Spring 2013

TECHNOLOGY today®

Southwest Research Institute®

San Antonio, Texas

Spring 2013 • Volume 34, No.2

TECHNOLOGY today

Director of Communications
Craig Witherow

Editor
Joe Fohn

Assistant Editor
Deborah Deffenbaugh

Editorial Assistant
Kasey Chenault

Design
Scott Funk

Photography
Larry Walther

Illustrations
Andrew Blanchard

Technology Today (ISSN 1528-431X) is published three times each year and distributed free of charge. The publication discusses some of the more than 1,000 research and development projects under way at Southwest Research Institute. The materials in Technology Today may be used for educational and informational purposes by the public and the media. Credit to Southwest Research Institute should be given. This authorization does not extend to property rights such as patents. Commercial and promotional use of the contents in *Technology Today* without the express written consent of Southwest Research Institute is prohibited. The information published in Technology Today does not necessarily reflect the position or policy of Southwest Research Institute or its clients, and no endorsements should be made or inferred. Address correspondence to the editor, Department of Communications, Southwest Research Institute, P.O. Drawer 28510, San Antonio, Texas 78228-0510, or e-mail *jfohn@swri.org*. To be placed on the mailing list or to make address changes, call (210) 522-2257 or fax (210) 522-3547, or visit *update.swri.org*.

About the Institute
Since its founding in 1947, Southwest Research Institute (SwRI) has contributed to the advancement of science and technology by working with clients in industry and government. Performing research for the benefit of humankind is a long-held tradition. The Institute comprises 11 divisions engaged in contract research spanning a wide range of technologies.

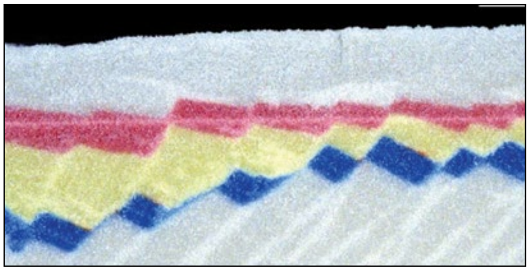
Southwest Research Institute on the Internet:
swri.org

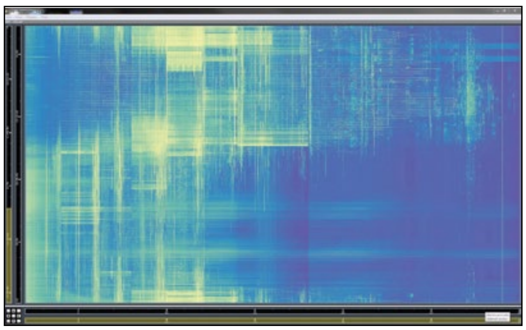
COVER

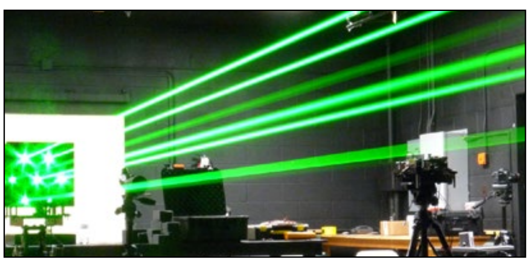
About the cover
Exposed rock strata can reveal folds, faults and other deformation features that also exist deep underground in the same formation and may have significance for the performance of oil and gas reservoirs.

CONTENTS

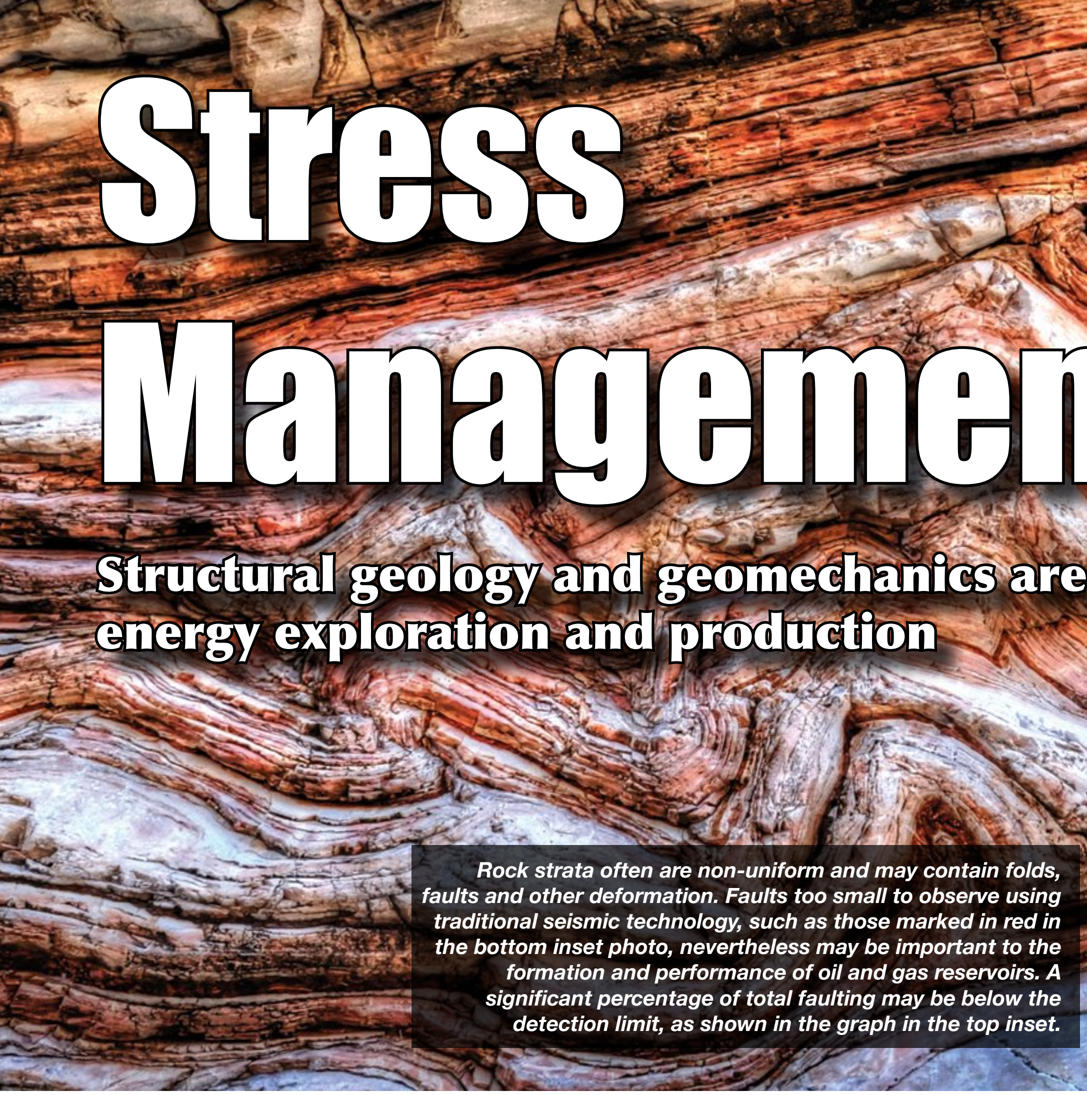
ARTICLES





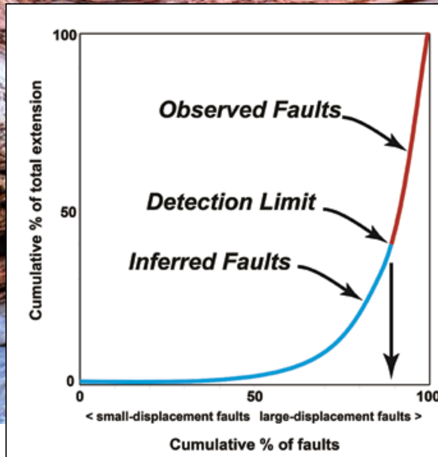


Departments



Stress Management

Structural geology and geomechanics are applied to energy exploration and production



Rock strata often are non-uniform and may contain folds, faults and other deformation. Faults too small to observe using traditional seismic technology, such as those marked in red in the bottom inset photo, nevertheless may be important to the formation and performance of oil and gas reservoirs. A significant percentage of total faulting may be below the detection limit, as shown in the graph in the top inset.

By David A. Ferrill, Ph.D., Alan P. Morris, Ph.D., Kevin J. Smart, Ph.D. and Ronald N. McGinnis

After more than 150 years of oil and gas production following the first successful oil well in Pennsylvania in 1859, most of the easy-to-produce oil and gas reservoirs have already been found. New hydrocarbon discoveries tend to be more structurally complex and located in tighter rock, at greater depths or in deeper water. Finding these harder-to-reach resources, and then producing from them, calls for ever-increasing expertise in characterizing and understanding the influences of geologic structures on the deposition and deformation of reservoir, seal, and source strata.

Over the years, new and more sensitive seismic technologies have been developed to reveal formerly unrecognized subsurface geologic structures. In many cases, however, the products of geologic deformation which occur as faults, folds and fractures are still below the detection limits of 3-D seismic reflection data, thus requiring a geologist to predict or infer subseismic-scale deformation. To be successful in these increasingly challenging exploration and production environments, petroleum geologists need higher resolution tools, but perhaps more important, they need sophisticated training to aid interpreters as they analyze the data generated by the improved hardware and software tools. A team of geologists from Southwest Research Institute (SwRI) has developed approaches to aid oil and gas exploration and improve the prospects for successful production from unconventional reservoirs.

The process involves collecting data to characterize the natural deformation, rock mechanical properties and stress environments; studying outcrops to characterize reservoir rocks or their analogs; analyzing stress fields, both past and present, and predicting stress changes resulting from production activities such as hydraulic fracturing and pressure declines; and performing geomechanical analyses using physical analog and numerical modeling techniques.

Stress and geomechanical analyses allow geologists to leverage limited static data and thus track dynamic stress and deformation over time. The time scales range from geologically instantaneous seismic deformation caused by earthquakes or induced hydraulic fracturing, to longer-term production

Dr. David A. Ferrill is director of the Earth, Material and Planetary Sciences Department. He is a structural geologist with international research experience in various tectonic regimes and oil and gas exploration. Dr. Alan P. Morris, a staff scientist, is a structural geologist with expertise in quantitative analysis of rock deformation. Dr. Kevin J. Smart, a principal scientist, is a structural geologist with cross-training in computational solid mechanics. Ronald N. McGinnis, a senior research scientist, is a structural geologist with expertise in characterizing mechanical stratigraphy and the control it has on deformation. All are with the Earth, Material and Planetary Sciences Department of the Geosciences and Engineering Division at Southwest Research Institute.

(field lifetime) scales, and ultimately to geologic time scales.

The basics of reservoir analysis

Geologic structure, stress and fluid pressure conditions, and geomechanical behavior of rock are key elements in determining trap, reservoir and charge in hydrocarbon systems. Conventional hydrocarbon traps are commonly formed by geologic structures such as domes, anticlines, and sealing faults. Fracture and fault systems can also compromise trap integrity and may be difficult or impossible to detect. So-called unconventional resource plays, where the source and reservoir rock are the same, are becoming increasingly important in hydrocarbon exploration and production. These unconventional plays are typically dependent on induced fracturing ("fracking") for their economic viability, and therefore the presence or absence of natural faults and fractures, the ambient stress state, and the mechanical characteristics of the reservoir rocks are critical factors in planning effective production strategies.

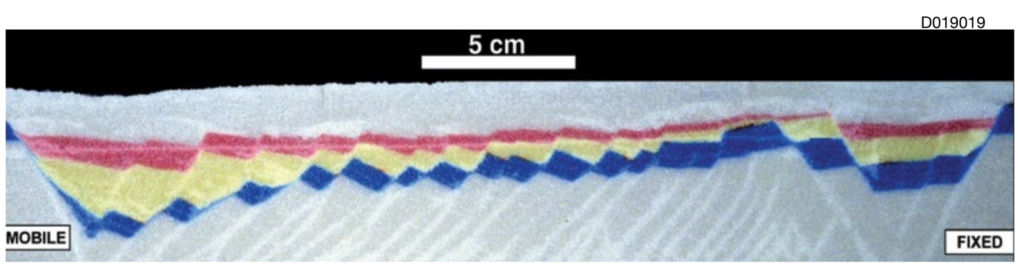
Reservoir quality, especially in tight (low porosity) reservoir rock, is often enhanced by open natural fractures. In contrast, small-displacement sealing faults can significantly reduce reservoir quality and compartmentalize hydrocarbon reservoirs. Increasing fluid pressure to stimulate hydraulic fracturing in unconventional shale or tight sand reservoirs takes advantage of ***in situ*** stress and fluid pressure conditions to reactivate natural fractures and induce new fractures to create or enhance fracture permeability. In contrast, declining fluid pressures over a reservoir's productive lifetime can cause naturally permeable faults and fractures to close or lose their permeability, thus reducing overall reservoir permeability or compartmentalizing the reservoir.

In many cases, hydrocarbon generation and migration into a reservoir depends on stress conditions, geomechanical properties of rock, deformation processes, and geologic structure. These conditions commonly combine to provide pathways for migration of hydrocarbons from the site of source rock maturation, sometimes called the "kitchen." In unconventional reservoirs, the kitchen is also the reservoir, and conditions that are favorable for migration are detrimental to the richness of the reservoir because they allow some hydrocarbons to escape.

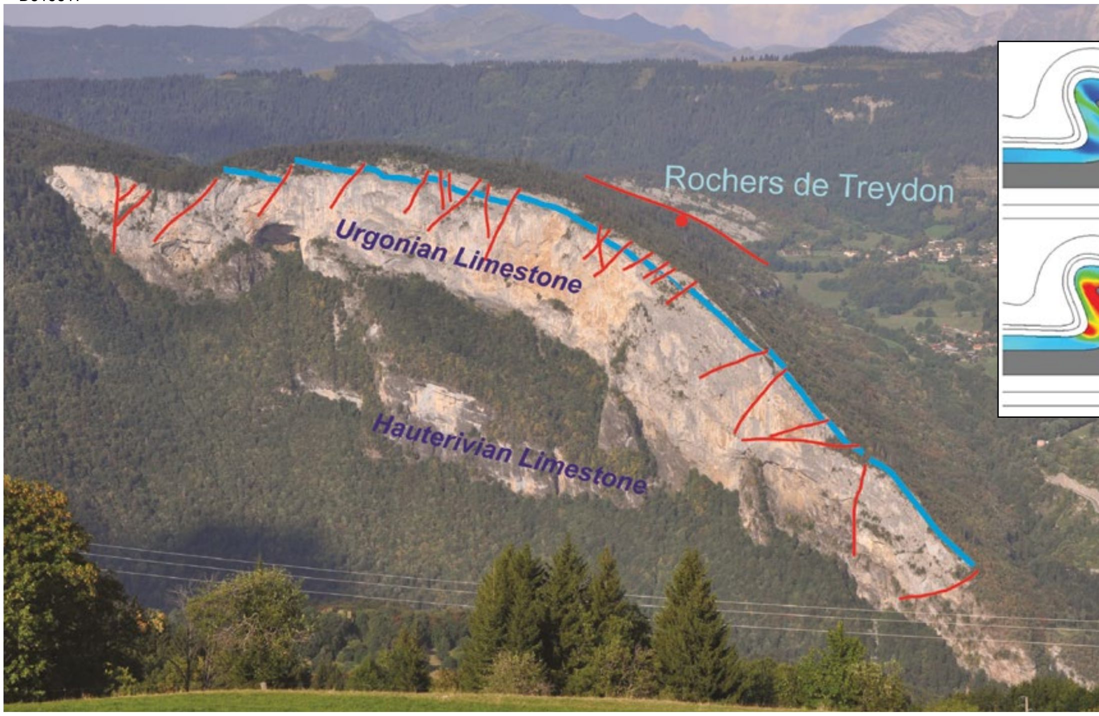
Although, with virtually no significant exceptions, oil and gas reservoirs are buried beneath the earth's surface, direct analogs of the rock types and structural features (folds, faults and fractures) can be observed first-hand somewhere at the earth's surface. In the spirit of H.H. Read's observation that the best geologists are the ones who have seen the most rocks, it is essential to develop an understanding of reservoir behavior by observing and analyzing rocks in the field. To this end, geologists inform their models by studying the closest field analogs to the reservoir rocks they wish to understand.

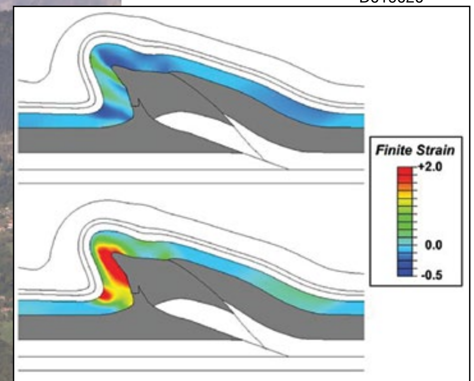
Modeling applications

Geomechanics is the application of mechanical (or rock mechanical) principles to geologic problems. Although geomechanical modeling often invokes the idea of computer-based analysis, the structural geology community has a well-established record of using physical analog as well as numerical modeling techniques to understand structural geology and geomechanics problems.



