

National Aeronautics and Space Administration



**TECHNOLOGY**

# INNOVATION

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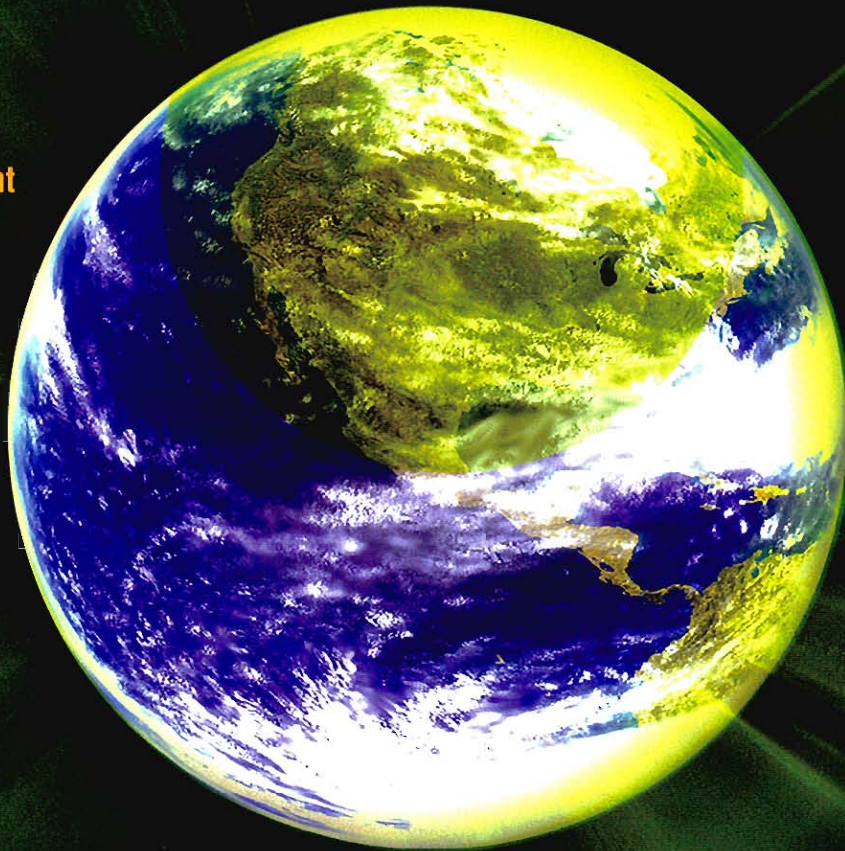
# SUSTAINABILITY

**PLUS**

**Wastewater Treatment  
Technology with  
Applications in  
Space and on Earth**

**A Green  
Technology  
Initiative  
Addresses NASA's  
Technology Needs**

**Ocean Surface  
Satellite Aids  
in Extreme Event  
Warnings**



NASA Innovations: Helping to Sustain the

## EARTH AND ITS RESOURCES

departments

To view online and for past issues, visit  
<http://www.ipp.nasa.gov/innovation>

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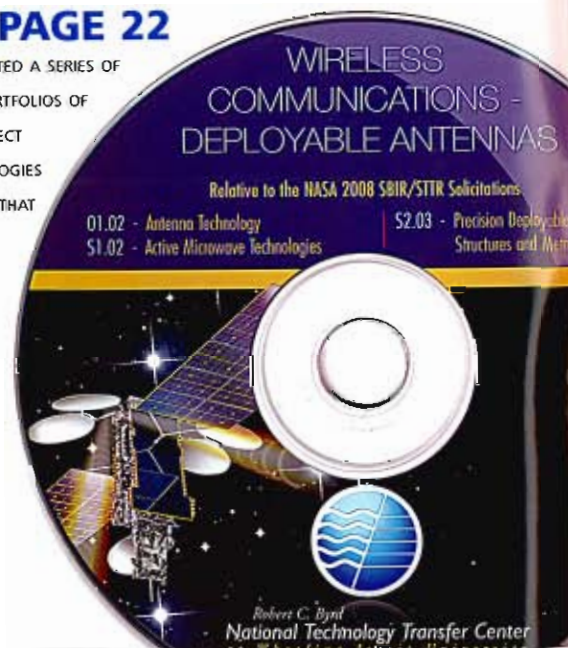
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A directory of NASA's IPP national offices and allied organizations

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THE NTTC HAS CREATED A SERIES OF CDS CONTAINING PORTFOLIOS OF INFORMATION ON SELECT SBIR/STTR TECHNOLOGIES AND THE COMPANIES THAT DEVELOPED THEM



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UPFRONT with...

