

Aerospace Technology INNOVATION

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Precision Casting For Foundries

Quake Forecast Data With GPS

NASA Technology Spins Off New Company



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COMMERCIAL DEVELOPMENT MISSION UPDATE

Date*	Flight	Payload	Sponsor/Coordinator
1/97	STS-81	Commercial Generic Bioprocessing Apparatus (coming back from Mir) Materials in Devices As Superconductors (MIDAS) (coming back from Mir)	BioServe Space Technologies Langley Research Center
3/97	STS-83/MSL-01	Astro-Plant Generic Bioprocessing Apparatus	BioServe Space Technologies
9/97	STS-86* Shuttle/Mir-07	Commercial ITA Biomedical Experiments-01 (CIBX) Commercial Generic Bioprocessing Apparatus (CGBA) Liquid Phase Sintering (samples going to Mir) (Payloads go into Mir for extended operations)	Instrumentation Technology Associates, Inc. BioServe Space Technologies Consortium for Materials Development in Space
1/98	STS-89 Shuttle/Mir-08	Astroculture (™) X-Ray Detector Test Materials In Devices As Superconductors (MIDAS)	Wisconsin Center for Space Automation & Robotics Center for Macromolecular Crystallography (UAB) Langley Research Center
Key		STS—Space Transportation System	ITA—Instrumentation Technology Associates, Inc.
*As of 1/97		MDA—Materials Dispersion Apparatus	MSL—Microgravity Science Laboratory UAB—University of Alabama at Birmingham

WELCOME TO INNOVATION

Aerospace Technology Innovation

by Robert Norwood

NASA HAS REACHED A MAJOR MILESTONE IN our new approach to smaller, faster and cheaper spacecraft. In the summer of 1994, NASA Administrator Daniel Goldin announced a new initiative for smaller NASA spacecraft launching the Agency on a new course, and implementing a new way of doing business. This initiative epitomized the "faster, better, cheaper" approach to spacecraft development and highlighted NASA's new, leaner management style. It revolutionized the way NASA and its industry partners design, build, launch and operate small spacecraft for scientific missions and commercial activities in space.

The initiative was and continues to be extremely important, not only to future NASA missions, but to the U.S. position in the global commercial small satellites market. With participation from large and small companies and minority firms and universities, this initiative strengthens the U.S. competitive position in the small spacecraft market. Developing the technology baseline for small, highly reliable spacecraft for commercial space ventures will create the basis for and accelerate the introduction of lower-cost constellations of spacecraft for application to global communications, remote sensing or other broad-area, information-based networks.

One significant result of this new approach to smaller, cheaper spacecraft was a class of spacecraft suited to the Discovery science missions. One of those missions entailed a small Mars Pathfinder spacecraft scheduled to land on the planet Mars in the summer of 1997. As promised in the announcement two years ago, NASA has launched the Mars Pathfinder spacecraft on its historic mission to realize our new family of small spacecraft based on advanced technology (some of which has been reported in *Innovation*) and to explore Mars with a robot.

Mars Pathfinder will land on Mars, open up and allow a six-wheeled robotic rover to drive out and begin exploring the Martian terrain. Pathfinder was launched on December 4, 1996 aboard a Delta rocket. This is just one month after the launch of Mars Global Surveyor. The single spacecraft will cruise directly to Mars, enter the atmosphere with a Viking-derived heat shield and land with the aid of parachutes, rockets and airbags.

Landing of the Pathfinder rover, named Sojourner after Sojourner Truth, a great American pioneer, is scheduled for July 4, 1997 at the mouth of an ancient outflow channel called Ares Vallis, near the site of the 1976 Viking 1 lander in Chryse Planitia. The site was chosen for the variety of rock and soil samples it may present.

A small 10-kilogram (22-pound) rover will be carried on the Pathfinder and become the first rover ever to explore the Martian surface. The rover is mounted on one of four panels on the tetrahedral-

shaped lander and tied down with a connector that will be separated. After landing, the Pathfinder lander will deploy its three solar panels for power, the camera will view the surroundings and the rover will be positioned for deployment. Rolling down a deployment

ramp, the rover will then be independent to explore the surface, using the only lander data and communications functions for contact with Earth. After the lander transmits its engineering data and panoramic image of the Martian landscape to Earth, much of its mission will be focused on supporting the rover with imaging telecommunications and data storage. Data will be relayed back to Earth for about a month. If the lander and rover remain in working condition, the mission could be extended up to one year.

We are very excited about this new NASA mission and the introduction of innovative technology to benefit the new family of scientific and commercial spacecraft as well as non-aerospace commercial and educational products. We will provide updates on these developments in the future. ✨

THE INITIATIVE WAS AND CONTINUES TO BE
EXTREMELY IMPORTANT, NOT ONLY TO
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U.S. POSITION IN THE GLOBAL
COMMERCIAL SMALL SATELLITES MARKET.

TECHNOLOGY TRANSFER

NASA and Red Pepper Launch Hot Item

Shuttle software technology launches company's value to \$225 million.

A NASA TECHNOLOGY THAT SCHEDULES pre-launch work for the Space Shuttle fleet is the foundation of a San Mateo, California software company whose market value grew to \$225 million in just three years.

The Red Pepper Software Company spiced up NASA's Ground Processing Scheduling System (GPSS) to help some of America's Fortune 500 companies respond to customer demands and maximize company profits.

GPSS is a software scheduling tool that helps planners manage the thousands of overlapping activities that simultaneously prepare the four Space Shuttle orbiters for launch.

While technicians repair the heat-shielding tiles on an orbiter, others may be modifying the crew module or installing a payload. GPSS reacts to any refurbishment scheduling glitches with real-time solutions, mini-

mizing a possible domino effect on the fleet and reducing processing costs.

Now, Texas Instruments, Bausch & Lomb, Coors and Hewlett Packard are applying GPSS via Red Pepper. "We were looking for a tool to help manage our worldwide business transactions from one facility in California," said Tom Davis of Hewlett Packard. "We've found that tool in Red Pepper's Response Agents."

Response Agents are the commercial software systems inspired by GPSS. Supplementing existing transactional and shop control systems, they help production and distribution centers satisfy customer demands by optimizing materials, capacity and labor in real-time.

"Response Agents are a new, proactive approach to planning," said Monte Zweben, president of Red Pepper. "Though we have done much work to bring this technology to the commercial market, the roots of this growing product line can be traced directly back to NASA research."

Zweben led the GPSS development team from Ames Research Center, Kennedy Space Center and Lockheed Space Operations Company while holding a position as deputy branch chief at Ames. Zweben envisioned a commercial version of GPSS with similar benefits to industry after watching it reduce Shuttle turnaround time and costs and increase operational efficiency.

Zweben left NASA in 1993 to establish Red Pepper, and Kennedy granted the company the GPSS copyright license in August 1993.

Red Pepper's quick success attracted the attention of People Soft Inc., a worldwide client/server business software provider. People Soft recently acquired Red Pepper, which employed more than 100 at the time of the merger, at a market value of \$225 million.

While Red Pepper accelerates investments in research looking for broader applications of GPSS, NASA focuses on its intended use. "Though we are very proud of KSC's role in this project's commercial success, we will continue to enhance GPSS for support of future vehicle processing applications," said NASA GPSS Task Manager Nicole Passonno. ✨

Red Pepper Software Company of San Mateo, CA spiced up NASA's ground processing scheduling system (GPSS) for private industry and watched its market value grow to \$225 million. GPSS schedules the thousands of activities that ready the Space Shuttle fleet for launch at Kennedy Space Center.



For more information, contact Joel Wells at KSC. ☎ 407/867-2468,

☎ 407/867-2692, ✉ Joel.Wells-1@ksc.nasa.gov

Please mention that you read about it in *Innovation*.

Portable System Cuts Time, Paperwork

PROCESSING SPACE SHUTTLE PAYLOAD processing missions test procedures can be time consuming and paper-intensive.

A new portable data collection system cuts the time to process a procedure, reduces the paper used and improves information gathering after the test.

The Quality Assurance Portable Data Collection (QAPDC) system, developed under the Small Business Innovative Research program (SBIR) for NASA Kennedy Space Center (KSC) will help KSC migrate to a paperless procedure system for Space Shuttle payload processing operations.