This photograph shows a vertical slice through a model of extensional faulting that uses unconsolidated sand to simulate brittle rock. Physical analog modeling is useful for simulating fault systems.





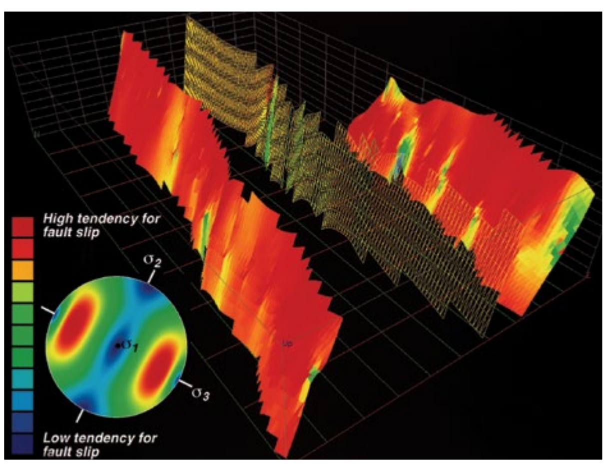
Red lines show faults on a field photograph from an SwRI study of the plunging Bargy anticline in Haute Savoie, France. The inset shows 2-D finite element simulation of the Bargy anticline with contours of minimum (upper diagram) and maximum (lower diagram) principal strain magnitudes (red=extension, blue=contraction).

Therefore, these two approaches should be thought of as complementary.

Physical analog models typically employ a model material or materials whose behavior in the lab is analogous to some material in nature. Among the most commonly used materials for studying geologic phenomena are dry sand, wet clay and silicone putty. Physical analog models have the advantage of allowing very large strains to develop and failure (fault rupture) to occur. They are especially well-suited to the study of complex three-dimensional structures as they form, and they can provide powerful conceptual insights. The primary disadvantages are the difficulty in building multiple near-identical models, which makes parametric study challenging, and the limitations on extractable information. For example, the geometry and developmental history of a structure are available, but quantitative stress values are not.

Numerical models also have a long history of use in understanding structural geology and geomechanics problems. Numerical models offer the advantage of providing detailed information such as stress, strain, temperature and pore pressure throughout the entire evolution of the structure, both temporally and spatially. In general they are well-suited to parametric studies where one or more components are systematically varied; for example, material properties and loading conditions. Even with recent advances in computer power, however, complex three-dimensional numerical models are still difficult to construct and may take days or even weeks to run.

Finite element modeling is particularly powerful for oil industry problems because it allows modeling of systems across all scales and time frames, simulating large displacements and strains, implementing diverse material model (viscous, elastic, plastic, viscoelastic or elastic-plastic) behavior, simulating permanent deformation and tracking realistic stress, strain and fluid pressure.



Slip tendency analysis of three fault surfaces illustrates that minor fluctuations in fault orientation result in significant changes in slip tendency within a homogeneous stress state. Slip tendency can correlate with fault zone permeability and serve as an indicator of fault leakage, migration pathways or areas at high risk for loss of circulation during drilling.

Major strides have been made in recent years in simulating oilfield-scale structures, calibrating models against quantitative measures of geometry, deformation, or stress and fluid pressure information and testing the influence of variables such as rock strength and the role of bedding plane slip. These results have demonstrated that finite element forward models can replicate large-scale geometries and patterns of smaller-scale deformation within layers. Results have also highlighted the key role that mechanical layering and bedding plane slip can have on deformation, and the importance of factoring this into numerical simulations. New results are demonstrating the utility of finite element modeling to simulate induced hydraulic fracturing in mechanically layered rocks, including the generation of tensile and shear failure.

Summary

Structural geology, stress and geomechanical analysis are important components of oil and gas industry exploration and production. This is especially true as the industry enters increasingly complex and

SwRI program illuminates Eagle Ford geology for oil and gas producers

Before risking millions to drill a new well, oil company geologists might wish they could peer through thousands of feet of solid rock to better understand what lies below.

Through a program managed by Southwest Research Institute's (SwRI) Geosciences and Engineering Division, geologists are studying the deeply buried South Texas formation known as the Eagle Ford Shale by visiting the places where it is exposed at the ground surface.

The Eagle Ford Formation is a highly productive oil and gas reservoir. In the industry, it's a type known as "unconventional," which generally means that the source rock for the hydrocarbons is also the reservoir, a situation sometimes called self-sourced. Variability in mineralogy, natural fracturing, and ambient stress state influence the industry's ability to hydraulically fracture the reservoir, therefore making it a challenge to develop an optimal drilling strategy.

Geologists want to know how pre-existing 'natural' fractures might influence hydraulic fracturing and well performance, what types of fractures are likely to be produced, how far they will extend and what volume of rock a well may be able to produce from. The answers to these questions are crucial to drilling strategy.

To help answer such questions and understand the fundamental relationships between stratigraphy, natural fracturing, and stress conditions, SwRI in 2011 organized a joint industry project for producers in the Eagle Ford and associated formations.

Midway through its first two-year phase, the Eagle Ford Joint Industry Project includes eight member oil companies. It offers geologists a chance to view outcrops of the Eagle Ford and associated formations at locations in West and South Central Texas.

D019021

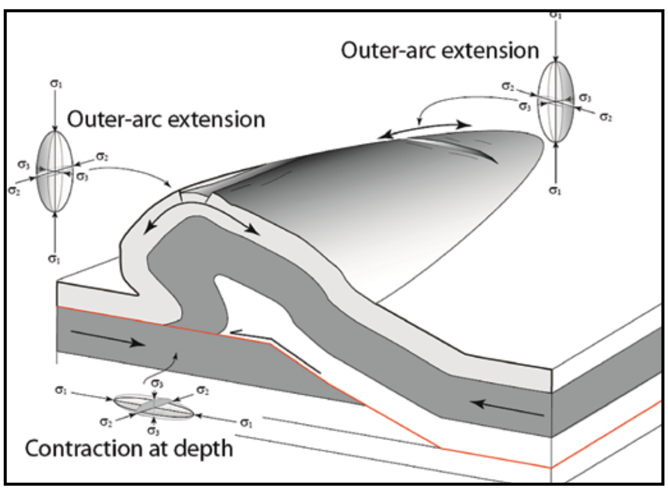
Petroleum-bearing strata can be better understood by viewing locations where they outcrop, such as this exposure of the Boquillas Formation, also known as the Eagle Ford, in a road cut near Del Rio, Texas.

From studies of those outcrops, investigators analyze the stratigraphy and mechanical behavior of the strata and natural deformation including faulting, folding, and fracturing, as well as past and present stress conditions. The analyses help producers understand the pre-existing natural deformation, as well as the important role that mechanical stratigraphy plays in controlling distribution and style of faulting, fracturing and related deformation.

In addition to outcrop-based analyses, the project includes geomechanical simulation of natural and induced fracturing to better understand the behavior of the Eagle Ford and other mechanically layered or heterogeneous self-sourced (unconventional) reservoirs. These results are transforming how companies understand and plan development in the Eagle Ford.

Membership fee for the consortium is $75,000 for each two-year phase.

Contact Ferrill at (210) 522-6082 or david.ferrill@swri.org.



D019018

This conceptual model of a plunging fold shows opposing geologic forces at work, such as extension at the outer arc compared to contraction at deeper locations.

challenging geologic environments both conventional and unconventional. Sound understanding of structural geology and geomechanics concepts can be developed through classroom and outcrop studies. Site-specific structural geologic and geomechanical investigations are often warranted to address exploration and production challenges, and the selection of the approach(es) depends on the problem, setting and available data. Mapping is often the first order of business, and many problems can be preempted by careful interpretation, consideration of multiple working hypotheses for areas of poor data, and better mapping. It is never too early in a project to start thinking about subseismic scale structure, mechanical stratigraphy, stress and fluid pressure conditions, and perturbations to structural geologic and geomechanical conditions that will occur due to injection and extraction processes. Efforts to understand these factors should start simple, start early in the project and be updated using additional data as they become available.

Questions about this story? Contact Ferrill at (210) 522-6082 or david.ferrill@swri.org or Morris at (210) 522-6743 or alan.morris@swri.org.

Acknowledgments

We appreciate the thoughtful review by Dr. Gary Walter. Portions of this work were supported by several Southwest Research Institute Internal Research and Development projects.

A Good Scout™

An SwRI-developed tool enables signal analysts to scan an area's radio spectrum and locate signal sources.

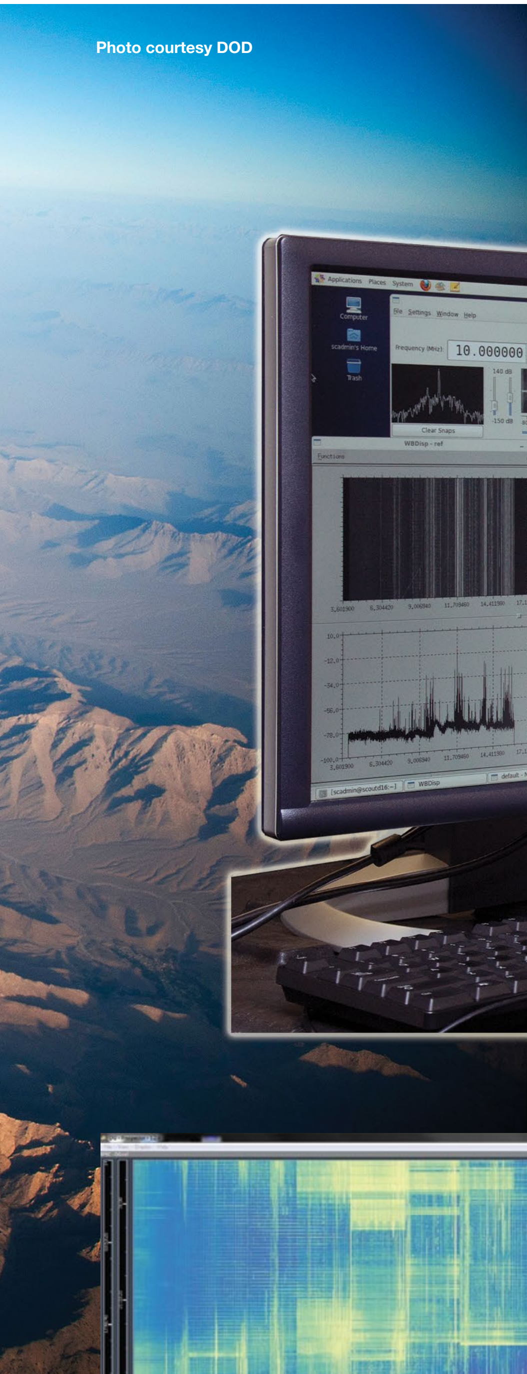
By James H. Nixon

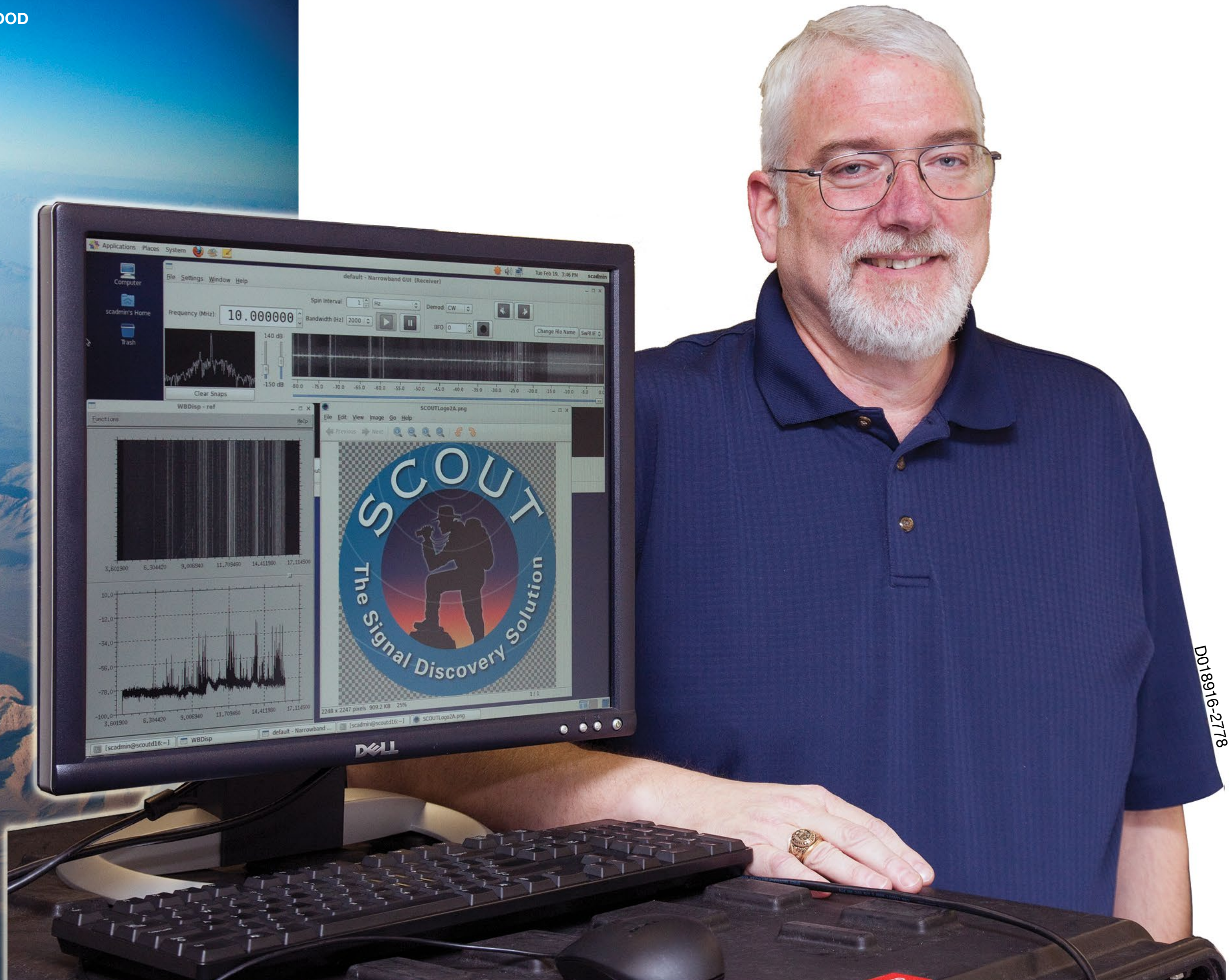
Tourists who find themselves in an exotic locale typically spend some time taking in the local sights and sounds to get a better sense of the place and its people. Likewise, before military specialists can operate safely in some remote and potentially hostile part of the world, they also need a sense of the local environment's electronic sights and sounds.

An almost universal facet of modern communications is the unseen and silent chatter of wireless communications, both friendly and hostile. Unlike normal broadcast radio or TV stations, the sources of this chatter don't advertise their broadcast frequencies. It is up to signal intelligence, or SIGINT, specialists to detect the signals, locate their source and interpret their significance to the mission at hand. Engineers at Southwest Research Institute (SwRI) have been conducting research in antennas and geolocation for more than 60 years. A newly developed system — dubbed Scout — is a portable, yet highly capable system for supporting radio frequency (RF) survey teams deploying to uncharted geographic regions.

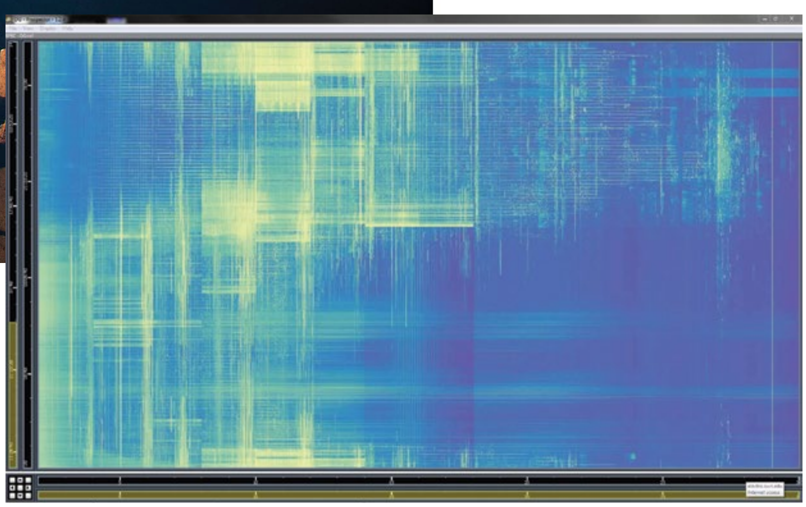
Reading the signals

Scout comprises a family of wideband radio frequency survey and direction-finding systems that operate in the high, very high and ultra-high (HF, VHF and UHF) frequency ranges. It provides a view into the types of communications transmissions employed in the geographic region of interest. If a network of Scouts is deployed, the locations of these transmitters can be determined using direction finding and radiolocation techniques. Such surveys are an important first step in





James H. Nixon is director of the SIGINT Solutions Department in SwRI's Signal Exploitation and Geolocation Division. He leads the design, development and deployment of modern radio communications intelligence solutions. His expertise includes wideband and narrowband signal acquisition and direction-finding systems.