**Douglas A. Comstock**

Director, NASA Innovative Partnerships Program



Since its creation 50 years ago, NASA has nurtured partnerships to transfer NASA-derived technologies for public benefit. These benefits have reached throughout the economy and around the globe. NASA's research has not only enhanced our understanding of air and space, but also our understanding of the Earth and how to sustain the Earth and its resources. This issue of *Technology Innovation* is dedicated to highlighting a few of the important contributions made by NASA technology towards sustainability of our planet.

In the cover story, NASA's Deputy Administrator, the Honorable Shana Dale, introduces some of the many areas in which NASA and its technologies are making a positive contribution to sustainability. Other stories provide a more detailed look at some of these exciting projects and technologies, including the following:

- A satellite system helping researchers improve current models for predicting hurricane intensity and tsunami warnings,
- Software and a hotspot-detecting sensor that were instrumental in helping firefighters battle the 2008 wildfires in southern California,
- A wastewater treatment system that is under development for long-duration missions on the moon and Mars, and is also being considered for use at Earth-bound water treatment facilities,
- Technologies to monitor oil and gas pipelines to detect leaks, encroachment and intrusions, and ground disturbances and movements,
- A "smog blog" to help government and health officials as well as the public monitor air quality and mitigate negative health issues in Central America and the Caribbean.

NASA also is applying sustainability practices in our facilities and operations. In this issue, you will read about how NASA is using "green" materials and practices in new construction of Agency facilities, and how NASA is studying the feasibility of building a biogasification plant that would provide an alternate fuel source at Johnson Space Center and help scientists there to study the technology for use in addressing waste issues and energy needs for operations on the moon and Mars.

NASA works with partners from industry, academia and other federal agencies in developing technologies for the space program and also in adapting them for other applications including sustainability. For example, you will read about how NASA is actively working with Google and the environmental community to identify new areas for partnership.

These stories on sustainability represent a few of the many ways that NASA's expertise and technologies are contributing to a cleaner and safer Earth. I hope you enjoy reading about them in this issue of *Technology Innovation*. As always, I welcome your feedback. Please feel free to contact me at [doug.comstock@nasa.gov](mailto:doug.comstock@nasa.gov).

# Innovative Research

## NVision Adapts HazNet Emergency Management System for NASA Projects

By Kevin Schultz  
NVision Solutions Inc.

Recent natural and man-induced disasters have given the emergency management arena opportunities for developing valuable lessons learned.

Hurricane Katrina devastated the Gulf Coast in 2005, demanding immediate responses from emergency relief organizations. Government agencies and non-government organizations worked frantically to aggregate the best available geospatial data as a baseline for mapping and tracking the devastation, supplies, relief, search and rescue, debris removal, reconstruction and other response and recovery efforts.

Both during and after the storm, data providers quickly generated new geospatial data, digital imagery, feature datasets and location-based content. Operating independently, these organizations often struggled to effectively communicate, collaborate and share data. Problems such as licensing, data ownership restrictions and a non-existent centralized data repository complicated efforts to work together. Moreover, tools did not exist for exploiting geospatial data from various stakeholders.

To alleviate some of these problems, NVision worked with NASA, the Department of Homeland Security (DHS), the Federal Emergency Management Agency (FEMA), Boeing and NAVTEQ to develop the Web-based, Geographic Information System (GIS)-centric "All Hazards Network" (HazNet) application.

HazNet provides a coherent, real-time, Common Operating Picture (COP) for public safety, homeland security,

counter-terrorism, anti-force protection, emergency management and disaster planning, response and recovery. HazNet incorporates the DHS strategy-oriented National Incident Management System (NIMS), the procedure-oriented Incident Command System (ICS) and the standardized government formats, nomenclature and icons.

Based on its interoperable design, HazNet communicates with existing systems and tools, networks with remote incident reporting devices (i.e., portable field units) and integrates the relevant information for innovative crisis situational awareness and collaborative decision-making. HazNet leverages ESRI ArcEngine and Leica Geosystems ERDAS TITAN geospatial technology to host, serve, share and manage the data. By employing these technologies, NVision provides a secure, permission-based, real-time data sharing, access and distribution solution while simultaneously protecting licensing and ownership rights.

