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## T<sup>2</sup> EVENTS

International Space Congress &  
International Space Exposition  
Hyderabad, India  
September 24-28, 2007

National Manufacturing Week  
Chicago, Ill.  
September 25-27, 2007

Tech Transfer & Early Stage  
Investing Conference  
Boston, Mass.  
October 17-18, 2007

SSTI 11th Annual Conference  
Baltimore, Md.  
October 18-19, 2007

FLC Mid-Atlantic Region  
Annual Meeting  
St. Michaels, Md.  
October 22-24, 2007

2007 Earth Sciences for Society  
Denver, Colo.  
October 28-31, 2007

## T<sup>2</sup> FACT

The first lamp was invented around 70,000 B.C. A hollow rock, shell or other natural found object was filled with moss or a similar material that was soaked with animal fat and ignited. Humans began imitating the natural shapes with manmade pottery, alabaster, and metal lamps. Wicks were later added to control the rate of burning.

- Mary Bellis, About.com

# NEWSLINK

August 2007

## DC ON T<sup>2</sup>

by Gary Jones, FLC Wash., DC Representative



Greetings from D.C. On July 17, the House Committee on Science and Technology, Subcommittee on Technology and Innovation, chaired by David Wu, D-OR, held what appears to be the first in a series of hearings (at least two) on technology transfer, convening a general oversight hearing on Bayh-Dole.

As Chairman Wu noted in his opening remarks, Bayh-Dole was a response to economic conditions the U.S. faced 25 years ago, i.e., recession, declining productivity and increasing competition from abroad. Supporting university-based innovation and technology transfer to industry was an important step in meeting those challenges. He noted that this policy is still important today, but it is now time "to assess the impact of Bayh-Dole and how we can improve technology transfer from Federal investment in technology." To that end, this first hearing elicited university and industry input

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## CORROSION PROTECTION FOR SPACE AND BEYOND

by Luz Marina Calle, Corrosion Technology Laboratory

Since its establishment in July 1962, NASA's Launch Operations Center has served as the departure gate for every American manned mission and hundreds of advanced scientific spacecraft under the Launch Services Program.

The center was renamed the John F. Kennedy Space Center (KSC) in late 1963 to honor the president who put America on the path to the moon. Today, NASA is on the edge of a bold new challenge: the Constellation Program. Constellation is a program to create a new generation of spacecraft for human spaceflight, consisting primarily of the Ares I and Ares V launch vehicles, the Orion crew capsule, the earth departure stage and the lunar access module. These spacecraft will be capable of performing a variety of missions, from Space Station resupply



Anthropometry specialist Mark Boehmer (right) of General Dynamics Advanced Information Systems prepares firefighter Paul Bauer, a 19-year veteran and a part-time firefighter engineer, for a 3-D anthropometry scan while dressed in full turnout gear.

## AFRL IMPROVES FIREFIGHTER SAFETY

by John Schutte, AFRL Human Effectiveness Directorate

A study underway at the Air Force Research Laboratory's Human Effectiveness Directorate (AFRL/HE) could lead to improved safety standards and fewer on-the-job deaths for the nation's firefighters—who are being injured or killed while racing to save the lives of others.

The study was sparked by International Association of Fire Chiefs (IAFC) statistics showing that—due to outdated manufacturing guidelines, the large size and bulk of turnout gear, and inadequate fire engine seat design—25 percent of U.S. firefighters cannot buckle their seatbelts

while riding in a fire engine. Since 2000, 36 of the 52 firefighters who died as a result of traffic accidents involving fire engines were not wearing seatbelts at the time of the accident.

In fact, motor vehicle-related incidents—including

See Firefighter Safety, page 4



KSC's beachside atmospheric exposure site includes a full weather data station, a cathodic protection compatibility tank, seawater immersion tanks, and an onsite laboratory, in addition to the numerous racks for atmospheric exposure.

As the nation's premier spaceport, KSC will play a critical role in this new chapter in exploration, particularly in the conversion of the launch facilities to accommodate the new launch vehicles. To prepare for this

endeavor, the launch site and facilities for the next generation of crew and cargo vehicles must be redesigned, assembled

NASA Corrosion, page 6

# FED LABS FLASH | TECHNOLOGY TRANSFER NOTES

## ORBACH TO LEAD DOE TECH TRANSFER

Secretary of Energy Samuel W. Bodman today strengthened the Department of Energy's (DOE) efforts to transfer energy technologies from DOE national laboratories and facilities to the global marketplace by naming Under Secretary for Science, Dr. Raymond Orbach, as Technology Transfer Coordinator, in accordance with the Energy Policy Act of 2005 (EPAAct).

Secretary Bodman also established a Technology Transfer Policy Board, chaired by the Under Secretary for Science, to assist with coordinating and implementing policies for DOE's technology transfer activities.