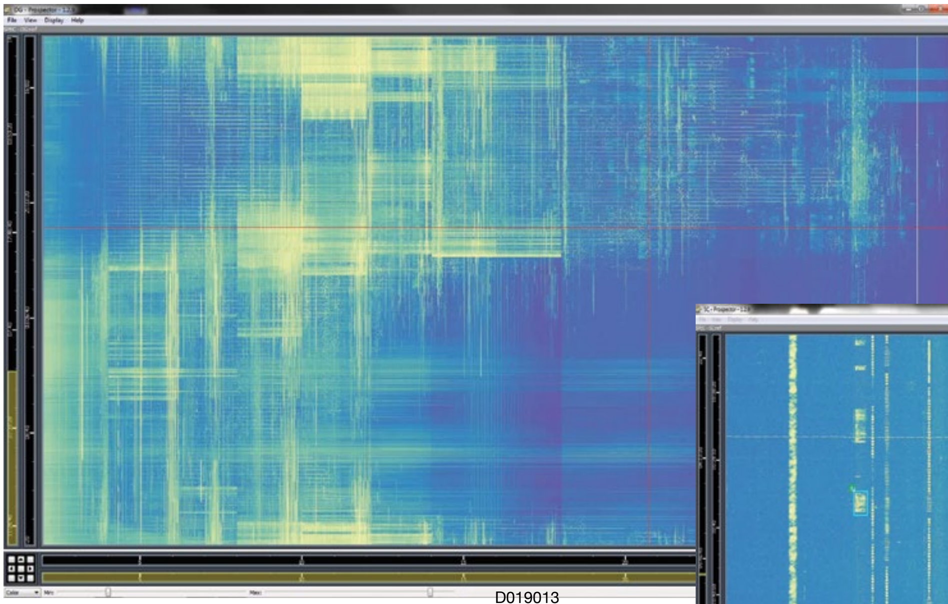


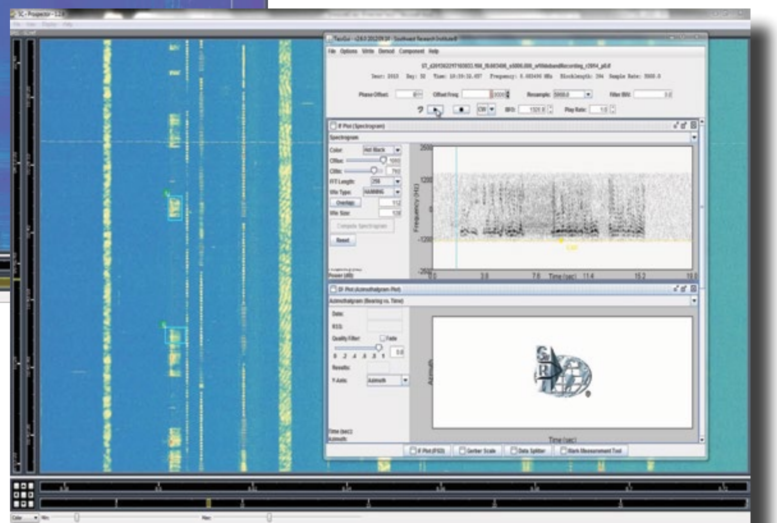
One aspect of the Scout system is an SwRI-developed function known as "Prospector," whose user interface allows the operator to select from a stored display of radio frequency activity over the past 24 hours.

understanding an adversary's modes of communication and preparing military and intelligence sources for the electronic battlefield.

SIGINT is derived from electronic signals and systems used by adversaries for communications systems, radars and weapons systems. It provides a vital window into the capabilities, actions and intentions of adversaries. A category of SIGINT called communications intelligence, or COMINT, focuses on exploiting an adversary's communications signals. These types of signals include voice, Morse code and many digitally coded signals, such as those used by cell phones and data modems.

Scout includes a radio antenna, special radio signal tuners and a number of high-performance servers similar to those used by information technology



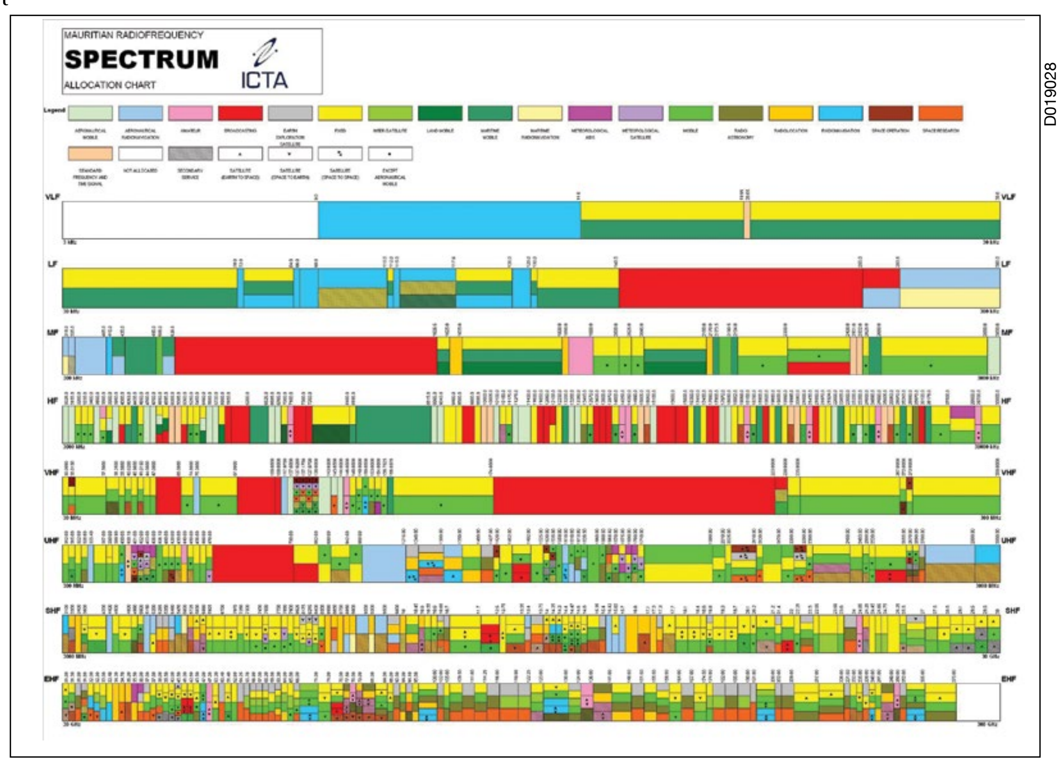


An operator can select a single RF signal (left top photo) for analysis by Scout software (right bottom photo).

data centers and for scientific research. Once the radio spectrum is digitally converted to ones and zeros by the special wide-bandwidth radio receiver hardware, the digitized radio spectrum is transferred over a high-capacity local area network to an array of computer servers. SwRI-developed software running on these servers performs a number of signal processing steps needed to take the raw RF environment and transform it to useful information. The first step in this process is to automatically detect signal events occurring anywhere within the frequency coverage of the system. Once such energy has been detected, the system builds a software radio receiver that filters and isolates the new energy into a narrow-band channel.

Adding a sense of direction

The Scout system can construct hundreds of these channels simultaneously. Once the new energy has been channelized, it is routed to one of many mission prosecutor software services. Within these mission prosecutors, the channel is automatically analyzed by SwRI-developed modulation recognition software to determine the general type of modulation employed and ascertain whether the energy comes from a voice, Morse code or digital modem signal, and what kinds of digital modulation techniques are being employed. Additional processing is applied to digitally modulated signals to further refine the identification process, ultimately resulting in a determination of the specific type of modem employed, and in some cases, the underlying data protocols in use.



Scout operates across the RF spectrum, as shown in this usage allocation chart.

If the digital signal is recognized by the system, it is then demodulated and decoded to extract the underlying data being communicated. Even signals that are not part of the Scout signal-of-interest library are catalogued. This information can help the user discover new signals of interest. If the unit is equipped with the radio direction-finding option, a line of bearing is computed from the Scout's location to the radio transmitter. Moreover, a number of Scouts can be networked together and the various lines of bearing can be triangulated so that the radio transmitter's estimated location can be computed. The final results are stored in a database. Web browser-based tools are provided with the system to allow any authorized user on the Scout network access to the collection results.

D018916-2860

An SwRI engineer prepares a Scout system for operation. The unit is much more compact than earlier systems.

Record now, playback later

Scout also supports manual search and user-driven signal discovery operations. The automatic RF environment cataloguing operation requires that the user already know many details about the signals of interest. In many cases the types of signals are known, and the automatic search capability will confirm that they exist in the geographic region of interest. However, if an adversary deploys a newly invented signal waveform, the automatic system may not identify those emissions or characterize them in enough detail to assist the user. For these situations, the SwRI team developed a graphical user interface (GUI) tool, called Prospector, which is deployed with Scout to enable the operator to visualize the RF environment and search for interesting and unique signal activity. This is accomplished by storing the last 24 hours of RF spectrum on Scout's internal hard drive. An operator who sees an interesting signal event can simply draw a box around the signal and Scout constructs a software radio on the spot that channelizes the signal and presents the waveform in another SwRI-developed tool called Tass. Tass provides a multitude of signal analysis tools that enable the breakdown of signal structures, including demodulation of fundamental modulation schemes. Scout's ability to store the entire radio-frequency environment on disk and channelize any part of the spectrum at will is akin to having "TiVo® on steroids" — except that instead of storing only your favorite channels, Scout stores everything on the RF spectrum, enabling the operator to reconstruct any kind of signal event after the fact.

Combining capabilities of earlier systems

Originally developed to replace a now-retired system, Scout not only exceeds its predecessor's capabilities in automatic detection of known signals of interest, but also has a fully integrated direction-finding capability. The way signals are described in Scout is compatible with U.S. Department of Defense formats, enabling Scout to leverage new signals as they are developed by others. Additionally, 24 hours of RF environment storage and a GUI enable the user to manually scour the last 24 hours of RF activity and reconstruct and locate a signal event. This capability was previously performed by other systems that were separate from Scout's predecessor.

Scout does a job that previously required a number of systems from multiple vendors. By combining automatic search and signal identification functions with a manual search tool, Scout reduces the hardware resources required to support RF survey missions and also reduces the cost.

Scout is based on commercially available, high-performance servers widely used in data centers across the globe. All of the signal processing required to support the operating modes consists of software rather than expensive special-purpose processing components such as those developed for the aerospace industry. This combination of commodity hardware and a software-defined framework gives Scout an unprecedented level of scalability and expandability. Leveraging the commercial computer market allows the use of the latest computer technology with minimal risk of obsolescence and keeps costs economical, while taking advantage of the latest breakthroughs in the globally driven computer market.

Although Scout's primary application is in support of U.S. and allied military, law enforcement and intelligence communities, potential commercial applications could include surveying other types of radio spectrum signals, such as electromagnetic interference emissions from industrial and power distribution sources.

Questions about this article? Contact Nixon at (210) 522-2619 or jim.nixon@swri.org.

A Dazzling Development in Security

An SwRI-developed technology fends off intruders using an eye-safe laser

By Joseph N. Mitchell

The dazzler was tested outdoors at distances greater than a mile.

D018966-7001

Joseph N. Mitchell is a senior research engineer in the Applied Physics Division. He specializes in developing electro-optical, laser, infrared and remote sensing systems. He has worked on a variety of programs including biometrics acquisition, industrial inspection and measurement, standoff imaging, spectroscopy, novel optical materials and in development of miniature and MEMs-based opto-mechanical devices.

Imagine that you are captain of a small naval vessel off the coast of an unfriendly nation where other ships have been subject to harassment or attacks. It's dusk, and it is difficult to see clearly. Suddenly, your crew spots a small fishing boat off the port side about a mile away and closing fast. You try to signal the boat, but it continues to approach. You have seen many fishermen in these waters, and now you have a decision to make: Is this just another fisherman who simply doesn't see you, or is this an attack? A wrong decision could cost the lives of your crew, or it could create an international incident and kill innocent civilians.

A team of engineers from Southwest Research Institute (SwRI) is working on a program with the U.S. Navy to develop a technology to assess, slow and even thwart these potential threats, without harming people. The Long Range Ocular Interrupter, known informally as the "laser dazzler," uses a high-intensity but eye-safe visible laser source to deliver a dazzling, brilliant beam to targets more than a mile away. It is used to help determine the intent of an unknown person or vessel by their response to it. It operates at multiple levels of effect, ranging from a low-intensity alert level to a glare level that would cause most people to turn away and leave the area.

If the intent of the approaching vessel appears hostile, the level of effect can be further increased to slow or even suppress an individual's ability to take action. If the individual or vessel continues to approach, then the hostile intent is clear and a more aggressive response can be initiated.

Using light for nonlethal deterrent

The "dazzling" effect inherent in bright flashing illumination has been studied for several decades. The critical parameter is optical intensity (also referred to as power density). An "eye-safe" laser is one that has an intensity below a threshold known as the maximum permissible exposure (MPE). This level varies depending on the exposure duration and the wavelength of the light. At bright intensities below the MPE permanent damage does not occur, but

One application of the laser dazzler is to help determine the intent and inhibit the actions of potentially hostile individuals.

Photo courtsey DOD D019027

D018653-1657

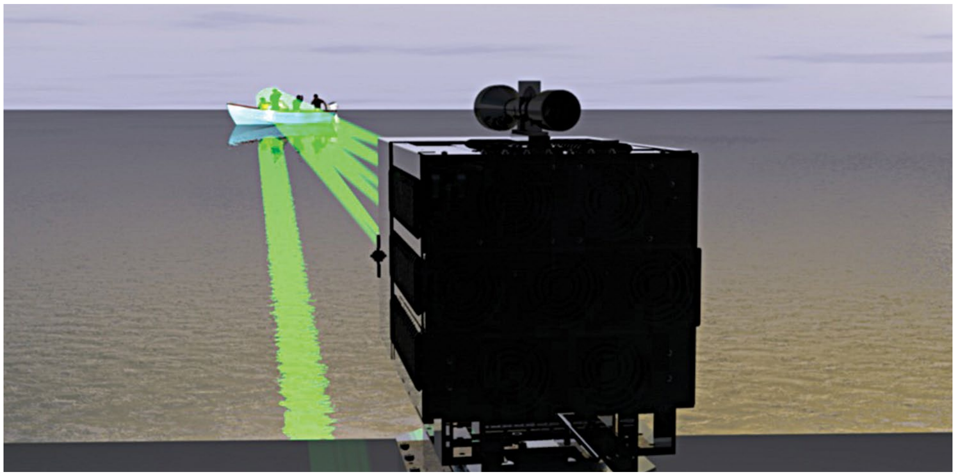
temporary impairment, such as glare or flash-blindness, can degrade the ability to perform visually oriented tasks. With flash-blindness, an individual exposed to sudden changes in illumination experiences a temporary state during which nothing can be seen except an afterimage. The eye is protected from this to some degree by the natural blink-aversion response, but bright or flashing lights actually can attract the eye.

Flashing lights or images can induce further neurologic effects that may stun, or make an individual experience dizziness or be unable to act. Because the human eye is most sensitive to green light, illumination in this wavelength range produces the most “bang for the buck” and also results in the longest re-adaptation time after the illumination is removed.

Laser applications

The laser dazzler can be used in a wide range of operations. It can help reduce civilian casualties and keep warfighters out of harm’s way by allowing them to engage at a safe distance. Besides maritime applications, the system also can be used at roadside checkpoints, embassies and military base access points, and for crowd dispersal in riot situations to reduce injuries and property damage.