The QAPDC system won the NASA SBIR of the Year Award (software category) at Technology 2006.

SENTEL Corporation of Alexandria, Virginia, OPTIMUS Corporation of Silver Spring, Maryland and KSC developed the system. SENTEL and Optimus are commercializing the system. KSC is developing the system for use in Space Station processing.

QAPDC incorporates a hand-held, pen-based computer platform. The system can install many data collection forms, record data against those forms, imprint controlled signature authority, maintain the integrity of the data collected and relay the data to a computer network for analysis and archiving.

John Lekki of KSC said KSC has tested the prototype and "overall the concept is good. We still have some adjustments to make, but we'll be able to get away from the paper system." QAPDC's deployment is about a year-and-a-half away.

The KSC launch team has direct communication with the inspector and immediate status of completed tests with the system. Lekki said, "Data is collected and transmitted through the KSC network in real time."

SENTEL Chief Technical Officer Kevin Jackson said, "The unique part is that QAPDC is not tied specifically to any piece of hardware. This enables clients to use their existing hardware. Since it is Windows-based we have all of its advantages and can ride on improvements in that system. We can also make it Web capable."

The server system has an intelligent forms converter that automatically formats the form or procedure electronically for execution on a pen computer.

Information temporarily can be stored on the pen

computer and later transferred to a central personal computer. QAPDC can search and retrieve interactions and generate task status reports and trend analyses.

QAPDC benefits include real-time task monitoring and improved data availability. QAPDC reduces latency, paper-intensive inspection processes and need for re-keying data.

QAPDC also could be used by the aerospace and airline industries, the shipbuilding industry, warehouse and shipping industries, law enforcement agencies and public utilities.

"Our goal is to have a commercial product next year," Jackson said. ✱

For more information about the product, contact John Lekki at KSC.

☎ 407/867-3690 or Kevin Jackson at SENTEL. ☎ 703/739-0084

☎ 703/739-6028 ✉ kjackson@sentel.com Please mention that you read

about it in *Innovation*.

Surgery In The Dark

DOING SURGERY IN THE DARK MAY NO longer hinder battlefield medics thanks to NASA technology.

Thermalscan, Inc. of Baton Rouge, Louisiana is working with the Office of the Secretary of Defense and the U.S. Army Night Vision Laboratory to develop a battlefield care system that uses infrared imaging. Doctors would be able to see patients in the dark using body-generated heat via a head-mounted infrared camera and monitor.

"The camera sees heat like our eyes see visual light, which allows for operations in complete darkness such as in a cave or on a moonless night. The setup has potential to allow doctors to suture in the dark and find veins for inserting an intravenous needle," said Thermalscan, Inc. Founder Jim Davidson. The system also can detect if blood is getting to an organ not easily visible to the naked eye.

Davidson received his initial education in thermal and infrared image analysis while working with Stennis Space Center in 1995 on a Small Business Innovation Research (SBIR) contract to develop a pavement survey and management system.

Thermalscan is a nondestructive testing company that uses infrared cameras to find maintenance problems not visible to the naked eye. Davidson had an interest in roofs and buildings and their maintenance

A Thermalscan, Inc. battlefield care system uses infrared imaging so doctors can see patients in the dark via their body-generated heat.



and energy problems. He had seen a demonstration of infrared imaging devices, while a civilian architect at Eglin Air Force Base, and thought the technology would be good for architectural inspection.

Davidson began working with Stennis and its Louisiana Technology Transfer Office on an SBIR project to develop a way to survey the condition of roads using this technology in 1991. His system uses a combination of line-scan video and an infrared camera to collect high-resolution images of pavement conditions.

Once Thermalscan's contract with Stennis was over in 1995, Davidson began working with Medical Thermal Diagnostics on another SBIR contract using his knowledge of infrared image analysis. The initial research applied the technology to improve determination of risk factors for breast cancer. While the breast cancer research is proving successful, Thermalscan also is developing the battlefield trauma device.

"This system is important because normal emergency triage, or determining the condition of the patient, can be done in total darkness. It is possible to see if someone is breathing with this system since you can see the chest moving and the warm air coming from the mouth and nose," Davidson said.

This system is not hindered by bright lights and actually will help daylight operations and detection of bruises and hemorrhaging. ✱

For more information about the product, contact Jim Davidson. ☎ 504/388-3970.

For more information about SBIR at Stennis, ☎ 601/688-3964. For more information about the Louisiana Technology Transfer Office, contact Roy Keller. ☎ 504/334-5555. Please mention that you read about it in *Innovation*.

NASA Anti-Fire Device Protects Firefighters

A NEW EASY-TO-USE, AFFORDABLE FIRE detection device will help firefighters see invisible flames and navigate through smokey buildings.

SafetyScan of Buffalo, New York, will manufacture and market FIRESCAPE through an exclusive patent licensing agreement with NASA.

The fire imaging device shows invisible flames of alcohol and hydrogen fires during the day and sees through smoke. The device also finds origins of visible fires.

SafetyScan specializes in fire safety electronic products. FIRESCAPE is the first affordable commercial product for fire imaging. FIRESCAPE should be available to U.S. fire departments by spring.

"SafetyScan has a very compatible product line that is already targeted to the firefighting industry. This allows for easy incorporation of the NASA fire imager technology," said Brenda Smith of the Stennis Space Center Technology Transfer Office.

FIRESCAPE is used like binoculars. It has no moving parts exposed to the environment. Optics are sealed to protect them from smoke and grit. FIRESCAPE also is operational in less than five seconds and may be used for two continuous hours without recharging.

Firefighters who deal with hydrogen or alcohol fires typically rely on the antiquated "broom method" to locate invisible flames. This method involves holding out a corn straw broom and waving it around an area to see if it catches fire. Firefighters who use FIRESCAPE will be able to remain at a safe distance and forgo risky methods.

Two other benefits of FIRESCAPE are its simple operation and \$5,000 per unit cost. The fire imager is easy to operate with a push button on/off switch and a button to compensate for sunny and cloudy conditions.

The fire imager originally was developed by two Stennis engineers to fight hydrogen and alcohol fires which have invisible flames in daylight due to their clean-burning chemical makeup.

The engineers drew on their experience in thermal imaging technology to develop the device. Thermal imaging is used at Kennedy Space Center for ice detection on the Space Shuttle and on filtered cam-



A firefighter uses the fire imager to “see” through dense smoke during a fire imager demonstration.

eras used for rocket engine plume diagnostics. More expensive thermal imagers are available to firefighters.

“There was a huge gap in technology between the \$3 broom and the \$30,000 thermal imagers,” said Heidi Barnes, one of the Stennis engineers who developed the device. “Firefighters need a reliable but economical device to assist them in their work.” ✱

For more information about FIRESCAPE, contact Mark Stroze of SafetyScan. ☎ 716/828-0392. Please mention that you read about it in *Innovation*.

Maytag And NASA Team Up To Do The Dishes

MAYTAG’S FAMOUS LONELY REPAIRMAN is likely to stay that way, at least if NASA has anything to say about it.

Representatives of Maytag Corporation’s Jackson, Tennessee, dishwasher manufacturing plant teamed up with engineers at Marshall Space Flight Center (MSFC) to incorporate

state-of-the-art aerospace technologies from NASA and its contractors into future dishwasher designs.

Maytag asked MSFC to help evaluate changes and find areas where further refinements and improvements were possible. MSFC Technology Transfer Office industrial team for Tennessee, NASA Engineer Fred Schramm and Lockheed Martin Engineer Jeff Cornelius began work on the request.

Help for Maytag was found at another NASA contractor, Teledyne Brown Engineering (TBE) of Huntsville, Alabama. TBE’s Chester Simmons led an effort that provided Maytag’s designers with insights into factors that influence dishwasher performance.

TBE found that Maytag’s dishwasher design was very close to its maximum thermal efficiency but recommended some fine tuning to improve performance by 10 to 20 percent.

TBE’s engineers also studied location of heat energy absorption in a dishwasher as it washes and dries. They found the thermoplastic polymer tub retained less heat than did porcelain models. This finding would affect performance.

