

NEWSLINK

FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER

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DOT-NASA Seek Transportation Solutions with Remote Sensing

City traffic reduced to a crawl; structural weaknesses in more than half of about 500,000 U.S. bridges; potential disruptions in thousands of miles of pipeline;

road closures due to natural disasters; inspection of thousands of miles of highway pavement. These are but a few of the many issues the **Department of Transportation (DOT)** oversees and controls. Imagine, however, the possibility of monitoring any of these complex problems from one room—simply with the press of a button.

Such potential may well become a reality with the Remote Sensing (RS) Program for Transportation. Pairing DOT's experience in technology assessment and application with NASA's RS research expertise, the two agencies have formed a formidable partnership to seek solutions to mounting transportation problems using RS technologies.

Labs, Universities, and Industry

“Our challenge is to couple satellite sensing and the imagery with land-based systems, including Geo-Positioning System, Intelligent Transportation System and Geospatial Information Systems,” said **Dr. K. Thirumalai**, Chief Engineer of DOT's **Research & Special Programs Administration** Office of Innovation, Research and Education and RS Program Manager. The program goal is to develop a fuller picture with better modeling of designated areas, using “cheaper, better, smarter tools to work with.”

In full swing for a year, the DOT-NASA partnership seeks solutions in identified transportation requirements with innovative commercial RS and geospatial information technologies via two methods: university consortia that advance the RS technology base, with each serving as one-stop assistance to state and local agencies on applications in a particular area of expertise; and short-term technology application projects by RS and transportation



Easing Traffic Flow: In one of its many applications, remote sensing technology will make it possible to monitor traffic more effectively, reducing the number of tie-ups.

New Technology Applies Inventory Tracking Symbol

Product identification technology pioneered by **NASA** for tracking space shuttle parts may someday track stolen automobile parts or parts targeted for recall. Applying compressed symbology—a two-dimensional symbol marking system—to parts marking was developed at NASA's **Marshall Space Flight Center** in the early 1990s and commercialized in 1997. Since then, automobile parts manufacturers such as **General Motors** and **Daimler-Chrysler** have adopted the process.

“Compressed symbology was a natural fit for marking automobile parts for several reasons,” said **Sally Little**, Marshall Space Flight Center's Technology Transfer Program Director. “Manufacturing has increased its parts and process tracking; limited marking space exists on many items, especially electronic components; demand for permanent identification has increased in order to

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service providers and industries that demonstrate onsite the technologies' uses in transportation issues. Universities with leading-edge R&D programs and industries work together in specialized areas and share the cost of development activities.

Four Major Areas

"We took the best talents we have [from DOT and NASA] and coupled them with the best from universities and industry," Thirumalai noted. The results of this broad national program address the neediest areas in transportation:

- n Traffic Surveillance, Monitoring and Management—flow of people and goods between geographical areas
- n Environmental Impact Assessment—observation, analyses of urban growth, and the effects and changes caused by transportation needs
- n Transportation Infrastructure Management—maintenance, operation and renewal of pavement, bridges, pipelines, rail lines, harbors, and airports
- n Hazards, Safety, and Disaster Assessment—supervision of and response to urban and localized hazards, public safety, and disaster assessment needs.

Bringing RS technologies to fruition is a long process, but there may be a faster payoff in small niches such as disaster or physical infrastructure inventory and management—for example, monitoring traffic disturbances during the New Mexico fires. The RS Program has also begun activity in the environmental assessment area by monitoring areas onsite; there may be potential in using RS to monitor pipeline disturbances or find leaks thousands of miles away.



Protecting the roadways: Maintenance and operation of infrastructures, such as bridges and roadways, will be simplified with imagery provided by remote sensing.

Attention: Labs and Industry

Labs and industries are invited to participate. "We're looking for innovations that have high payout in transportation applications," Thirumalai stated. "If you see a potential solution to a problem [with a technology], we'd like to hear about it, and work with you." **NL**

For more information: Dr. K. Thirumalai, K.Thirumalai@rspa.dot.gov, <http://scitech.dot.gov/whatsnew.html>.

