

# MESA starts largest production series in its history

By Sue Major Holmes

Sandia's Microsystems and Engineering Sciences Applications complex has begun making silicon wafers for three nuclear weapon modernization programs, the largest production series in MESA's history.

MESA's silicon fab in October started producing base wafers for Application-Specific Integrated Circuits (ASICs) for the B61-12 Life Extension Program (LEP), W88 ALT (alteration) 370, and W87 Mk21 Fuze Replacement nuclear weapons. Planning and preparation took years and involved more than 100 people.

"We left no one untouched. If you were standing still, you got something to do," says Jayne Bendure (1747), who was in charge of organizing 1,000 line items that had to be checked off before wafer production began.

Chief of Staff Dave Sandison (110), a senior manager at MESA's Silicon Fab when the manufacturing readiness process began in July 2011, says detailed requirements for making war reserve-quality ASICs produced a gigantic list "in regular 12-point font about 4 feet long that went down the wall in my office."

He implemented weekly meetings to review what had been accomplished and what was on tap for the coming week. The meetings focused on hitting deadlines and

(Continued on page 4)

*"We left no one untouched. If you were standing still, you got something to do."*

— Jayne Bendure



MESAFAB WORKER Penny Moore (1747) loads a cassette into a photolithography machine at the MESAFab, which is now producing base wafers for Application-Specific Integrated Circuits for the nuclear weapons program. Planning and preparation for production took years and involved more than 100 people. (Photo by Lloyd Wilson)

## Sandia LabNews

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### Engineered Safety



Staying safe: identify and control energy sources. See page 6.

### DOE taps Sandia computer engineer Michael Johnson as CIO

Most recent assignment was in White House Office of Science and Technology Policy

By Lindsey Kibler

Long-time Sandian Michael Johnson (8900) is the new chief information officer (CIO) for the US Department of Energy. DOE Secretary Ernest Moniz announced the appointment on March 9.

A computer engineer and intelligence analyst, Michael's work at Sandia has included modeling the US nuclear weapons complex and managing analyses of national security systems. He will take a leave of absence from Sandia to fill the DOE position.

As CIO, Michael will oversee DOE's multi-billion dollar information technology program spread across more than 21 national laboratories and other sites.

"Michael brings to the department leadership team over 25 years of management and policy experience, and deep expertise in cyber, information sharing and safeguarding, intelligence, and national continuity policy," Moniz said in his announcement. "He will play a crucial role providing advice and support to the secretary, deputy secretary, and program offices across the DOE complex to help fulfill the department's mission of advancing the national, economic, and energy security of the United States through scientific and technological innovation and the environmental cleanup of the national nuclear weapons complex."

Michael most recently served as assistant director for Intelligence Programs and National Security Systems in the White House Office of Science and Technology Policy (OSTP). He led cybersecurity efforts and oversaw OSTP's National Security/Emergency Preparedness portfolio.

"Michael's contributions to our nation's cybersecurity have been substantial and wide-ranging. His knowledge and experience have brought Sandia national recognition, and we look forward to working closely with him in his new role," says Sandia President and Labs Director Paul Hommert.

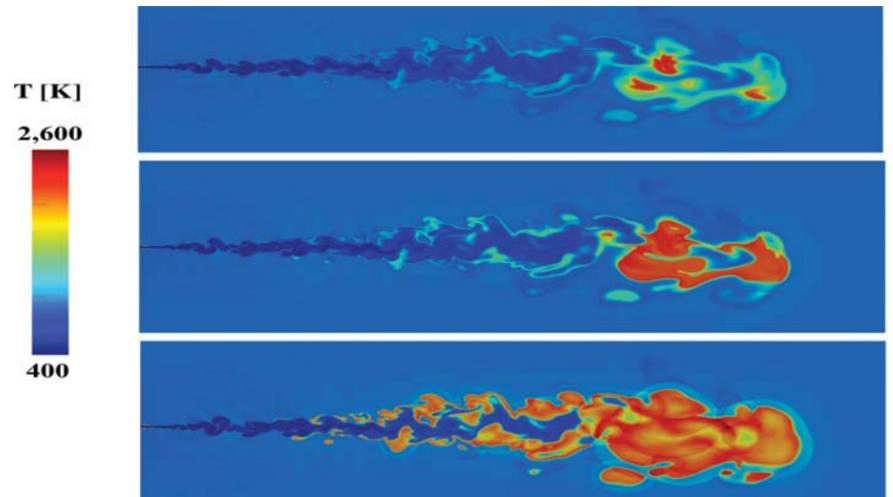
Michael previously was chief scientist in the Department of Homeland Security's Office of Intelligence and Analysis. He worked in support of the director of National Intelligence and was a principal deputy to the Intelligence Community chief information officer. He also was director of Intelligence Community Integration, where he oversaw enterprise information and systems management.

