National Aeronautics and Space Administration

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tech transfer

KSC NEWS

CRYOGENICS TEST LABORATORY

James Fesmire has been working in cryogenics for 25 years. Read more on page 4 about how his lab supports NASA missions and his involvement with the Innovative Partnerships Program.

in this issue:

photo credit: **Tom Farrar**, NASA Kennedy Space Center

Meet the Staff: Joni Richards SBIR/STTR Technology Infusion Manager

photo credit: Tom Farrar, NASA Kennedy Space Center

Joni Richards

At times Joni Richards feels like the sports agent in the movie *Jerry McGuire*: "Help me help you," she tells the contracting officer's technical representatives (COTRs) at strategic brainstorming sessions to determine which technologies are worth developing beyond their Phase II results in the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) program.

"When COTRs are able to explain with great enthusiasm how a particular technology can address a Mission Directorate's technical gap," she said, "that's the ammunition I need to represent their interests and to infuse the technology."

As SBIR/STTR Technology Infusion Manager (STIM) for Kennedy Space Center, Richards is essentially a technology "broker." When the matchmaking works, NASA benefits from a cost-effective way to infuse technology into its missions, and small businesses have technology with commercial potential.

The biggest obstacle Richards faces is time, due to the rapid pace of competing technological developments. Because of the long technology-development process—Phase I feasibility studies last six months to a year, and Phase II prototype development can take two years—researchers and program managers need to think ahead about the technical challenges that they will be facing three years from now.

"We don't want to have companies develop a technology for two years, then tell them it no longer meets our needs," she said. "Instead, we want to maintain a collaborative environment through ongoing communication between the small business and the COTR. The role of the COTRs is crucial to the success of infusing a technology, yet their efforts behind the scenes often go unnoticed."

Richards keeps alert to Phase I technologies that can move directly to Phase III utilization, infusing the technology into a mission that much sooner. She also has the ability to scout out Phase I and II SBIR/STTR technology developed at other government agencies, ultimately avoiding duplication of development efforts. She organizes meetings of COTRs that are conducting research in similar technical areas, which gives them an opportunity to discuss the potential of combining efforts and leveraging their technologies to create products and services that benefit NASA as well as have commercial applications.

When that happens, Richards can "show them the money." And everybody wins. ■

NTR Corner: Robert Youngquist

Technology title: **Upgrades to the Surface Light Optimizer Tool (SLOT)**

Inventors: **Douglas Willard, Michael Fuchs, Robert C. Youngquist**

Case #: **KSC-13074**

Photo credit: Tom Farrar, NASA Kennedy Space Center

The SLOT device, which attaches to installed spacecraft windows via a hand-pumped vacuum, reveals damage or defects that can compromise the window's performance.

What it is: The SLOT uses water and light to detect minute and subsurface defects in Orbiter windows. Such flaws increase the likelihood that a window could break under the stress of launch, a catastrophic event that would cost the crew their lives. This improved version of the SLOT solves design problems that have plagued the original tool since it was invented in the mid-1990s.

What makes it better: The original SLOT had problems with light reflection that reduced its efficacy in detecting window flaws. Several attempts were made to improve the design, but they either failed or introduced additional problems. This new version uses high-quality suction cups and a hand pump to ensure strong bonding to the window. Each suction cup is independently valved, providing redundant attachment. An internal Plexiglas® cylindrical lens with a large water reservoir increases the amount of light that is coupled into the window and removes the need to add water during use, making it easier for inspectors to spot window flaws.

How it might be used: Now in use to locate defects in Orbiter windows, this version of the SLOT may be adopted by the Constellation program to inspect windows on the Crew Exploration Vehicle.

Tech transfer status: No patent application has been filed; the technology is most valuable within the space program on windows once they have been installed. ■

James Fesmire and

While dipping bronze impellers from liquid nitrogen to water and back again a thousand times over during his first job at Kennedy Space Center (KSC) as an engineering student in 1983, James Fesmire had plenty of time to contemplate how liquefied nitrogen works and the concept of cold. He has been hooked on cryogenics ever since. In 1997, he started KSC's Cryogenics Test Laboratory.

Mr. Fesmire, what exactly is cryogenics?