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counter theft or misrepresentation; and manufacturers need to include more data for more accurate traceability."

Compressed symbology is desirable to the automobile industry for the same reasons NASA developed the technology. "NASA tracks millions and millions of parts, even tiny electrical parts no larger than a dime," said **Fred Schramm**, manager of engineering application projects. "Since barcodes were implemented in the mid-1980s, they have been used extensively and have saved NASA millions of dollars annually through automatic data entry from manufacturing work orders and other paper media.

"Barcode labels, however, didn't work well on some parts, especially ones that were small, and even if you had barcodes that small, the sticky labels came off, contaminating the process with glue and paper. To ensure the timely flight-worthiness of the shuttle, we needed new methods of marking that wouldn't damage the parts and an identification system as efficient as barcodes," Schramm added.

NASA chose a two-dimensional matrix symbol that can store up to 100 times as much information as a one-dimensional, linear barcode in the same amount of space. The matrix symbol is a small, square-shaped mark resembling a checkerboard. The mark is scanned like a barcode but, unlike barcodes, the symbol is scanned using a charged-coupled device.

In August 1997, Marshall Technology Transfer formed an alliance with **CiMatrix** and its parent company, **Robotic Vision Systems, Inc.**, to develop commercial applications for NASA's marking processes for the "Data Matrix." The alliance also enabled two years of development of new marking methods that would satisfy NASA's requirements on stress-critical hardware.

"The applications for Data Matrix are unlimited," said **Don Roxby**, director of CiMatrix's Symbology Research Center. "Our staff has applied readable symbols on more than 80 different materials, including metal, plastic, glass, paper fabric, ceramics and others. We have tailored the application process to the material, and some materials can be marked using multiple methods."

But it doesn't stop there, said Schramm, because NASA has part identification needs that go beyond marks you can see. Identification markings might be covered by paint, cork, foam, or a number of other coatings designed to protect the part. Six methods of reading identification symbols under coatings, through containers, and within an assembly are being patented. NASA has begun soliciting partners to develop portable devices for these technologies.

According to Schramm, "This identification process will have untold implications for industry, as well as NASA, and the new marking methods, possibly ready this year, should open the door to marking stress-critical hardware." **NL**

For more information: Fred Schramm, (256) 534-0823



FED LABS FLASH

Technology transfer news, notes, and events within the federal lab community

Cold Regions Lab Researcher Wins Hammer Award

Charles Korhonen, of the U.S. Army Engineer Research and Development Center's Cold Regions Research and Engineering Laboratory, recently received the Hammer Award for his role as team leader of the Low-Temperature Repair Team for the Sequoyah Nuclear Power Plant. The concrete floors in Sequoyah's ice storage rooms needed repairs, but shutdown of the rooms was not an option because of the potential of lost revenue and service. Korhonen and his team developed a lightweight Portland cement concrete mixture that allowed repairs without shutting down the plant or disrupting service. This new concrete mix was placed, consolidated, finished, and cured at below-freezing temperatures without thermal protection. Ordinary concrete would not have survived. The Hammer Award recognizes government teams that show innovation by putting customers first, empowering employees, cutting red tape, or achieving results Americans care about. The hammer is symbolic of "hammering away at building a better government"—one that works better and costs less.

For more information: Charles Korhonen, (603) 646-4438

Grinding Grains Leads to New Ukrainian Partnership

The Department of Energy's Kansas City Plant is facilitating a new partnership between Ukrainian scientists and engineers and an American-based company, **Pinnacle Technology**, to launch a Cooperative Research and Development Agreement (CRADA). This CRADA will yield new innovative technology in the area of biomass grinding, which will be used in plastics to make a stronger and less expensive product by blending agricultural and industrial products. The result will be the reduction of waste material, the recovery of usable goods, and the improvement of existing products by using the recovered materials in food for farm animals, fertilizer for plants, additives for consumer goods, or fillers for engineered materials.