He is a member of the Intelligence and National Security Alliance Board of Advisors where he contributes to cyber intelligence publications.



MICHAEL JOHNSON

### Two CRF groups team up to simplify models for improving engines



A LARGE EDDY SIMULATION CALCULATION of a liquid n-dodecane jet auto-igniting using an optimized chemical model coupled with a detailed turbulence closure. The case selected identically matches companion experiments being performed in Sandia's high-pressure spray combustion vessel. The coupled system of models captures complex scalar mixing and ignition transients with a nice balance between accuracy and cost. Research in this area is ongoing.

By Holly Larsen

For years, US automakers have been customizing the generic combustion process models from Sandia's Combustion Research Facility (CRF) to design cleaner and more efficient engines for cars and trucks. To support this process — essential to a sustainable energy future — CRF researchers are constantly seeking to make these basic models not only more accurate and reliable, but easier and faster for industry to use.

(Continued on page 3)



#### Iron Rain

Researchers at Sandia's Z machine have helped untangle a long-standing mystery of astrophysics: why iron is found spattered throughout Earth's mantle. See page 9.

#### Inside . . .

Report finds shared opportunities for H<sub>2</sub> and natural gas . . . . . 3  
Sandia's CPAT a finalist for prestigious Edelman Prize . . . 6  
Daughter's rare illness draws Sandian into a world of support . . 8

## That's that

A couple of weeks back, an opinion piece in the *Albuquerque Journal* took issue with some aspects of the way DOE's national laboratories are managed. The article was written by credible, knowledgeable sources who see these things from a much higher vantage point than do I. I'm in no position to comment on their overall perspective but I did take issue with one aspect of their piece. The authors wrote that "DOE's excessive emphasis on pervasive inspections for safety and other compliance issues has resulted in what some term the 'world's largest work-free, safe zone.'" That's a catchy turn of phrase, but it bothers me because, whatever the writers' intentions, it trivializes the larger issue of workplace safety. It suggests, to my perhaps too suggestible ear, that safety isn't a worthy area of concern. The writers will say that's not what they're saying, and I'm sure they're right. I'm telling you how I, wearing my Joe Public hat, interpret their words. I think, intended or not, the public, comes away with a very wrong idea of what goes on a national laboratory.

Look, we all know that Sandia and the entire DOE laboratory system have seen an increased emphasis on safety in recent years. Maybe some of the emphasis has been "excessive," as the writers assert, but I ask you to consider the alternative. Would it be better to have too little emphasis on safety? Is there a magic formula for what constitutes a "just right" amount of emphasis? If there is, I don't know it and I don't think anyone else does, either. The only thing we have to go by is statistics, and the numbers suggest that with more of the right kind of emphasis, injuries go down, often way down, in the workplace. How is that not a good thing?

I'll tell you this: If I'm the laboratory director at any one of DOE's facilities, the very last thing I want to do is to have to call the family of an injured - or heaven forbid, killed - worker. Imagine the conversation: "We had some safety protocols drawn up, but we never implemented them because they seemed excessive." That wouldn't happen on my watch. I'd want to be in a position to say, "We did everything we could to make this workplace safe."

Much of what we do is inherently risky; when you're doing the hard stuff the nation expects of us, there are risks involved. I imagine that there could be a point where "excessive" emphasis on reducing the risk to absolute zero could end up in a place where literally nothing gets done. That's what the writers are suggesting with that "work-free safe zone" slam.

Again, it's a clever phrase; I think it's the take-away comment in the entire piece as far as the general reader is concerned. But that assertion is just as wrong as it could be. Our *Lab News* team has just finished putting together the annual *Labs Accomplishments* issue, which we'll publish two weeks from now in lieu of the regular April 3 edition of the *Lab News*. Every single page of that document is a refutation of the idea of "work-free safe zones." It's a reminder - as if any of us who work here need one - of the incredible work we do here every single day across an astonishing breadth of science and engineering disciplines. And remember, *Labs Accomplishments* is just a small sampling of the work we do - far, far more is left out than gets in.