The Coordinator and the Policy Board will undertake a comprehensive review of the DOE's technology transfer policies, with the goal of deploying energy technologies to the marketplace at an accelerated rate.

"The Under Secretary for Science is uniquely positioned to expand and enhance the Department's coordination of world class scientific research to further the deployment of technologies that are ripe for commercialization," Secretary Bodman said. "By applying scientific research to develop energy solutions, we are advancing President's Bush plan to

increase the use of cleaner, more efficient energy technologies that will reduce our nation's reliance on foreign sources of energy."

To establish a framework for continuity and uniformity of technology transfer activities throughout the DOE complex, the Policy Board will consist of DOE officials from relevant offices, and will meet to review the technology transfer activities of the DOE national laboratories and other DOE facilities.

The Policy Board will advise the Coordinator on funding for technology transfer activities; efforts to engage the private sector; and review of contract and other legal mechanisms governing access to the Department's facilities by state and local governments, universities and industry.

The Coordinator and the Policy Board will develop a technology transfer execution plan required by EPAAct.

The Coordinator and the Policy Board will establish and oversee the activities of the Technology Transfer Working Group, which will include representatives from DOE national laboratories and other DOE facilities authorized to conduct technology transfer activities, and from field officials responsible for overseeing these technology transfer activities.

## NIST RECOMMENDS BUILDING CODE CHANGES

by Michael E. Newman, NIST Public Affairs

Safer buildings—especially tall structures—that are more resistant to fire and more easily evacuated in emergencies are the goal of the first comprehensive set of building code changes recently approved by the International Code Council (ICC) based on recommendations from the Commerce Department's National Institute of Standards and Technology (NIST).

The recommendations were based on the findings of NIST's three-year investigation of the collapses of New York City's World Trade Center (WTC) towers on Sept. 11, 2001. The changes will be incorporated into the 2007 supplement to the ICC's International Building Code (IBC), a model code used as the basis for building regulations promulgated and enforced by U.S. state and local jurisdictions. Those jurisdictions have the option of incorporating some or all of the code's provisions but generally adopt most provisions.

"We fully endorse these code changes and are gratified that NIST's WTC recommendations have stimulated fundamental and substantial changes in

U.S. building codes and standards that represent a significant improvement in public safety over current practice," said Shyam Sunder, lead WTC investigator for NIST. "NIST is committed to continuing our work to support industry and the nation's building and fire safety officials so that the remaining recommendations are also fully considered."

All but one of the proposed changes (one change was approved earlier) to the IBC based on the NIST WTC recommendations were submitted in March 2006 by the ICC's Ad Hoc Committee on Terrorism Resistant Buildings, its Code Technology Committee and the U.S. General Services Administration.

The proposals addressed areas such as increased resistance to building collapse from fire and other incidents, use of sprayed fire-resistive materials, performance and redundancy of fire protection systems, fuel oil storage/piping, elevators for use by first responders and evacuating occupants, and the number and location of stairwells.

More info: <http://www.nist.gov>



## BUREAU OF RECLAMATION AWARDS CONTRACT FOR HYDROELECTRIC UNITS AT HOOVER, DAVIS AND PARKER DAMS

On July 25, the Bureau of Reclamation awarded a \$984,358 contract to Koontz Electric Company, Inc., of Morrilton, Arkansas, as part of its hydroelectric generator unit control modernization program at Hoover, Davis, and Parker dams.

The modernization includes replacing mechanical and analog control equipment that has been in service for more than a decade with new digital technology.

It also will include the governors, protective relays and other equipment for the 26 generators at the three lower Colorado River dams.

Koontz will install equipment that is being supplied under a \$5.7 million contract Reclamation awarded to L&S Electric of Schofield, Wisconsin, on October 4, 2006.

Work under this contract is expected to be completed in 2012.

## FLC NEWSLINK

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# TECH WATCH | LABORATORY TECHS READY FOR TRANSFER

## ARGONNE'S NANOLUBE

Federally mandated reductions in the amount of sulfur allowed in diesel fuels and lubricating oils will significantly reduce particulate emissions from diesel-fueled vehicles. However, removing the sulfur reduces the lubricating capacity of diesel fuel and lubricating oils, which can accelerate wear in fuel system components and engines. To address these issues, Argonne National Laboratory (ANL) has developed boron-based additives to improve the lubricity of fuels and lubricants. These additives are environmentally safe and inexpensive, and have an unusual capacity to enhance the antifriction and antiwear properties of sliding surfaces in diesel and gasoline engines. The unusual lubricating mechanism of these additives is controlled by their very special chemical structure and their ability to form strongly bonded protective boundary films on rubbing surfaces.

