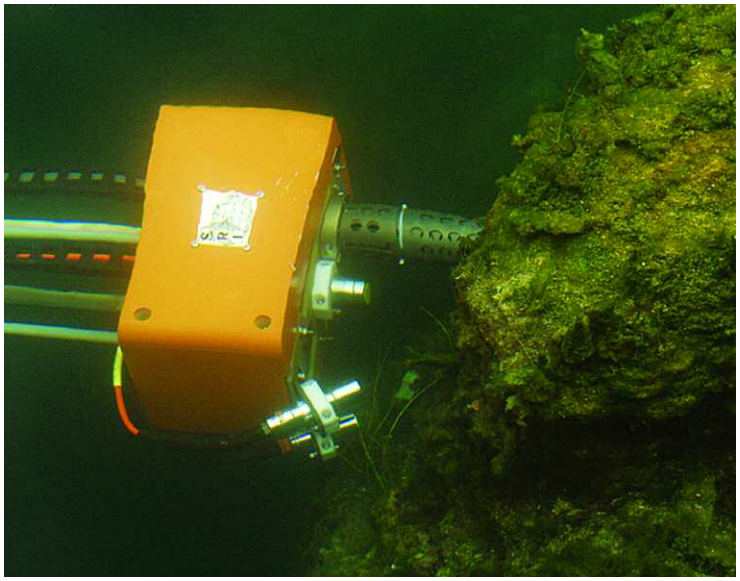
## Brief notes about the world of science and technology at Southwest Research Institute



### Underwater probe to explore Earth and possibly Jupiter s moon

SwRI scientists are part of a NASA-funded team developing an autonomous underwater probe to evaluate technology concepts that eventually may be used to search for life in the oceans of Jupiter's moon Europa.

The vehicle, called DEPTHX for Deep Phreatic (pertaining to underwater rock formations) Thermal Explorer, was integrated and tested in Austin, Texas, by Stone Aerospace Inc., with funding from the NASA Advanced Science and Technology for Exploration of Planets program and the NASA Ames Research Center. Engineers and scientists from SwRI's Automation and Data Systems Division and Space Science and Engineering Division developed sensors, machine vision and sample-return technologies for the robot vehicle under contract with Stone Aerospace.

Before sending a mission to Jupiter's moon, however, the technologies for autonomous exploration, mapping and life detection are being developed and tested here on Earth.

DEPTHX has undergone preliminary tests in above-ground tanks and also in lakes around Austin. Recent tests included exploring La Pilita, a 310-foot-deep sinkhole located north of Tampico in the Mexican state of Tamaulipas. Later it was to be sent to the bottom of a deep, water-filled sinkhole named Zacaton, also located north of Tampico. There, DEPTHX will use its autonomous systems as it dives more than 1,500 feet to the bottom, gathers and analyzes samples along the way and then finds its way back to the surface.

After Zacaton, the next development step could be to send the probe into Lake Vostok in Antarctica, a body of water about the size of Lake Ontario but which has been sealed off from the outside world for thousands of years by an ice cap 2.5 miles thick.

Like the Antarctic lake, scientists believe Europa, about the size of Earth's moon, contains liquid-water oceans beneath an icy crust that is up to six miles thick. A robot vehicle based on technologies developed on DEPTHX might be sent on some future mission to Europa, possibly around 2014, to penetrate the ice and explore the water beneath in search of microbial life.

"Except for the ice cover, extreme temperatures and remote distance, Zacaton contains many aspects of the challenging environment that will be encountered at Lake Vostok or Europa," said Dr. Ernest Franke, an Institute engineer in the SwRI Automation and Data Systems Division. "The deeper parts of Zacaton are completely unexplored and unmapped. The DEPTHX team is developing new methods for autonomous navigation and mapping so the robot vehicle can explore the unknown three-dimensional world and safely return to the surface.

The vehicle was built by Stone Aerospace with collaboration from SwRI, the University of Arizona, the University of Colorado, the University of Texas at Austin and Carnegie-Mellon University.