The insights and recommendations from the NASA/TBE effort have guided Maytag’s changes. Assistance provided to the Maytag plant is part of a national industrial outreach program operated by NASA’s Southeast Regional Technology Transfer Alliance. NASA and its contractors have pooled their engineering resources at MSFC, Stennis Space Center, Kennedy Space Center and the Southern Technology Applications Center. Up to 40 hours of free technical assistance may be provided to U.S. firms.

“America’s space program is paying off for American business and industry. Technologies, developed for the nation’s space program by NASA and its contractors, are now at work in thousands of American firms,” MSFC Technology Transfer Office (TTO) Manager Harry Craft Jr. said. “Now Maytag is among them.” ✱

For more information about this partnership, contact Jeff Cornelius at MSFC, ☎ 205/544-2766, 📠 205/544-3151, ✉ jeff.cornelius@msfc.nasa.gov For more information about technical assistance, ☎ 800/USA-NASA. Please mention that you read about it in *Innovation*.

Quicker Rehabilitation For New Knee Brace Wearers

A GROUP OF NASA PROPULSION ENGINEERS have developed an innovative knee brace from space technology that could mean quicker and less painful rehabilitation for patients who use it.

Marshall Space Flight Center (MSFC) engineers Michael Shadoan, Neill Myers, John Forbes, Kevin Baker and Darron Rice invented the Selectively Lockable Knee Brace. The innovative brace allows movement of the knee. Knee braces now on the market lock the knee in a rigid, straight-leg position.

Shadoan said, "the Selectively Lockable Knee Brace, a spin-off of technology used in developing propulsion systems at MSFC, is designed to help patients who have a loss of muscle control from the thigh down due to a stroke or an accident."

"The Selectively Lockable Knee Brace allows the knee to function while supporting the leg," said Myers. "The brace may be used by a patient recovering from a knee injury when the patient needs to use the knee, but the knee cannot carry the full weight of the patient."

The upper part of the brace attaches around the thigh, and the lower part is secured by a stirrup around the shoe. "It works by allowing the knee to bend when weight is not on the heel," said Myers. "Once weight is placed on the heel, the knee brace locks into position."

A Horton Orthotic Lab technician tests MSFC inventors' Selectively Lockable Knee Brace prototype.



Shadoan, Myers, Forbes, Baker, and Rice have contributed time over the last three years to design the brace's prototype. They recently received a patent for the brace.

The inventors are working with Horton Orthotic Lab of Little Rock, Arkansas, to test the prototype and verify its design. "Field tests now underway will allow us to gather the information needed to 'tweak' the brace for final design," said Shadoan. It's not certain when the brace will be available commercially. ✨

For more information about the product, contact Michael Shadoan at MSFC. ☎ 205/544-5276, ✉ michael.shadoan@msfc.nasa.gov Please mention you read about it in *Innovation*.

NASA Promotes Technology Transfer At Technology 2006

NASA CO-SPONSORED THE TECHNOLOGY 2006 exposition in Anaheim, California, October 29–31. Co-sponsors were *NASA Tech Briefs* magazine and the Technology Utilization Foundation. The central purpose of this event is to help U.S. business tap the latest technologies developed by and for federal researchers. With exhibitors from NASA and the major Department of Energy, Department of Defense, and Department of Agriculture federal labs, Technology 2006 is a premiere event to promote technology transfer and commercialization.

Technology 2006 was held in conjunction with the Telecon XVI trade show, the largest event in the country for the videoconferencing and telemedicine industries. NASA Administrator Daniel Goldin gave the keynote speech at Technology 2006. Mr. Goldin focused on how NASA technology innovations, in medical and communications technologies, have paved the way for doctors now to be able to care for patients in remote and rural areas. This is the promise of telemedicine.

NASA and the National Technology Transfer Center also unveiled a new searchable CD-ROM containing the NASA technologies which have the hottest commercial potential. It contains data about more than 15,000 different technologies being developed by or for NASA and can be sorted by topic, company and other identifiers.

The NASA marketing team rolled out an aggressive marketing effort to see that U.S. companies could take advantage of our most important discoveries. NASA displayed its strengths by seven industry

categories ranging from materials to software to medical technologies. This strategy made NASA's efforts much more focused and made it easy for the targeted industries to define which specific technologies might be of value to their companies. This new strategy was very well received by industry and a great learning experience for the NASA centers. ✨

For more information, contact Michael Weingarten at NASA Headquarters. ☎ 202/358-1680, ✉ mweingarten@hq.nasa.gov Please mention that you read about it in *Innovation*.

Precision Casting For Foundries

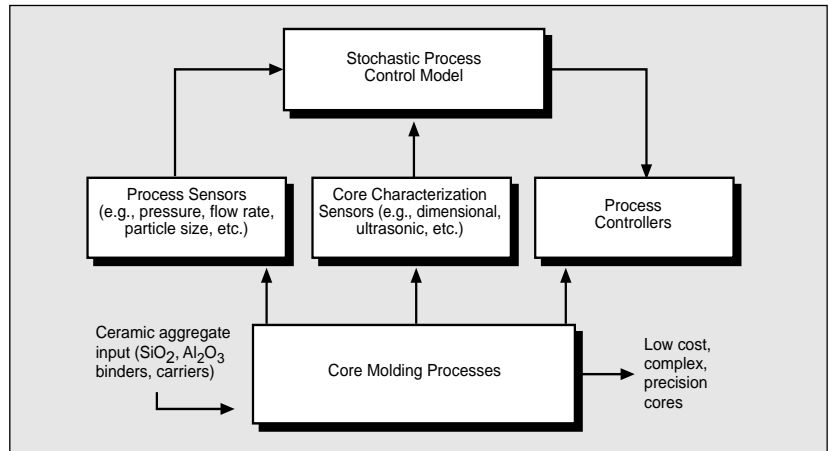
NASA AND SEVERAL COMPANIES ARE WORKING together on an Aerospace Industry Technology Program (AITP) project to overcome key technical barriers that limit casting applications in aerospace and other industries.

The U.S. foundry industry wants increased casting performance to meet consumer demands for lighter, stronger and less costly products. Foundries can enhance their competitiveness by meeting these demands with shorter, more flexible product cycles using computer modeling, process simulation and rapid prototyping.

Casting begins with the core-making process. Cores are produced by blowing or injecting a mixture of ceramic aggregate and free-flowing carrier into a die. Investment casting industry cores typically are composed of silica or alumina injected into a die with a wax carrier. Sandcasting industry cores typically are composed of silica coated with a resin binder and delivered to a die with air. Both core types must be strengthened after molding by appropriate chemical or thermal reactions prior to casting. Tool design, molding and curing process parameters are currently defined by trial-and-error techniques.

The AITP project focuses on manufacturing and production processes by developing technologies for: predictive models to eliminate trial-and-error; real-time process monitoring and control to increase casting dimensional accuracy; and rapid prototyping to reduce prototype development time.

Project researchers are developing computational methods based on the physics of the processes that produce cores for investment and sand castings. They



Sensors and control models will enable real-time, intelligent process control.

have developed extensive dimensional databases on cores to anchor the predictive models. Enhanced process design produces components more quickly, less expensively and at better quality because it eliminates trial-and-error and reduces variability.

Advanced sensor and controls have been installed on core machines so foundries can monitor and control the internal and external dimensions of their cores and castings in real time during the core-making process. By minimizing variability, better dimensional accuracy is obtained.

Production lead-time must be shortened. The project has developed technology that produces "wax" patterns for investment castings, shortening casting development times to months and, ideally, weeks. Complex automotive sand castings and structural aerospace castings often have required three to four years to develop and certify. Rocket engine gas generator bodies that had been produced from several formed and welded components now can be investment cast as one piece.