The Real-time Emergency Action Coordination Tool (REACT) forms the core of HazNet, which connects multiple REACT systems together into an overarching network. REACT is NVision's original low-cost and easy-to-use first responder decision support system built with geospatial technology to provide scalability and vertical integration. The portable field units use the latest smart-phone technology equipped with GPS, digital camera, voice recorder and real-time wireless connectivity. The HazNet application only requires Internet access, a HazNet user account and access permissions set.

Emergency management officials in Hancock County, Miss., and St. Tammany Parish, La., use the current HazNet version, whereas Jefferson Parish, La., employs an older customized version of REACT. NVision and Hancock County Emergency Operations Center (EOC) staff deployed HazNet during Hurricane Ike. Staff generated mapbooks, modeled the potential impact, collected real-time incidents using portable field units, assessed damaged areas and created detailed damage reports.

## EXAMPLES OF HOW NASA IS WORKING WITH SMALL BUSINESSES AND ACADEMIA

PHOTO CREDIT: NVISION SOLUTIONS INC.



### NASA Upgrades, Enhancements and Customization

Through a NASA Small Business Innovation Research (SBIR) Phase 3 contract, NVision is upgrading, enhancing and customizing the HazNet EMS for use at NASA's Stennis Space Center (SSC), Michoud Assembly Facility and Headquarters.

One enhanced capability involves integrating an intuitive large-format multi-user interactive touch-table display device ([www.intuiface.com](http://www.intuiface.com)) to aid NASA in visualizing and managing hazardous situations, enabling collaborative problem-solving and decision-making and conducting preparedness exercises. For the first time, the customized HazNet system will provide the NASA EOC staff with a seamless system for accessing information from the following sources:

- SSC's institutional GIS
- Recent studies on hurricane flood and wind effects for SSC, Michoud and surrounding areas
- NASA's soon-to-be-installed automated mass notification system

- NASA's CCTV cameras that monitor hazardous areas
- SSC's upgraded weather station array

NVision is providing some additional enhancements and customization of HazNet. These capabilities and features include the following:

- Incorporating 3D building displays
- Adding known or measured flood inundation data
- Working with NOAA to develop a Web-based ALOHA (Areal Locations of Hazardous Atmospheres) program for air dispersion modeling
- Incorporating existing NASA management software modules for establishing security and safety zones required in emergency situations
- Deploying within NASA network security and Web standards
- Integrating emergency vehicle and asset tracking
- Including a shelter management system
- Providing other emergency management capabilities

This SBIR Phase 3 contract will provide a significant upgrade to the currently available NASA EOC technology. Moreover, NASA awarded Geospatial Research Innovation an SBIR Phase 3 contract for upgrading the SSC weather station array and providing the capability to extract data from NOAA coastal tide stations and from the National Weather Service for integrating into HazNet.

### Tips for Partnering with NASA

For businesses that are or will be working with NASA on similar partnerships, the following tips may be of assistance:

- Find partners outside of NASA who can either help pilot the technology or provide partial or full matching funds for the project. In addition to NASA, NVision received support from federal and local government (e.g., USDA; USGS; St. Tammany Parish, La.; and Hancock County, Miss.), the private sector (e.g.,



PHOTO CREDIT: NVISION SOLUTIONS INC.

Boeing), academia (e.g., University of Mississippi) and others to "snowball" the project into something bigger and directly relevant to the general public.

- Secure support letters from subject-matter experts whom you have briefed or to whom you have demonstrated the project. They can be of great help in making the project as widely relevant as possible.
- Justify the project's value in terms of commercial use, benefits to society and benefits to NASA. Use keywords and address critical and/or emerging issues, needs and initiatives.
- Build a public relations machine around the project with these activities: Construct creative press releases to highlight your project. Ask your local newspaper and TV news station to do a feature story. Inform your state and national representatives about the project. Give presentations and demonstrations at conferences. Submit the project for industry and government awards.