The boron-based fuel and oil additives developed by ANL take advantage of this special structure to enhance the lubrication properties of low-sulfur diesel fuels and lubricating engine oils. ANL's patented nanoboric acid powders and liquid media additives can reduce friction by 50% to 90% (depending on concentration) under a wide range of boundary lubricated sliding conditions.

*More info:* Stephen Lake, 630-252-5685, slake@anl.gov

## NAVY COATING

The Naval Research Laboratory (NRL) has developed a new self-decontaminating coating for use in filters, protective clothing, and disposable wipes that is capable of actively destroying pesticides and related chemical agents on contact. The coating comprises a thin, layered, composite film containing enzymes, which actively degrade chemical toxins, and a polyelectrolyte binder. It is readily applied to substrates such as beads, fabrics, or paper by inexpensive methods such as dip coating, spin coating or spraying.

The Navy's non-covalent method for incorporating enzymes within the polyelectrolyte film maintains enzyme activity, while stabilizing and protecting the enzyme from denaturation due to mechanical, chemical, and environmental stress. For example, filters prepared using beads coated with films containing organophosphorous hydrolase enzyme completely hydrolyzed methyl parathion (MPT) pesticide in an aqueous-alcohol solution under continuous flow conditions at room temperature for at least eight months.

The materials offer unique platforms as effective systems for the active, self-decontamination of chemical toxins for homeland defense, agricultural, and related applications.

*More info:* www.nrl.navy.mil

## PNNL TECH IMPROVES BEER, PHARMACEUTICALS



*This technology can be integrated with a glass fermentor such as this one, allowing a noninvasive online monitoring capability.*

Pacific Northwest National Laboratory (PNNL) has developed a new spin on an existing acoustic inspection technology. This ultrasonic technology eliminates the need for time-consuming and costly sampling of slurries in large containers. Savings like this are particularly appealing to fermentation-based industries, such as beer and pharmaceuticals.

In an experimental or production fermentation process, it is frequently necessary to monitor the growth of organisms within the fermentor. The typical method for doing this is a laborious and invasive process of collecting, diluting and counting a sample at periodic intervals.

Through this technology's capabilities, the size and concentration of particles within opaque slurries can be

tracked by attaching an acoustic-based technology to the outside of a large tank or vat, much like those used to make beer and medicinal drugs.

PNNL's patented technique is novel in its fusion of information extracted from both acoustic backscatter—referring to the deflection of energy from a sent signal—and transit measurements, including velocity, amplitude and frequency data.

Conceptually, this acoustic technology is relatively simple. It consists of either a single transducer or paired transducers—devices that resemble ear phones and that transform electric signals into sound energy—placed on opposite sides of a container. Both the backscattered acoustic signals and the acoustic signals that transit the vessel contain useful information about the slurry.

The signals from the transducers are digitized and analyzed so an operator can immediately detect changes in the fermentation process. The technology can be automated, runs continuously unattended, and can be configured to trigger process controls such as valves and switches.

PNNL has a successful history with acoustic technologies. The laboratory's first acoustic inspection device was originally developed to verify compliance with a bilateral treaty between the former Soviet Union and the U.S. This latest acoustic technology has attracted inquiries from top name breweries in the U.S. and Europe. PNNL is seeking R&D collaborators as further development is likely necessary before the technology can be licensed.

*More info:* www.pnl.gov



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*Firefighter Safety, from page 1*

Mark Boehmer of General Dynamics Advanced Information Systems prepares firefighter Sara Auxier for a 3-D body surface scan in AFRL's computerized anthropometry research and design facility.

ing vehicle rollovers where firefighters are ejected or fall out—are the second leading cause of firefighter line-of-duty fatalities.

Prompted by those numbers, the National Fallen Firefighters Foundation approached Jennifer Whitestone, president of Total Contact, Inc., an anthropometry surface scanning company in Germantown, Ohio, to study the body size and shape of firefighters.

The data will be used to develop new industry guidelines to improve the fit and function of safety equipment, clothing, and vehicles used by firefighters, and will be added to the Air Force anthropometry program database.

“Air Force firefighters and other occupations require personal protective gear, and this study will provide us with an updated anthropometric database of the firefighter population and help define methodologies for improving fit and accommodation,” said Scott Fleming, an anthropologist in AFRL/HE's Biosciences and Protection Division, Biomechanics Branch (HEPA).

Grants totaling \$200,000 from the Department of Homeland Security and the National Institute of Standards and Technology are funding the study. The IAFC, the NFFF, the Safety Task Force of the NFPA 1901 Fire Apparatus Stan-

dards Committee, and the Fire Apparatus Manufacturers Association jointly lobbied for the project to address apparatus design flaws.