Cryogenics is the branch of physics that relates to the effects of very low temperatures. Cryogenic engineering has to do with the production of cold and how to use it. You can store a lot of stuff in a small space, like liquid hydrogen and liquid oxygen propellants for rockets. You can use them as a cost-effective method of transporting all kinds of industrial gases. And you can use the temperature to do something useful, like freezing old tires so they can be crunched up to make roadways, cooling high-powered magnets to direct the paths of subatomic particles in quantum physics research, performing brain surgery with special instruments, or cooling new power cables for much more efficient transmission of electrical energy.

There is nothing in our modern society that doesn't rely on cryogenics. Food, medicine, manufacturing, recycling, computers, transportation—everything involves cryogenics at some point.

What does the Cryogenics Test Laboratory do?

We have four technology focus areas: thermal insulation systems; cryogenic components, including pumps, valves, and new sensor technology; propellant process systems, such as rocket-loading systems; and low-temperature applications. We have 20 people in our lab, plus guest researchers who come and go, and new engineers we help train in cryogenics and vacuum.

We've done a lot of problem solving for the Space Shuttle, particularly on the external tank, where we demonstrated our new aerogel material systems to insulate certain problem spots. The liquid hydrogen fueling umbilical, for example, now includes our aerogel insulation system to help prevent hazardous debris that could damage the Shuttle.

Our expertise was called upon when a piece of foam insulation broke off during flight and tore a hole in the Columbia. We have developed new cryogenic insulation standards for thermal performance data and testing methods to provide much better understanding of the way launch vehicle insulation systems work in the extreme environments of cryogenics and space flight.

We use a collaborative network approach to work with companies and institutions all over the world. Our cryogenics lab doesn't support just one project, program, or function. We're here to develop the technologies of tomorrow while helping with the low-temperature problems of today.

We do long-term research with practical applications. Our approach is to take a look at the total system and think how to achieve the most energy-efficient and cost-effective products. We come up with new methods of cryogenic testing and have patented a whole family of insulation test instruments, called cryostats. We've helped develop aerogel and polyimide composites, and we have patents pending on them as well as on foam, plastics, and multilayer insulation materials. We have experience with novel designs for valve, pumps, heat exchangers, and sensor applications. We also take things that have

Brekke Coffman fills the Cryostat-4 with liquid nitrogen to test new insulation systems for future space exploration missions.

the Cryo Crew

been developed for moderate temperatures and work with industry to redevelop them to work for cryogenics.

What are aerogels?

Modern aerogels are low-density, solid-state foams with pore sizes inside the material typically around 10 nanometers—a true nano-material that works as the world's best thermal-insulating solid. Because of the unique physical and chemical properties of aerogels, we can use them to insulate elements that are impossible to insulate with conventional materials. In the early 1990s, I was part of a research project on xerogel, a very dense structure in the form of a thin film sealant that solved problems with leaks in vacuum systems. At the time, vacuum-jacketing of piping and tanks was the only way to go in cryogenics. However, vacuums are expensive to effect and maintain, and if you lose your vacuum, you also could lose your precious supply of argon or helium. We needed something more reliable and more forgiving for a wider range of applications. So I thought of making a flexible aerogel that could be used easily in piping designs. This aerogel turned out to be the answer.

So aerogels are important for your laboratory?

Aerogels were the impetus for starting the Cryogenics Test Lab. Among my responsibilities in the 1990s was to test materials to produce thermal-conductivity data under cryogenic and vacuum conditions. We couldn't do that with aerogels. The material was too good for the standard instruments available. I had to find something that would test its limits under real-world, actual-use conditions.

So, I invented a machine, Cryostat-1, a 1-meter-tall insulation test instrument using different vacuum levels and liquid nitrogen evaporation to measure heat energy. We've since built several improved models in different configurations for all types of materials and have four patents for them. Our cryostats give precise thermal performance measurements in a simple, economical way. They can measure a very wide range of heat leak rates, down to milliwatts, and in environments ranging from high vacuum to ambient pressure.

In 1997, I began working with Dr. Stan Augustynowicz through a Space Act Agreement (SAA) with MVE Inc. (now Chart Industries). The two of us were a little crazy about cryogenics, but we had a long-range vision. And we had this insulation testing capability to build on. Together, we drafted a plan for a research testing laboratory that would be unique, dedicated to cryogenic applications across the board, and responsive to people who were working to solve low-temperature problems.