Below are links to the IntuiLab's IntuiFace multitouch

interactive surface and application platform, which NVision will integrate with HazNet:

- Virtual Earth Demo:  
<http://www.youtube.com/watch?v=4R7yO-6S-u0>
- Multitouch Show Off:  
<http://www.youtube.com/watch?v=8pwo0o5150s>
- More videos: [http://www.intuiface.com/index.php?option=com\\_content&task=view&id=16&Itemid=30](http://www.intuiface.com/index.php?option=com_content&task=view&id=16&Itemid=30) ■

*Kevin Schultz is lead proposal writer for NVision Solutions Inc.*

*For more information, please contact the author at [kschultz@nvisionsolutions.com](mailto:kschultz@nvisionsolutions.com). To view a video demonstrating HazNet, please visit: <http://www.jumpcut.com/fullscreen?id=DA594AB6204E11DDBAEF000423CF4092&type=movie>.*

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

Technologies are available for licensing and joint development at each of the NASA Field Centers through their Innovative Partnerships Program (IPP) offices. Here are details on several available technologies. For a comprehensive list, go to <http://lipp.nasa.gov>

## Fire-resistant, Lightweight Electrical Insulation Material

NASA's Langley Research Center has developed a new class of polyimide composite electrical insulation materials for wires, cable and bus pipe. These materials have been shown to withstand a 12-hour gas flame test while maintaining structural and electrical circuit integrities. They show promise for use in high-voltage, high-power systems and can improve survivability and continuity of the electrical power supply. Besides fire resistance, these materials also provide weight and space savings because of their lightweight nature and exceptionally high performance capability.

NASA developed the wire insulation for exploration and space operations. The technology also has applicability to other high-voltage, high-power systems for the Navy, high-rise building construction and other industries.

### Technology Details

The technology combines the superb heat resistance and dielectric properties of the RP46 polyimide, reinforced with glass or quartz fibers or fabric. RP46, developed at NASA, exhibits high mechanical strength and structural durability at elevated temperatures. It

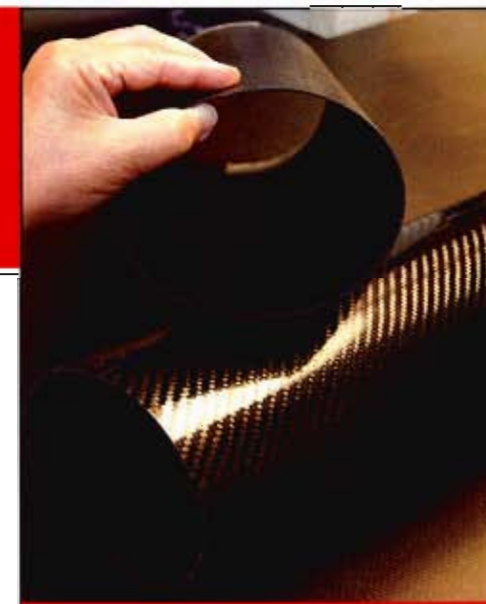


PHOTO CREDIT: NASA

A MOTORCYCLE MUFFLER PROTOTYPE MADE FROM RP46, WHICH EXHIBITS HIGH MECHANICAL STRENGTH AND STRUCTURAL DURABILITY AT ELEVATED TEMPERATURES.

also features significantly less moisture absorption and is therefore less susceptible to moisture-induced damage. RP46 demonstrates excellent thermal oxidative stability and chemical corrosion resistance. The advantage of using glass or quartz fiber reinforcement is their ability to maintain physical integrity over a wide range of temperature, humidity, voltage and frequency.

A copper or aluminum bus pipe insulated with the material withstood several rounds of three-hour gas flame tests, each time being exposed to temperatures between 2,100°F and 2,300°F. No fire or fuse failure was observed. Results show that the insulated bus pipe has the ability to maintain both structural and electrical circuit integrity in extreme and corrosive environments.

### Benefits

- Safety and reliability – reductions in fire hazards as the insulation is rated for use at 2,300°F
- Weight reductions – lighter weight than similarly performing insulations
- Space reductions for wiring installations that are constrained by space limits
- Higher power, higher voltage systems due to lighter weight and higher temperature performance capability
- Improved properties compared to current insulation materials:
  - low dielectric constant (2.9 at 10 GHz), low dissipation factor, and permittivity
  - excellent moisture and chemical resistance
  - Halogen-free

### Applications

- Aerospace – space operations and exploration
- Marine – all-electric ships that require large amounts of power to be moved about the ship
- Construction – enables higher voltage power lines needed for high-rise buildings ■

*For details about licensing or joint development opportunities associated with this technology, or information on partnering with NASA, contact Langley at (757) 864-1178 or [LARC-DL-technologygateway@mail.nasa.gov](mailto:LARC-DL-technologygateway@mail.nasa.gov), or visit [technologygateway.nasa.gov](http://technologygateway.nasa.gov).*

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