Let me be fair to the writers of that *Journal* piece. They have wisdom and experience that I'll never be able to claim. With what I've said here, I don't mean to suggest that their concerns in the broad sense don't have merit. DOE is a human institution and a bureaucracy. As such, it seems perfectly appropriate to periodically examine its practices and to make course corrections. Is there too heavy a hand? Not heavy enough? These things ebb and flow over time. But "work-free safe zones"? C'mon. That's something that would be said only by individuals who no longer have to face the prospect of calling a spouse and telling him or her their loved one won't come home that night.

Finally, in tribute to Leonard Nimoy, who showed us that being the science officer on a starship could be cool, I sign off with . . .

Live long and prosper.

- Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

## Recent Patents

Note: Patents listed here include the names of active and retired Sandians only; former Sandians and non-Sandia inventors are not included. Following the listing for each patent is a patent number, which is searchable at the US Patent and Trademark Office website ([www.uspto.gov](http://www.uspto.gov)).

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Jonathan Wierer (1123), and Andrew A. Allerman (1126): Impurity-Induced Disorder in Nitride Materials and Devices. Patent No. 8,895,335.

Juan M. Elizondo-Decanini (2624): Neutron Generators with Size Scalability, Ease of Fabrication and Multiple Ion Source Functionalities. Patent No. 8,891,721.

Hongyou Fan (1815): Synthesis of Porphyrin Nanostructures. Patent No. 8,871,926.

Jeffrey Pankonin (5353), and Nicola Jean Kinzie (5352): An Ultra-Wideband Short-Pulse Radar With Range Accuracy For Short Range. Patent No. 8,854,254.

George T. Wang (1126): Method of Fabricating Vertically Aligned Group III-V Nanowires. Patent No. 8,895,337.

Jason Hamlet (5327): Multi-Factor Authentication. Patent No. 8,868,923.

H. Lee Ward (1123), and Anand Ganti (9336): Design, Decoding and Optimized Implementation of SECDED Codes over GF(q). Patent No. 8,892,985.

Gregory N. Nielson (1719), and Murat Okandan (1719): Structured Wafer for Device Processing. Patent No. 8,895,364.

Gregory N. Nielson (1719), and Murat Okandan (1719): Method of Forming through Substrate Vias (TSVS) and Singulating and Releasing Die Having the TSVS From a Mechanical Support Substrate. Patent No. 8,906,803.

Kurt W. Larson (5563), and Jason W. Wheeler (6533): Fast Electron Microscopy via Compressive Sensing. Patent No. 8,907,280.

Todd Bauer (1746), Jason Hamlet (5627), Ryan Helinski (5627), and Nathan J. Edwards (5956): Increasing Security in Inter-chip Communication. Patent No. 8,874,926.

Jack D. Heister (1522), David G. Moore (1522), Enrico C. Quintana (1522), and Kyle R. Thompson (1522): Multi-Step Contrast Sensitivity Gauge. Patent No. 8,858,076.

Michael V. Bredeman (5773): Reducing Current Reversal Time in Electric Motor Control. Patent No. 8,878,473.

Paul Clem (1816), Cynthia Edney (1816), Jon Ihlefeld (1816), David Ingersoll (2500), Kyle R. Fenton (2545), and Ganesan Nagasubramanian (2545): Solid State Lithium Battery. Patent No. 8,877,388.

C. Jeffrey Brinker (1000): Aerosol Fabrication Methods for Monodisperse Nanoparticles. Patent No. 8,864,045.

Paul Davids (1765), and David W. Peters (1765): Frequency Selective Infrared Sensors. Patent No. 8,897,609.

Paul G. Clem (1816), Michael B. Sinclair (1816), Hung Loui (5345), and James Carroll (5964): Resonant Dielectric Metamaterials. Patent No. 8,902,115.

Perry J. Robertson (1751), Philip L. Campbell (5629), John M. Eldridge (5632), Thomas D. Tarman (5643), Edward L. Witzke (6525): Stateless and Stateful Implementations of Faithful Execution. Patent No. 8,914,648.