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### Fritz named ASME Fellow

Steven G. Fritz, manager of the Medium Speed Diesel Engine Section in the Engine, Emissions and Vehicle Research Division, has been elected a Fellow of the American Society of Mechanical Engineers.

The Fellow grade of membership is conferred upon an ASME member with at least 10 years of active engineering practice and recognizes exceptional engineering achievements and contributions to the engineering profession. Fritz was cited for his work in diesel locomotive exhaust emissions characterization and control strategies.

Fritz joined the SwRI staff in 1986 after earning bachelor's and master's degrees in mechanical engineering from Michigan Technological University. During his more than 20-year career he has led several efforts concerned with diesel engine performance including engine wear and friction studies, exhaust emissions characterization, the effect of diesel fuel properties, and diesel aftertreatment technologies.

Fritz has been an active member of ASME since 1988. He served as chairman of the Internal Combustion Engine Division from 2002 to 2003, and has held positions on ASME national committees including the Soichiro Honda Medal Committee and the Nominating Committee.

He is the recipient of several ASME awards including four Internal Combustion Engine Division Best Paper Presentation Awards (1992, 1994, 1995, 1997), the Richard W. Woodbury Award (2004) and the ASME Dedicated Service Award.

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**Silvus awarded EDFAS Lifetime Achievement Recognition**

The Electronic Device Failure Analysis Society (EDFAS) awarded its first-ever Lifetime Achievement Recognition to Stan Silvus, manager of the Electronic-Component Failure-Analysis Laboratory in the Applied Physics Division at Southwest Research Institute. He received a plaque to commemorate the honor. EDFAS, an affiliate of ASM International, is dedicated to fostering education, communication, and collaboration in the failure analysis community for technology advancement, improved performance, and reliability of electronic devices and systems.

The lifetime achievement distinction recognizes "exceptional volunteer service in providing opportunities for professional development within the microelectronics failure analysis community." Silvus has served EDFAS since it was organized, and he is on the editorial committee for Electronic Device Failure Analysis, the quarterly magazine published by EDFAS. For many years, he has been involved in the International Symposium for Testing and Failure Analysis (ISTFA) conference series, which is now sponsored by EDFAS.

At SwRI, Silvus has designed and evaluated electronic and electromechanical systems. His expertise in design, development, and evaluation of electronic circuits and electromechanical devices for control and instrumentation applications has resulted in seven patents.

Since 1978, he has been responsible for planning construction-analysis and failure-analysis protocols, analyzing and interpreting technical data, and supervising lab personnel and equipment.

Silvus holds bachelor's and master's degrees in electrical engineering from Rice University. He is a charter member of EDFAS and a life member of the Institute of Electrical and Electronics Engineers (IEEE). He is a licensed professional engineer in Texas.

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**NASA accepts SwRI proposal for Mars Scout orbiter mission for study**

NASA has selected a proposal by Southwest Research Institute and its partners to develop a concept study report for a future $475 million robotic orbiter mission to Mars. The proposal — called TGE or "The Great Escape" — is one of two finalists being considered by NASA for a Mars mission to be launched in 2011; the proposal includes plans for the development and flight of the science payload, spacecraft and launch vehicle. Partnering with SwRI are Orbital Sciences Corporation, the University of Michigan, the Johns Hopkins University Applied Physics Laboratory and a host of other institutions.

In line with NASA's goal to gain a better understanding of Mars' atmosphere, climate, and potential habitability, the TGE mission aims to shed new light on the processes that caused Mars to evolve from its former wet and warm habitat to its current colder, dryer state. TGE will also examine certain aspects of the Martian environment critical to planning for future human exploration of the red planet.

"The science addressed by TGE is fundamentally important to understanding the evolution of the Mars climate and is relevant to Earth climate studies at a time when climate issues are of paramount importance here on Earth," said Dr. Don Hassler, TGE deputy principal investigator and a manager in the SwRI Space Studies Department.