The project team includes NASA executing agent, Lewis Research Center; project lead, Rockwell Aerospace/Rocketdyne Division, Canoga Park, California; Lockheed Martin Corporation, Denver, Colorado; Ford Casting Operations/Ford Motor Company, Dearborn, Michigan; General Electric CR&D, Schenectady, New York; PCC Airfoils, Inc., Beachwood, Ohio; Auburn University, Auburn, Alabama; Howmet Corporation, Whitehall, Michigan; University of Alabama at Tuscaloosa, Alabama; UES, Annapolis, Maryland; Aracor, Mountain View, California; Robinson, Inc., Beachwood, Ohio. ✨

For more information, contact Carl Ray at NASA Headquarters. ☎ 202/358-4652 ✉ cray@hq.nasa.gov or Neville Marzwell at Jet Propulsion Laboratory. ☎ 818/354-6543 ✉ Neville.J.Marzwell@jpl.nasa.gov Please mention that you read about it in *Innovation*.

Faster, Better, Cheaper Way To Resurface Bridges

BRIDGE RESURFACING PROJECTS MAY NO longer mean days of traffic woes thanks to NASA, the Alabama Department of Transportation and USBI Co. of Huntsville, Alabama.

Workers used an environmentally friendly spray system developed using Space Shuttle technology to apply a non-skid surface to a bridge south of Huntsville during a demonstration test. Traffic was crossing the bridge four hours later.

Current methods require workers prepare the surface, apply a resin system, manually lay down a coat of gravel or non-skid materials and apply a second coat of resin. The new spray system completes the job in one pass after the roadway is prepared.

Marshall Space Flight Center (MSFC) and USBI designed the resurfacing tool, which uses a USBI-developed Convergent Spray Technologies (CST™) spray process and nozzle. CST™ currently is used to apply a heat-resistant coating to the Shuttle's solid rocket boosters.

"Not only does it shorten the job, but the process does not harm the environment. It uses a solvent-free spray, significantly reducing hazardous waste normally associated with most spray applications," said USBI Materials Engineer Kyle Hamlin.

Common and recycled filler materials and common resin systems can be used with the spray equipment. This project's investigator used a mixture of ground flint and resin to resurface the bridge. The new coating provides a higher grade of traction and better protects the bridge from erosion.

"This project gives us the opportunity to evaluate a new pollution-prevention technology and to try out different adhesives and filler materials which could be used for other NASA programs," said Vernotto McMillan, a technical manager at MSFC.

The project is a product of a 1994 agreement between MSFC and the Federal Highway Administration's Region 4 office for the Southeastern United States. Marshall and its contractors agreed to provide innovative technology derived from the space program and use it for a variety of highway applications includ-

ing corrosion resistant coatings for metal bridges and non-skid surface treatment for pavements.

This multi-use time and money-saving process could have many commercial applications in the future. ✨

For more information, contact John West at MSFC. ☎ 205/544-6858, ✉ john.west@msfc.nasa.gov Please mention that you read about it in *Innovation*.

NASA Helps Inventors Zap Mosquitos

NASA MARSHALL SPACE FLIGHT CENTER (MSFC) engineers and an Arkansas inventor are targeting the mosquito.

After inventor Alvin Wilbanks of Environmental Products and Research, Inc. formally submitted a request for technology assistance to the Technology Transfer Office, MSFC Structure and Dynamics Laboratory engineers suggested a number of improvements to cut costs and improve efficiency that the firm adopted. MSFC also referred Wilbanks to a non-profit agency that helped him rapidly produce molds used to manufacture the new product's base and top structures.

The Mosquito Killing System (MKS) attracts mosquitos over a one-acre area. It relies on the insect's natural ability to sense heat and breathing to find its prey. The patented device uses a heat source to provide an image to attract the insects and gentle air currents that simulate breathing. A pheromone attractant lures the mosquitos into the device. The mosquitos are electrocuted once inside the device's killing zone.

MKS safety features include secure mounting points and a tip-over safety switch. It also has an energy-conserving photoelectric cell to activate the machine at dusk and turn it off at dawn. The device should cost about \$6 per month to operate using 110-volt alternating current and the energy-saving photoelectric feature. The self-cleaning device is environmentally friendly because it uses no chemicals to destroy the pests.

The company expects the MKS to be available to consumers in May. The firm estimates that municipalities could recoup their costs in five years because they may eliminate mosquito spraying during the summer. ✨

For more information about MKS, contact Alvin Wilbanks of Environmental Products and Research. ☎ 501/531-2159. For more information about technical assistance through MSFC, ☎ 800/USA-NASA. Please mention that you read about it in *Innovation*.

Workers resurface bridge with environmentally friendly spray system.



ADVANCED TECHNOLOGIES

Better Jet Engine From Shuttle Tests

DESIGN IMPROVEMENTS FOR A NEW, MORE fuel-efficient Boeing 777 jet engine resulted from tests to improve NASA Space Shuttle engine performance.

The new design gained a full half-percent in energy efficiency—meaning a savings of hundreds of gallons of fuel per flight, an annual savings of millions of dollars for the airline industry and a competitive edge in world markets. Researchers also are using the test results to fine-tune the large, electricity-generating turbines used by U.S. electric companies to save fuel.

NASA and Pratt & Whitney, a commercial and military aircraft engine design and manufacturing leader, conducted the tests at Marshall Space Flight Center in 1992.

Engineers analyzing the test results noticed they showed the effects of small fluttering “wakes” of gases—the unsteadiness of gases flowing through the turbine airfoils—on turbine efficiency.

Engineers explored existence of an “optimum position” for turbine airfoils. This position could mean less energy to drive the turbines, resulting in lower engine temperatures, longer-lasting hardware, less maintenance time and lower operational costs.

MSFC and Pratt & Whitney engineers repeated the initial tests for the engine of a Boeing 777 to be put into commercial service in 1995.

“Wakes flowed the turbine airfoils, coming out high in some places, low in others. We knew if we could align the airfoil or wakes, we could also get the peaks and valleys to align—all for better turbine efficiency,” said Stephen Gaddis, project engineer in MSFC’s Structures and Dynamics Laboratory where the tests were conducted.

The principle is much like one used by competitors in bicycle races: A cyclist will move in behind another racer to benefit from “drafting” created by the front cyclist. The biker in front serves to break the winds’ force, so the cyclist in the rear does not have to pedal as hard as the leader. Pratt & Whitney took these findings and modified its PW-4084 engine for the Boeing 777.

“We had been looking for ways to achieve efficiency improvement,” said Frank W. Huber, manager of turbine aerodynamics for Pratt & Whitney’s Government Engine Division in West Palm Beach, FL. “The clocking concept—the



Space Shuttle technology helps Pratt & Whitney improve turbine rotor designs for PW-4084.

aligning of the airfoils—was not new, but there were not sufficient data to validate this technique.”

“The tests at Marshall demonstrated that the concept worked—clearly showing the benefit of aligning the turbine airfoils,” said Huber. “We ultimately found that we could achieve significant improvement in engine performance.” ✱

For more information about the product, contact Stephen Gaddis at MSFC.

☎ 205/544-1612 📠 205/544-9358. Please mention that you read about it in *Innovation*.

Quake Forecast Data With GPS

A NETWORK OF 250 NASA GLOBAL POSITIONING System (GPS) receivers will help students and researchers forecast Los Angeles-area earthquakes. Students will help gather and analyze data.

NASA Administrator Daniel S. Goldin recently dedicated a new site in the Southern California Integrated GPS Network (SCIGN) at Rialto High School.

“This network is a tremendous example of how technology developed for space benefits life on Earth. This interagency project will give us detailed information never before available to track the invisible geologic

strains and stresses that lie beneath the California landscape,” Goldin said. “Such data should give us fresh insight into the forces that produce earthquakes and could one day help reduce the loss of life and property from such disasters.”

GPS uses data transmitted from a constellation of 24 Earth-orbiting satellites arranged so several are visible from any point on the Earth’s surface at any time. Someone using a GPS receiver can determine the site’s precise location by coordinating signals from the satellites.

“GPS is the most important new technology to emerge for the study of earthquakes in decades. This information will permit us to improve our estimates of the regional earthquake hazard in Southern California and to prioritize earthquake mitigation activities, including emergency preparedness and retrofit strategies,” said Dr. Tom Henyey, director of the USGS-NSF Southern California Earthquake Center (SCEC) in Los Angeles.

“The GPS network will continuously measure movements of the Earth’s crust with a precision of one millimeter per year, which will show us where strain is building up,” said Dr. Andrea Donnellan, a member of the SCIGN Coordinating Committee at Jet Propulsion Laboratory (JPL).