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### Retiree deaths

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Clarence Carter (89) . . . . .	Jan. 3
Robert Statler (90) . . . . .	Jan. 3
George Alder (73) . . . . .	Jan. 4
Benjamin Garcia (60) . . . . .	Jan. 6
Hans Edward Hansen (87) . . . . .	Jan. 7
E. Keith Mote (70) . . . . .	Jan. 8
Stephen Ross (73) . . . . .	Jan. 8
Earle George (90) . . . . .	Jan. 9
C. Clendenin (89) . . . . .	Jan. 10
Kenneth Cordes (93) . . . . .	Jan. 11
Anna Marie Sanchez (62) . . . . .	Jan. 14
Gilbert Lenert (91) . . . . .	Jan. 15
Margarito Griego (92) . . . . .	Jan. 16
Maurice Gilmer (84) . . . . .	Jan. 18
Mollie Miller (98) . . . . .	Jan. 20
Ruth Lighthill (93) . . . . .	Jan. 21
Stephen Neff (94) . . . . .	Jan. 22
Vicente Davis (65) . . . . .	Jan. 23
Henry Libby (89) . . . . .	Jan. 23
Dale Grover Irving (89) . . . . .	Jan. 24
John Smelser (92) . . . . .	Jan. 28
Robert Crouse (92) . . . . .	Jan. 30
Alice Adams (86) . . . . .	Jan. 31
Richard Demo (81) . . . . .	Feb. 4
Lois Amsden (89) . . . . .	Feb. 5
LeeAnna Koitmaa (65) . . . . .	Feb. 5
Charles Jakowatz (63) . . . . .	Feb. 7
Max McWhirter (94) . . . . .	Feb. 7
George Kominiak (73) . . . . .	Feb. 13
Carol Wade (66) . . . . .	Feb. 17

# Uncertainty

(Continued from page 1)

This is no small task.

The problem lies in combustion chemistry's notorious complexity and its interplay with flow turbulence, which encompasses thousands of coupled reactions that must be described over large ranges of pressure and temperature. Further, the chemical concentrations must often be resolved down to parts-per-billion levels for different pollutant species. It's little wonder, then, that equations that describe the physics of combustion may take a year or more to solve using a high-performance supercomputer — a scale of computing resources that is simply not viable for the private sector.

"The CRF has a lot of experience in developing combustion models that provide accurate and reliable results," says Joseph Oefelein, who with colleagues Loyal Hakim and Guilhem Lacaze (all 8351), applies Large Eddy Simulation (LES) to mathematically model diverse combustion processes. "But now we have to distill new knowledge about combustion into models that can run even faster. Industry consistently makes the case that if a model takes more than a day to run, they can't use it."

## Streamlining models with uncertainty quantification

The LES construct used by Joseph, Loyal, and Guilhem resolves the larger energetic scales of a given flow and models the smaller-scale physics associated with combustion. This significantly reduces the computational burden of the combustion equations. However, LES is very sensitive to a variety of factors. A seemingly minor change to a key parameter can dramatically alter the model's predictive accuracy. To overcome this challenge, the modelers consulted with fellow CRF scientists Habib Najm and Mohammad Khalil (both 8351), specialists in state-of-the-art application of Uncertainty Quantification (UQ).

Using UQ, this research team hopes to identify and better understand the portions of the LES model that are most sensitive to a design issue in question, such as the formation of soot or nitric oxide emissions within an engine. Instead of seeking a single result, UQ helps to characterize the range of results that occur from running aspects of the LES model multiple times with different values for key parameters. Analyzing the range enables researchers to determine which parameters are most sensitive and must be accounted for more accurately in the models and which are less sensitive and can be abbreviated or omitted. UQ then allows researchers to create a "surrogate" model — a simpler version of the full LES model that captures the essential elements, yielding useful answers while cutting computational time and costs.

So far, the LES-UQ team has demonstrated the feasibility of UQ's application to LES using the well-studied Sydney bluff-body HM1 flame as a test platform. "By using Bayesian inference methods, we are able to prop-



WHEN UQ MET LES — Mohammad Khalil, Joseph Oefelein, Guilhem Lacaze, Loyal Hakim, and Habib Najm (all 8351), researchers at Sandia's Combustion Research Facility, are applying Uncertainty Quantification (UQ) principles to Large Eddy Simulations (LES) to create simpler combustion models. Here the team discusses results for a project on statistical calibration of simplified chemical mechanisms for diesel engine combustion. (Photo by Randy Wong)

agate uncertainty through the simulations and understand the effects of various simulation inputs on predicted quantities of interest, such as engine performance and emissions characteristics," says Guilhem.