The TGE team will receive $2 million to conduct a nine-month feasibility study this year. In late 2007, NASA will select one of the two studies for full development as a Mars Scout mission.

NASA's Jet Propulsion Laboratory manages the Mars Exploration Office for the Mars Exploration Program of the NASA Science Mission Directorate.

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**Westbrook wins award of merit, named ASTM Fellow**

Steven R. Westbrook, a principal scientist in the Fuels and Lubricants Research Division, has been selected for the ASTM International 2007 Award of Merit. With the award also comes recognition as a Fellow of ASTM.

Established by the ASTM International Board of Directors in 1949, the Award of Merit is the highest society award granted to members for distinguished service and outstanding participation in ASTM committee activities. ASTM is one of the world's largest voluntary standards development organizations.

Westbrook earned a bachelor's degree in chemistry from Texas Lutheran University and a master's of business administration from The University of Texas at San Antonio. Since joining the SwRI staff in 1979, Westbrook has conducted research on fuel stability additives, diesel fuel-degradation reaction mechanisms, the effects of fuel container surfaces on fuel quality and fuels from alternative sources. He has studied advanced analytical methods for field analysis of fuels, and his recent work has involved bio-diesel oxidation and oxidation test methods.

Westbrook has been participating in ASTM activities since 1979, currently serving as the chairman of the ASTM subcommittee on burner, diesel, marine and nonaviation gas turbine fuels. He has also served as chairman of other ASTM sections involving fuel stability and cleanliness. Westbrook has received the Committee D2 Awards of Appreciation and Excellence. The D2 Committee establishes standards for distillate fuels. In addition to ASTM, he is also chairman of the International Association for Stability, Handling, and Use of Liquid Fuels.

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**Allegrini, F.**, **M.I. Desai**, H. Kucharek, G.M. Mason and E. Möbius. "Acceleration of Heavy Ions at CME-driven Interplanetary Shocks Near Earth." Presented at the Heliophysics Missions Joint Science Workshop: The Heliospheric Network, Oxnard, Calif., November 2006.

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**Anderson Jr.**, **C.E.**, T. Behner, D.L. Orphal, V. Hohler and D.W. Templeton. "Reverse Ballistic Experiments of Long-Rod Penetration into Lead and Borosilicate Glass." Presented at the 31st International Conference & Expo on Advanced Ceramics and Composites, The American Ceramics Society, Daytona Beach, Fla., January 2007.

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**Bonivtch, A.R.**, **W.L. Francis**, **D.E. Moravits**, G.R. Paskoff, B.S. Shender **B.H. Thacker** and **D.P. Nicolella**. "Development, Verification, and Validation of a Parametric Cervical Spine Injury Prediction Model." Presented at the Society of Women Engineers Conference, Kansas City, Mo., October 2006.

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**Burch, J.L.**, **J. Goldstein**, **W.S. Lewis**, **D.T. Young**, A.J. Coates, M.K. Dougherty and N. Andre. "Tethys and Dione: Sources of Outward Flowing Plasma in Saturn's Magnetosphere." Presented at the American Geophysical Union, Fall Meeting, San Francisco, December 2006.

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**Clair, P.J.** "Internet Protocol Version 6 Networks — What Do the Coming Changes Mean for Intelligent Transportation Systems?" Paper presented at TransPO 2006 Exhibition and Conference, Palm Harbor, Fla., November 2006.

**Clair, P.J.** "Maintaining System Security for Critical Public Safety and Traffic Management in Combined ITS/DOT Business Network Environments." Paper presented at the Intelligent Transportation Society of Arizona Annual Meeting, Phoenix, Ariz., November 2006.

**Clair, P.J.** "Wireless Trends, Tools, and Tips." Paper presented at ITS Texas Wireless, San Antonio, May 2006, ITS Arizona, Phoenix, November 2006, ITS Texas, Houston, November 2006, TransPO 2006 Exhibition and Conference, Palm Harbor, Fla., November 2006.