SCIGN began in 1990 with four GPS receivers as a NASA-funded prototype project. It detected very small motions of the Earth’s crust in Southern California associated with the June 1992 Landers and January 1994 Northridge earthquakes.

Currently, SCIGN has 40 GPS receivers operating. The remaining receivers will be installed over the next three years.

“With data from the 40 receivers, we have determined that Southern California has continued to move since the Northridge quake in 1994. This may mean that stress is being relieved in part without earthquakes, which may reduce the overall earthquake hazard,” Donnellan said.

GPS data helps identify active buried faults that do not reach ground surface, and GPS measurements are useful in characterizing earthquake damage. Agencies can monitor off-site probable damage to dams, bridges and buildings via receivers placed on or near the structures. ✱

For more information about SCIGN, contact Dr. John Schied at JPL,

☎ 818/354-9627, FAX: 818/393-1492, ✉ john.schied@jpl.nasa.gov

Please mention that you read about it in *Innovation*.

NASA, FAA To Improve Commercial Research

NASA AND THE FEDERAL AVIATION Administration will work together to initiate research and develop methods and technologies that will make commercial aircraft service safer, more efficient and more affordable.

Dr. Robert Whitehead, NASA’s Associate Administrator of Aeronautics, and George L. Donohue, FAA’s Associate Administrator for Research and Acquisitions, have agreed to a NASA/FAA Integrated Plan for Air Traffic Management Research and Technology.

NASA and the FAA initiatives will improve the efficiency of our nation’s airspace system using the latest aerospace technologies. A NASA/FAA Integrated Product Team will manage the plan. The team will address the plan’s near- and long-term requirements, initially emphasizing improvements that can be implemented within the next 10 years.

Joint NASA/FAA activities will study the details of all aircraft classes’ flight operations including the roles of flight crews and air traffic controllers, integration of air traffic management and cockpit and fleet management, cockpit situation awareness, conflict detection and resolution, and flight restrictions and safety.

The study and the ensuing system will accommodate all users, including transport and general aviation aircraft, rotorcraft and military aircraft. It will ensure that all avionics requirements are cost effective and affordable. Cost benefit assessments for more flexible flight operations will substantiate each step in the transition. The assessments will include projections on the impact to both airspace users and air traffic management service providers.

More flexible flight operations could mean new roles for flight crews and air traffic controllers. Emerging technologies may permit closer integration of air traffic management, cockpit flight management and operational control centers. Development of automation technologies and pilot/controller roles will enable users to accurately predict and resolve conflicts efficiently and safely.

Cockpit situational awareness, on the airport surface and throughout airspace, will be improved using technologies developed for the Traffic Alert and Collision Avoidance System (TCAS) and Automatic Dependent Surveillance Broadcast (ADS-B). Flight crews will

have more say in air traffic management decisions once those technologies are developed further.

Flight restrictions will be minimized and aircraft operations maximized with development of concepts, technologies, responsibilities and procedures for those areas. Flight restrictions for high density areas will continue.

The team will analyze and simulate safety hazards and develop tools to proactively detect potential hazardous situations so that the highest level of safety may be maintained. ✨

For more information, contact Herb Schlickemaier at NASA Headquarters.

☎ 202/358-4638 or ✉ hschlickemaier@hq.nasa.gov Please mention that you read about it in *Innovation*.

NASA Technology Helps Pilots Taxi

TXI NAVIGATION AND SITUATION AWARENESS (T-NASA) is one of several advanced technologies NASA and the Federal Aviation Administration (FAA) are developing to increase traffic-handling capacity at existing airports.

Air traffic is projected to increase 32 percent in the next decade. The integrated T-NASA system will help pilots taxi more safely and efficiently especially in low-visibility weather conditions. T-NASA is part NASA's \$100 million Terminal Area Productivity (TAP) program. It is being tested at Ames Research Center. Ames and Langley Research Center have planned a T-NASA flight demonstration and a mission simulation for next year.

"Pilots taxi at airports today basically like they did in the 1950s. They receive verbal route clearance and follow airport signs," said Ames Scientist Dr. David Foyle, technical leader of the T-NASA research development team. "The only cockpit aid currently available to taxiing pilots is a paper airport layout chart despite the technological boom in avionics, GPS satellite positioning technology and advanced display media."

T-NASA is a cockpit display system that combines software and navigational devices. Pilots manually control taxi maneuvers with T-NASA. The system has three components:

- a Head-Up Display (HUD) shows the cleared taxi route in virtual reality on a glass visor in front of the cockpit windshield.



T-NASA's Head-Up Display (HUD) shows cleared taxi route using virtual reality.

- an electronic moving map of the airport on the instrument panel shows the pilot's aircraft position in relation to other aircraft.
- virtual three-D audio techniques produce traffic warnings that sound like they emanate from the traffic's direction.
- T-NASA updates the displays in real-time by using GPS satellite positioning and an airport layout database. HUD depicts the taxiway with a series of virtual cones. Virtual signs show the angle and direction of the turn. These virtual cones and signs move and change as the pilot taxis as if the objects are actually on the taxiway. The pilot's cleared route looks like a virtual highway on the ground.

"Airline schedules become tighter and more intertwined as the amount of air traffic increases," said Dr. Robert McCann, T-NASA team member. "Bad weather at a major airport means tremendous disruptions on the schedules as backups occur. If we can increase the efficiency of airline surface operations so that planes can get from runway to gate and from gate to runway very efficiently, then we can impact airline schedules and reduce delays. I think that is the bottom line for taxpayers." ✨

For more information about T-NASA, contact David Foyle at Ames Research Center. ☎ 415/604-3053, ✉ dfoyle@mail.arc.nasa.gov Please mention that you read about it in *Innovation*.

COMMERCIAL DEVELOPMENT OF SPACE

Microprobes Plunge Into Mars Surface

TWO NASA NEW MILLENNIUM PROGRAM microprobes, hitchhiking to Mars aboard NASA's 1998 Mars Surveyor Lander, will chart the course for NASA's vision of a network approach to planetary science in the 21st century.

New Millennium Program Manager, Kane Casani said, "the probes will be the first technology validated in this new network approach to planetary science. Networks of planetary landers will address dynamic, complex systems." For example, a single lander can report on the report on weather at one spot on a planet, but a network of landers is needed to characterize the planet's dynamic climate. Similarly, a single seismometer will indicate if a quake has occurred on a planet, but a network of seismometers can measure the size of a planetary core. "We need multiple spacecraft to go beyond our initial reconnaissance to completely characterize dynamic planetary systems the way we are able to do on Earth."

The microprobes will complement the climate-related scientific focus of the Mars Exploration

Program's 1998 Mars Surveyor Lander by demonstrating an advanced, rugged microlaser system for detecting subsurface water. Data on polar subsurface water will aid in projecting the amount of water on Mars. Future Mars missions might use similar probes to search for subsurface ice and minerals evidence in the search for life on Mars.

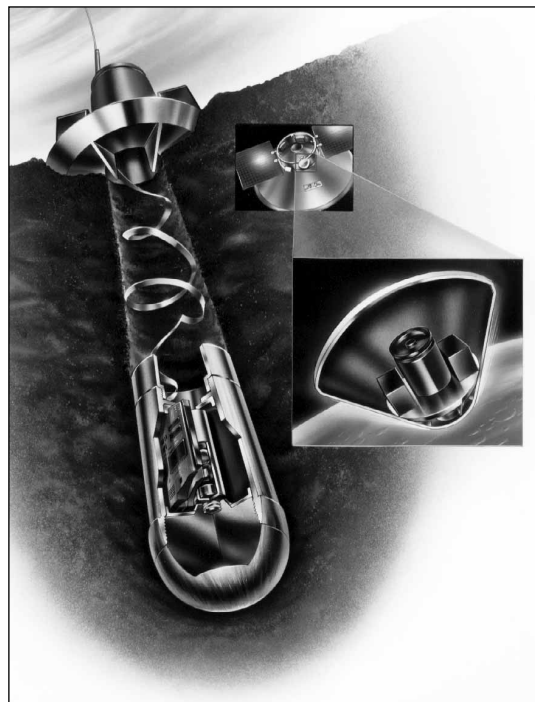
"A successful microprobes mission could lead to a wide range of scientific activities not affordable with conventional technology. Microprobes penetrators also may be the most efficient, effective way to obtain soil samples and measurements from below the Martian surface," said Dr. John McNamee, manager of the 1998 Mars Surveyor Lander and Orbiter project at Jet Propulsion Laboratory.