This example has fueled the team's confidence that UQ can dramatically reduce combustion simulation complexity, and therefore runtime, while retaining a useful level of accuracy. The effort has now been extended to include a focus on statistical calibration of simplified chemical mechanisms for diesel engine combustion.

## Making multidisciplinary teams work

Multidisciplinary teams have become a reality of the modern world — but working effectively with people in different fields, with different expertise, can be challenging. Joseph credits some of the success of the combined LES-UQ team to experience. "The more we collaborate, the better we understand the optimal interface between various areas of expertise and thus how to share the workflow between team members."

Also working in the team's favor is the fact that the UQ techniques being developed are nonintrusive — that is, they do not require changes to the complex simulation code to which they are being applied. Thus, UQ has widespread applicability, from chemistry to materials science to nuclear engineering. Habib finds experience in other fields informs his intuition for applying UQ to LES. "Fortunately, I don't have to rely solely on experiments in combustion areas. UQ research in entirely different fields is helping me expe-

## Sandia California News

dite UQ's application to Large Eddy Simulation."

Finally Joseph points to the advantages of co-location. "Our workspaces are all close to each other, so it's easy to get together to talk about ideas and what's working or not on a near-daily basis. Sometimes all we need is a quick discussion in the hallway to move to the next step."

For this team, next steps are numerous: acquiring a better understanding of the range of errors that can affect LES itself, regardless of UQ use; decoupling numerical and model errors; quantifying the cold-flow versus combustion attributes of scalar mixing; testing the UQ approach on different flame types; and testing the approach using different LES codes.

The team is optimistic, anticipating that in just a couple of years, this marriage of UQ with LES will be ready for much more routine application. The improved simulation capability couldn't come at a better time for automakers, who are attempting to implement advanced, low-temperature combustion engine designs. Further, CRF expects its techniques for applying UQ to LES to bear fruit not just throughout the transportation sector — cars, trucks, buses, rail, jets — but in any industry employing computational fluid dynamics.

# Sandia finds shared opportunities for natural gas and hydrogen fuel cell vehicle markets

By Holly Larsen

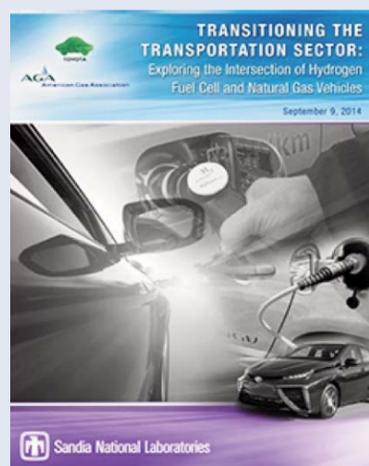
Fueling stations that offer both hydrogen and natural gas could benefit distributors of both fuel types, says a new Sandia report, "Transitioning the Transportation Sector: Exploring the Intersection of Hydrogen Fuel Cell and Natural Gas Vehicles."

The report, from a workshop last fall supported by DOE's Vehicle Technologies and Fuel Cell Technologies offices, considered common opportunities and challenges in expanding the use of hydrogen and natural gas as transportation fuels. Organized by Sandia, the American Gas Association, and Toyota Motor Corp., the workshop included participants from the auto industry, freight delivery fleets, gas suppliers, gas storage developers, utilities, academia, industry associations, national laboratories, and federal and state governments.

"Although natural gas and hydrogen have an obvious intersection — natural gas is the feedstock for 95 percent of hydrogen produced in the United States — this workshop was the first to actively probe synergies, competition, and new ways of developing both fuels in tandem," says Dawn Manley (8350), deputy director of chemical sciences.

## Fueling stations could serve both fuel types

Participants identified fueling stations as one area where companies can better capitalize on synergies between the two fuels. Station operators could cater to both types of users, as natural gas and hydrogen fuels generally compete for different market segments (natural gas for fleets and hydrogen for consumers).