A biomedical engineer formerly with HEPA, Ms. Whitestone leveraged resources at AFRL/HE's Computerized Anthropometric Research and Design laboratory via a Cooperative Research and Development Agreement (CRADA) between the Air Force and General Dynamics Advanced Information Systems. The CRADA opens Air Force test facilities and equipment to commercial clients who might otherwise not have access to specialized equipment like AFRL's 3-D anthropometric body scanner.

Scanning began in July on about 30 firefighters—mostly white males—who volunteered as test subjects. A total of 120 firefighters, including females and minorities, are needed to ensure a valid sampling that mirrors the firefighter population.

“Body size is correlated to ethnicity; that's been proven by many anthropometry studies, so we need to account for those body types,” Ms. Whitestone explained.

The study will dovetail with a comprehensive, separately funded project by the National Institute of Occupational Safety and Health (NIOSH) to collect anthropometric data from about 1,000 firefighters nationwide. Coincidentally, NIOSH officials were proposing their study when Ms. Whitestone visited to discuss her project, and she considered using the NIOSH facility in Morgantown, W. Va.

“NIOSH was writing a proposal to measure firefighters in their own study and we were pretty happy about that. But we wanted to use the Air Force facility because it's right here and we could get the study finished more efficiently,” she said. “Plus, I really admire the way AFRL researchers conduct a project. They're very careful and professional.”

Officials of those organizations plan to share information with NIOSH and perhaps broker a formal collaboration between NIOSH and the Air Force.

“We'll transition our protocol and lessons-learned to NIOSH, help train them and help them embark on their national survey of firefighters,” Ms. Whitestone said. “I've always wanted to see these two organizations come together and share information and protocols.”

“This is such a great springboard for the NIOSH study,” Ms. Whitestone continued. “If we can produce results that are useful and of value to the firefighting community and the manufacturers, NIOSH can use that as leverage for additional funding for their study and to help show the merit in what we're trying to do for firefighters.”

A firefighter's bulky turnout gear may weigh from 20 to 40 pounds or more, with bulging pockets of equipment further hindering mobility. When sitting three or four abreast in a fire engine seat, firefighters often cannot buckle seatbelts properly or must use seatbelt extensions.

Even when seatbelts are fastened, they may not work as intended because of improper fit when extended over the firefighters' gear.

Part of the problem is that fire ap-

paratus, including fire engine seats, is manufactured to outdated human design standards developed in the 1970s; but, humans have changed significantly since then.

“Humans have increased an inch per decade in height, and firefighters as a group are heavier than other non-military occupations by about 20 pounds,” Ms. Whitestone said. “And the seats are not designed to accommodate turnout gear.”

Anthropometry studies have been conducted on other professions, including police, nurses, agricultural workers and truck drivers, but this is the first study of firefighters, according to Ms. Whitestone, who points to the irony that such a revered group of first-responders—most of whom are not even full-time professionals—cannot protect themselves as they rush to save the lives of others.

“Eighty percent of the firefighters in the United States are volunteers, and only 20 percent are paid professionals,” she explained. “So we as a nation depend on volunteers to fight fires and put their lives on the line, and it's time we take care of them.”

Firefighters who wish to volunteer as test subjects may contact Ms. Whitestone for more information at 937-855-6107.

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# PPPL ASSISTS IN THE DEVELOPMENT OF ARTIFICIAL MUSCLE



Lew Meixler and Lenore Rasmussen prepare a metal wire sample for plasma treatment at PPPL.

Princeton Plasma Physics Laboratory (PPPL) collaborator Lenore Rasmussen has the gift of serendipity. Two disparate life experiences sparked the polymer chemist's interest in the development of electro-responsive "smart materials"—electrically driven polymers that are strong and durable enough to act as artificial muscles in prosthetic devices and robotics.

Her early experience identifying DNA proteins and an injury suffered by her cousin in a farm accident triggered her interest in development of the materials. She brings to this work an extensive background in chemistry, biology, and biochemistry.

Rasmussen was using electrophoresis—the movement of suspended particles through a gel under the

action of a strong electric field—to separate and identify protein molecules and DNA. "There are little wells in which you put your proteins or DNA samples. You turn on the electricity and watch how they migrate. Different proteins or DNA fragments will go through the gel at different speeds that depend on their molecular weights. The larger, heavier molecules will have a harder time getting through. One of the wells would contain known proteins for comparison. For DNA, the smaller fragments would move further and longer ones would end up closer to the starting point," explained Rasmussen. But, as fate would have it, one day she made a mistake formulating the gel. "I goofed up mixing stuff together and (as a result) the gel responded

to the electricity by contracting—a eureka moment," she said. Later, while she was a grad student at Purdue pursuing a degree in biophysics, one of her cousins was spreading hay on a land reclamation project. He slipped and his leg got caught in the hay spreader. His foot was not detached, but much of the muscle and circulation in the calf of his leg were damaged. Initially, doctors were not sure he would keep the leg. If gangrene set in, he would have to have it amputated. "I was the scientist and biologist in the family, so they asked if I could go and look at prosthetics to see what was out there in case he needed one. While I really liked what I saw for legs, I really hated what I saw for arms and hands. As it turns out, my cousin's leg healed. He had a lot of recovery and

still has a slight limp. But I kept thinking about my experience with the gels in DNA analysis and the need for better prosthetics. So I went on to Virginia Tech partly to get the background in polymer chemistry that I would need to develop artificial muscles," said Rasmussen.