If you have worked under SAAs, you must have been involved with the Innovative Partnerships Program (IPP), right?

Oh, yes. Our lab got its start with aerogels, and our work with aerogels got its start through the IPP's SBIR (Small Business Innovation Research) program. In 1992, I wrote a solicitation for the flexible aerogel blanket insulation. Aspen Systems in Marlborough, Massachusetts, responded. We started a Phase I feasibility study, which led to a Phase II prototype, and eventually that work resulted in a spinoff company, Aspen Aerogels.

We also enter into reimbursable SAAs with companies that want test data for their standard materials or that want to develop new materials for new applications. Anytime you introduce a new material, you have to

continued on page 9

Barry Meneghelli performs surface area analysis of an aerogel material.

Partnership Boosts Critical Care on Ground

If you decide to abort a mission after launch, you have to be very sure you're right. A judgment error one way could cost millions of dollars; erring on the other side could cost lives. And if the launch vehicle has a built-in program that automatically aborts the mission under certain conditions, you need to make sure it has no foundational or information technology glitches.

A team of researchers from Kennedy Space Center (KSC), Stennis Space Center (SSC), and the Applied Research Laboratory at Penn State University took on the challenge of ground operations health management, under the auspices of the 2007 Partnership Seed Fund from the Innovative Partnerships Program.

Future ground operations will require a quick turnaround as more missions are launched. Spacecraft can be processed faster if more tasks are done with the assistance of automated systems. To that end, the team designed software that makes decisions based on data from sensors, uses data-management standards, and has interoperable modules.

"The demonstration with an operational system lends important credibility to the accomplishments," said Fernando Figueroa, the co-principal investigator from SSC. "A next step would be to use the methods and technology to implement a pilot capability for ground operations at KSC, or for a rocket engine test stand at SSC."

In February 2008, the team demonstrated a pilot implementation of an integrated system health management (ISHM) capability at KSC's Launch Complex 20. The demonstration included several significant accomplishments, including the detection of anomalies such as sensor failures and leaks, determination of causes and effects, communication among health nodes, and user interfaces. KSC project manager Michelle Amos commented, "Implementing the ISHM concepts significantly improves launch availability for the Constellation program." ■

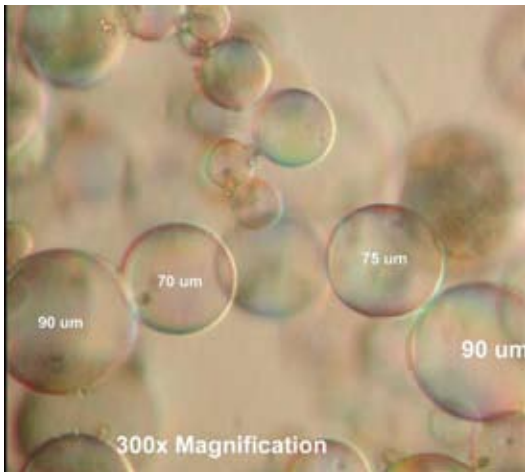
Tiny Bubbles Celebrate Seed Fund

The koozie on that 850,000-gallon can of liquid hydrogen (LH2) sitting on the launch site could use an upgrade. A 2007 Seed Fund project proposed by researchers at Stennis Space Center (SSC) solidified a partnership among researchers at Kennedy Space Center (KSC), 3M, and Technology Applications Inc. that could modernize large cryogenic tanks around the world.

For decades, large cryogenic storage tanks have been insulated with perlite. However, as the perlite degrades with age, it loses its insulation efficacy. In 2000, KSC's Cryogenics Test Laboratory (see page 4) began testing glass bubbles as bulk-fill insulation. By 2006, research on small vessels had determined that the glass-bubble insulation reduced liquid hydrogen boil-off losses by more than 30 percent.

According to the Seed Fund project co-principal investigator, Jared Sass, "Extending the data from the lab scale tanks to the launch pad tanks would require one giant leap of faith." To bridge that gap, KSC collaborated with SSC on a proposal to perform a full-scale field demonstration on a large cryogenic tank. The project was designed to allow engineers to test the thermal performance and understand the logistics needed to install glass bubbles in cryogenic tanks of any size.

