus and Method by James Blair, Luis Izquierdo, and Vibart Scott (all Code 694)

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

Systems, Methods, and Apparatus of a Nitinol Valve by Rebecca Gillespie (Code 695)

Information Capturing Method by Michael Hinchey (Code 694)

Patents Received: 1

U.S. Patent No. 7,346,461: Systems And Method Of Analyzing Vibrations And Identifying Failure Signatures In The Vibrations by Norden Huang (Code 614, retired) and Liming Salvino (Naval Surface Warfare Center) ■