Currently, prosthetics for the arm and hand are not functional unless they utilize three-pronged metal devices that are controlled mechanically. Rasmussen wondered if a prosthetic limb could respond directly to a neural impulse and whether they could be made more attractive and highly functional. In 2003 she established Ras Labs, LLC, a small, for-profit, innovative research and development laboratory devoted to projects that utilize polymer chemistry, biochemistry, biology and engineering. Rasmussen envisions artificial muscles, or actuators, that are comprised of an electro-responsive polymer gel (the smart material) containing embedded electrodes, all encased in a flexible coating that acts as a kind of skin.

The smart material is cross-linked, meaning that a side bond has been formed between polymer chains to increase strength and toughness. The embedded electrodes serve a dual role: providing the electric stimulus, much like a nerve, and attaching the smart material to a lever, like a tendon attaches muscle tissue to bone.

When the electrodes are energized with direct current, the smart material contracts or expands, depending on the formulation. It then relaxes when the current is turned off, acting much like real muscle tissue responding to a neural impulse from the brain. The goal is for both the electro-responsive smart material and the embedded electrodes to move as a unit, analogous to muscles and nerves moving together. Rasmussen tested a variety

*See Artificial Muscle, page 8*

## DC on T<sup>2</sup>, from page 1

on Bayh-Dole. There were five witnesses providing testimony; two from industry (chemical and IT) and three from academia. They were asked to respond to the following general questions: 1) what has been the impact of Bayh-Dole on federally funded university research and technology transfer, 2) how has Bayh-Dole shaped university-industry collaboration, 3) what is the possible effect of the increasing globalization of research, 4) has Bayh-Dole influenced basic university research, academic collaboration and dissemination of knowledge – has it created any barriers, and 5) what changes in Bayh-Dole legislation, if any, may be appropriate as we look forward.

While these bear on the overall assessment of the current legislation, the top four feed directly into the last—which could have an impact on the tech transfer community going forward. Given space constraints, I point you to the submitted witness testimony and highlight some of their comments below—particularly concerning what they see as any

challenges Bayh-Dole has created and their thoughts on proposed legislative fixes.

Not surprisingly, academic and industry opinions vary regarding the benefits of Bayh-Dole and its impact on university-industry relations. While acknowledging challenges to implementation, two of the three speakers from academia indicated that they felt Bayh-Dole had been successful in achieving its primary objective—to promote the utilization of inventions arising from federally funded research. One commented that they "believe that Bayh-Dole works well as intended ..." and that it has "encouraged the formation of productive university-industry partnerships..." Another noted that "by almost any objective standard, the Bayh-Dole Act has been an exceptional success." Several of the speakers point to the statistics created by AUTM on licenses, startups and new products introduced since 1980 as evidence to that effect.

The two industry witnesses had quite different impressions on the efficacy of Bayh-Dole. Both speakers

stated that while the Act encouraged technology transfer, its focus on intellectual property (IP), in the words of one, had created a "contentious climate ... which discourages research collaboration between industry and U.S. universities." One gave the Act "a poor to failing grade" concerning its goal of promoting collaboration. In the industry witness' opinion, Bayh-Dole had focused attention away from collaboration and toward ownership of IP, leading to "frustration, mistrust and damaged relationships" and what he termed the "silent breaking," where industry decides it's too costly to work with universities and they "walk away." Both speakers commented on the fact that foreign universities do not have the IP expectations created by Bayh-Dole, causing industry to look outside the U.S. for university collaborations.

The issue of Bayh-Dole and university-industry collaborations implies that the university research is supported in some way by federal funding in the first place. This was a significant discussion point for both industry panelists, in questioning what level of federal funding is needed to trigger Bayh-Dole rights by universities. As one stated, "U.S. universities have

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*NASA Corrosion, from page 1*

and tested. One critical factor that is being carefully considered during the renovation is protecting the new facilities and structures from corrosion and deterioration.

*A Resource for Corrosion Research*

NASA began corrosion studies at KSC in 1966 during the Gemini/Apollo programs with the evaluation of long-term protective coatings for the corrosion protection of carbon steel. The KSC environment near the launch pads has been documented by the American Society of Materials (ASM) as one of the most corrosive, naturally occurring environments in the world. With the introduction of the space shuttle in 1981, the already highly corrosive conditions at the launch pads were rendered even more severe by the acidic exhaust from the solid rocket boosters. In the years that followed, numerous studies have identified materials, coatings and maintenance procedures for launch hardware and equipment exposed to the highly corrosive environment at the launch pads. Research and development of technologies that offer corrosion protection and prevention at the launch facilities are high on NASA's priority needs list.