In September 2008, the team installed glass bubbles in a 50,000-gallon tank at SSC after removing perlite that was installed in the 1960s. Once the tank is filled with LH2, the team waits, monitoring the liquid level for the next couple of months to assess how well it protects against heat and boil-off losses.



These glass bubbles are being tested as a new insulation material for cryogenic storage tanks as part of a project funded by IPP's Partnership Seed Fund. (image courtesy of Jared Sass)

"This Seed Fund project has been immensely important in moving this technology from the lab to actual use in the field," Sass said. "The results will provide the basis to effectively trade the increased insulation expense up front to get a payback in 2 to 10 years, and savings for decades after that."

The program is gaining traction. Glass-bubble insulation is being considered in the refurbishment specification for the LC-39B LH2 tank for the Constellation program. ■

Voltage Sensor Charged for Success

A spark is all it would take to wreak havoc or catastrophe in the space program at any step along the way to launch. Static charge buildup causes problems for Kennedy Space Center's (KSC's) operations because of the flammability of fuels for rockets and the delicacy of spacecraft electronics. Static can build during the manufacturing process, and KSC needed a way to detect static charges generated after assembly workers entered a facility.

QUASAR Federal Systems (QFS) developed a Remote Voltage Sensor (RVS) that can detect a potential charge of 100 volts from 1 meter away. The device is small enough for workers to comfortably wear and has no moving parts, thus eliminating it as a charge source. The RVS consists of a dime-size sensor that can be affixed to a cap or collar to communicate with a control module about the size of a pager that can be clipped to a belt. The system, the first to allow practical, real-time monitoring and detection of electrostatic hazards at a distance, is portable, rugged, low power, and low cost. Its ability to alert workers to potentially explosive conditions could save lives.

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs give small high-tech companies and research institutions the opportunity to participate in government-sponsored research and development. KSC's SBIR partnership with QFS is one example.

The SBIR Phase I feasibility study was completed in 2004; Phase II prototype development was accomplished in 2005 and 2006. In 2007, the Department of Defense's Defense Advanced Research Projects Agency (DARPA) heralded QFS for its advances to state-of-the-art defense technology.

QFS, which has a patent pending for its RVS, has gone on to craft a strategic alliance with MKS Instruments, a global provider of instruments and subsystems that analyze and control critical parameters of manufacturing processes. MKS incorporated the RVS into its product line. The RVS system is finding success in sensitive manufacturing facilities such as those that produce semiconductor wafers and flat-panel displays. ■

The lightweight Remote Voltage Sensor enhances personnel safety and device protection. (photo courtesy of QUASAR Federal Systems, Inc.)

Q&A

Q: When should I file a new technology report (NTR)?

A: The earlier the better.

- An NTR should be submitted as soon as you recognize that you have a new invention. This may occur in the middle of a project while R&D is still ongoing, or it may be during normal end-of-project reporting. The process of writing programmatic and mission progress reports also may assist you in recognizing and describing a new innovation.
- The earlier your invention is reported to the Innovative Partnerships Program (IPP) Office, the more effectively and efficiently IPP can help protect NASA's interest in the technology as well as seek external partners.
- Even if your invention is "just an idea," filing the NTR right away enables IPP to provide guidance and assistance.
- Most importantly, you should submit the NTR before making any public disclosure of your innovation. Premature disclosure could result in NASA losing its rights to the invention, which jeopardizes partnership opportunities and eliminates the possibility of royalty payments to you and Kennedy Space Center.

You can file your NTRs online at http://entre.nasa.gov. For more information, contact Lew Parrish in KSC's Innovative Partnership Program Office (Lewis.M.Parrish@nasa.gov or 867-5033). ■

photo credit: James Blair, NASA

photo credit: Stafford-Harnett, NASA

photo credit: Stafford-Markowitz, NASA

A FAST Flight Yields Key Data for New Technologies

A new effort by the Innovative Partnerships Program is providing a unique opportunity for recently developed space hardware to be tested in a microgravity environment at Ellington Field near Johnson Space Center.