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Currey, J.A., P. Leucht, A. Vercnocke, D. Hansen, E.L. Ritman, **D.P. Nicolella** and J.B. Brunski. "A Micro-CT Based System for Determining Strain Fields at a Bone-Implant Interface in the Mouse Tibia." Presented at the 52nd Annual Meeting of the Orthopaedic Research Society, Chicago, March 2006.

**Dannemann, K.A.**, **R. Wei**, J.H. Arps, **S.A. Mullin** and **J.H. Bradley**. "Ballistic Evaluation of a Novel Nanocomposite." Presented at the 31st International Conference & Exposition on Advanced Ceramics & Composities, Daytona Beach, Fla., January 2007.

# TECHNICAL STAFF ACTIVITIES

**Dannemann, K.A.**, **A.E. Nicholls**, **S. Chocron** and **C.E. Anderson Jr.** "Characterization of Damage Development in Intact, Confined Borosilicate Glass." Presented at the 31st International Conference & Expo on Advanced Ceramics and Composites, The American Ceramics Society, Daytona Beach, Fla., January 2007.

**Dellenback, S.W.** "Deploying Extensible and Scalable Traffic Management Systems for the State of Florida." Paper presented at the 13th ITS World Congress, London, October 2006.

**Dellenback, S.W.** and **R.L. Strain**. "Software Process Management Techniques to Improve Systems Operation." Paper presented at the 13th ITS World Congress, London, October 2006.

**Desai, M.I.**, C.M.S. Cohen, C.W. Smith, M.A. Lee, Y. Litvinenko, D.V. Reames, C.K. Ng, A.J. Tylka, J. Kota, J. Giacalone, J.R. Jokipii, I. Sokolov, T. Gombosi, I.I. Roussev, G. Li, G.P. Zank, and J. Tessein. "Recent Results of the 2005 LWS TR&T Focus Team for Solar Energetic Particles." Presented at the 2006 Fall Meeting of the American Geophysical Union, *EOS Trans. Am. Geophys. U., 87(52), Fall Meet. Suppl., SH23C-03,* San Francisco, December 2006.

**Desai, M.I.**, **D.J. McComas**, G.M. Mason and N.A. Schwadron. "Composition and Spectra of Upstream Ion Events Near the Earth's Bow Shock," Presented at the Heliophysics Missions Joint Science Workshop: The Heliospheric Network, Oxnard, Calif., November 2006.

**Desai, M.I.**, G.M. Mason, J.E. Mazur and J. R. Dwyer. "Solar Cycle Variations in the Quiet-Time Composition of the Suprathermal Heavy Ion Population Near 1 AU." Presented at the Solar Heliospheric and Interplanetary Environment (SHINE) Workshop, Midway, Utah, August 2006.

**Desai, M.I.**, G.M. Mason, R.E. Gold, S.M. Krimigis, C.M.S. Cohen, R.A. Mewaldt, J.E. Mazur and J.R. Dwyer. "The Seed Population for Large Solar Energetic Particle Events." Presented at the Symposium on the Composition of Matter, Grindelwald, Switzerland, September–August 2006.

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**Dinwiddie, C.L.**, **R.E. Grimm**, **R.N. McGinnis**, **D.E. Stillman** and E. Heggy. "Moderately to Poorly Welded Tuff, Bishop, California: Geophysical and Geological Characterization to Determine the Source of Radar Scattering." Presented at the American Geophysical Union Fall Meeting, San Francisco, December 2006.

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**Dunn, D.S.**, **Y.M. Pan**, **X. He**, **L.T. Yang** and **R.T. Pabalan.** "Evolution of Chemistry and Its Effects on the Corrosion of Engineered Barrier Materials." Paper presented at the 30th Symposium on the Scientific Basis for Nuclear Waste Management—MRS Fall Meeting, Boston, November 2006.