To combat the harsh environment, NASA established the Corrosion Technology Laboratory at KSC. This facility has complete capabilities for corrosion research and testing. Scientists and engineers at the laboratory are working to reduce the impact of corrosion and even to develop new corrosion-prevention technologies as NASA prepares KSC for the Constellation Program.

The laboratory facilities include a beachside atmospheric exposure site, an electrochemistry and coating development laboratory, an accelerated corrosion laboratory, a coatings application facility, and a photo documentation laboratory. The beachside atmospheric exposure site includes a full weather data station, a cathodic protection compatibility tank, seawater immersion tanks, and an onsite laboratory, in addition to numerous racks for atmospheric exposure. This site has been actively maintained for more than 40 years and has generated a

historical database for the evaluation of new materials. The site has remote access network connectivity for data acquisition and real-time video by the Internet. These facilities, available to companies and individuals outside of NASA, can provide a way for the finishing industry to advance corrosion-resistant technologies.

*Corrosion-Resistant Coating Advances*

Corrosion in concrete is a major concern in areas with marine environments like the space center.

The Corrosion Technology Laboratory has developed technology to protect both concrete and steel rebar in concrete. KSC's two shuttle launch sites each consist of 68,000 yd<sup>3</sup> of concrete weighing 1.3 million lb. As these two launch pads are being reconstructed to accommodate the manned Ares I (crew launch vehicle) and the unmanned Ares V (cargo launch vehicle) in support of the Constellation Program, the lab will continue developing technology to protect these structures. Recently, a sacrificial galvanic coating was developed to prevent the corrosion of steel rebar in concrete. NASA licensed the patented technology to two companies. The coating is currently being reformulated and tested on structures throughout the world.

NASA uses different types of coatings to protect flight hardware, launch pad structures and ground support equipment. Barrier coatings, such as epoxies and urethanes, are used to isolate the surface of a metal structure from the corrosive environment. Conversion coatings, such as the Super Koropon primer used for corrosion protection of areas throughout the Orbiter, convert the surface into a hard, durable, corrosion-resistant layer. And sacrificial coatings, such as the zinc-rich primers used at the launch pads, offer corrosion protection by corroding in preference to the carbon steel.

Smart coatings, a more recent development, represent the state-of-the-art of coating technology. These coatings sense the environment and provide an appropriate response. The Corrosion Technology Laboratory is currently developing "smart coatings" for corrosion

detection and control at an early stage to prevent further corrosion. The lab is also involved in the development of self-cleaning photocatalytic coatings that remove contamination without human intervention.

*A Better Understanding*

The Corrosion Technology Lab and its work are considered unique within NASA. New procedures have been developed for rapidly evaluating corrosion-resistant alloys, protective coatings and other materials, thereby enhancing the safety and reliability of the nation's launch infrastructure and flight hardware. The results of this research will benefit the new structures for launch. For example, Launch Complex 39B will undergo the beginnings of its conversion to the Ares I facility with the building of three to four new tall lightning masts, followed by stripping the pad of the fixed and rotating service structures currently used to access the shuttle and insert payloads into the Orbiter.

The Launch Complex will resemble the Apollo-like "clean pad" design for the first time since 1977. Two new moveable launch platforms and a launch tower will be constructed to accommodate the Ares I, and a new "roller coaster" escape system, replacing the existing slide wire system, will connect the launch tower with a new fortified bunker located 1000 meters from the pad. Fortifying the new platforms, tower and escape system with alloys and protective coatings will greatly enhance the safety and reliability of this equipment.

KSC corrosion experts use test equipment such as acidic and standard salt spray chambers, weatherometers, AC and DC electrochemical corrosion instrumentation, adhesion testers, data loggers, and other instrumentation to research the corrosion behavior of materials in various environments, including the interiors of the processing facilities and on transport equipment.

The Vehicle Assembly Building is currently undergoing modifications to accommodate the simultaneous assembly and checkout operations for both the shuttle and for the Ares I. Eventually, the building will allow for the assembly of

both an Ares I and Ares V when lunar missions commence after 2018. NASA will also build two new mobile launch platforms designed to handle the Ares I with the current crawler-transporters and will eventually replace the Apollo-era machines with new units when the Ares V goes online. Corrosion-resistant materials are vital to sustain the operability and life of these structures.

Current projects in the Corrosion Technology Laboratory also support the future development of space vehicles by examining technology that will prevent corrosion of materials in the space environment.