For more information: Tanya Snyder, tsnyder@kcp.com

NASA, FEMA Partner to Use Science and Space Tech for Disaster Prevention

NASA and the Federal Emergency Management Agency (FEMA) have partnered on a major natural-disaster initiative. Affiliated with Project Impact: Building Disaster Resistant Communities, the agreement will allow the two federal agencies to apply science, technology and remote-sensing research images of the Earth taken by satellites to emergency management issues on the ground, such as mapping of flood plains and earthquake fault lines and observation of wildfires and other natural hazards. The imaging will help state and local officials model and

understand drainage and run-off, which are vital to their disaster preparedness. At the same time, NASA scientists will gain valuable data for technology development; validation and calibration of satellites; and the understanding of land use, land cover, and flood hazards.

For more information: David Steitz, (202) 358-1730

CERF and IIEC Relocate

To accommodate a growing staff, the **Civil Engineering Research Foundation and International Institute for Energy Conservation (CERF/IIEC)** has relocated. The new offices are located at 2132 K Street, NW, Suite 700, Washington, DC 20037-1810. The telephone number is (202) 785-6420 (direct lines for staff can be found at www.cerf.org/staff.htm), and the new fax number is (202) 833-2604. CERF is a nonprofit organization created by the **American Society of Civil Engineers** to bring together diverse groups within the civil engineering community to "facilitate, integrate, and coordinate" common solutions to complex research challenges facing the design, construction, and environmental industries. CERF's affiliate, IIEC, works to accelerate the global adoption of sustainable energy policies, technologies, institutions, and practices that foster environmentally and economically sound development. CERF/IIEC has regional offices in Africa, Asia, and Europe, as well as project offices in India, the Philippines, China, and Latin America.

For more information: Aimee Stoffel, astoffel@cerf.org

DOE Adds Two New Gas Turbine Projects to Research Program

The Department of Energy (DOE) has announced two new gas turbine research projects, both to be pursued by **General Electric**. One will develop combustor improvements to lower nitrogen oxide formation; the other will develop a "smart" sensor and control package for existing and future turbines.

For more information: www.fe.doe.gov

NASA Publication Highlights New Commercial Technologies

A breast cancer detection system and a personal search-and-rescue beacon represent the range of NASA's 42 most recently commercialized products featured in the 2000 issue of *Spinoff*, the annual publication that highlights commercial products benefiting from NASA technology. Since NASA's inception in 1958, space program technologies have introduced Americans to hundreds of new or improved products. The 2000 issue describes the latest products and their possible economic and social impacts on health and medicine, transportation, public safety, computer technology, manufacturing technology, and environment and resources management. **NL**



TECHNOLOGY WATCH

Federal laboratory technologies available for technology transfer

NASA Device Warns Pilots of Dangerously Low Cabin Pressure

NASA Kennedy Space Center plans to license a technology designed to prevent aircraft accidents by warning the crew of potentially dangerous or deteriorating cabin pressure altitude conditions. This technology provides an alert when a programmed cabin pressure altitude is reached and an alarm if a second programmed altitude is reached, or 30 minutes between the two altitudes. The size and weight of a personal pager, the device uses a calibrated, temperature-compensated, pressure transducer that functions independently of other aircraft systems.

For more information: Nicole Martel, (919) 541-6310

Army Data Acquisition Systems Hit the Highways

The U.S. Army's Aberdeen Test Center (ATC) is supporting Volvo Trucks North America (VTNA) and its partners in a Department of Transportation (DOT)

program, the Intelligent Vehicle Initiative (IVI). The goal of the program is to increase safety on American highways by accelerating the deployment of on-vehicle safety devices. The two-year, 100-vehicle, nationwide operational test will allow DOT and VTNA to understand the required technical performance, user acceptance, and benefits of the collision countermeasures. The IVI application uses a data acquisition system to monitor and record from three automotive data buses on Volvo trucks, in addition to global positioning system time and location, and three analog inputs.