**Dykes, S.G.**, **R.A. Klar**, **A.R. Roberts** and **C.C. Mangels**. "A Link-Layer Broadcast Service for SpaceWire Networks." SpaceWire Working Group Meeting 8, ESTEC, Noordwijk, Netherlands, January 2007.

**Ebert, R.W.**, **D.J. McComas**, **H.A. Elliott** and J.T. Gosling. "A Catalogue of ICME Events and Their Properties: A Study of the Recent Ulysses Plasma and Magnetic Field Data." Presented at the 2006 AGU Fall Meeting, San Francisco, December 2006.

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**Francis, W.L.**, **A.R. Bonivtch**, **D.E. Moravits**, G. Paskoff, B. Shender, **B.H. Thacker** and **D.P. Nicolella**. "Probabilistic Response of a Validated and Verified Parametric Cervical Spine Finite Element Model." ASME Summer Bioengineering Conference, Amelia Island, Fla., June 2006.

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**Gladstone, G.R.** "Planetary X-ray Auroras." Presented at the 1st European Planetary Science Congress, Berlin, September 2006.

**Gladstone, G.R.**, **K.D. Retherford**, T. Majeed, **J.H. Waite Jr.**, S.W. Bougher, J. Maillard and E. Lellouch. "Jupiter 2-micron Auroral Imaging with Canada-France-Hawaii-Telescope Fourier Transform Spectrometer (CFHT/FTS): Thermospheric Ion and Neutral Winds." Presented at the American Geophysical Union Fall Meeting, San Francisco, December 2006.

**Goldstein, J.**, **J.L. Burch**, **W.S. Lewis**, **D.T. Young**, A.J. Coates, C.T. Russell, N. Andre and J.S. Leisner. "Injections at Saturn: Bulk Parameters and Pitch Angle Distributions of Electrons." Presented at the 2006 Fall Meeing of the American Geophysical Union, San Francisco, December 2006.

**Goldstein, R.**, **W.F. Huebner**, **J.D. Walker** and **E.J. Sagebiel**. "A Study of Techniques for Seismology of Asteroids." Presented at the Spacecraft Reconnaissance of Asteroid and Comet Interiors, Santa Cruz, Calif., October 2006.

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**Green, R.** "Advances in Hydrogeological Assessments in Support of Nuclear Power Plant Certification." Presented at the Best Practices for the New Nuclear Power Plant Certification and Combined Operating License Application Processes Conference. Atlanta, November 2006.

**Green, R.**, **C. Manepally**, **R. Fedors**, J.P. Gwo and **K. Smart**. "A Model for Understanding Flow Processes and Moisture Distribution in Rock Rubble." Presented at the 2006 Fall Meeting of the American Geophysical Union, San Francisco, December 2006.

**Grim, E.T.** "Achieving High-Accuracy Time Distribution in Network Centric Data Acquisition and Telemetry Systems with IEEE 1588." International Telemetering Conference (ITC), San Diego, October 2006.

**Grimm, R.E.**, **D.E. Stillman**, E. Heggy, **C.L. Dinwiddie** and **R.N. McGinnis.** "Moderately to Poorly Welded Tuff, Bishop, California: Ground-Penetrating Radar Performance." Presented at the 2006 Annual Meeting of the American Geophysical Union, San Francisco, December 2006.

**Hanson, H.S.** and **K.A. Bartels**. "Medical Device Development Processes at SwRI." Presented at the Industrial Technology Research Institute (ITRI), Hsinchu-City, Taiwan, December 2006.

Hartle, R.E., E.C. Sittler, M.D. Shappirio, R.E. Johnson, J.G. Luhmann, S.A. Ledvina, J.F. Cooper, A.J. Coates, K. Szego, M.H. Burger, D.G. Simpson, **F. Crary** and **D.T. Young**. "Saturn Magnetosphere Ion Erosion by Titan: Penetration and Loss of Water Group Ions in Upper Atmosphere." Presented at the American Geophysical Union, Fall Meeting, San Francisco, December 2006.