These projects include the testing of stainless steel in oxygen-deficient environment and the fracture of high-strength, low-alloy steels. The results of these projects will help protect vehicles launching from a third launch complex NASA is considering — 39C — which will be used primarily to accommodate future Mars missions when more than one Ares V would be required to launch the Mars-bound spacecraft into low-earth orbit.

As NASA prepares to move forward, the Corrosion Technology Lab at KSC will evolve to provide a better understanding of the corrosion processes affecting NASA's redesigned launch sites, structures, facilities and launch vehicles. Such knowledge will undoubtedly benefit the future finishing industry as a whole.



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## MICRO/NANO MACHINES

Lawrence Berkeley National Laboratory (LBNL) is seeking a qualified partner(s) to work in a collaborative effort to further develop, test, and commercialize improved micro and nano machining technologies to manufacture medical cardiac stents used to shore up weak blood vessels leading to the heart.

LBNL's technology offers the potential to lower stent production costs, improve quality, and provide safer operation.

*More info:* Ka-Ngo Leung, KNLeung@lbl.gov, 510-486-7918

## STRONGER PLASTIC, RUBBER

Agricultural Research Service (ARS) scientist Lei Jong has discovered a method using defatted soy products to improve the strength of rubber products. Defatted soy products do not contain soybean oil. All of the steps and the equipment for ARS's method are the same as current commercial practices.

However, ARS's method uses defatted soy flour (DSF) in place of carbon black, which is used in automobile tires and other products to increase their mechanical strength.

This invention can be used in various industries such as rubber, plastic, and coatings to significantly improve the strength and biodegradability of a variety of polymer products.

The advantage of using this technology versus other conventional fillers is that defatted soy products give a higher reinforcement effect in rubbers at a comparative or lower cost.

*More info:* Lei Jong, 309-681-6240, jongl@ncaur.usda.gov

## BUG REPELLANT

Agricultural Research Service (ARS) scientists have isolated a natural compound, callicarpenal, from the American beautyberry that has been shown to repel mosquitoes, ticks, and fire ants. Callicarpenal, an all-natural insect repellent, is an alternative to commercially available synthetic repellents and more effective than currently available natural repellents on the market.

Callicarpenal is as effective as DEET and more effective than picaridin (Bayrepel) in the bioassays used against mosquitoes, and is also as effective as DEET and picaridin against the deer tick. It could be a good alternative to synthetic repellents such as DEET and picaridin, and could be marketed as an all-natural repellent. Callicarpenal is potentially a safer and perhaps more effective insect repellent. The market potential is huge because 38 percent of Americans use a DEET-based product every year.

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## BAROBALL™

Barometric pumping is a remediation technique that removes volatile contaminants from soil in the vadose zone, above the water table. At Washington Savannah River Company (WSRC), scientists have developed a control valve that increases the efficiency of barometric pumping. The BaroBall™ control valve allows natural soil gas to flow out of an underground well, while restricting airflow from the surface into the well. Air flowing into the well from the surface will dilute and possibly spread contaminants still present in the subsurface.

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## MANAGING ADHD

Attention Deficit Hyperactivity Disorder (ADHD), the most common behavioral disorder in childhood, is estimated to affect three to five percent of people in the United States, both children and adults.

National Institutes of Health inventors Maximillian Muenke, Mauricio Arcos-Burgos, and F. Xavier Castellanos have identified haplotypes of latrophilin 3 (LPHN3) that increase the susceptibility for development of ADHD. LPHN3 is a G-protein coupled receptor that is specifically expressed in the brain's mesolimbic system, which is associated with ADHD.

*Applications:* Identifying individuals with enhanced susceptibility for ADHD; using LPHN3 haplotype information to design individualized treatments.

*Licensing Contact:* Tara Kirby, Ph.D.; 301-435-4426; tarak@mail.nih.gov

## HORMONE REPLACEMENT

The utility of estrogenic substances in the practice of medicine is well documented. Estrogens may be used for the replacement of the natural hormone estradiol in hypogonadism, following the removal of the ovaries, or cessation of ovarian activity during menopause. Inventor Hyun K. Kim of the National Institutes of Health announced a new family of novel, active estrogens that are nitrate esters of estradiol. These nitrate esters possess enhanced estrogenic activity following oral administration. estrogens.

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## LANL SENSORS

Los Alamos National Laboratory (LANL) scientists are looking for industry partners to develop and commercialize sulfur-resistant, high-temperature, solid-state gas sensors using patented chemically modified terbium-yttrium-zirconium oxide (Tb-YSZ) ceramic coatings. LANL gas sensors can be used to monitor the presence and concentration of O<sub>2</sub>, CO, NO<sub>x</sub>, and hydrocarbon with superior selectivity in most environments, especially in corrosive and high temperature settings.