The 1998 Mars Lander will launch in January 1999 and spend 11 months traveling to Mars. The microprobes will separate from the spacecraft's cruise ring just prior to the surveyor lander's entry into the Martian atmosphere. The microprobes will plummet to Mars and plunge into the planet within 120 miles of the '98 Lander targeted for Mars' icy south polar region.

Technologies to be demonstrated on this second New Millennium flight are a lightweight, single-stage entry aeroshell; a miniature, programmable telecommunications subsystem; power microelectronics with mixed digital/analog integrated circuits; an ultra low-temperature lithium battery; a microcontroller and flexible interconnects for system cabling. *In-situ* instrument technologies that directly measure the Martian surface include a meteorological pressure sensor, a soil temperature measurement sensor and a water and soil sample experiment.

Lockheed Martin Electro-Optical Systems is the primary industry partner for the microprobes' integration and test programs. Jet Propulsion Laboratory (JPL) manages the New Millennium program for the Office of Space Science and Office of Mission to Planet Earth. JPL manages the Mars '98 Lander for the Office of Space Science. Lockheed Martin Astronautics Corporation is developing the Mars '98 Lander under JPL contract. ✱

The 1998 Mars Surveyor Lander mission will carry two highly-advanced microprobes. The microprobes will demonstrate an advanced microlaser system for detecting subsurface water on the Red Planet.



For more information, contact Diane Ainsworth at JPL. ☎ 818/354-5011, ✉ diane.e.ainsworth@jpl.nasa.gov Please mention that you read about it in *Innovation*.

Marine Biologist Study Whales Via Satellite

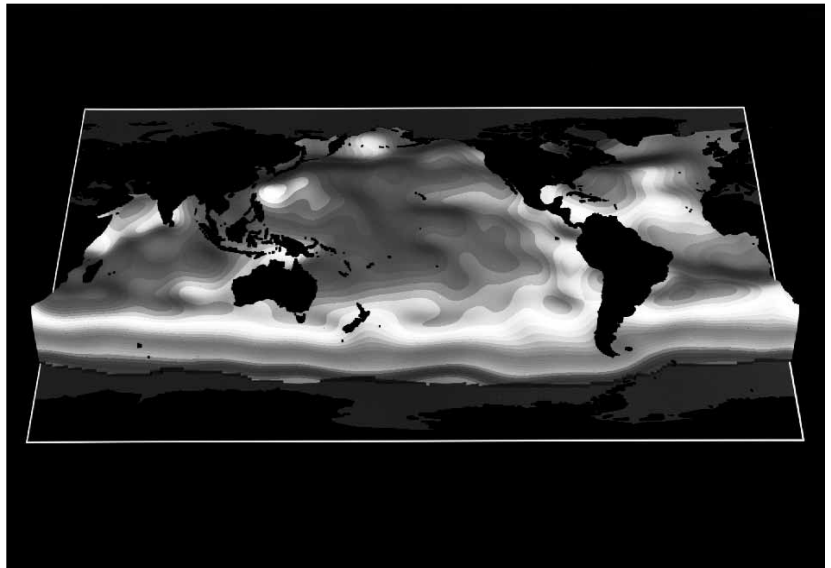
MARINE BIOLOGISTS RECENTLY USED maps of ocean currents produced by NASA's TOPEX/POSEIDON satellite to locate and count sperm whales and dolphins in the Gulf of Mexico.

TOPEX/POSEIDON altimeter data information from the European Space Agency's ERS-2 satellite was used in near real-time to generate circulation feature maps. University of Colorado at Boulder (UCB) researchers faxed the maps they generated to scientists aboard the research ship R/V Gyre, sponsored by Texas A&M University, the Texas Institute of Oceanography and the National Biological Service. Scientists read the maps of rapidly changing ocean features to determine if whales and dolphins might be present in certain areas.

The U.S. and France jointly developed TOPEX/POSEIDON to study global ocean circulation, but marine biologists also use its data to pinpoint where sperm whales and dolphins feed. "Evidence exists that whales prefer to feed in the edges of cyclonic eddies, and the satellite data gives us a good picture of where those oceanographic features are located," said George Born, a TOPEX/POSEIDON project principal investigator from UCB.

The R/V Gyre surveyed the northeastern Gulf of Mexico for 18 days in October. A previous survey indicated whales and dolphins were contacted most frequently in the area where warm water eddies break off from the Gulf Loop Current, a strong ocean that circulates around the Gulf of Mexico.

The expedition's goals were to make visual and acoustic census of marine mammals and to define their habitat in the northeastern Gulf in areas potentially affected by oil and gas activities, said Dr. Randall Davis, head of Texas A&M's marine biology department. "Altimeter data like that from TOPEX/POSEIDON are the only information that



enable on-site adjustments to the cruise plan to optimize the survey track, ultimately saving us time and money," Davis said.

The TOPEX/POSEIDON satellite uses an altimeter to bounce radar signals off the ocean's surface to get precise measurements of the distance between the satellite and the sea surface. Data are combined with measurements from other instruments that pinpoint the satellite's exact location in space. Every 10 days scientists produce a complete map of global ocean topography that can be used to calculate the speed and direction of worldwide

Marine biologists used ocean circulation feature maps generated with TOPEX/POSEIDON satellite data in their recent count of sperm whales and dolphins in the Gulf of Mexico.

EVERY 10 DAYS SCIENTISTS PRODUCE
A COMPLETE MAP OF GLOBAL OCEAN
TOPOGRAPHY THAT CAN BE USED TO
CALCULATE THE SPEED AND DIRECTION
OF WORLDWIDE OCEAN CURRENTS.

ocean currents.

"Scientists continue to find new applications for this project. They can study not only ocean currents, but also the creatures that inhabit the oceans," said Dr. Lee-Leung Fu, TOPEX/POSEIDON project scientist at Jet Propulsion Laboratory, which manages the U.S. portion for NASA's Mission to Planet Earth. ✨

For more information about TOPEX/POSEIDON, contact Annette deCharon.

☎ 818/354-4887, 📠 818/354-0368, ✉ annette.decharon@jpl.nasa.gov

Please mention that you read about it in *Innovation*.

NASA Technology Spins Off New Company

IN THE MID-1980'S, GODDARD SPACE FLIGHT Center's GSFC Jim Chesney was asked to develop a new telemetry system.

Through this directive, Chesney founded Goddard's Microelectric Systems Branch. When he realized the technologies he was developing had commercial application, Chesney created a program to make the technology available commercially.

Today, after commercial entities did not make use of the technology, Chesney left his job at Goddard and formed his own company.

TSI Telsys designs, manufactures and supports Gateway Systems for the telemetry, remote sensing and high data rate SatCom communities. Gateway Systems seamlessly interconnect local and wide area terrestrial networks to space communications networks at speeds of up to 300 Mbps.

TSI Telsys' network management application, Gateway Management Software (GMS), allows users to remotely control, operate and monitor Gateway Systems, as well as other ground station equipment via a graphical user interface.

Chesney reported on the recent delivery of two Test and Simulation Satellite (TSS) Gateway Systems

to Marshall Space Flight Center (MSFC). The delivery, worth \$550,000, is in addition to MSFC's spring delivery worth \$2 million. The most recent delivery uses TSI Telsys VIP card which is based on TSI TelSys Reconfigurable Systems Technology.

"Our ability to rapidly develop solutions for our customer's unique needs stems from the flexibility inherent to our Reconfigurable Systems Technology. We can even make major logic changes to systems after a delivery, greatly extending the life of our customer's equipment. Without modifying the physical hardware, we can make changes to a card at the core logic level after it has been installed," Chesney said.