The development program for the laser dazzler has been a rapid undertaking, going from an initial study of several possible design concepts to a prototype for field evaluations in just eight months. From initial evaluations, the SwRI team developed a system design that uses an array of laser sources of low to moderate power. This has the advantages of redundancy in the event of loss or partial failure of any of the lasers, reduced cost per watt of



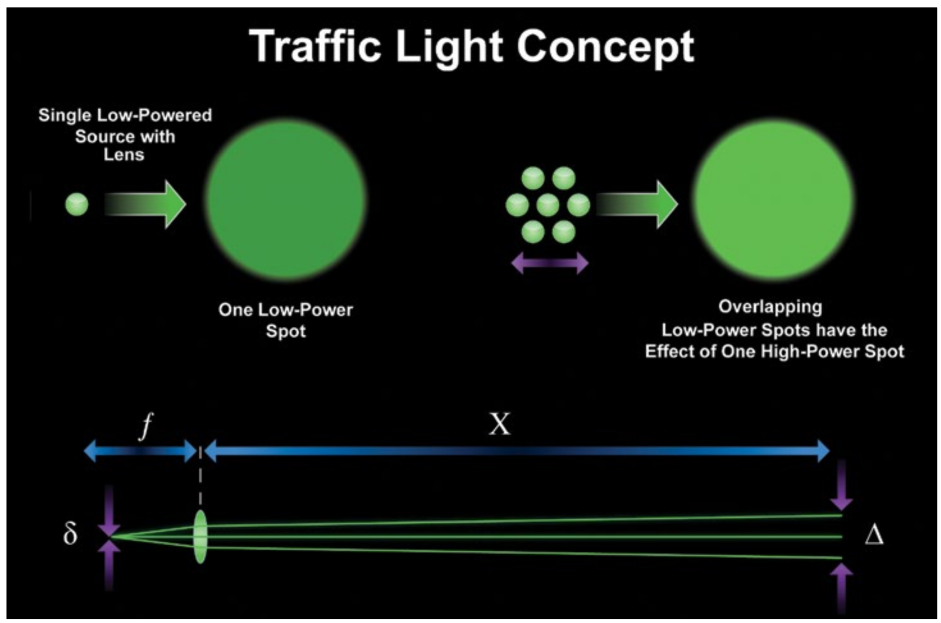
D019024

A concept illustration shows the laser dazzler in operation as it tracks an unknown vessel.

Photo courtesy DOD

The dazzler could be used to safely disperse crowds in riot situations to reduce the risk of civilian injuries or property damage.

D019018



D019011

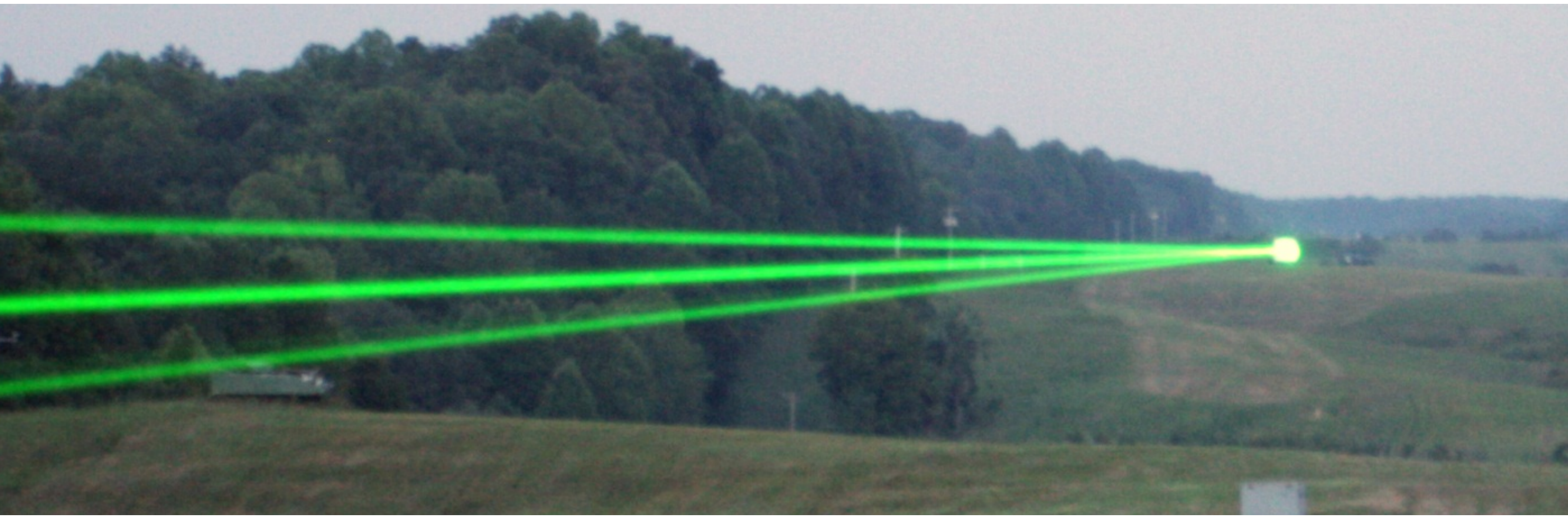
The dazzler uses an array of moderate power sources whose beams are designed to expand and merge into a single large beam at the system's operating range. Spot size at the operating range is a function of distance, source divergence and lens focal length.

optical power and a more distributed heat load to improve cooling. Although some early concepts involved combining the beams into a single large-output beam within the dazzler, the selected design keeps the beams separate and relies on a small amount of divergence that allows the beams to overlap at long range. The beams are aligned so that by the time they reach a certain distance, they have expanded to the desired size and are essentially fully overlapped. Keeping the beams separate enables the use of small, lightweight, low-cost optical components and provides for scalability should more lasers be required. In addition, alignment of the beams is simplified and can even be electronically controlled through small manipulations of the lenses rather than movement of the entire laser modules.

Building a dazzler

Once the general system design was developed, SwRI engineers fabricated a prototype system intended for field evaluations to prove both the feasibility of the design and determine its effectiveness. Although considerably larger and heavier than the production model, the prototype model was built to allow for quick assembly and easy troubleshooting. It was made from commercial off-the-shelf components wherever possible, allowing the SwRI team to design and assemble the prototype in less than four months. The prototype contained an active cooling system for the lasers, including thermoelectric coolers and forced air, individually adjustable lenses, a focusing mechanism for the entire lens assembly, an alignment scope and electronics to monitor and control the laser power and temperature, safety interlocks, power supplies, and strobe controls.

Characterizing the system's performance was a significant part of the effort, using parameters such as optical power density, spot uniformity and the effects of atmospheric turbulence, among others. In addition, the team wanted to characterize the system's performance under a range of environmental conditions. SwRI engineers conducted a series of indoor and outdoor tests at several sites, including SwRI's headquarters in



The dazzler was tested under daylight conditions at Fort A.P. Hill. D019018

San Antonio, a three-mile range at Fort A.P. Hill in Virginia and a 1.5-mile over-water range at Dahlgren, Va. The SwRI team was able to evaluate performance in both day and night conditions in the summer heat of South Texas, during the blowing wind and dust of an approaching thunderstorm and during rain, mist and fog conditions. Although these conditions resulted in different effects on the laser beams, the dazzling effect remained effective regardless of atmospheric conditions.

Future development

With the successful demonstration of the concept, SwRI engineers have begun work on the next phase of the program: developing a production-grade system, then building several laser dazzler units for expeditionary deployment. Custom lasers are being manufactured for SwRI by a subcontractor. These will be more robust in a wide range of ambient conditions and will be able to maintain power levels even under relatively high ambient temperatures without active cooling.

SwRI will integrate these lasers into a military-grade, ruggedized package that will include control electronics, a power supply and the user controls. The dazzler system will include a number of features designed to simplify and automate its use, including a pointing and tracking system, a day/night imaging system, automatic range detection to ensure eye safety and maintain optical power levels appropriate for different targets, and dynamic control of the laser beam's divergence and spot pattern.

The laser dazzler prototype is shown in operation. D019025

Now, imagine once again you are the naval captain envisioned at the beginning. You order the laser dazzler to be deployed. Your ship's crew points it toward the approaching boat and fires the laser at warning level. The boat continues to approach and swerves to evade the beam, but the dazzler adjusts its alignment to follow the boat's motion. Your crew increases the laser's intensity and activates the strobe effect. The boat slows, then turns sharply and starts heading away, eventually disappearing in the distance.

You may never find out who was in the other boat, but your own crew and vessel are safe and you didn't have to deploy lethal force. In a few years, the use of lasers in situations such as this could be a reality as an alternative to conventional weaponry.

Questions about this article? Contact Mitchell at (210) 522-5799 or joe.mitchell@swri.org.

A Moon-shot in the Dark

An SwRI-developed instrument observes mercury, other chemicals in the plumes of intentional lunar impacts by two spacecraft.

When NASA's twin GRAIL spacecraft made their final descent for impact onto the Moon's surface in December 2012, the Lunar Reconnaissance Orbiter's (LRO) sophisticated payload was in position to observe the effects. As plumes of gas rose from the impacts, the Lyman Alpha Mapping Project (LAMP) aboard LRO detected the presence of mercury and hydrogen and measured their time evolution as the gas rapidly expanded into the vacuum of space at near-escape velocities.

NASA intentionally crashed the GRAIL twins onto the Moon on Dec. 17, 2012, following successful prime and extended science missions. Both spacecraft hit a mountain near the lunar north pole, which was in shadow at the time. Developed by Southwest Research Institute (SwRI), LAMP uses a novel method to peer into the darkness of the Moon's permanently shadowed regions, making it ideal for observations of the Moon's night-side and its tenuous atmospheric constituents.

"While our results are still very new, our thinking is that the hydrogen detected from the GRAIL site might be related to an enhancement at the poles caused by hydrogen species migrating toward the colder polar regions," said Dr. Kurt Retherford, LAMP principal investigator and a principal scientist at SwRI.

In October 2009, LAMP observed the impact on the Moon of NASA's Lunar Crater Remote Observation and Sensing Satellite (LCROSS), making the first confirmation of the presence of atomic mercury, molecular hydrogen and carbon monoxide, along with smaller amounts of calcium and magnesium. Based on the analysis of lunar samples from the Apollo missions, G.W. Reed, a chemist at the Argonne National Laboratory, predicted an enhancement of mercury near the poles and its permanently shaded regions as far back as 1999. However, the prediction went unnoticed until it was cited by the LAMP team in the scientific literature. The new mercury measurements are being used to study the migration process behind this enhancement.

"Combining GRAIL results with LCROSS results could tell us more about hydrogen and water near the poles," said Dr. Thomas Greathouse, a LAMP team member and SwRI senior research scientist. "We have begun to understand that the amount of water ice near the polar regions is higher than was previously thought, but we don't fully understand how it gets there."

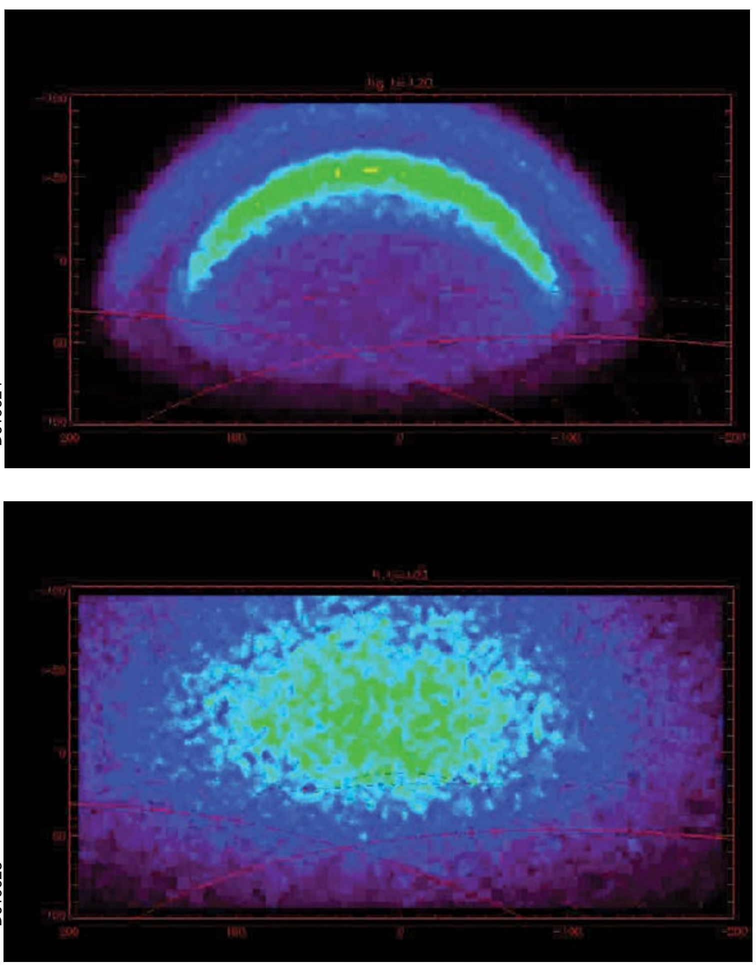
LAMP usually observes the night-side lunar surface using light from nearby space (and stars), which bathes all bodies in space in a soft glow. This Lyman-alpha glow is invisible to human eyes but visible to LAMP as it reflects off the Moon. However, the new detection of Lyman-alpha emissions from native lunar atomic hydrogen gas released by the impact is a first for LAMP, and for any previous instrument.

The NASA Goddard Space Flight Center in Greenbelt, Md., developed and manages the LRO mission. LRO's current Science Mission is implemented for NASA's Science Mission Directorate. NASA's Exploration Systems Mission Directorate sponsored LRO's initial one-year Exploration Mission that concluded in September 2010.

Contact Retherford at (210) 522-3809 or kurt.retherford@swri.org.

D019024

D019023



Animation models show the time evolution for mercury (top) and hydrogen (bottom) as plumes of gas rapidly expand into the vacuum of space following the planned impact of the GRAIL twins onto the lunar suface.

TECHNICS

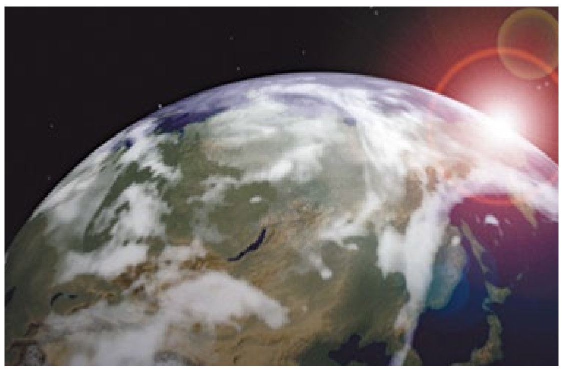
Brief notes about the world of science and technology at Southwest Research Institute

SwRI, University of New Hampshire collaborate on new Space Science Department

Southwest Research Institute (SwRI) and the University of New Hampshire have signed a research collaboration agreement enabling the organizations to augment their areas of expertise and seek opportunities in astrophysics, Earth and ocean science, and larger and more complex space science missions. The agreement took effect March 11, 2013.

Dr. Jim Burch, vice president of SwRI's Space Science and Engineering Division, and Harlan Spence, director of UNH's Institute for the Study of Earth, Oceans, and Space (EOS), will oversee the collaboration for their respective organizations.

"The collaboration benefits both institutions because it allows SwRI access to a much wider range of science disciplines and allows UNH to benefit from SwRI's extensive science mission management expertise," said Burch.



The five-year agreement calls for SwRI to open a new department — the SwRI Earth, Oceans and Space (SwRI-EOS) Department — at UNH's Durham, N.H., campus. The agreement also allows SwRI and UNH to team up on proposals to NASA, the National Oceanic and Atmospheric Association and the National Science Foundation.

Contact Burch at (210) 522-2526 or jim.burch@swri.org.

SwRI receives NACE International Distinguished Organization Award

Southwest Research Institute (SwRI) received the prestigious NACE International Distinguished Organization Award, given by the leading professional society for the corrosion control industry, in recognition of outstanding contributions by an organization to the field of corrosion science or engineering.

The award recognizes organizations that have, over a sustained period of time, made outstanding contributions in the field of corrosion science or engineering, or have provided major technological contributions to either field. The Institute was recognized for its sustained contributions to both industry and government organizations in fundamental and applied aspects of corrosion science, corrosion life prediction, corrosion sensing and monitoring, corrosion testing and development of corrosion-resistant coatings.

SwRI has been actively engaged in the corrosion field for more than 40 years, supporting the oil and gas, petrochemical, pipeline, nuclear and aerospace industries, as well as civilian and defense agencies of the U.S. government and various foreign commercial and government organizations.

SwRI launches third high-efficiency gasoline engine consortium

Southwest Research Institute (SwRI) has launched its third cooperative research program aimed at developing a high-efficiency gasoline engine for the light-duty automotive and medium-duty engine markets. This four-year effort will expand on earlier efforts to improve gasoline engine technology for future emissions and fuel economy requirements.

The HEDGE®-III (High-Efficiency Dilute Gasoline Engine) consortium incorporates new and more aggressive efficiency, performance and emissions goals that are in line with existing and potential future regulations and expectations. The overall goal is to develop the most cost-effective solutions for future gasoline engine applications. In addition to focusing on high levels of exhaust gas recirculation (EGR) and supporting technologies such as high-energy ignition and advanced boosting systems to develop strategies for high efficiency, the consortium will examine topics outside of cooled EGR that contribute to high-efficiency engine operation as well as develop tools for developing high-efficiency engines.

HEDGE-III will target the Low Emission Vehicle III (LEV III) standards and, for the first time, extensively investigate cold-start technologies and monitor particle mass/particle number (PM/PN) emissions on a regular basis. Efficiency goals include a "best efficiency" of 43 percent and part-load efficiency goals that target diesel-like fuel consumption, with the target of "best in class" cycle emissions. In addition, the consortium will impose transient performance targets to make sure the high-efficiency engines are capable of providing high customer satisfaction.