*More Info:* Michael Erickson, 505-667-8087, michaele@lanl.gov

## TRAINING SKILLS

An innovation from NASA's Langley Research Center (LRC) is a system of providing physiological self-regulation training for mental or physical optimizing purposes in sports or other complex skills, or for treating health problems, through the trainees'/users' psychophysiological signals.

The method provides for real-time modulation of task/environment interface that would allow a trainee to learn physiological self-regulation in order to modify the difficulty of the performance task and/or environment in which training is conducted. Employing proven techniques in biofeedback and physiological self-regulation, in conjunction with the innovation described herein, would enable athletes to develop self-efficacious outcome responses that can be translated into the operational domain of athletic competition.

*More info:* <http://technology.nasa.gov>

*DC on T2, from page 5*

taken the position that virtually all privately sponsored research is at least 'touched' in some way by federal funds and, therefore, subject to Bayh-Dole."

The third academic took somewhat of a middle-ground position, noting that the "effect of this surge in university patenting (facilitated by Bayh-Dole) has been both good and bad." The Act has, in fact, encouraged the introduction of new products into the marketplace, particularly in the biomedical field. On the other hand, he felt that universities often have a "short-run" bottom line perspective on licensing priorities, which in industries like IT can hinder rather than promote the dissemination of knowledge and product introduction. He highlighted the point made by others, that Bayh-Dole's impacts are industry-specific; often considered more positive in the bio field where exclusivity is key, while less supportive for IT where exclusivity can interfere with technology development. Regarding "what would they change," the comments ranged from leaving the language as is to suggested minor tweaks. From the academic side, the suggestions were aimed more at improving existing oversight actions. One noted that there was "a glaring weakness in the absence of effective Executive Branch oversight," indicating that implementation of Bayh-Dole was "increasingly uneven across federal agencies" and that it might be time to move this responsibility

from the Department of Commerce to the Office of Science and Technology Policy." Another encouraged greater attention to the oversight function regarding the provision to limit exclusive licensing and exercising march-in rights (if ever necessary) – but no need to change the Act.

From industry, the main concern was when Bayh-Dole should apply. As one put it, there is a need to add language that clarifies congressional intent "relative to university research supported with private rather than government funding ... [particularly] clarification of circumstances under which private and federal funding of related research can exist simultaneously without Bayh-Dole rights and obligations being triggered."

Overall, an interesting discussion with varying perspectives on the impact of Bayh-Dole on technology transfer. One thought that struck me as I listened to the testimony was that even though the stated purpose was to get university and industry views on Bayh-Dole, the federal government perspective was still noticeably absent. The federal agencies will no doubt have their chance to testify. As Chairman Wu noted in his opening remarks, "This will be our first hearing on technology transfer issues .. [we] will hold a subsequent hearing on Stevenson-Wydler." Stay tuned.

The hearing charter and witnesses' written testimony can be found on the House Science and Technology web site (<http://science.house.gov/subcommittee/tech.aspx>).

Gary can be reached at [gkjones@flcdc.cnchost.com](mailto:gkjones@flcdc.cnchost.com).

*Artificial Muscle, from page 6*

of polymers and found that poly (hydroxyethylmethacrylic acid)-poly(methacrylic acid) cross-linked network gels respond quickly to electricity and have all the other needed properties. But one challenge remained: after repeated cycles, the polymer detached often from the electrodes. However, from her former affiliation with Virginia Tech and with Johnson & Johnson's (J&J) Ethicon division, Rasmussen recalled that J&J performed plasma sterilization of its medical needles, and then coated them with polymers that allow them to slide more quickly into the patients, reducing discomfort. Plasma treatment not only sterilizes metal, but also improves the adherence of the polymer.

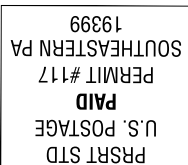
A potential solution was at hand. A colleague put Rasmussen in touch with Lew Meixler, PPPL's Head of Applications Research and Technology Transfer.

Rasmussen's discussions with Meixler resulted in the establishment of a Cooperative Research and Development Agreement (CRADA) last December between PPPL and Ras Labs. The CRADA, with PPPL participants Lew Meixler and Yevgeny Raitses, revolves around PPPL's plasma sterilization equipment, an excellent apparatus in which to treat metal samples with plasma.

To date, tests conducted at PPPL are encouraging, resulting in improved bond strengths.

Stainless steel and titanium metals are being treated with plasma comprised of ions of nitrogen, helium, or hydrogen. Following treatment, a polymer coating is sandwiched between two pieces of treated foil. Whatever is learned from the PPPL plasma treatments, Rasmussen will continue her quest for electro-responsive smart materials that can have a profound impact on prosthetics and robotics, with excellent control, dexterity, and durability.

If she is successful, a lot of folks may benefit.



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