Similarly, the report finds that if companies shift away from separate approaches and toward using common equipment, similar pressures, and the same manufacturing processes, they could enable economies of scale for storage equipment and handling. Common equipment could further improve the business case for co-locating infrastructure, driving down costs and expanding the market for both fuels.

Other observations include:

- Expanding markets are creating opportunities for new players and partnerships in transportation fuels.
- Multiple generations of vehicle and fueling infrastructure will coexist and are likely to suit different niches.
- While the growth of alternative fuels will be unpredictable, early station development can provide valuable lessons for long-term expansion.
- Thorough system requirements and cost assessments are needed to quantify the benefits of co-developing natural gas and hydrogen.

• Different policies may be more effective for different fuels. For example, aggressive deployment programs for natural gas vehicles have stimulated the development of complementary, unsubsidized fueling infrastructure. In contrast, zero-emission vehicle mandates and public investment in early hydrogen infrastructure have motivated automakers to produce hydrogen fuel cell vehicles.

Read the workshop report and findings on the DOE Office of Energy Efficiency and Renewable Energy's Vehicle Technologies and Fuel Cell Technologies offices' websites.

## MESA

(Continued from page 1)

determining what was needed to stay on track, which convinced him and his successor, Mike Daily, that they needed more people. “You start to see the same people’s names show up every week, and they’re on a gazillion things,” Dave says.

“It was a multiyear program executed with precision and dedication,” says Gil Herrera, director of Microsystems Science & Technology Center 1700. “I’m very, very proud of the team. Now the hard part begins: We’ve got to make the parts.”

### Center of Labs’ microsystems work

MESA is the center of Sandia’s investment in microsystems research, development, and prototyping. The 400,000-square foot complex of cleanrooms, labs, and offices houses the design, development, manufacture, integration, and qualification of trusted microsystems for national security applications.

MESA includes the Silicon Fab (SiFab), completed in 1988, and the Compound Semiconductor MicroFab, completed in 2006.

The SiFab, certified by DoD as a trusted foundry, develops and produces technologies for radiation-hardened complementary metal-oxide semiconductor (CMOS) integrated circuits and MEMS (micro-electromechanical systems). The MicroFab is a green-certified plant for III-V compound semiconductor material processing, post-silicon wafer processing, and advanced packaging, and for heterojunction bipolar transistor (HBT) production. Both fabs conduct R&D for future nuclear weapon and broader national security applications.

Kaila Raby (1754), manager for the Product Realization Team for ASICs, calls the production start a huge milestone. The SiFab will make ASICs through 2018 with the plant running its normal schedule of 24 hours a day, five days a week. In addition, the MicroFab is preparing to begin producing HBT integrated circuits in April, the first time MESA will produce HBT products for the stockpile, Kaila says.

Ten different silicon ASIC products go into the work on the B61-12, the W88 ALT, and the Mk 21 Fuze systems, Kaila says. Seven of the 10 ASICs have base wafers that are customized into product-specific designs during later production, she says. It’s these base wafers that the SiFab started manufacturing.

Sandia has invested in new manufacturing tools and processes for MESA, including 2-D marking, similar to bar-coding, for individual devices; an electronic production control system; automated lot acceptance support systems; streamlined quality management; and a greater focus on preventing defects, Gil says.



READY FOR ASICS — Some of the numerous people involved in planning and preparation for producing base wafers for Application-Specific Integrated Circuits at the MESAFab posed last October when production began. (Photo courtesy of MESA)

“A lot of things we’ve been working on for the last few years came together, and we’re doing all this while minimizing impacts to our other work for national security customers and the research mission,” he says.

### Identifying production needs as multiyear project

MESA SiFab finished wafer fabrication for the W76-1 nuclear weapon in 2009, and began identifying manufacturing needs for the B61 and W88 programs, says manager Dale Hetherington (1746). Dale and manager Alan Mitchell (1747) credit success to the hard work of many people within the fab organizations including the equipment maintenance, process, and engineering staff.

“A large part of our mission is research and development and work for other customers besides the nuclear weapons program, so while we’ve been getting ready for this NW production and doing a 1,000 line-item production plan, we’ve still been manufacturing prototypes for the NW complex, for other missions around Sandia, and other labs as well,” Dale says. “So it’s not as if we shut down and did nothing but get ready for production.”

Volume for ASIC production will be more than three times that of the W76-1 production. MESA uses a build-ahead process: build many wafers and store them so they’re ready when needed.