Testing new technologies in weightless conditions is an important step in making them available for applications in NASA space projects. So IPP created FAST, which stands for the Facilitated Access to the Space Environment for Technology Development and Training program. The first FAST flights, which were sponsored in part by NASA's Strategic Capabilities and Assets Program (SCAP), occurred in late August with the second round occurring a few weeks later.

Through the FAST program, IPP has tapped into SCAP's contract with the Zero Gravity Corporation of Las Vegas, Nevada, an FAA-approved company that provides weightless flights for entertainment, tourism, research, and education. By leveraging that contract, IPP is able to partner with competitively selected companies so that their technologies can be flown in the low-gravity environment of a parabolic flight. This flight opportunity is particularly important for innovations that are not sufficiently mature for adoption into major development programs.

"We see FAST as an excellent opportunity to partner with technology providers to further the development of their technologies," said David Makufka, chief of KSC's IPP Office. "FAST helps minimize risk to NASA missions by providing valuable reduced-gravity flight time for not only the technologies but also the developers.

Enabling Efficient Use of Cryo Fuels

Sierra Lobo, Inc., of Fremont, Ohio, has used funding from SBIR* and IPP's Partnership Seed Fund to develop Cryo-Tracker®, which was tested in KSC's Cryogenics Testbed Facility (see page 4) and now has flown aboard a FAST flight. The Cryo-Tracker mass gauging system is designed to accurately monitor the amount and condition of cryogenic fuels, helping ensure that engines use them efficiently during launch. Efficient use of fuel can free up weight and space, making room for more equipment and experiments.

Relevance to NASA missions: Laurie Walls, a Launch Services Program thermal/fluids analyst at KSC who has helped test Cryo-Tracker, has noted that its versatile design allows it to be used on expendable launch vehicles, such as the Delta and Atlas rockets, as well as Constellation Program launch vehicles and spacecraft. It also can be used in research projects and in ground testing and storage of cryogenic propellants.

The FAST experience: After flying aboard a FAST flight, Sierra Lobo's director of research and technology Mark Haberbusch said, "The flight opportunity provided by the FAST program is what the space program needs to qualify and prove new technologies in a relevant environment, especially those technologies developed by small businesses.... We were very successful and grateful for the funding and technical support provided by the NASA Launch Services Program and the Florida Institute of Technology."

Mining the Moon

Another example of a mission-relevant technology flown on FAST is the Pneumatic Mining System being developed by the SBIR company Honeybee Robotics Spacecraft Mechanisms Corporation of New York City. This novel method for excavating lunar soil is expected to use less power and have lower mass, less mechanical complexity, and better durability at extreme temperatures compared to existing systems.

Relevance to NASA missions: The SBIR-funded technology is directly relevant to the Lunar Precursor and Robotic Program (LPRP) and human lunar exploration mission objectives. The same technology could have applications on Mars, for mining asteroids, and even for terrestrial drilling in polar regions.

*SBIR = Small Business Innovation Research

The FAST experience: Although FAST's September flight schedule was cut short by Hurricane Ike, engineers' spirits were not dampened. "During our first day, we performed preliminary tests and, later that day, did some trouble-shooting to improve measurements," said Kris Zacny of Honeybee Robotics. "Our second day was almost perfect. We achieved 90% of the test requirements…. It looks like lower gravity does have a positive effect on the efficiency of pneumatic soil transfer."

A Valuable Program

The companies participating in the FAST flights definitely recognize the IPP program's value. "Having this 2-day experience of reduced-g flights, we are now much more experienced and know exactly how to prepare ourselves and experiments for the next flights," said Honeybee's Zacny. Sierra Lobo's Haberbusch added, "The data was just what we needed to validate the technology. "

IPP, which covers the cost of the parabolic flight while companies pay to integrate their experiments and conduct the tests during the flight, plans to have more flights in the months to come. More information about FAST is available online: http://www.ipp.nasa.gov/ii_fast.htm ■

Providing a Home for FAST Experiments: FASTRACK™

KSC researchers and Space Florida have been collaborating to develop an adaptable, robust carrier for space experiments. Designed to accommodate two standard Space Shuttle middeck lockers or one double locker, FASTRACK™ will enable investigators to test experiments, apparatus, and analytical techniques in hardware compatible with the International Space Station. The system also can be used to perform reduced-gravity science experiments as part of FAST or other parabolic flight opportunities.

photo credit: NASA

KSC project manager Jim Ball tests the FASTRACK™ on a low-gravity engineering unit test flight.