The on-board applications record the information in three formats: histograms, event logs, and time-history recordings. An automated computer program "calls" each unit daily to retrieve the data files. After the file has been retrieved, the files are erased from each unit and loaded into an Oracle database. Each file identifies the vehicle, location and time, in addition to the parameters recorded.

For more information: Luigi Matrippolito, (410) 278-7736, lmastrip@atc.army.mil

Instrument Measures Diesel Particles

There is a growing body of evidence regarding the deleterious health effects of diesel exhaust emissions.

Airborne particulates are known to constitute a major human health risk. DOE Lawrence Berkeley National Laboratory (LBNL) has developed a dedicated instrument for real-time sizing of diesel exhaust particles to study particle characteristics as a function of engine type, load, RPM, fuel composition, and post-combustion processes. The Diesel Particle Scatterometer (DPS) performs rapid, in situ measurements of the size, distribution, and optical properties of exhaust from both new, cleaner and older diesel engines. The new instrument shows good sensitivity and discrimination of the diesel exhaust for various running conditions and using different dilution ratios. Once the DPS is commercialized, it will provide the means for particle characterization for engine manufacturers, service facilities, and for state and federal emissions compliance.

For more information: LBNL Technology Transfer Department, (510) 486-5366, TTD@lbl.gov

Cleaner, More Capable Aviation Fuels on the Horizon

The Air Force Research Laboratory (AFRL) is conducting ongoing research on aviation fuels that may have far-reaching benefits for both military and commercial users. Perhaps one of its biggest success stories over the past decade was the development of the +100 Thermal Stability Improver Additive, which reduces the effects of fouling/coking in aircraft fuel systems and engines. Today, this additive is used in thousands of Air Force aircraft daily, with commercial airlines and international

military planning to use it in the near future. Efforts are also underway to minimize the environmental effects of these jet fuels, with AFRL teaming with the DOE to develop cleaner aviation fuels. Last October, AFRL and DOE signed a Memorandum of Understanding to collaborate on research, development, and demonstrations in this area. This five-year, cost-shared effort supports the DOE's Ultra Clean Transportation Fuel Initiative, which is focused on providing the nation with affordable, clean transportation fuels from petroleum, natural gas, coal and other energy resources.

For more information: Sandy Turner, (937) 255-6830, sandra.turner@wpafb.af.mil



Making highways safer: The Intelligent Vehicle Initiative will result in the deployment of safety devices on vehicles.

TECH WATCH *continued*

Heat Pipes to Help Cool Car

Engineers at DOE's National Renewable Energy Laboratory are embarking on a demonstration project to examine the use of heat pipes to cool automobile instrument panels. The experiment uses water heat pipes to extract thermal energy from an instrument panel and transport it outside the vehicle. Engineers developed the heat pipe design based on software developed at Los Alamos National Laboratory. The goal is to cut automobile emissions by reducing the amount of energy it takes to keep car occupants comfortable. If the demonstration is successful, the prototype heat pipes will be incorporated into a car's instrument panel and tested outdoors.

For more information: Sarah Holmes Barba, (303) 275-3023, sarah_barba@nrel.gov.

Simple Mechanical Device Measures Strain in Coated Surfaces

NASA Ames Research Center has provided a simple mechanical means for quantifying strain in coated surfaces under realistic thermal and mechanical loading conditions. This patented method was originally developed to measure strain in infrared optical coatings. A cantilevered beam is coated on the upper surface and a downward force is applied to the free end of the beam until the coating fails. The strain is then determined based on dimensions, deflection, and the point of the beam where the coating failure occurs. Advantages of this device include the ability to measure coating strain without destroying substrate material, capability of determining strain over a wide temperature range, and its low cost to fabricate. The mechanical device is suited to any application where mechanical properties of a surface coating or its bonding strength need to be determined, such as automobiles and integrated circuit boards.