Havill, L.M., M.R. Allen, **T.L. Bredbenner**, D.B. Burr, **D.P. Nicolella**, S. Levine, D.M. Warren and M.C. Mahaney. "Age-Related Changes in Trabecular Bone Mechanical and Material Properties in Baboon Vertebrae." Presented at the Annual Meeting of the American Association of Physical Anthropologists, Anchorage, Alaska, 2006.

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**He, X.** "Crevice Corrosion Initiation and Propagation Tests." Paper presented at the Nuclear Waste Technical Review Board Workshop on Localized Corrosion of Alloy 22 in Yucca Mountain Environments. Las Vegas, September 2006.

**He, X.**, **D. Dunn** and A.C. Csontos. "Potentiodynamic Polarization and Galvanic Coupling to Evaluate Localized Corrosion of Alloy 22 in Chloride Solutions." Paper presented at the Electrochemical Methods in Corrosion Research 9th International Symposium, Dourdan, France, June 2006.

Hill, T.W., M.F. Thomsen, R.L. Tokar, **F.J. Crary**, **D.T. Young**, A.J. Coates, M.K. Dougherty, C.M. Jackman and C.T. Russell. "Observations of Plasmoids in Saturn's Magnetotail." Presented at the 2006 Fall Meeting of the American Geophysical Union, San Francisco, December 2006.

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# TECHNICAL STAFF ACTIVITIES

## Internal Research

*Funded January 1, 2007*

**Bredbenner, T., D. Nicolella, E. Franke, M. Rigney** and **J. Ling.** "Three-Dimensional Strain Mapping in Highly Porous Structures."

**Das, K., D. Basu, S. Painter, L. Howard** and **S. Green.** "Development of Advanced Turbulent Flow Simulation Techniques for Use in Nuclear Reactor Safety Analysis."

**Huffman, K.** "Analysis of Multi-Weapons System Generalized Simulation Architecture."

**Kartaltepe, E.** "Investigation into the Development of a Heavy-Duty Vehicle Probe Data Platform."

**Khair, M.** "Development of In-Cylinder Technologies to Meet Tier IV Non-Road Emission Regulations."

**McHardy, S.** "An Improved Process Technology for Medicinal Chemistry Utilizing a Multidisciplinary Approach."

**Morris, A.** and **D. Ferrill.** "Strain-Based Prediction of Subseismic Faults in Rocks."

**Neely, G.** "Assessment of a 2006 Renault Megane Diesel Car for U.S. Tier 2 Bin 5 Emissions."

**Nixon, J., A. Bos** and **T. Hornsby**. "Establishing Feasibility for Web-Based, Real-Time RF Receiver Control."

**Polendo, J., J. Hipp, K. Lysiak** and **L. Huyse.** "Design of Accurately Modeled Direction-Finding Antenna Installations."

**Previc, F., B. Fisher, S. Huffman** and **W. Couvillion.** "A Real-Time System for Body Visualization During Whole-Body Motion."

**Rafkin, S., T. Finley, S. Smith** and **M. Tapley.** "A Feasibility Study of a New Frontiers Class Mission to Titan."

**Sanders, D.** and **D. Durieux.** "Effectiveness of Non-Immersive vs. Immersive Scenario Training."

**Tinsley, J.** "Measure Signal Performance Metrics on a Blade Processor Architecture."

**Tussing, M., B. Westmoreland, M. Megel** and **B. Thacker.** "Causal Investigation of Heavy-Duty Diesel Engine Structural Limitations to Peak Cylinder Pressure and Development of Architecture Sufficient for Model Year 2015 Pressure Requirements."

## Patents

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**Burkhardt**, **G.L.**, **A.E. Crouch** and **J.L. Fisher**. "System and Method Using a Collapsible Coil for Inspection of Pipelines Having Internal Restrictions." U.S. Patent No.: 7,154,264. December 2006.

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