FASTRACK's performance was tested in September, when it carried three science investigations on a parabolic flight. Its development was co-sponsored by Space Florida, IPP, and NASA's Science Mission Directorate. Design, fabrication, and testing of the experimental rack also involves the Bionetics Corporation of Newport News, Virginia. ■

Innovator Insights *(continued from page 5)*

know how it will affect other materials, its wearing characteristics, its response to hostile conditions, and on and on. Before you manufacture billions of parts, you need to know how they will behave over time and under extreme conditions.

With the help of the IPP Office, we currently have SAAs with 3M, Cabot Corporation, and Lydall for testing many different thermal insulation systems. We continue to work with Aspen Aerogels and provide testing services throughout NASA and the aerospace industry.

We have several patents on our cryostat technologies, layered composite insulation system, and aerogel foams and plastics, and we are open to licensing possibilities.

What's ahead for cryogenics?

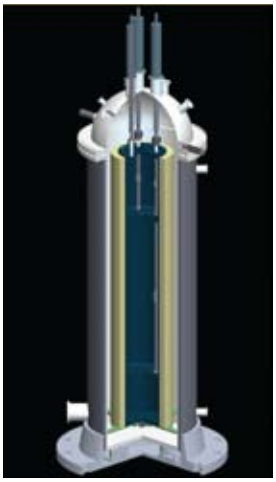
Our goal is to make cryogens flow like water, which I estimate should take only about 50 years more. The challenge with a hydrogen economy is producing, storing, and transporting a boiling liquid. Liquid hydrogen is –423 °F; the Earth is +80 °F. That's a 500-degree temperature difference. To start with, we need to have very good thermal insulation over everything. Aerogels will certainly help, but the entire system design and operation must be optimized for energy efficiency. That is the key.

I believe in thinking big and working small. We must do our part in preserving Earth and learning from space. Saving a few percent of trillions of kilowatt-hours saves billions of dollars, and that to me is very exciting. Energy conversation and energy independence go hand in hand, and insulation is in the middle of all of it.

We intend to stay relevant to NASA missions today and tomorrow because we have an impact on improving the lives of human beings today and tomorrow. ■

Partnership Strengthens Aerogels

Kennedy Space Center and Cabot Corporation have entered a partnership that aims to develop thermal insulation systems capable of supporting significant mechanical loads. Until now, systems for low-temperature piping and storage tanks have required separate components for thermal insulation and structural support. Because structural supports account for up to half of the total heat load, the designs have been somewhat inefficient. The advent of nanoporous aerogels may change all that.



NASA's Cryostat-100 is critical in the execution of the partnership between NASA and Cabot.

The KSC and Cabot collaboration could bridge the gap between thermal efficiency and mechanical functionality by developing a substance with the strength to provide significant structural support without robbing the system of insulation quality. Nanoporous aerogels are known for their best-in-the-world thermal insulation ability. Recent developments indicate that packaged forms of granular aerogel can support significant mechanical loads.

Cabot, a global provider of fine particle technology, will prepare several samples of granular aerogel with various opacities and particle sizes and distribution. Cabot will perform the initial tests on the samples to determine thermal performance at cryogenic temperatures and under various conditions, such as vacuum or compressed environments.

KSC will test the most promising samples in its state-of-the-art Cryostat-100 instrument and 1,000-liter tank in the Cryogenics Test Laboratory (see page 4). The tests will determine the absolute k value of the load-supporting aerogels and compare their performance to existing insulating materials.

KSC will use the best-performing materials to construct piping and tanks that transfer and store cryogenic fluids. The tanks and piping need high-performance insulation to lessen the work necessary to reduce boil-off of these expensive liquids.

The new material holds potential for commercial application in liquefied natural gas (LNG) applications, such as piping, storage tanks, and transport vessels, as well as in storage and transportation systems for cryogenic liquids. ■

Breathe Easy: Partnership with BCS Life Support

Emergency personnel might one day have a better air supply source, thanks to a partnership between KSC and BCS Life Support.