For more information: Martin Zeller, (213) 743-2927, zeller@usc.edu

Sandia Aiming for Electric Hybrid Cars

Lithium-ion research at the DOE's Sandia National Laboratories is playing a key role in an effort aimed at producing hybrid electric cars that perform at 80 miles per gallon. Hybrid vehicles combine a gasoline- or diesel-powered engine with an electric motor to increase fuel economy. Sandia is a participant in the Partnership for a New Generation of Vehicles, a government-auto industry research collaboration whose goal is to produce a prototype electric hybrid sedan by 2004.

For more information: Howard Kercheval, (505) 844-7842, hkerch@sandia.gov

System Provides More Accurate Dredging of Navigable Waterways

The U.S. Army's Topographic Engineering Center (TEC) has developed a global positioning system-based technology that eliminates tidal uncertainties of hydrographic surveys in coastal areas and navigable waterways. This results in more accurate depth data, translating into lower dredging costs and—potentially—lower transportation costs. Currently, this technology provides, on a continuous basis, the height of water above chart datum as a survey vessel navigates a waterway. The technology will also be used in the future to display the vertical distance between the ship's keel and the dredging project depth. Currently used at selected ports in the eastern U.S., TEC's technology is currently being installed at others. Applications of the technology are especially beneficial to the dredging industry, government entities, port authorities, and maritime insurance companies.

For more information: John Griffin, (703) 428-6265, griffin@tec.army.mil

DOE Kansas City Plant and Missouri DOT Have Concrete Partnership

A new concrete evaluation system developed by Honeywell engineers at the DOE's Kansas City Plant (KCP) could pave the way for major improvements in the transportation and highway construction industries. The new automated system, designed and implemented through a CRADA between the Missouri Department of Transportation and KCP, scans concrete samples with a state-of-the-art microscope, color CCD camera, computer, and other high precision tools. Special imaging and pattern recognition software processes acquired concrete imagery and automatically recognizes voids—some as small as two microns. The CRADA has captured the attention of other state and federal highway agencies. In addition, KCP is preparing a second CRADA that will advance the technology and expand the system's detection and analysis capabilities.

For more information: Tanya Snyder, (816) 997-5937, tsnyder@kcp.com

Airframe Noise "Seen," Thanks to NASA Technology

Bright computer images of landing gear wind noise are enabling NASA engineers to pinpoint loud and preventable aircraft flight sounds more easily than in the past, raising the prospect of quieter take-offs and landings. In tests conducted at the Ames Research Center, the sounds have been depicted as colored images on a computer screen. These new test data

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provide critical visual information to aircraft designers concerned about possible enforcement of stricter aircraft noise rules. Using 70 microphones inside a wind tunnel wall and linked to a computer, engineers can see the vivid images of landing gear wind sounds. Researchers reduced noise significantly as they removed various combinations of landing gear parts from the test model in the wind tunnel. In June, Ames engineers plan to conduct more tests in the facility's larger 40 x 80 foot tunnel. Airframe flyover noise and surface wing pressures with and without landing gear extended will be measured. Noise control devices will also be evaluated.

For more information: John Bluck, (650) 604-5026

Computer Model Mimics Multitasking Humans

Office of Naval Research (ONR)-supported researchers at Carnegie Mellon University have developed a computer model that mimics the cognitive ability of humans to perform multiple tasks simultaneously. In a recent competition, the Carnegie model simulated the performance of an air traffic controller and performed as well as a human undergoing the same test. The test included managing seven tasks simultaneously while coping with frequent interruptions. By substituting computer models for humans, operators gain valuable experience at much less cost and disruption to the training organization. Eventually, operators in command and control environments may receive the majority of their training in simulated environments.

For more information: Diane Banegas, (703) 696-2868, banegad@onr.navy.mil.

NASA Safety System Steers Pilots Clear

Overcrowded airports mean overcrowded runways, taxiways, and ramps. Ground collisions at U.S. airports are occurring more frequently, but engineers at NASA's Langley Research Center have developed a way to keep aircraft on track and away from dangerous encounters. The Runway Incursion Prevention System (RIPS) would give pilots and air traffic controllers an early warning if another plane or ground vehicle is about to intrude onto the runway. Combining an electronic moving map display of runways and taxiways with a screen that gives the pilot real-time guidance, RIPS provides audio and visual alerts if another plane or vehicle is about to encroach onto the runway. The system also uses specially developed computer software, global positioning system signals, and ground technologies developed by the Federal Aviation Administration (FAA). In October, NASA conducted a demonstration of RIPS at Dallas-Fort Worth International Airport for an audience of news media, FAA officials, and other government and industry representatives.