"During HEDGE-II, we built a 2-liter prototype dedicated-EGR gasoline engine that is the most efficient multi-cylinder spark ignition engine I've seen," said Dr. Terry Alger, assistant director in SwRI's Engine, Emissions and Vehicle Research Division. "The port-fuel-injected engine achieved 207 grams/kilowatt-hour, which compares very favorably to a similarly sized U.S. diesel engine in terms of fuel consumption. With a combination of its fuel injection system and stoichiometric combustion (correct amount of air and fuel mixture to burn all the fuel), it has potential for ultra-low hydrocarbon emissions with no particulates."

HEDGE-III is a four-year, annual renewal cooperative research program with an annual fee of $125,000 for original equipment manufacturers and $70,000 for suppliers.

Contact Alger at (210) 522-5505, or talger@swri.org.

SwRI's Alger elected Fellow of the Society of Automotive Engineers

Dr. Terry Alger, assistant director of the Engine and Vehicle Research and Development Department in the Engine, Emissions and Vehicle Research Division at Southwest Research Institute (SwRI), has been elected a Fellow of the Society of Automotive Engineers (SAE).

D017542-6878

Fellow is the highest grade of membership in the SAE and recognizes long-term members who have made a significant impact on the society's mobility technology through leadership, research and innovation. The distinction is bestowed on about 20 recipients each year. Alger is recognized for his "work on advanced SI (spark ignition) engine technology in which he has repeatedly demonstrated the rare combination of technical and business leadership that results in research that breaks through to production." He received the award, as well as the SAE Lloyd L. Withrow Distinguished Speaker Award that is conferred upon those speakers at SAE meetings who have received the Oral Presentation Award more than twice over the past years, during the SAE World Congress in Detroit April 16–18. Alger has authored more than 40 published papers and holds 10 U.S. patents.

Contact Alger at (210) 522-5505 or talger@swri.org.

Particle sensor consortium enters its second year

After a successful first year in which it demonstrated the potential of operating real-time particle sensors in engine exhaust systems, the Particle Sensor Performance and Durability (PSPD) consortium will focus its second year of research on improving the sensors' durability and reliability.

First-year research focused on investigating the performance of the spark-plug-sized exhaust particle sensors at different levels of engine exhaust velocity, temperature, particle concentration, electric charge and size distribution.

"The consortium's goal is to develop particulate matter sensors for production engine emission systems that will provide value similar to that being provided by NO_x sensors," said consortium Principal Investigator Dr. Imad Khalek, a senior program manager in the Engine, Emissions and Vehicle Research Division at Southwest Research Institute. Twelve sensors were mounted in engine exhaust systems and used simultaneously during the first year.

"This opens up the possibility of using real-time, onboard particle sensing for numerous engine and instrument applications such as onboard diagnostics for exhaust particle filters, retrofit technology, engine control, inspection and maintenance, portable emissions, smoke meter replacement and others," Khalek said. "The applications of a real-time particle sensor are limitless."

Research goals in the second year will include both improved sensor performance and durability. The start date for Year 2 is June 1, 2013. The annual membership fee is $55,000. For more information see ***pspd.swri.org***.

Contact Khalek at (210) 522-2536 or ikhalek@swri.org.

SwRI to manage Numerical Propulsion System Simulation Consortium

Southwest Research Institute (SwRI) has been awarded a contract to become the manager of the Numerical Propulsion System Simulation (NPSS) consortium. NPSS is an advanced object-oriented, nonlinear thermodynamic modeling environment used by the aerospace industry for modeling turbomachinery, rocket engines, environmental control systems, ducting, vapor cycles and other equipment and phenomena. SwRI will assume responsibility for the consortium May 1.

NPSS originated in the 1990s as a NASA Glenn Research Center project with a focus on developing a rapid simulation capability for engine design.

"As industry adopted the software tool, it became more important to aerospace companies because it allowed for collaboration and model sharing for integration with other vehicle system models," said David Ransom, manager of the Machinery Structural Dynamics Section in SwRI's Mechanical Engineering Division. "The NPSS Consortium was formed, and NASA licensed the software to the consortium so industry partners could continue developing it for their needs."

As consortium manager, SwRI will provide overall project management and engineering support for maintenance and development activities as directed by the member companies. NPSS can be obtained by either the purchase of a commercial license or through consortium membership. See *npssconsortium.org*.

Contact Ransom at (210) 522-5281 or dransom@swri.org.

Publications

Avery, P. and S. Dykes. "Need for Secure Approach to Connected Vehicle Technology." *ITS International*, November/December 2012 edition (2012): Newsletter and eNewsletter.

Bayless, A.J., T.A. Pritchard, P.W.A. Roming, P. Kuin, P.J. Brown, M.T. Botticella, M. Dall'Ora, L.H. Frey, W. Even, C.L. Fryer, J.R. Maund and M. Fraser. "The Long-lived UV "Plateau" of SN 2012aw." *Astrophysical Journal Letters*, Vol. 764, No. 1, (2013): L13, doi:10.1088/2041-8205/764/1/L13.

Boyan, B., D. Hart, R. Enoka, D.P. Nicolella, E. Resnick, R. Berkley, *et al.* "Hormonal Modulation of Connective Tissue Homeostasis and Sex Differences in Risk for Osteoarthritis of the Knee." *Biology of Sex Differences*, Vol. 4, No. 1, (2013): 3, doi:10.1186/2042-6410-4-3.

Boyan, B., L. Tosi, R. Coutts, R. Enoka, D. Hart, D.P. Nicollela, *et al.* "Sex Differences in Osteoarthritis of the Knee." *Journal of the American Academy of Orthopaedic Surgeons*, Vol. 20, No. 10, (2012): 668–669.

Boyan, B., L. Tosi, R. Coutts, R. Enoka, D. Hart, D.P. Nicolella, et al. "Addressing the Gaps: Sex Differences in Osteoarthritis of the Knee." *Biology of Sex Differences*, Vol. 4, No. 1, (2013): 4, doi:10.1186/2042-6410-4-4.

Broerman, E.L. and S.B. Simons. "Unusual PD Pump Pulsation Solutions." *Compressor Tech Two*, Vol. 17, No. 9, (2012): 48.

Campbell, B.A., N.E. Putzig, L.M. Carter, G.A. Morgan, R.J. Phillips and J.J. Plaut. "Roughness and Near-surface Density of Mars from SHARAD Radar Echoes." *Journal of Geophysical Research*, (2013): in press, doi:10.1029/2012JE004262.

Canup, R.M., A.C. Barr and D.A. Crawford. "Lunar-forming Impacts: High-resolution SPH and AMR-CTH Simulations." *Icarus*, Vol. 222, No. 1, (2013): 200–219, doi:10.1016/j.icarus.2012.10.011.

Chan, K. "An Assessment of Delayed Hydride Cracking in Zirconium Alloy Cladding Tubes Under Stress Transients." *International Materials Review*, (2013): Online, http://www.ingentaconnect.com/content/maney/imr/pre-prints/1743280412Y.0000000013, doi:/10.1179/1743280412Y.0000000013.

Chan, K.S. and D.P. Nicolella. "Micromechanical Modeling of R-Curve Behaviors in Human Cortical Bone." *Journal of the Mechanical Behavior of Biomedical Materials*, Vol. 16, (2012): 136–152, doi:10.1016/j.jmbbm.2012.09.009.

Chocron, I.S., C.E. Anderson, K.A. Dannemann and A.E. Nicholls. "Pressure Effects on the Compressive Response of Confined Intact and Damaged Soda-Lime Glass." *Experimental Mechanics*, Vol. 53, (2013): 77–89, doi:10.1007/s11340-012-9632-2.

Cockeram, B. and K. Chan. "*In-situ* Studies and Modeling of the Deformation and Fracture Mechanism for Wrought Zircaloy-2 and Circaloy-2 as a Function of Stress-state." *Journal of Nuclear Materials*, Vol. 434, No. 1–3, (2013): 97–123, doi:10.1016/j.jnucmat.2012.11.005.

Collins, M.N., M. Reid, E. Dalton, K. Shannon and L.F. Garfias-Mesias. "Corrosion Under Mixed Flowing Gas Conditions of Various Connector Coatings." *Materials and Corrosion*, Vol. 64, No. 1, (2013): 7–13, doi:10.1002/maco.201106340.

DeForest, C.E., T.A. Howard and S.J. Tappin. "The Thomson Surface II Polarization." *Astrophysical Journal*, Vol. 765, (2013): 44.

Desai, M., M. Dayeh, R. Ebert, C. Smith, G. Mason and G. Li. "Ion Acceleration at CME-driven Shocks Near the Earth and the Sun." Space Weather – The Space Radiation Environment, *Proceedings of the 11th Annual International Astrophysics Conference,* Vol. 1500, (2012): 80–85.

Desai, M.I. "Shining Light on Solar Weather." *International Innovation: Environment,* September Edition, (2012): 56–59.

Dinwiddie, C.L., G.R. Walter, D.W. Esh and C.S. Barr. "Performance Impact of Fast Flow Paths Through Grout Monoliths Used for Radioactive Waste Disposal." *Proceedings of the Waste Management Conference*, Phoenix, Ariz., February 2013.

Fenton, L.K., R.K. Hayward, B.H.N. Horgan, D.M. Rubin, T.N. Titus, M.A. Bishop, D.M. Burr, M. Chojnacki, C.L. Dinwiddie, L. Kerber, A. Le Gall, T.I. Michaels, L.D.V. Neakrase, C.E. Newman, D. Tirsch, H. Yizhaq and J.R. Zimbelman. "Summary of the Third International Planetary Dunes Workshop: Remote Sensing and Image Analysis of Planetary Dunes." *Aeolian Research*, Vol. 8, (2013): 29–38, doi:10.1016/j.aeolia.2012.10.006.

Hendrix, A.R., K.D. Retherford, G.R. Gladstone, P.D. Feldman, D.M. Hurley, A.F. Egan, D.E. Kaufmann, P.F. Miles, J.W. Parker, D.G. Horvath, P.M. Rojas, M.H. Versteeg, M.W. Davis, T.K. Greathouse, D.C. Slater, J. Mukherjee, A.J. Steffl, W.R. Pryor and S.A. Stern. "The Lunar Far-UV Albedo: Indicator of Hydrated Materials and Space Weathering." *Journal of Geophysical Research*, Vol. 117, No. 12, (2012): E12001, doi:10.1029/2012JE004252.

Howard, T.A., S.J. Tappin, D. Odstrcil and C.E. DeForest. "The Thomson Surface III Tracking Features in 3D." *Astrophysical Journal*, Vol. 765, (2013): 45.

Livadiotis, G., D.J. McComas, N.A. Schwadron, H.O. Funsten and S.A. Fuselier. "Pressure of the Proton Plasma in the Inner Heliosheath." *The Astrophysical Journal*, Vol. 762, No. 2, (2013): 134, doi:10.1088/0004-637X/762/2/134.

Mandt, K.E., D.A. Gell, M. Perry, J.H. Waite Jr., F.A. Crary, D. Young, B.A. Magee, J.H. Westlake, T.E. Cravens, et al. "Ion Densities and Composition of Titan's Upper Atmosphere Derived by the Cassini Ion Neutral Mass Spectrometer: Analysis Methods and Model Comparison." *Journal of Geophysical Research*, Vol. 117, (2012): E10006, doi:10.1029/2012JE004139.

Mason, G.M., M.I. Desai, R.A. Mewaldt and C.M.S. Cohen. "Particle Acceleration in the Heliosphere." *Proceedings of the American Institute of Physics Conference*, Vol. 1516, (2013): 117–120.

McComas, D.J. "Update on IBEX and the Outer Boundary of the Space Radiation Environment." Space Weather: The Space Radiation Environment, *Proceedings of the 11th Annual Astrophysics Conference*, AIP Conference Proceedings. Vol. 1500, (2012): 222–227, doi:10.1063/1.4768770.

Michell, R.G., M.G. McHarg, M. Samara and D.L. Hampton. "Spectral Analysis of Flickering Aurora." *Journal of Geophysical Research*, Vol. 115, No. A3, (2012): A03310, doi:10.1029/2009JA014661.

Nicolella, D.P., M. O'Connor, R. Enoka, B. Boyan, D. Hart, E. Risnick, *et al.* "Mechanical Contributors to Sex Differences in Idiopathic Knee Osteoarthritis." *Biology of Sex Differences*, Vol. 3, No. 1, (2012): 28, doi:10.1186/2042-6410-3-28.

Technical Staff Activities

Parra, J. and X. Emery. “Geostatistics Applied to Cross-well Reflection Seismic for Imaging Carbonate Aquifers.” *Journal of Applied Geophysics*, (2013): Online, http://www.sciencedirect.com/science/article/pii/S0926985113000360, doi:10.1016/j.jappgeo.2013.02.010.

Patrick, E.L., K.E. Mandt, E.J. Mitchell, J.N. Mitchell, K.N. Younkin, C.M. Seifert and G.C. Williams. “A Prototype Mass Spectrometer for In-situ Analysis of Cave Atmospheres.” *Reviews of Scientific Instruments*, Vol. 83, (2012): 105–116, doi:10.1063/1.4761927.

Pian, E., N. Kawai and P.W.A. Roming. “Concluding Remarks. Death of Massive Stars: Supernovae and Gamma-ray Bursts.” *Proceedings of the International Astronomical Union (IAU) Symposium*, Vol. 279, (2012): 309–316, doi:10.1017/S1743921312013117.

Poduval, B., C.E. DeForest, J.T. Schmelz and S. Pathak. “Point-spread Functions for the Extreme-ultraviolet Channels of SDO/AIA Telescopes.” *Astrophysical Journal*, Vol. 765, (2013): 144.

Pogorelov, N.V., S.N. Borovikov, L.F. Burlaga, R.W. Ebert, J. Heerikhuisen, T.K. Kim, I.A. Kryukov, S.T. Suess, S.T. Wu and G.P. Zank. “Numerical Modeling of the Solar Wind Flow with Observational Boundary Conditions.” Space Weather – The Space Radiation Environment, *Proceedings of the 11th Annual International Astrophysics Conference*, Vol. 1500, (2012): 134–139, doi:10.1063/1.4768756.

Pritchard, T.A. and P.W.A. Roming. “Early Time Bolometric Light Curves of Type-II Supernovae Observed by Swift.” Death of Massive Stars: Supernovae and Gamma-Ray Bursts, *Proceedings of the International Astronomical Union (IAU) Symposium*, Vol. 279, (2012): 383–384, doi:10.1017/S1743921312013452.

Radioti, A., E. Roussos, D. Grodent, J.C. Gerard, N. Krupp, D.G. Mitchell, J. Gustin, B. Bonfond and W. Pryor. “Signatures of Magnetospheric Injections in Saturn’s Aurora.” *Journal of Geophysical Research*, (2013): in press, doi:10.1002/jgra.50161.

Roming, P.W.A., A.J. Bayless, C.R. Beebe, M.J. Brooks, M.W. Davis, R.A. Klar, J.M. Roberts, R.J. Rose and G.S. Winters. “Stabilized Dispersive Focal Plane Systems for Space.” Modern Technologies in Space and Ground-based Telescopes and Instrumentation II. *Proceedings of the SPIE Conference*, Vol. 8450, (2012): 84500K, doi:10.1117/12.926387.

Samara, M., R.G. Michell and D.L. Hampton. “BG3 Glass Filter Effects on Quantifying Rapidly Pulsating Auroral Structures.” *Advances in Remote Sensing*, Vol. 1, (2012): 53–57, doi:10.4236/ars.2012.13005.

San Andres, L. and T.A. Chirathadam. “Metal Mesh Foil Bearing and a Bump-type Foil Bearing: Comparison of Performance for Two Similar Size Gas Bearings.” *ASME Journal of Engineering Gas Turbines Power*, Vol. 134, No. 10 (2012): 102501, doi:10.1115/1.4007061.

Schwadron, N.A. and D.J. McComas. “Spatial Retention of Ions Producing the IBEX Ribbon.” *The Astrophysical Journal*, Vol. 764, No.1, (2013): 92, doi:10.1088/0004-637X/764/1/92.

Siewert, M., H.J. Fahr, D.J. McComas and N.A. Schwadron. “Spectral Properties of keV-Energetic Ion Populations Inside the Heliopause Reflected by IBEX-relevant Energetic Neutral Atoms.” *Astronomy and Astrophysics*, Vol. 551, No. A58, (2013): doi:10.1051/0004-6361/201219241.

Sluka, K., J. Berkley, M. O’Connor, D.P. Nicolella, R. Enoka, B. Boyan, *et al*. “Neural and Psychosocial Contributions to Sex Difference in Osteoarthritis of the Knee.” *Biology of Sex Differences*, Vol. 3, No. 1, (2012): 26, doi:10.1186/2042-6410-3-26.

Stern, A. and D.P. Nicolella. “Measurement and Estimation of Osteocyte Mechanical Strain.” *Bone*, (2013): Online, http://www.ncbi.nlm.nih.gov/pubmed/23369990, doi:10.1016/j.bone.2013.01.037.