KSC and BCS Life Support are working together to expand the usability of cryogenic liquid air (LAIR) in self-contained breathing apparatus (SCBA). Such a collaboration is expected to benefit not only emergency workers at KSC, who currently use a Liquid Air Pack SCBA, but also for public safety first responders, who currently use compressed air.

"Compressed-air SCBAs have been slowly improving over the last 20 years to a point where it is now common to have firefighting SCBA apparatus operating at 4,500 psi," explained KSC's Don Doerr, who is participating in the partnership. "This has been made possible by the use of new materials, such as composites and fiber-wound cylinders, for the storage vessels (tanks)." However, these high pressures bring safety risks that make the use of alternative air supply methods, such as liquid (cryogenic) air, more attractive.

Air stored as a cryogenic liquid will provide about twice the volume of ordinary com–pressed air; however, expanding LAIR's use within the emergency-response industry requires two technology advances. First is storage, maximized so that the LAIR does not "go bad" (via oxygen enrichment) before it can be used. "As you might guess, air at –320 °F will eventually boil off to a gas because of heat leaks into the system," said Doerr. "Basically we're looking to take the approach we use here at KSC with storage of liquid oxygen and apply it to liquid air, achieving the efficiencies that would allow LAIR to be stored for longer periods of time."

Second, the LAIR must be extractable from the SCBA tanks regardless of how they are physically oriented (i.e., the vessel must be attitude independent). The latter advance is required in order to meet the standards of the National Institute of Occupational Safety and Health (NIOSH). "If our work with BCS is successful, we could gain NIOSH certification for our Liquid Air Pack," Doerr noted. ■

Eclypse Circuit Analyzer Goes to War

Eclypse International has deployed a Kennedy Space Center (KSC) technology to Iraq and Afghanistan. The Corona, California, company that develops automated test equipment and specializes in circuit analyzers obtained the exclusive license for an instrument that detects failures in wires. The company is marketing the device as the ESP-Hand-held Standing Wave Reflectometer and sending it overseas in repair kits of Army and Marine Corps troops.

photo credit: NASA Kennedy Space Center

Inventor Pedro Medelius with his standing wave reflectometer (in his right hand), which was licensed by Eclypse International and introduced as a commercial product (in his left hand).

"It's very satisfying to know that this technology developed for NASA has applications in our military and our general aviation industry," said Pedro Medelius, the lead inventor of the device and an associate program manager and chief scientist with ASRC Aerospace Corporation at KSC.

The technology enables the user to rapidly connect, detect, and locate hard faults in wiring assemblies. The device performs the test in 4 seconds and displays the failure location in alpha-numeric characters. Though early models of the handheld device required an active computer connection, the newest models have the ability to store measurement information in the unit without the need for an active computer connection, an accessory software utility to download stored measurement data, and a measurement reference based on velocity of a known cable type. The device is easy to operate and offers significant cost savings.

The military's battle damage and repair kits use the KSC technology licensed by Eclypse International.

The meters have been included in more than 300 battle damage and repair kits for the Army and Marine Corps, and the Air Force ordered two for each Reserve Base in the country to handle aircraft maintenance. Fort Eustis in Virginia has integrated 100 of the instruments into the Army Aviation Tactical Command school training curriculum. The military plans to train 1,000 troops annually to become experts in locating and repairing battle damage to aircraft and vehicles.

Outside of the military, major airlines such as Continental, Qantas, United Airlines, and the RUAG Swiss Defense Aerospace Group as well as smaller Learjet companies have purchased the units to test for wiring failures without having to disassemble sections of aircraft. Technicians expect to reduce the time for troubleshooting aircraft by as much as 85 percent because the instrument indicates not only what the problem is but also where the trouble spot is along the wire.