For more information: Kathy Barnstoroff, (757) 864-9886, <http://avsp.larc.nasa.gov>

Ames Researchers Work to Guarantee Strength in Metal Parts

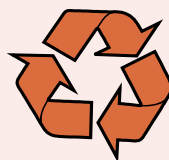
Automotive manufacturers may one day be able to guarantee the strength of mass-produced parts made from powdered metals with research conducted at the DOE's Ames Laboratory. Powdered metal components are common today as mass-produced parts made of steel, copper, brass, and aluminum. To make these parts, a powdered metal is poured into a die, and pressed and heated—or "sintered"—to bond the powder particles together as a solid mass. By merging the fields of nondestructive evaluation and powder metallurgy, Ames scientists have developed a new technique for observing the sintering process with an electromagnetic acoustic transducer. The transducer enables the bonds in powdered metals to be evaluated in real time as the parts sinter in a furnace. The prime benefit is the elimination of wasted time and materials required by current parts examination methods. Data from use of the transducer could turn guesswork into formulas that engineers could use to predict correct processing conditions when mass producing parts.

For more information: Jim Foley, (515) 294-8252

Alternative Glazing Shines in Vehicle Test

Researchers at the DOE's National Renewable Energy Laboratory recently completed a side-by-side vehicle test in Phoenix, designed to determine the benefits of using a new alternative window glazing versus standard glazing. Test results indicate that the new solar reflective glass reduced passenger compartment temperatures and heat gain. Lower interior temperatures could allow automobile manufacturers to reduce the size of air conditioners in vehicles or let passengers use their air conditioners for a shorter time—resulting in improved fuel economy and reduced tailpipe emissions. **NL**

For more information: Sarah Holmes Barba, (303) 275-3023



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SPOTLIGHT ON SUCCESS

Success stories from the federal lab community

ORNL's Graphite Foam May Aid Transportation

Artificial diamonds. Buckyballs. Carbon foam with high thermal conductivity. These products are the results of serendipitous discoveries made by researchers working with carbon. Carbon foam was discovered in 1998 at the **Oak Ridge National Laboratory (ORNL)** by carbon researcher **James W. Klett**. The foam received an R&D 100 Award from *R&D Magazine* as one of the 100 most significant innovations in 1999. In June 1999, ORNL's method for making this special graphite foam was licensed exclusively to **Poco Graphite** in Decatur, Texas, which calls the product PocoFoam™.

"This is a truly revolutionary material that will find uses in many applications," says **Patrick Davis** of the DOE's **Office of Transportation Technologies**. "Specifically, we believe carbon foam is an enabling technology that will solve critical heat rejection problems we must overcome before fuel-cell and advanced power electronics technologies can be introduced into automobiles."

The key to carbon foam's conductivity is its unusual graphite crystal structure. It has a skeletal structure full of air pockets, making it only 25-percent dense and lightweight. The network of ligaments in the foam wicks away heat from its source better than do most high-performance graphite fibers. PocoFoam™, three to nine times more thermally conductive than typical lightweight carbon foams, conducts heat better than aluminum but at one-fifth the weight.

Transportation Applications

Because of its conductive qualities, carbon foam has potential uses in a number of areas, including transportation. For example, the foam could be used to make a smaller, lighter car radiator that might be placed away from the front of the car to give it an energy-saving and less polluting aerodynamic design. Because a smaller radiator can make a car lighter and faster because of the aerodynamic design, automotive racing teams are interested in foam radiators. Presently, a car radiator prototype using PocoFoam™ is being built.