Stillman, D.E., J.A. MacGregor and R.E. Grimm. “The Role of Acids in Electrical Conduction Through Ice.” *Journal of Geophysical Research*, Vol. 118, (2013): doi:10.1029/2012JF002603.

Titus, T.N., R.K. Hayward and C.L. Dinwiddie. “Interdisciplinary Research Produces Results in the Understanding of Planetary Dunes.” *Eos Transactions, American Geophysical Union*, Vol. 93, No. 38, (2012): 367.

Westlake, J.H., C.P. Paranicas, T.E. Cravens, J.G. Luhmann, K.E. Mandt, H.T. Smith, D.G. Mitchell, J.H. Waite Jr., A.M. Rymer and J.E. Wahlund. “The Composition of Titan’s Ionospheric Outflow.” *Geophysical Research Letters*, Vol. 39, (2012): L19104, doi:10.1029/2012GL053079.

Wilkes, J.C. and D. Childs. “Improving Tilting-pad Journal Bearing Predictions: Part I – Model Development and Impact of Rotor Excited Versus Bearing Excited Impedance Coefficients.” *ASME Journal of Engineering Gas Turbines and Power*, Vol. 135, No. 1, (2013): 12502, doi:10.1115/1.4007367.

Wilkes, J.C. and D. Childs. “Improving Tilting-pad Journal Bearing Predictions: Part II – Comparison of Measured and Predicted Rotor-pad Transfer Functions for a Rocket-pivot Tilting-pad Journal Bearing.” *ASME Journal of Engineering Gas Turbines and Power*, Vol. 135, No. 1, (2013): 12503, doi:10.1115/1.4007368.

Wilkes, J.C. and D. Childs. “Tilting-pad Journal Bearings – A Discussion on Stability Calculation, Frequency Dependence, and Pad and Pivot Flexibility.” *ASME Journal of Engineering Gas Turbines and Power*, Vol. 134, No. 12, (2012): 122508.

Wilson, G.R. III, T. Edwards, E. Corporan and R.L. Freerks. “Certification of Alternative Fuels and Blend Components.” *Energy Fuels*, Vol. 27, No. 2, (2013): 962–966, doi: 0.1021/ef301888b.

Winters, G.S., K.D. Retherford, M.W. Davis, S.M. Escobedo, E.L. Patrick, E. Bassett, M.E. Nagengast, M.H. Fairbank, P.F. Miles, J.W. Parker, G.R. Gladstone, D.C. Slater and S.A. Stern. “The Southwest Research Institute Ultraviolet Reflectance Chamber (SwURC): A Far Ultraviolet Reflectometer.” *Proceedings of the SPIE (Society of Photo-Optical Instrumentation Engineers)*, Vol. 8495, (2012): doi:10.1117/12.930184.

Zank, G.P., J. Heerikhuisen, B.E. Wood, N.V. Pogorelov, E. Zirnstein and D.J. McComas. “Heliospheric Structure: The Bow Wave and the Hydrogen Wall.” *The Astrophysical Journal*, Vol. 763, No. 1, (2013): 20, doi:10.1088/0004-637X/763/1/20.

Presentations

Allegrini, F., H.O. Funsten, S.A. Fuselier, P.H. Janzen, D.J. McComas, D.B. Reisenfeld and N.A. Schwadron. “Interstellar Boundary Explorer (IBEX) Observations of Energetic Neutral Hydrogen from Solar Wind Reflected off the Surface of the Moon.” Paper presented at the 2012 American Geophysical Union (AGU) Fall Meeting, San Francisco, December 2012.

Alvarez, J., B. Walls, M. Matthews, P. MacDoran and K. Gold. “Chameleon™: A Signal of Opportunity Receiver for Space Navigation and Remote Signals Intelligence Applications.” Paper presented at the 2012 Military Communications Conference (MILCOM 2012), Orlando, Fla., November 2012.

Technical Staff Activities

Anderson, C.A., I.S. Chocron, K.A. Dannemann, A.E. Nicholls and N.L. Scott. "Testing Boron Carbide Under Triaxial Compression." Paper presented at the 37th International Conference and Exposition on Advanced Ceramics and Composites, Daytona Beach, Fla., January 2013.

Bell, J., J.H. Waite Jr., K.E. Mandt and B.A. Magee. "Updated Results from the Titan Global Ionosphere-Thermosphere Model." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Boice, D.C. "Our Moon: Celestial Orb that Rules the Night." Paper presented at the Oasis Center, San Antonio, November 2012.

Boice, D.C. "Space Invaders." Paper presented at the Oasis Center, San Antonio, February 2013.

Boice, D.C. "The Heat Is On! The Urban Heat Island of San Antonio." Paper presented at the Oasis Center, San Antonio, January 2013.

Boice, D.C. and R. Goldstein. "Chemical Processes in the Icy Plumes of Enceladus." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Bonfond, B. "At the Other End of the Field Lines: The Auroral Consequences of Io's Volcanism and Its Interaction with the Jovian Magnetosphere." Paper presented at the Io Workshop, Boulder, Colo., July 2012.

Bonfond, B. "Dynamics of the Main/Rotation Aurora." Paper presented at the International Space Science Institute (ISSI) Workshop on Giant Planet Magnetodiscs and Aurorae, Bern, Switzerland, November 2012.

Bonfond, B. "Main Oval Expansion and Spectacular Outer Emission in Jupiter's Aurora: Is Io Responsible?" Paper presented at the Europlanet Workshop: Aurora and Magnetospheres of Giant Planets, Kamari, Greece, May 2012.

Bonfond, B. and R. Gladstone. "Understanding the 3D Morphology of the Jovian Aurora Using Juno-UVS Observations: Simulations and Tomographic Reconstruction." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Broerman, E.L. "Case Study – Uncommon, Very Effective Solution to PD Pump Pulsation and Vibration Problem." Paper presented at the 28th International Pump User Symposium, Houston, September 2012.

Broerman, E.L. and K. Mueller. "Recip Generated Pulsations in a Centrifugal Compressor Piping System." Paper presented at the 2012 Gas Machinery Conference, Austin, Texas, October 2012.

Broerman, E.L. and S.B. Simons. "Pump Piping System – Insufficient Dampeners." Paper presented at the 28th International Pump Users Symposium, Houston, September 2012.

Broerman, E.L. and S.B. Simons. "Unusual PD Pump Pulsation Solutions." Paper presented at the 2012 Gas Machinery Conference, Austin, Texas, October 2012.

Broiles, T.W. and M.I. Desai. "Radial Evolution of the Three-dimensional Structure in CIRs between Earth and Ulysses." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Bunnell, E., C.M. Fowler, F. Bagenal and B. Bonfond. "Anticipating Juno Observations of the Magnetosphere of Jupiter." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Buzulukova, N., M.C.H. Fok, E.C. Roelof, J. Goldstein, P.W. Valek, J.A. Redfern and D.J. McComas. "Ring Current Dynamics and Low Altitude ENA Emissions as Seen by TWINS and the CRCM." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Chirathadam, T.A. and B.A. White. "A Metal Mesh Foil Bearing and a Bump-type Foil Bearing: Comparison of Performance for Two Similar Sized Gas Bearings." Paper presented at the ASME International Gas Turbine Institute Turbo Expo, Copenhagen, Denmark, June 2012.

Christian, E.R., M.A. Dayeh, H.O. Funsten, D.J. McComas and N.A. Schwadron. "Setting a Lower Limit for the Distance to the IBEX ENA Ribbon." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Clark, G.B., F. Allegrini, D.J. McComas, B.M. Randol and P.W. Valek. "Response in Electrostatic Analyzers due to Backscattered Electrons: Case Study Analysis with the Juno JADE-E Instrument." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Clarke, J.T., D. Bhattacharyya, J. Montgomery, J.C.M. Gerard, D.C. Grodent and B. Bonfond. "Likely Detection of UV Auroral Emission from the Magnetic Footprint of Callisto." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Cox, P.A., C.E. Weiss, R.E. Tannous, I.S. Chocron, C.E. Anderson and M. Boczek. "Mine Blast Loading Using CONWEP." Paper presented at the 2012 Warheads and Ballistics Symposium, Naval Postgraduate School, Monterey, Calif., August 2012.

Dayeh, M.A., D.J. McComas, F. Allegrini, M.I. Desai, R.W. Ebert, G. Livadiotis and N.A. Schwadron. "Latitudinal Variation of Heliospheric ENAs and Their Correlation with Solar Wind Observations." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

DeForest, C. and T.A. Howard. "Imaging the Origins of Solar Wind Variability." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

DeForest, C. and T.A. Howard. "Observations of Solar Eruptions in the Heliosphere." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Desai, M., F.A. Allegrini, M.A. Dayeh, B. De Majistre, H. Funsten, J. Heerikhuisen, D.J. McComas, N. Pogorelov, N.A. Schwadron, G.P. Zank and S.A. Fuselier. "Spectral Properties of .05-6 keV Energetic Neutral Atoms Measured by the Intersteller Boundary Explorer (IBEX) Along the Lines-of-Sight of the Voyager Directions." Paper presented at the 10th Asia Oceanic Geophysical Society – American Geophysical Union (AOGS-AGU) Joint Assembly, Singapore, August 2012.

Desai, M.I., F. Allegrini, M.A. Dayeh, B. DeMajistre, H.O. Funsten, J. Heerikhuisen, D.J. McComas, N.V. Pogorelov, C.L. Prested, M. Opher, N.A. Schwadron, G.P. Zank and S.A. Fuselier. "Intensities and Spectral Properties of 0.03-6 keV Energetic Neutral Atoms Measured by the Interstellar Boundary Explorer (IBEX) along the Lines-of-Sight of Voyager." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Desai, M., M. Dayeh, G. Mason, G. Li, and R. Ebert. "Understanding the Physical Link Between Energetic Storm Particle Events and Large Gradual Solar Energetic Particle Events." Paper presented at the 2012 Asia Oceania Geosciences Society (AOGS) – American Geophysical Union (AGU) (WPGM) Joint Assembly, Singapore, August 2012.

Dinwiddie, C.L., R.N. McGinnis, D.E. Stillman, K.L. Bjella and R.E. Grimm. "Internal Sedimentary Structure and Aqueous-phase Distribution of the Great Kobuk Sand Dunes, Northwestern Alaska: Insights from an Arctic Aeolian Analog." Paper presented at the 3rd International Planetary Dunes Workshop, Flagstaff, Ariz., June 2012.

Dinwiddie, C.L., R.N. McGinnis, D.E. Stillman, K.L. Bjella and R.E. Grimm. "Satellite Data Constrain Interpretations of Geophysical Data from the Great Kobuk Sand Dunes, Alaska." Paper presented at the SEG/AGU Joint Workshop on Cryosphere Geophysics, Boise, Idaho, January 2013.

Technical Staff Activities

Dinwiddie, C.L., T.I. Michaels, D.M. Hooper and D.E. Stillman. "Environmental Conditions and Meteorologic Context for Modification of the Great Kobuk Sand Dunes, Northwestern Alaska." Paper presented at the 3rd International Planetary Dunes Workshop, Flagstaff, Ariz., June 2012.

Dinwiddie, C.L., G.R. Walter and R.J. Lenhard. "Feasibility Study for Development of a Long-term, Densely Monitored, Engineered Soil Cover Testbed Facility at Southwest Research Institute in San Antonio, Texas." Paper presented at the U.S. Nuclear Regulatory Commission (NRC), San Antonio, January 2013.

Ebert, R.W., M.A. Dayeh, M.I. Desai, G. Li and G. M. Mason. "Multipoint Analysis of a Co-rotating Interaction Region and its Associated Energetic Particles at STEREO-A, STEREO-B, and ACE: Observations and Modeling." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Elliott, H.A., D.J. McComas and P.A. Delamere. "New Horizons Solar Wind Around Pluto (SWAP) Measurements from 5 to 23 AU." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Feldman, P.D., D.M. Hurley, K.D. Retherford, G.R. Gladstone, S.A. Stern, W.R. Pryor and J.W. Parker. "Lunar Reconnaissance Orbiter Lyman Alpha Mapping Project (LRO/LAMP) Observations of Temporal Variability of Lunar Exospheric Helium during June and July 2012." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Frisch, P.C., J.D. Slavin, M.A. Dayeh, H.O. Funsten, J. Heerikhuisen, P.H. Janzen, K. Avinash, G. Livadiotis, D.J. McComas, H.R. Mueller, N.V. Pogorelov, D.B. Reisenfeld, N.A. Schwadron and G.P. Zank. "Charging of Interstellar Dust Grains in the Inner Heliosheath." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Fritz, S. "Locomotive Biodiesel Program Updates." Paper presented at the National Biodiesel Board Annual Technical Workshop, Kansas City, Mo., October 2012.

Fritz, S., J. Hedrick and T. Weidemann. "Development of a Low Emissions Upgrade Kit for EMD GP20D and GP15D Locomotives." Paper presented at the 2012 ASME Internal Combustion Engine Division Fall Technical Conference, Vancouver, British Columbia, September 2012.

Funsten, H.O., P.C. Frisch, D. Higdon, P.H. Janzen, G. Livadiotis, D.J. McComas, S. Reese, D.B. Reisenfeld and N.A. Schwadron. "The Circularity of the IBEX Energetic Neutral Atom (ENA) Ribbon." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Garcia-Hernandez, A., H. Delgado-Garibay, M. Leon-Dorantes and M. Munoz-Prior. "Hydraulic Evaluation of an Offshore Pumping Station." Paper presented at the 28th International Pump User Symposium, Houston, September 2012.

Garcia-Hernandez, A., F. Viana, H. Delgado-Garibay, E. Rayon, M. Leon-Dorantes and M. Munoz-Prior. "Hydraulic Modeling of an Offshore Crude Oil Emulsion Pumping System." Paper presented at the Pipeline Simulation Interest Group (PSIG) Annual Meeting, Santa Fe, N.M., May 2012.

Gerard, J.C., D. Grodent, R. Aikaterini, J. Gustin, B. Bonfond and J.T. Clarke. "North-South Asymmetries in Jupiter's FUV Aurora: Quasi-simultaneous Observations with Hubble." Paper presented at the European Planetary Science Congress, Madrid, September 2012.

Gladstone, G.R., K.D. Retherford, S.A. Stern, A.F. Egan, P.F. Miles, M.H. Versteeg, M.W. Davis, J.W. Parker, D.E. Kaufmann, T.K. Greathouse, A.J. Steffl, J. Mukherjee, P.M. Rojas, P.D. Feldman, D.M. Hurley, W.R. Pryor and A.R. Hendrix. "The Earth's Geocorona and Geotail Observed by Lunar Reconnaissance Orbiter's (LRO's) Lyman Alpha Mapping Project (LAMP) Instrument." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Goldstein, J. "A Tale of Two Plasmaspheres: The Inner Magnetospheres of Earth and Saturn." Paper presented at Stanford University, Stanford, Calif., August 2012.

Goldstein, J. and D.J. McComas. "TWINS Stereo ENA Observations of Geomagnetic Disturbances: Weak, Moderate and (Not Quite) Extreme." Paper presented at the Earth-Sun System Exploration 5 Meeting, Kona, Hawaii, January 2013.

Goldstein, J., H. Spence, G.D. Reeves, M.F. Thomsen, R.M. Skoug, H.O. Funsten and R. Livi. "Test Particle Simulation of Thermal Plasma Distribution Observed by the HOPE Instrument on RBSP-ECT." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Goldstein, J., P.W. Valek, D.J. McComas, J.A. Redfern and F. Soraas. "TWINS Stereo Imaging Observations of Trapped and Precipitating Ions." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Goldstein, R., D.C. Boice, J.L. Burch and T.W. Hill. "Preparations for Rosetta Encounter: Comet Observations and Modeling — Lessons Learned from Enceladus." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Gustin, J., B. Bonfond, D. Grodent and J.C. Gerard. "Conversion from HST ACS and STIS Auroral Counts into Brightness, Precipitated Power and Radiated Power for H2 Giant Planets." Paper presented at the European Planetary Science Congress, Madrid, September 2012.

Hedrick, J., S. Fritz, M. Jaczola and H. Holmes. "Diesel Particulate Filter Retrofit Screening Tests on a 1500 kW Gen Set Locomotive." Paper presented at the 2012 ASME Internal Combustion Engine Division Spring Technical Conference, Turin, Italy, May 2012.

Hedrick, J., S. Fritz and K. Plunkett. "Diesel Particulate Filter Retrofit of a 1500 kW Multi-Engine Genset Locomotive." Paper presented at the 2012 ASME Internal Combustion Engine Division Fall Technical Conference, Vancouver, British Columbia, September 2012.

Hess, S., P.A. Delamere, B. Bonfond and D. Vincent. "Satellite-induced Electron Acceleration and Related Auroras." Paper presented at the European Planetary Science Congress, Madrid, September 2012.

Holmquist, T.J. "Modeling Multiple Impacts onto Glass Targets (Work in Progress)." Paper presented at the 37th International Conference and Exposition on Advanced Ceramics and Composites, Daytona Beach, Fla., January 2013.