NASA engineers use the reflectometer to detect intermittent wire failures in cable used in the Space Shuttle's solid rocket boosters and to locate electrical shorts in cables in the orbiter. The instrument allows engineers to determine if a cable is the source of a wiring problem without having to de-mate both ends of the cable. Once a cable is de-mated, all systems that have a wire passing through the connector have to be retested once the cable is reconnected. Therefore, the reflectometer saves many hours of revalidation testing on systems unrelated to the original problem. ■

Inventions and Contributions Board: A Select Membership

By Carol Anne Dunn

Dr. Jacqueline Quinn

Dr. Robert Youngquist

Do you know who the Inventions and Contributions Board (ICB) members are for Kennedy Space Center (KSC)? Do you know what the ICB members' functions are and when they meet? In my day-to-day activities as the Awards Liaison Officer for KSC, I often ask our scientists, engineers, and technicians these questions. And I am often amazed at the answers I receive. People do not know (a) what happens to their award write up and how it is processed and (b) what a Center's ICB member's function is once the award is processed.

Well, allow me to explain.

KSC has two ICB members: Dr. Jacqueline Quinn and Dr. Robert Youngquist. Both Jackie and Bob, who work within the Applied Technology Directorate with the Applied Sciences Division, were nominated to the ICB a little over two years ago, and their nominations were approved by the Center Director.

The ICB meets every quarter to review and assess the value of technologies generated under NASA funding. When asked how their science disciplines help with their ICB assignments, Jackie and Bob agreed that "it helps with understanding the various submissions as well as in assessing the potential impact on NASA, the government, and society." Bob added that being able to travel to Washington to participate in the ICB meetings at NASA Headquarters is extremely interesting.

They both appreciate having the opportunity to review technology from all 10 NASA Centers. "There is some amazing research being done at individual centers, as well as at KSC," Jackie said. Although she is unfamiliar with some of this research, she believes that being able to review the ongoing research from across the Agency gives ICB members unique insight into NASA's technological endeavors.

Both Bob and Jackie agree that being in a position to reward people for their scientific contributions is highly gratifying. That NASA had the foresight to establish the ICB to encourage scientific endeavor is healthy for the agency and the nation. ■

Inventions and Contributions Board Awards

April 1 to September 30, 2008

†*Contractor*

Board Action Awards:

A Mars Simulation Chamber for the 21st Century by Andrew Schuerger†

Electrical Connector Bulkhead Feed-thru Leak Check Device by Brian Elleman†, Kyle Nielsen†, Scott Gillespie†, and Douglas Buford†

Electrodynamic Dust Removal System by Carlos Calle, Judith McFall†, Charles Buhler†, Ellen Arens, Judson Clements†, and Albert Chen†

ET SLA Cork Ear Protective Cover by Caryl McEndree†

Experimental Modal Vibration Analysis for Condition Monitoring of Large Castings by Rudolph Werlink and Ravi Margasahayam

External Tank Foam Repair Coring Guide by Antonio Rodriguez†, Caryl McEndree†, and James Hart†

Fiber Plant Administration Tool by David Miller†, Doug England, William Toler, and Philip Gvozd

Flow Detection System for the Orbiter Purge Vent and Drain Window Cavity Conditioning System by Barry Slack, Curtis Ihlefeld, and Thomas Moss

General Camera Calibration Method for Bird Vision System by Christopher Immer† and John Lane†

Hydrogen Fire Detector Calibration Unit by William Haskell†, John Gates†, and Robert Youngquist

Liquid Galvanic Coatings for Protection of Imbedded Metals by Louis MacDowell, III and Joseph Curran†

Main Propulsion System Flowliner Shear Tool by Adam Dokos

Mobile Launcher Platform (MLP) Narrow Hand Cart by David Hanson†, John Chamberlin†, and Caryl McEndree†

Modular Wireless Data Acquisition System by Pedro Medelius†, Anthony Eckhoff†, and Norman Blalock†

Reliable Socket Contact Rescue Tool by Jeffrey Thompson†

Three Upgrades Made to the Surface Light Optimizer Tool (SLOT) Used to Inspect Orbiter Windows by Douglas Willard, Michael Fuchs, and Robert Youngquist

Torque Holding Fixture for Forward and Aft Orbiter Handling Shafts by Antonio Rodriguez†

Wireless Vacuum Jacketed (VJ) Fault-Tolerant Instrumentation Software by Bradley Burns†, Carlos Mata†, Angel Lucena, and Jose Perotti ■

Editor's note: Due to space constraints, we are unable to list the awards for patent applications, software release, and NASA Tech Briefs articles.

Kennedy Tech Transfer News

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- 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

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