Chesney retired from NASA and founded the company in 1994. The Columbia, Maryland, business, a subsidiary of TSI Telsys Corporation, Vancouver, British Columbia, is a spin-off company formed expressly to commercialize the technology developed under Chesney's leadership at Goddard.

In 1985, the Microelectronics Systems Branch began research and development on technology to support CCSDS, a protocol developed by NASA to meet its increasingly sophisticated requirements speedier data processing and to develop maximum commonality, reusability and interoperability among all new systems deployed by NASA. The initial product line includes communication processing switches that support Jet Propulsion Laboratory's Deep Space Network and NASA's Mission to Planet Earth.

The new system can receive telemetry from space much faster, according to Don Vargo of GSFC. The Gateway System also can remove header and trailer codes from data automatically, do frame synchronization and REED-Solomon Error Detection. He said the system reduces the costs and complexity of accessing satellite data by processing and distributing data in real-time.

Although TSI Telsys' products and technology were developed for satellite telemetry applications, the system can be used in the commercial communication field to process voice, imagery and text data quickly. Industry interest in the space-data-receiving system is high because of the need to link space-data satellite networks to terrestrial networks that use protocols like Asynchronous Transfer Mode (ATM). *

For more information about the Gateway System, contact Don Vargo at Goddard Space Flight Center. ☎ 301/286-2642,

✉ donald.j.vargo@gsfc.nasa.gov or James Chesney at TSI/Telsys,

☎ 410/872-3900, ✉ jchesney@tsi-telsys.com

Please mention that you read about it in *Innovation*.

Following 26 years with NASA, James Chesney founded TSI-Telsys, Inc. which designs and manufactures Gateway System products that autonomously perform CCSDS telemetry data processing and distribution for satellite imaging.



MOVING FORWARD

Space Program Insulation Down To Earth

A SPACE AGE INSULATION DERIVED FROM NASA materials is finding a myriad of new applications right here on Earth.

Energy Q Radiant Barrier is the commercial name for the material, manufactured and marketed by Tech 2000 LLC of Roswell, Georgia. The company and president, Preston E. Foster, were inducted into the U.S. Space Agency Foundation Hall of Fame in 1996.

NASA has used highly-effective radiation barriers made of aluminized polymer film since the days of the Apollo missions. The insulation ensured constant, comfortable temperatures inside the command modules and permitted the astronauts to work in their shirtsleeves.

The material has been used to protect the inner workings of satellites and a number of unmanned spacecraft, and it protects the Space Shuttles' computers.

The double-sided material, made of 99 percent pure aluminum with a fire-resistant polypropylene insert, reflects 97 percent of the heat that strikes it.

Energy Q uses reflective technology to reduce energy consumption—key for homes, offices, industrial plants and farm buildings. Energy Q is being used in protective clothing, sleeping bags and emergency care thermal blankets.

Researchers are investigating the use of Energy Q to line bridges and golf courses and to wrap water pipes for sprinklers and irrigation systems. Food storage systems from picnic coolers to pizza delivery bags to refrigerated vans and railroad cars are lined with the material. ✱

For more information about technical assistance programs for U.S. businesses, contact Marshall Space Flight Center ☎ 800/USA-NASA. Please mention that you read about it in *Innovation*.

Aircraft Cited for Innovation

AN EXPERIMENTAL AIRCRAFT THAT LEARNS as it flies is one of *Popular Science* magazine's Best of What's New for 1996.

The remotely piloted jet-powered hypersonic waverider aircraft, LoFLYTE™, has a computerized flight control system developed for NASA and the Air Force by Accurate Automation Corp.,

Chattanooga, Tennessee, under the Small Business Innovation Research (SBIR) program.

LoFLYTE's flight control system has a neural network that learns by mimicking the aircraft's remotely-sited pilot. LoFLYTE is being prepared for flight demonstrations to take place at Edwards, California with support from Dryden Flight Research Center.

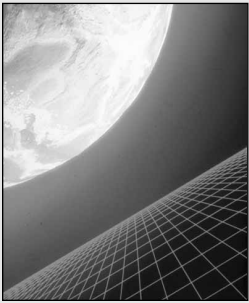
LoFLYTE's flight controller consists of a network of multiple-instruction, multiple-data neural processors. The network continually alters LoFLYTE's responses. The neural network could be trained to control the aircraft over time. Use of neural networks in-flight could help pilots of future aircraft fly in quick decision situations and help damaged aircraft land safely even when controls are partially disabled.

Individuals cited for their work with LoFLYTE are James L. Hunt, Langley Research Center; Dr. Kervyn Mach, Air Force Wright Laboratory; and Robert Pap, Accurate Automation Corp. ✱

For more information about LoFLYTE, contact James L. Hunt at Langley. ☎ 757/864-3732, ☎ 757/864-8545, ✉ j.l.hunt@larc.nasa.gov or Robert Pap at Accurate Automation Corp. ☎ 423/894-4646, ☎ 423/894-4645. Please mention that you read about it in *Innovation*.



An Engineer determines the inclination of a LoFlyte™ Wind Tunnel Model.



NASA Technology At Work

Optical Diagnostics Of Biological Fluids And Tissues

NASA Lewis Research Center seeks partners to transfer new technology developed for studying and characterizing various biological fluids. The characterization of biological fluids challenges the designers of optical diagnostics instrumentation. To address this challenge, a process known as Dynamic Light Scattering (DLS) is used to characterize dilute macromolecular solutions. DLS is not widely accepted in biological and biochemical labs because of the awkward design of its more conventional systems. To alleviate this problem, NASA Lewis Research Center developed a fiber-optic DLS probe to study various biological fluids. The state-of-the-art compact design of the fiber-optic probe offers a fast method of quantitatively and noninvasively characterizing a variety of biological fluids. The fiber-optic DLS probe has several benefits and potential commercial uses such as, ability to characterize protein solutions, blood, and viruses, spermatozoa and synovial fluids; ability to analyze skin and tissue. The system is compact, durable and free of optical alignment. The DLS fiber-optic probe also provides accurate characterization of biological fluids, low laser power, fast measurement time, portability and it is adaptable. A patent application has been filed and companies have expressed an interest in commercializing this technology. ✳

For more information contact: Dr. Rafat Ansari, Lewis Research Center ☎ 216/433-5008. Please mention that you read about it in *Innovation*.

ATM Multimedia Error-Correcting Codecs

To develop a system that will enhance the reliability of all wire-based and wireless communications that use ATM cells through a unique and innovative approach not in existence today, the NASA Lewis Research Center has been actively involved in research and technology development in satellite communications and networking. With ATM technology emerging as a prominent information carrier, ATM cells will most likely travel not

only through the fiber based networks, but through various transmission media. NASA's Small Business Innovation Research (SBIR) Program is sponsoring an on-going Asynchronous Transfer Mode Multimedia Error Correcting contract for purposes of investigating, designing and fabricating ATM coders and decoders. Potential commercial uses include wireless ATM communication, satellite communications, multi-rate ATM PC-to-PC communication. Benefits include compatibility of satellite communications with existing ATM networks, improved quality of service via error correcting coding, and significant contribution to ATM technology. ✳

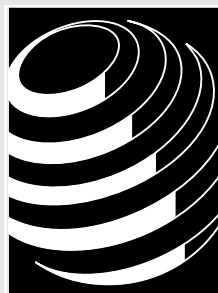
For more information, contact: Heechul Kim, Lewis Research Center ☎ 216/433-8698 or Jorge Quintana, Lewis Research Center ☎ 216/433-6519. Please mention that you read about it in *Innovation*.

Directional Electrostatic Accretion Process

NASA Lewis Research Center is seeking commercial development of its Directional Electrostatic Accretion Process (DEAP), a computer controlled manufacturing technology that creates metal products without molds, dies or tooling. DEAP's potential commercial uses include low volume tool-less manufacturing, electronics manufacturing and special materials composing. DEAP's tooling elimination cuts time and labor costs so that a non-tooled product may be produced profitably in smaller quantities allowing U.S. industries to take advantage of low-and moderate-volume producing markets. DEAP also is cleaner because solder is precisely placed eliminating the need for chemicals necessary for mask application and removal. A patent has been awarded for the technology and a second patent is pending. Lewis Research Center seeks partnerships and or patent licensing for this technology. ✳

For more information, contact: Richard C. Oeftering, Lewis Research Center, ☎ 216/433-2285. Please mention that you read about it in *Innovation*.