Hooper, D.M., C.L. Dinwiddie and R.N. McGinnis. "Meltwater-induced Debris Flows on Cold-climate Aeolian Dunes and the Implications for Analogous Processes on Mars." Paper presented at the 3rd International Planetary Dunes Workshop, Flagstaff, Ariz., June 2012.

Howard, T.A., C.E. DeForest, J. Tappin and D. Odstrcil. "Revelations on Heliospheric Imaging of Polarized Light." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Hurley, D.M., P.D. Feldman, K.D. Retherford, J. Cook, S.A. Stern, *et al.* "Modeling Insights into the Lunar Helium Exosphere." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Janzen, P.H., D.B. Reisenfeld, F. Allegrini, M. Bzowski, P.C. Frisch, H.O. Funsten, M.A. Kubiak, H. Kucharek, D.J. McComas, N.A. Schwadron and J. Sokol. "IBEX Polar Heliospheric ENA Flux Variations and Correlations with Solar Wind Observations over More Than Three Years." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Jung, H., T. Ahn, R. Pabalan and D. Pickett. "Corrosion Study of SIMFUEL in Aerated Carbonate Solution Containing Calcium and Silicate." Paper presented at the Materials Research Society Symposium on the Scientific Basis for Nuclear Waste Management XXXVI, Boston, November 2012.

Killough, R. "I See We Still Like C." Paper presented at the 3rd ACM Conference on Data and Application Security and Privacy (CODASPY) 2013, San Antonio, February 2013.

Klar, R., S. Miller, M. Brysch and A. Bertrand. "Performance of the Magnetospheric Multiscale Central Instrument Data Handling." Paper presented at the IEEE Aerospace Conference 2013, Big Sky, Mont., March 2013.

Koets, M., J. Alvarez, M. Tapley, B.D. Moore, J. Pruitt and W. Toczynski. "Enabling Fractionated Spacecraft Communications Using F6WICS." Paper presented at MILCOM 2012, Orlando, Fla., November 2012.

Koets, M.A., J. Alvarez, M. Tapley and B. Walls. "Communications Infrastructure for Fractionated Spacecraft." Paper presented at Workshop on Spacecraft Flight Software, San Antonio, November 2012.

Lamb, D.A., S. Saar and C. DeForest. "Evolution of Coronal Bright Points and Photospheric Magnetic Fields." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Lee, M.A., N.A. Schwadron, L.A. Saul, E. Moebius, P.A. Bochsler, M. Bzowski, S.A. Fuselier, H. Kucharek, D.J. McComas and P. Wurz. "Radiation Pressure from IBEX Observations of Interstellar Neutral Hydrogen." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Leonard, T., E. Moebius, P.A. Bochsler, S.A. Fuselier, D. Heirtzler, H. Kucharek, M.A. Lee, D.J. McComas and N.A. Schwadron. "Combined Maximum Likelihood Fitting and Analytical Modeling of the Interstellar Neutral Gas Flow as Observed by IBEX." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Livadiotis, G., D.J. McComas, N.A. Schwadron, M. Opher, H.O. Funsten, S.A. Fuselier and M.A. Dayeh. "Thermal Pressure of the Proton Plasma in the Inner Heliosheath." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Llera, K., J. Goldstein, J.A. Redfern, P.W. Valek and D.J. McComas. "Statistical Correlation of TWINS Low-Altitude Emission with Stormtime Solar Wind Pressure and Sym-H." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

MacGregor, J.A., D.E. Stillman and R.E. Grimm. "A Revised Model of Low and High-frequency Conduction in Polar Ice." Paper presented at the SEG/AGU Joint Workshop on Cryosphere Geophysics, Boise, Idaho, January 2013.

Mandt, K.E., A. Nagy, J.H. Waite Jr., J. Bell, S. Bougher and B. Magee. "Sensitivity Study of the Cassini INMS Flyby-specific Measurements of the Nitrogen Isotope Ratios and Ar Mixing Ratios to Evaluate the Eddy Diffusion Coefficient in Titan's Atmosphere." Paper presented at the American Astronomical Society (AAS) Division for Planetary Sciences (DPS) Meeting, Reno, Nev., October, 2012.

Martinez, J. "ITS Florida: A Brief History." Paper presented at the ITS Nevada Chapter Meeting, Las Vegas, November 2012.

Martinez, J. "Leveraging ITS for Environmental Gains." Paper presented at the 2012 Transpo Conference, Bonita Springs, Fla., October 2012.

Martinez, J. "SunGuide Version 6.0 and Beyond." Paper presented at the Institute of Transportation Engineers (ITE) Student Chapter Meeting at Florida International University (FIU), Miami, October 2012.

Martinez, J. "Visual Analytics for Improved Transportation Operations." Paper presented at the 2012 Transpo Conference, Bonita Springs, Fla., October 2012.

McClung, R.C., M.P. Enright, W. Wu and R. Shankar. "Integrating Computational Materials Engineering into Probabilistic Damage Tolerance Analysis for Component Design." Paper presented at the 2013 Annual Meeting of the Minerals, Metals and Materials Society (TMS), San Antonio, February 2013.

McComas, D.J. "Outer Heliosphere Implications from IBEX ENAs and Direct Interstellar Neutrals." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

McComas, D.J. and N.A. Schwadron. "Disconnection from the Termination Shock: The End of the Voyager Paradox." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Michell, R.G., B. Bristow, D. Hampton and M. Samara. "Magnetospheric Dynamics Inferred from the Ionospheric-thermospheric Response." Paper presented at the Coupling Energetics and Dynamics of Upper Atmospheric Regions (CEDAR) Workshop, Santa Fe, N.M., June 2012.

Michell, R.G., D. Powell, M. Samara, J.M. Jahn, M. Pfeifer, S. Ibarra and D.L. Hampton. "Engaging the Athabascan Native American Students of Venetie, Alaska in the Auroral Research Occurring Over Their Village." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Michell, R.G. and M. Samara. "Auroral Observations at SwRI." Paper presented at the Auroral Structure and Kinetics Workshop, Helsinki, Finland, June 2012.

Michell, R.G. and M. Samara. "Statistical Study of NEIAL Occurence in the PFISR Data and Correlated Auroral Forms." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Michell, R.G., M. Samara and D. Hampton. "MOOSE: Imager Calibration Summary (and Plans for Cross Calibration with Other Optics)." Paper presented at the Coupling Energetics and Dynamics of Upper Atmospheric Regions (CEDAR) Workshop, Santa Fe, N.M., June 2012.

Michell, R.G., M. Samara, J. Chau, D. Janches and M. Sulzer. "Multi-instrument Campaigns: Radar and Optical Meteor Comparisons at 3 Different Radars." Paper presented at the Coupling Energetics and Dynamics of Upper Atmospheric Regions (CEDAR) Workshop, Santa Fe, N.M., June 2012.

Mintz, T.S., X. He, L. Miller, R. Pabalan, Y.M. Pan, L. Caseres, G. Oberson and D. Dunn. "Coastal Salt Effects on the Stress Corrosion Cracking of Type 304 Stainless Steel." Paper presented at the 2013 National Association of Corrosion Engineers (NACE) CORROSION Conference, Orlando, Fla., March 2013.

Mitchell, E.J., E.L. Patrick, K.E. Mandt, J.N. Mitchell and G.C. Williams. "*In-situ* Measurements of Air Samples from Groundwater Wells with a Field Deployable Mass Spectrometer." Paper presented at the Geological Society of America (GSA) Annual Meeting, Charlotte, N.C., November 2012.

Mitchem, S. "Discussion on the Aggregation of Electric Vehicles for G2V and V2G Applications." Paper presented at the IEEE Computer Society San Antonio Chapter Meeting, San Antonio, February 2013.

Moebius, E., P.A. Bochsler, M. Bzowski, P.C. Frisch, S.A. Fuselier, H. Kucharek, T. Leonard, D.J. McComas, L. Petersen, L.A. Saul, N.A. Schwadron and P. Wurz. "Diagnostics of the Interstellar Gas with IBEX Neutral Atom Observations in the Inner Heliosphere." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Technical Staff Activities

Mohanty, S., R. Nes, E.L. Tipton and D. Pickett. "High-burnup of Spent Nuclear Fuel and Its Implications for Disposal Performance Assessments." Paper presented at the Materials Research Society Fall Meeting – Scientific Basis for Nuclear Waste Management XXXVI, Boston, November 2012.

Moore, T.E., E.J. Summerlin, A.F. Figueroa-Vinas, E.R. Christian, J.F. Cooper and D.J. McComas. "Pick-up Ion Lifetime with Interstellar Ion Super-thermal Tails." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Nicolaou, G., D.J. McComas, F. Bagenal and H.A. Elliott. "Fluid Properties of Plasma Ions in the Distant Jovian Magnetosphere Using Solar Wind Around Pluto (SWAP) Data on New Horizons." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Ogasawara, K., V. Angelopoulos, M.A. Dayeh and D.J. McComas. "ENA Flux Enhancement from the Expanding Magnetosheath: IBEX and THEMIS Observations." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Opher, M., C.L. Prested, D.J. McComas, N.A. Schwadron and G. Toth. "Probing the Nature of the Heliosheath with the Heliospheric Neutral Atom Spectra Measured by IBEX in the Voyager 1 Direction." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Osborne, D., D. Biagini, H. Holmes, S. Fritz, M. Jaczola and M. Iden. "PR30C-LE Locomotive with DOC and Urea Based SCR: Baseline and Initial After-treatment Emissions Testing." Paper presented at the 2012 ASME Internal Combustion Engine Division Spring Technical Conference, Turin, Italy, May 2012.

Osborne, D., D. Biagini, H. Holmes, S. Fritz, M. Jaczola and M. Iden. "PR30C-LE Locomotive with DOC and Urea Based SCR: Field Trial and Emissions after 1,500 and 3,000 Hours of Operation." Paper presented at the 2012 ASME Internal Combustion Engine Division Fall Technical Conference, Vancouver, British Columbia, September 2012.

Osidele, O. "A Collaborative Geospatial Decision Support System (CGDSS) for Managing Coastal River Basins." Paper presented at the NASA Gulf of Mexico Initiative 2013 ROSES Workshop, New Orleans, January 2013.

Osidele, O. and R. Green. "Time Series Modeling of Environmental Impacts in Gulf of Mexico Coastal Basins." Paper presented at the Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, January 2013.

Osidele, O., A. Sun and R. Green. "A Prototype Location-based Web Content Management System for Engaging Gulf of Mexico Coastal Communities." Paper presented at the Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, January 2013.

Pabalan, R., L. Yang and K. Chiang. "Boric Acid Corrosion of Concrete Rebar." Paper presented at the Workshop on Long-term Performance of Cementitious Barriers and Reinforced Concrete in Nuclear Power Plants and Radioactive Waste Storage and Disposal, Cadarache, France, November 2012.

Pabalan, R.T., G.W. Alexander, D.J. Waiting and C.S. Barr. "Experimental Study of Contaminant Release from Reducing Grout." Paper presented at the Workshop on Long-term Performance of Cementitious Barriers and Reinforced Concrete in Nuclear Power Plants and Radioactive Waste Storage and Disposal, Cadarache, France, November 2012.

Pabalan, R., L. Yang and K. Chiang. "Experimental Study and Reactive Transport Modeling of Boric Acid Leaching of Concrete." Paper presented at the Workshop on Long-term Performance of Cementitious Barriers and Reinforced Concrete in Nuclear Power Plants and Radioactive Waste Storage and Disposal, Cadarache, France, November 2012.

Payan, A.P., A. Rajendar, C.S. Paty, B. Bonfond and F. Crary. "Using a 2D Model of the Io Plasma Torus to Investigate the Effects of Density Variations on the Morphology and Intensity of the Io Footprint." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Perry, M.E., T.E. Cravens, K.E. Mandt, B.D. Teolis, R.L. Tokar, H.T. Smith, R.L. McNutt, Jr. and J.H. Waite Jr. "Cassini INMS Observations of Ions and Neutrals in Saturn's Inner Magnetosphere." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Pogorelov, N.V., S.N. Borovikov, R.W. Ebert, J. Heerikhuisen, T.K. Kim, I. Kryukov, J.D. Richardson, S.T. Suess and G.P. Zank. "Nonstationary Phenomena in the Heliosheath." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Pritchard, T.A., P. Roming and A.J. Bayless. "UV Bolometric Flux Contribution and Template Light Curves of Core Collapse Supernovae Observed with the Swift Ultra-Violet/Optical Telescope." Paper presented at the 2013 American Astronomical Society (AAS) Meeting, Long Beach, Calif., January 2013.

Putzig, N.E. "CAT Scans of Mars: Three-dimensional Imaging of the Polar Layered Deposits With Shallow Subsurface Radar (SHARAD)." Paper presented at the University of Arizona Lunar and Planetary Laboratory Colloquium, Tucson, Ariz., January 2013.

Putzig, N.E., F.J. Foss II, B.A. Campbell and R.J. Phillips. "Martian CAT Scan: Three-dimensional Imaging of Planum Boreum with Shallow Radar Data." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Putzig, N.E., F.J. Foss II, B.A. Campbell and R.J. Phillips. "Three-dimensional Imaging of the Martian Polar Ice Caps from Orbit with the MRO Shallow Radar Sounder." Paper presented at the SEG/AGU Joint Workshop on Cryosphere Geophysics, Boise, Idaho, January 2013.

Radioti, A., D. Grodent, J.C. Gerard, B. Bonfond and J. Gustin. "On the Origin of Saturn's Polar Auroral Arcs." Paper presented at the European Planetary Science Congress, Madrid, September 2012.

Rimpel, A.M. and J.C. Wilkes. "Tutorial: Applications of Supercritical CO2 Power Cycle: Fundamentals and Design Considerations." Presented at the sCO2 Power Cycle Technology Roadmapping Workshop, San Antonio, February 2013.

Roming, P., T.A. Pritchard, P.J. Brown and S. Immler. "The Rest Frame UV Properties of Type IIn Supernovae." Paper presented at the 2013 American Astronomical Society (AAS) Meeting, Long Beach, Calif., January 2013.

Rose, R., J. Dickinson and A. Ridley. "CubeSats to NanoSats; Bridging the Gap between Educational Tools and Science Workhorses." Paper presented at the Annual IEEE Aerospace Conference, Big Sky, Mont., March 2012.

Roth, L, J. Saur, K.D. Retherford, D.F. Strobel and P.D. Feldman. "Influence of Induction Signals from the Interior on the Variation of Io's Equatorial Aurora Spots." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Samara, M., R.G. Michell, D.L. Hampton and T. Trondsen. "MOOSE: A Multi-spectral Observatory Of Sensitive EMCCDs for Innovative Research in Space Physics and Aeronomy." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Samara, M., R.G. Michell, J.M. Jahn, M. Pfeifer, S. Ibarra, D.L. Hampton and D. Powell. "Interactive Auroral Science for Hearing-impaired Students." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Technical Staff Activities

Saur, J., S. Duling, L. Roth, P.D. Feldman, D.F. Strobel, K.D. Retherford, M.A. McGrath, F. Musacchio and A. Wennmacher. "Ganymede's Magnetic Field Environment from Hubble Space Telescope Observations and Modeling." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Saur, J., S. Duling, L. Roth, P.D. Feldman, D.F. Strobel, K.D. Retherford, M.A. McGrath, F. Musacchio and A. Wennmacher. "Hubble Space Telescope Observations of Ganymede's Time-variable Auroral Ovals." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Saur, J., S. Duling, L. Roth, P.D. Feldman, D.F. Strobel, K.D. Retherford, M.A. McGrath, F. Musacchio and A. Wennmacher. "Mapping Ganymede's Time-Variable Aurora in the Search for a Subsurface Ocean." Paper presented at the German Physical Society (DPG) Meeting, Jena, Germany, February 2013.

Schwadron, N.A., F. Adams. H.O. Funsten, P. Desiati, P.C. Frisch and D.J. McComas. "Anisotropies in TeV Cosmic Rays Related to Entry into the Heliosphere and the IBEX Ribbon." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Schwamb, M.E., C.J. Lintott, D. Fischer, J.M. Brewer, M.J. Giguere, S. Lynn, M. Parrish, K. Schawinski, R. Simpson, A.M. Smith, J.A. Orosz, J.A. Carter, A. Howard, G. Torres, J.R. Crepp, W.C. Keel, W.F. Welsh, N.A. Kaib, D. Terrell, R. Gagliano and K.J. Jek. "Planet Hunters in the Kepler Extended Mission." Paper presented at the 221st American Astronomical Society (AAS) Meeting, Long Beach, Calif., January 2013.

Shaffner, J., J.B. Jessie, C.S. Barr, C. Grossman, M. Fuhrmann, G. Alexander, L.S. Parks, R.T. Pabalan, D.A. Pickett, C.L. Dinwiddie, G.R. Walter, B. Dasgupta and L.D. Howard. "U.S. Nuclear Regulatory Commission Plan for Monitoring Disposal Actions Taken by the U.S. Department of Energy at the Savannah River Site F-Area Tank Farm Facility in Accordance with the National Defense Authorization Act for Fiscal Year 2005." Paper presented at the U.S. Nuclear Regulatory Commission (NRC), San Antonio, January 2013.