In addition, the **Department of Defense** is interested in smaller radiators for personnel carriers. Other potential uses for PocoFoam™ include application as an aid for cooling brakes and oil and transmission fluid in automotive systems; as an anode in lithium-ion batteries being developed to power electric cars; a replacement material for aluminum blocks for gasoline-electric hybrid cars; and as an agent to protect electronic components on space satellites from heat damage.

Poco Graphite has an exclusive license to produce graphite foam using ORNL's patented method. The company has started pilot production of PocoFoam™ in the form of sheets and blocks, and has the machining capability to produce finished parts made of the foam. Last May the first PocoFoam™ product was sold. **NL**

For more information: Carolyn Krause, (865) 574-7183, krausech@ornl.gov, www.pocofoam.com.

For more success stories, visit the FLC web site at www.federallabs.org

Technology Transfer on the Web

Chemical Casualty Care Division (CCCD)

<http://ccc.apgearmy.mil>

This site features many of CCCD's instructional products in the medical management of chemical casualties. Training course materials are available for download.

EV World®

<http://www.evworld.com/>

Learn more about electric, hybrid, and fuel cell vehicles from this informative site.

2001 Fuel Economy Site

<http://www.fueleconomy.gov/>

This site, a joint venture of the DOE and EPA, was developed to help educate the public about the importance of fuel economy and the benefits of driving a more fuel-

efficient vehicle. Provides fuel economy information and greenhouse gas information for new and used vehicles dating back to 1985.



Green Car

<http://www.environmentaldefense.org/programs/PPA/vlc/index.html>

This site is a guide to cleaner vehicle production, use and disposal. Includes information on what happens at different stages of a vehicle's life cycle from beginning to end.

Your Next Car

<http://www.yournextcar.org/>

This site focuses on the future trends and technologies of the automobile. **NL**



COMING ATTRACTIONS

April 24-25, 2001

Northwest Measurement, Control, Information and Automation 2001

Portland, OR

Sponsored by the Portland and Pacific Cascade Sections of the International Society for Measurement and Control, this conference will provide information and technology related to devices, software, and services for the measurement, control, information, and automation market.

503-720-7893; jh@nwmcia.com or www.nwmcia.com

April 24-26, 2001

Process Industries Exposition (PIE)

Houston, TX

More than 5,500 chemical processing industry (CPI) representatives from all sectors of the CPI industry will attend this meeting. Subject areas to be featured include safety and environmental issues, process control and automation, and maintenance and retrofit issues. Visit the FLC in Booth 1418!

www.processexpo.com

April 29-May 1, 2001

AGA Operations Conference and Biennial Exhibition

Dallas, TX

Sponsored by the American Gas Association, this show features products offered for the operating functions of gas utility and transmission companies.

410-997-0763, aga@epponline.com

April 30-May 4, 2001

2001 FLC National Meeting

Burlington, VT

With a theme of "FLC and Beyond," this year's meeting is unique because the FLC is partnering with the Transatlantic Technology Forum (TTF) to offer attendees a variety of educational sessions focused on tech transfer practices and processes from around the world—offering the chance to learn new ways of conducting tech transfer. Basic and advanced training will be offered.

Sherry Nacci, 856-667-7727 or www.federallabs.org

May 3-4, 2001

The 26th Annual AAAS Colloquium on Science and Technology Policy

Washington, DC

This meeting provides a forum for discussion and debate about budget and other policy issues facing the S&T community. Since its inception in 1976, this event has grown into the major public meeting in the U.S. on science and technology issues—attracting nearly 500 of the nation's top S&T experts.

www.aaas.org/spp/dspp/rd/colloqu.htm

June 24-27, 2001

Biotechnology Industry Organization

San Diego, CA

More than 5,700 biotechnology leaders, executives, and researchers from around the globe will attend. Subject areas include biopharmaceuticals and vaccines, cancer research, genetic research and testing, chemistry advances, technology transfer, biotechnology R&D, and information technology. Visit the FLC in Booth 1133!

www.bio.org/events/2001/event2001home.html

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