Technology Opportunity Showcase highlights some unique technologies that NASA has developed and which we believe have strong potential for commercial application. While the descriptions provided here are brief, they should provide enough information to communicate the potential applications of the technology. For more detailed information, contact the person listed. Please mention that you read about it in *Innovation*.



NASA Field Centers

Ames Research Center

Selected technological strengths are Information Technologies, Aerospace Systems, Autonomous Systems for Spaceflight, Computational Fluid Dynamics and Aviation Operations.

Bruce Webbon

Ames Research Center
Moffett Field, California 94035-1000
415/604-6646
bwebbon@mail.arc.nasa.gov

Dryden Flight Research Center

Selected technological strengths are Aerodynamics, Aeronautics Flight Testing, Aeropropulsion, Flight Systems, Thermal Testing and Integrated Systems Test and Validation.

Eugene (Lee) Duke

Dryden Flight Research Center
Edwards, California 93523-0273
805/258-3802
duke@louie.dfrc.nasa.gov

Goddard Space Flight Center

Selected technological strengths are Earth and Planetary Science Missions, LIDAR, Cryogenic Systems, Tracking, Telemetry, Command, Optics and Sensors/Detectors.

George Alcorn

Goddard Space Flight Center
Greenbelt, Maryland 20771
301/286-5810
george.e.alcorn.1@gsfc.nasa.gov

Jet Propulsion Laboratory

Selected technological strengths are Near/Deep-Space Mission Engineering, Microspacecraft, Space Communications, Information Systems, Remote Sensing and Robotics.

Merle McKenzie

Jet Propulsion Laboratory
Pasadena, California 91109
818/354-2577
merle.mckenzie@ccmail.jpl.nasa.gov

Johnson Space Center

Selected technological strengths are Artificial Intelligence and Human Computer Interface, Life Sciences, Human Space Flight Operations, Avionics, Sensors and Communications.

Henry (Hank) Davis

Johnson Space Center
Houston, Texas 77058
713/483-0474
henry.l.davis@jsc.nasa.gov

Kennedy Space Center

Selected technological strengths are Emissions and Contamination Monitoring, Sensors, Corrosion Protection and Bio-Sciences.

Bill Sheehan

Kennedy Space Center
Kennedy Space Center,
Florida 32899
407/867-2544
william.sheehan-1@kmail.ksc.nasa.gov

Langley Research Center

Selected technological strengths are Aerodynamics, Flight Systems, Materials, Structures, Sensors, Measurements and Information Sciences.

Joe Heyman

Langley Research Center
Hampton, Virginia 23665-5225
757/864-6005
j.s.heyman@larc.nasa.gov

Lewis Research Center

Selected technological strengths are Aeropropulsion, Communications, Energy Technology and High Temperature Materials Research.

Ann Heyward

Lewis Research Center
Cleveland, Ohio 44135
216/433-3484
ann.o.heyward@lerc.nasa.gov

Marshall Space Flight Center

Selected technological strengths are Materials, Manufacturing, Non-destructive Evaluation, Biotechnology, Space Propulsion, Controls and Dynamics, Structures and Microgravity Processing.

Harry Craft

Marshall Space Flight Center
Huntsville, Alabama 35812
205/544-5419
harry.craft@msfc.nasa.gov

Stennis Space Center

Selected technological strengths are Propulsion Systems, Test/Monitoring, Remote Sensing and Non-intrusive Instrumentation.

Kirk Sharp

Stennis Space Center
Stennis Space Center, Mississippi
39529-6000
601/688-1929
ksharp@ssc.nasa.gov

NASA's Business Facilitators

NASA has established several organizations whose objectives are to establish joint sponsored research agreements and incubate small start-up companies with significant business promise.

Dr. Jill Fabricant

Johnson Technology Commercialization Center
Houston, TX
713/335-1250

John Gee
Ames Technology Commercialization Center
Sunnyvale, CA
408/734-4700

Dan Morrison
Mississippi Enterprise for Technology
Stennis Space Center, MS
601/688-3144

Dianne Rucki
Lewis Incubator for Technology
Cleveland, OH
216/229-9445

Maria Clark
Florida/NASA Business Incubation Center
Titusville, FL
407/383-5200

Small Business Programs

Paul Mexcur
Small Business Innovation Research Program (SBIR)
301/286-8888
paul.mexcur@pop700.gsfc.nasa.gov

Carl Ray
Small Business Technology Transfer (STTR)
202/358-4652
cray@hq.nasa.gov

NASA-Sponsored Commercial Technology Organizations

These organizations were established to provide rapid access to NASA and other federal R&D and foster collaboration between public and private sector organizations. They also can direct you to the appropriate point of contact within the Federal Laboratory Consortium. To reach the RTTC nearest you, call 800/642-2872.

Carolyn Suckow
Far West Technology Transfer Center
University of Southern California
213/743-2353

Dr. William Gasko
Center for Technology Commercialization
Massachusetts Technology Park
508/870-0042

J. Ronald Thornton
Southern Technology Applications Center
University of Florida
904/462-3913

Gary F. Sera
Mid-Continent Technology Transfer Center
Texas A&M University
409/845-8762

Lani S. Hummel
Mid-Atlantic Technology Applications Center
University of Pittsburgh
412/383-2500

Christopher Coburn
Great Lakes Industrial Technology Center
Battelle Memorial Institute
216/734-0094

David Moran
National Technology Transfer Center
Wheeling Jesuit University
800/678-6882

Doris Rouse
Research Triangle Institute Technology Applications Team
Research Triangle Park, NC
919/541-6980

NASA ON-LINE

Go to **NASA's Commercial Technology Network (CTN)** on the World Wide Web at <http://nctn.hq.nasa.gov> to search NASA technology resources, find commercialization opportunities, and learn about NASA's national network of programs, organizations, and services dedicated to technology transfer and commercialization.

MOVING FORWARD

Publications

NASA Spinoff '96 is an annual publication that highlights products and services made possible by NASA-developed technology. It will be available online, February '97. Contact Jonathan Root, at 202/358-1845, e-mail, jonathan.root@hq.nasa.gov ✱

Events

NASA's marketing team will showcase its hottest technologies at the National Design and Engineering Show, March 10-13, in Chicago, Illinois. Contact Michael Weingarten, at 202/358-1680, e-mail, mweingarten@hq.nasa.gov ✱

Multi-Media

STARS-An Integrated, Multidisciplinary Finite Element Structural, Fluids, Aerolastic, and Aeroservoelastic Analysis Computer Program. Stars is a multidisciplinary, finite element-based, highly graphics-oriented, linear and nonlinear analysis tool. Its range of application includes structural analysis, heat transfer, linear aerodynamics, computational fluid dynamics (CFD), and controls engineering. It provides extensive graphics capabilities for convenient model development as well as postprocessing of analysis results. STARS is written in

FORTRAN 77 for IBM PC compatible systems running Windows 95/NT and the IBM RS/6000.

NASA/FLAGRO (Fatigue Crack Growth Computer Program) was developed as an aid in predicting the growth of pre-existing flaws and cracks in structural components of space systems. It provides the fracture mechanics analysis with a computerized method of evaluating the "safe crack growth life" capabilities of structural components. NASA/FLAGRO can be used to evaluate the damage tolerance aspects of given structural design. Written in FORTRAN 77 and C-language for IBM PC series and compatibles, Macintosh II computers, HP 9000/700's running HP-UX, DEC 4000 series computers running OSF/1, Sun 4's running SunOS, DEC VAX running VMS, SGI running IRIX, and an IBM RS/6000 running AIX.

STARS, NASA/FLAGRO and other NASA computer programs are available from COSMIC-NASA's Partner for Software Technology Transfer. Call 706/542-3265 or visit the COSMIC web site at <http://www.cosmic.uga.edu/> for more information.

On-line, NASA's Commercial Technology Policy is available on the Web (<http://nctn.hq.nasa.gov.nctn/Agenda/ctpolicy.html>). The document describes NASA policies to promote technology commercialization. ✱



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