Siebenaler, S.P. "Continuous Leak Detection for Offshore Pipelines." Paper presented at the 4th Subsea and Arctic Leak Detection Symposium, Houston, December 2012.

Siebenaler, S.P. "Field Testing of Acoustic Leak Detection Systems." Paper presented at the 2012 PRCI Pipeline Research Exchange, Grapevine, Texas, February 2013.

Stillman, D.E., R.E. Grimm, T.I. Michaels and K.P. Harrison. "Formation of Recurrent Slope Lineae (RSL) by Freshwater Discharge of Melted Cold Traps." Paper presented at The Present-day Habitability of Mars Meeting, Los Angeles, February 2013.

Stillman, D.E., R.N. McGinnis, C.L. Dinwiddie, R.E. Grimm and K.L. Bjella. "Interpretations of the State and Abundance of Water in Polar Dunes from In-situ and Laboratory Electrical Property Measurements." Presented at the SEG/AGU Joint Workshop on Cryosphere Geophysics, Boise, Idaho, January 2013.

Valek, P.W., R. Ilie, J. Goldstein, D.J. McComas and J.D. Perez. "Storm Phase Variation of Energy and Composition of Low Altitude and High Altitude Energetic Neutral Atoms as Observed by TWINS." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Waite, J.H. Jr., K.E. Mandt, J. Westlake, J. Bell, B. Magee, B. Teolis, R. Perryman, et al. "Titan's Upper Atmospheric Composition and Structure: Cassini INMS Results." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Webb, C. "Hybrid Electric Exhaust Energy Augmentation for Improving Low Load Emissions System Operation." Paper presented at the SAE 2013 Emissions Control for Light Duty Automotive Vehicles Symposium, Detroit, January 2013.

Westlake, J.H., C.P. Paranicas, T.E. Cravens, J.G. Luhmann, K.E. Mandt, H.T. Smith, D.G. Mitchell, A.M. Rymer, M.E. Perry, J.H. Waite Jr. and J.E. Wahlund. "The Composition of Titan's Ionospheric Outflow: Mass Resolved INMS Observations of Exospheric Ions from the T40 Flyby." Paper presented at the American Astronomical Society (AAS) Division for Planetary Sciences (DPS) Meeting, Reno, Nev., October 2012, and at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Wieland, D., M. Blinn and C. King. "T-38 ASIP Going the Extra Inch." Paper presented at the 2012 Aircraft Structural Integrity Program (ASIP) Conference, San Antonio, November 2012.

Wu, Z., Y. Chen, G. Li, Y. Liu, M.I. Desai, R.W. Ebert, G.M. Mason, F. Guo and C. Tang. "Observation of Energetic Particles Associated with a CIR Pair." Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Zieger, B., M. Opher, N.A. Schwadron, D.J. McComas and G. Toth. "Does a Slow Magnetosonic Bow Shock Exist in the Local Interstellar Medium?" Paper presented at the 2012 AGU Fall Meeting, San Francisco, December 2012.

Internal Research

Funded January 1, 2013

Andrews, J., D. Rose, M. Vincent and J. Peterson. "Mission Operations Center Capability Development."

Bailey, G. and M. Jones. "Development of Advanced Analysis of Aluminum Cylinder Heads."

Blackstone, L. "Feasibility Study for Embedded Software Control of Flexible RF Filters."

Boehme, K., A. Burmeister and B. Davis. "Wideband Wireless Capability on Small Tactical Platforms."

Buie, M. "NEO Survey Simulator."

Callahan, T. and J. Chiu. "Diesel and Natural Gas Dual Fuel Engine Operating Envelope."

Fisher, B. and R. Logan. "High-Fidelity Physics-Based Simulation of Construction Equipment."

Gutierrez, G. and G. Rossini. "Applied CNS Formulations for Treatment of Chemical Warfare Threats and Traumatic Brain Injury."

Hicks, F. and J. Pruitt. "Alternative Advanced Electronic Countermeasure Techniques."

Lu, B. and S. Hudak. "Crack-Size Effect in Corrosion-Fatigue Crack Growth."

Michell, R. and M. Samara. "Fostering International Collaborations for Auroral Imaging at the European Incoherent Scatter Radar Facilities."

Mohanty, S. "Chemical-Based Tertiary Oil Recovery from Carbonate Rocks."

Ogasawara, K., S. Livi and K. Coulter. "Fabrication and Characterization of a Single Crystal Diamond Detector for <300 keV Particles."

Pruitt, J. and A. Fleischmann. "Practical Metamaterial Phase Shifter."

Rivera, M., R. Garcia, J. Mitchell, G. Roach and J. Boehme. "Development of a Wireless Power Transfer Technique for Quick-Charging Inaccessible Electronic Devices."

Schindhelm, E. "Design Study for a UV/Optical/IR Telescope on the International Space Station."

Shoffner, B., S. Kouame, C. Ellis-Terrell, K. Coulter and T. Alger. "Investigation of an Oleophobic Coating Effect on Gasoline Direct-Injection (GDI) Engine Components to Reduce Carbon Deposits."

Technical Staff Activities

Sturgeon, P. and R. Garcia. "Dynamic Real-time Lane Modeling."

Young, E. "Pre-Fight Demonstration of a Solid-State Motion Compensation Camera."

Funded April 1, 2013

Allsup, C., C. Gomez and J. Nicho. "Robotic Handling of Unstructured Materials: Semi-Random Component Pick and Place for Assembly."

Barth, E. "Capability Development for a Titan Microphysics Model: Particle Shape and Cloud Composition."

Bessee, G. "Investigation of the Rheology and Tribology Properties of Mono-Oleate as an Additive for SAE J1488-10 Emulsified Fuel-Water Separation Test Method."

Cheng, X., Q. Ni, T. Bredbenner and D. Nicolella. "A New Generation of Bone Cements/Grafts Based on Magnetic Calcium Phosphate Nanoparticles (MCaP NPs) Using a Magnetic Field-Triggered Polymerization Process."

Chiang, K. "Development of Protective Coatings to Resist Type II Hot Corrosion."

Cox, P.A., J. Mathis, M. Grimm and C. Weiss. "Design, Analysis and Instrumentation of a Full-Scale Reusable Landmine Test Rig."

De Los Santos, A., D. Guerrero and M. Freeman. "Development of High Voltage Optocoupler for Space Applications."

Dennis, G. "Characterization of a Low-Cost Radar/Radiometer as a Close-Range Blast Detection Sensor."

Feng, M., C.K. Tan and D. Daruwalla. "High Octane Number Gasoline Production from Lignin."

Fisher, J. "EDAS-MS Upgrade and Demonstration Preparation."

Grimm, R. and D. Stillman. "Field Tests for the Geophysical Detection of Subsurface Ice."

Gutierrez, G. and G. Rossini. "Development of Novel Formulations of Cholesterol-Lowering Drug to Treat Ischemia Reperfusion Injury."

Koets, M. and C. Sauer. "Automatically Generated Verilog for FPGAs in Radiation Environments."

Nicolella, D., T. Eliason and T. Bredbenner. "Development of a Dynamic Finite Element Model of the Temporomandibular Joint (TMJ) and Study of Joint Mechanics."

Poduval, B. "Validating CSSS Model to Investigate Slow Solar Wind Origins."

Poduval, B. and C. DeForest. "Development and Demonstration of Computer Vision Software for Solar Transient Events."

Rigney, M., C. Lewis, M. Blanton and T. Whitney. "Control of Laser Coating Removal Process."

Rincon, C., R. Wei, C. Bitsis and P. Lee. "Development and Characterization of Low Friction-Nanocomposite Films/Coatings for Piston Rings."

Varner, D., J. Dickinson and M. Koets. "Investigation of Cognitive Radio Methodologies for SATCOM."

Webb, C. "Simulation of Transient Engine Exhaust Gas Conditions Using R-FOCAS HGTR Burner System."

Wyrick, D. and K. Smart. "Integrated Physical Analog and Numerical Modeling of Geologic Structures."

Young, L. "Innovative Pluto Observations."

Young, L., M. Buie, C. Olkin and E. Young. "Multi-Level Modeling of Pluto's Surface and Atmosphere."

Zhan, R. and C. Webb. "Development of a Methodology to Generate OBD Threshold SCR Catalysts for Heavy-Duty Diesel Applications."

Patents

Alger, T., B. Mangold, J. Gingrich and D. Mehta. "EGR System with Dedicated EGR Cylinders." U.S. Patent No. 9,291,891. October 2012.

Amann, M. and T. Alger. "Evaluation of Non-fuel Components on Engine Knock Performance." U.S. Patent No. 8,327,687. December 2012.

Cabell, L. and J. McDonough. "Bis-Quaternary Pyridinium-Aldoxime Salts and Treatment of Exposure to Cholinesterase Inhibitors." U.S. Patent No. 8,404,850. March 2013.

Chiang, K-T. and R. Wei. "Conformal Magnetron Sputter Deposition." U.S. Patent No. 8,277,617. October 2012.

Chadwell, C. "HCCI Combustion Timing Control with Decoupled Control of In-cylinder Air/EGR Mass and Oxygen Concentration." U.S. Patent No. 8,371,120. February 2013.

Couvillion, W.C., E. Peterson. "Image Analogy Filters for Terrain Modeling." U.S. Patent No. 8,289,326. October 2012.

Deforest, C. "Dual Acquisition Miniature All-Sky Coronagraph. U.S. Patent No. 8,280,104. October 2012.

Fisher, J.B., S. Bowers, K. Van Sickle, W. Couvillion, R. Wright and J. Cannon. "System and Method for Overlaying Ultrasound Imagery on a Laparoscopic Camera Display. U.S. Patent No. 8, 267,852. September 2012.

Furman, B., S. Wellinghoff and M. Rubal. "Surface Treatment and Exchange of Nanostructures from Aqueous Suspension into Organic Media and into Polymer-Matrix Composites." U.S. Patent No. 8,415,491. April 2013.

Hayles, R. and J. Moryl. "System and Method for Position of Range Estimation, Tracking and Selective Interrogation and Communication." U.S. Patent 8,378,922. February 2013.

Hill, R. "Biometric Device Based on Luminescence." U.S. Patent No. 8,417,959. April 2013.

Khair, M., S. Simescu, G. Neely and V. Ulmet. "Passive NOx and PM Aftertreatment for Diesel Engine." U.S. Patent No. 8,316,633. November 2012.

Light, G., A. Puchot, A. Cobb and E. Laiche. "Magnetostrictive Sensor for Tank Floor Inspection. U.S. Patent No. 8,358,126. January 2013.

McDonough, J., H. Dixon, M. Kimmel, L. Cabell and S. Wellinghoff. "Modified Calcium Phosphate Nanoparticle Formation. U.S. Patent No. 8,309, 134. November 2012.

Megel, M., D. McKee, B. Westmoreland and K. Denholm. "Hybrid Ceramics/Sand Core for Casting Metal Parts Having Small Passages." U.S. Patent No. 8,267,148. September 2012.

Miller, M. and D. Strickland. "Chiral Plasmonic Structures for Mediating Chemical Transformation and Detection of Molecules with Spatial Chirality. U.S. Patent No. 8,379,198. February 2013.

Miwa, J. "Control of NO/NO2 Ratio to Improve SCR Efficiency for Treating Engine Exhaust Using Bypass Oxidation Catalyst." U.S. Patent No. 8,420,036. April 2013.

Persyn, J., J. McDonough and J. Oxley. "Dry to Wet Injector." U.S. Patent No. 8,361,012. January 2013.

Sagebiel, E. "Shaped Explosive Charge." U.S. Patent No. 8,375,859. February 2013.

Shukla, P., T. Mintz, B. Dasgupta, J. Fisher and O. Pensado-Rodriguez. "Local Electrochemical Impedance Spectroscopy (LEIS) for Detecting Coating Defects in Buried Pipelines." U.S. Patent No. 8,310,243. November 2012.

Surampudi, B. and J. Steiber. "Position Estimation for Ground Vehicle Navigation Based on Landmark Identification/Yaw Rate and Perception of Landmarks." U.S. Patent No. 8,301,374. October 2012.

Webb, C. and J. Mathis. "Mass Air Flow Compensation for Burner-based Exhaust Gas Generation System." U.S. Patent No. 8,425,224. April 2013.

RECENT FEATURES

Recent Features from *Technology Today*

Mars on Earth *(Winter 2013)*
Cynthia L. Dinwiddie, Ph.D.
The Great Kobuk Sand Dunes in Alaska provide an Earth analog for Martian geology.

Measuring the Radiation Environment on Mars *(Winter 2013)*
Donald M. Hassler, Ph.D.
An SwRI-led instrument is determining radiation hazards for future manned missions to Mars.

Fit for Service *(Winter 2013)*
Joseph Crouch and Curtis Sifford
SwRI engineers use a variety of techniques to ensure the integrity of pressure vessels and other structures.

Within ARMS Reach *(Winter 2013)*
Roland Benke, Ph.D.
An SwRI-developed technique enhances the capability of portable gamma ray imaging devices.

A Cosmic Energy Source in 3-D *(Summer 2012)*
David T. Young, Ph.D.
SwRI-developed Hot Plasma Composition Analyzers will fly aboard four satellites studying magnetic reconnection as part of NASA's Magnetospheric Multiscale mission.

Shared Research *(Summer 2012)*
SwRI's extensive consortia experience stems from a 1984 law.

A Cast of Thousandths *(Summer 2012)*
An SwRI-developed method of casting diesel engine cylinder heads with greater precision wins an R&D 100 Award.

Unmanned and Downrange *(Summer 2012)*
Ryan D. Lamm
SwRI engineers successfully demonstrated military applications for autonomous unmanned ground vehicles during 2012.

Clues from Burning Furniture *(Spring 2012)*
Marc L. Janssens, Ph.D., FSFPE
An SwRI-led study of how upholstered furniture burns will help fire investigators reduce uncertainty in determining the cause of a fire.

Searching the Moon's Shadows *(Spring 2012)*
Lunar Reconnaissance Orbiter's LAMP reveals craters' hidden features.

Fax requests for articles previously published in Technology Today **to (210) 522-3547 or e-mail** *jfohn@swri.org*. **Recent** Technology Today **features, as well as a listing of older titles, are available online at** *technologytoday.swri.org*. **To receive an online subscription, visit** *update.swri.org*.

coming up

Trade Shows

Look for Southwest Research Institute at the following:

- **AAPG 2013 Annual Convention & Exhibition**, Pittsburgh; May 19-22, 2013
- **Space Tech Expo**, Long Beach, Calif.; May 21-23, 2013
- **ASME Turbo Expo**, San Antonio; June 3-7, 2013
- **Advanced Automotive Battery Conference Europe**, Strasbourg, France; June 24-28, 2013
- **Institute of Food Technologists**, Chicago; July 13-16, 2013
- **The 40th Annual Meeting & Exposition of the Controlled Release Society**, Honolulu; July 21-24, 2013
- **AUVSI Unmanned Systems North America**, Washington, D.C.; August 12-15, 2013
- **F-16 and Proven Aircraft/TCG World Wide Review**, Ogden, Utah; September 9-13, 2013
- **AUTOTESTCON**, Schaumburg, Ill.; September 16-19, 2013
- **42nd Turbomachinery Symposium and the 29th International Pump Users Symposium**, Houston; September 30-October 3, 2013
- **IMPACT Fall**, Boston; October 6-8, 2013
- **IASH**, Rhodes, Greece; October 6-10, 2013
- **International Telemetering Conference/USA (ITC/USA) 2013**, Las Vegas; October 21-24, 2013
- **Automotive Testing Expo 2013 North America**, Novi, Mich.; October 22-24, 2013
- **ASNT Annual Conference**, Las Vegas; November 4-7, 2013
- **SupplySide West**, Las Vegas; November 14-15, 2013

employment

Southwest Research Institute is an independent, nonprofit, applied research and development organization. The staff of almost 3,000 employees pursue activities in the areas of communication systems, modeling and simulation, software development, electronic design, vehicle and engine systems, automotive fuels and lubricants, avionics, geosciences, polymer and materials engineering, mechanical design, chemical analyses, environmental sciences, space sciences, training systems, industrial engineering and more.

SwRI is always looking for talented technical staff for its San Antonio facilities and for locations elsewhere in the United States. We welcome your referrals. The Institute is an Equal Opportunity Employer, M/F/D/V, committed to diversity in the workplace. Check our employment opportunities at ***jobs.swri.org***.

Technology Today
Southwest Research Institute
6220 Culebra Road
P.O. Drawer 28510
San Antonio, Texas 78228-0510
United States

Nonprofit Org.
U.S. POSTAGE
PAID
Permit No. 234
San Antonio, Texas

Benefiting government, industry and the public through innovative science and technology

Southwest Research Institute
swri.org

Find Us On YouTube facebook twitter LinkedIn