“We typically build early because the wafers have to be diced into chips, the chips packaged and delivered to subsystem customers, and those subsystems then integrated into higher-level systems,” Dale says. “We have a production plan that factors in all the various chips for the B61, W88, and W87 programs.”

Production required prototyping in advance so designs were in place and ready to manufacture, and setting up quality systems and making sure they were rigorously documented, Alan says.

Wafer production is a critical part of the ASIC process but is only one step toward the final product and acceptance by NNSA. “While we build the wafers in our fab, when we’re done with them they have to be electrically tested, they need burn-in and reliability evaluation, they need packaging, so there are multiple sets of work activities from initial customer engagement through the design phases and into manufacturing,” Alan says.

### MESA does it all: R&D, production, and development

Senior manager Paul Raglin (1210) points out MESA’s fabs are unique: They do R&D and production of ASICs and HBTs, all in-house with trusted components. “We can go directly into the stockpile with all the certifications,” he says.

MESA receives about \$50 million a year through NNSA’s Readiness in Technical Base and Facilities (RTBF), Paul says. While RTBF provides base-level funding, the W88 and B61 programs furnish additional money for staff and materials.

The Sandia silicon fab revitalization (SSiFR) program has pledged \$150 million over seven years to replace aging tools and transition MESA to 8-inch wafers by about 2020, Paul says.

A manufacturability review in late 2011 evaluated how various areas and tools operated. Curt Dundas (1746) says that snapshot became the basis for deciding what needed improvement and what could affect the SiFab’s ability to increase manufacturing capacity. The team worked down the list of needed improvements, evaluating any significant change to make sure it wouldn’t cause problems, he says.

“In manufacturing, it’s always about continuous improvement,” Curt says. “You’re never done. You just arrive at the point of a new snapshot.”

Jayne began organizing line items in August 2012 so the fab could switch from producing a primarily R&D line to an NW line. She says, however, most processes for controls, repeatability, and documentation already existed. “We reviewed everything, we improved the things we thought we needed to improve for NW, and we worked with our technology development group [1760] to make sure we were solid on what we needed to do.”

The plan required identifying tasks and who could keep those moving and involving enough people to get everything done on time. “It was a lot of work but having it structured like that was the only way to do it. People don’t mind hard work if they see you marching toward a big goal,” Jayne says.

She credits the production start to early planning, the structured plan, and senior management support. “But if not for the ability of the hands-on folks on the floor we would never have been successful in the time we had,” she says.

## Air Force Secretary visits Sandia



SECRETARY OF THE AIR FORCE Deborah Lee James visited Sandia last week as part of a trip to New Mexico that included a stop at Kirtland Air Force Base. At the beginning of her visit to Sandia, James was briefed by Labs Director Paul Hommert on Sandia’s missions and the importance of the Labs’ foundation (research, people, facilities and tools) to mission execution. During her visit, the secretary was briefed on weapons-related issues, physical and cyber security, and Sandia’s space-related mission work. She also toured several Sandia facilities, including MESA and Z machine. In the photo above, at Z, James is briefed by Kelly Hahn, staff member, Neutron and Particle Diagnostics Dept. 1677. Looking on are Paul Hommert, to James’ immediate left, and Pulsed Power Sciences Center 1600 Director Duane Dimos.

# IRON RAIN

## fell on early Earth, new Z machine data supports



WHEN WORLDS COLLIDE — Sandia's Z machine provides hard data on the surprisingly low amount of pressure required to metamorphose iron from a massive intrusive force to a gentle vaporized mist as astrophysical bodies collided in space during the later stage of Earth's formation. That reduced pressure — 40 percent lower than formerly assumed by theoreticians — helps explain the splashes of iron in Earth's mantle. This artist's concept shows a celestial body about the size of our moon slamming at great speed into a body the size of Mercury. (Image Credit: NASA/JPL-Caltech)

**By Neal Singer**

Researchers at Sandia's Z machine have helped untangle a long-standing mystery of astrophysics: why iron is found spattered throughout Earth's mantle — the roughly 2,000-mile thick region between Earth's core and its crust. It seemed more reasonable that iron arriving from collisions from planetesimals ranging from several meters to hundreds of kilometers in diameter, during Earth's late formative stages, should have powered bullet-like directly to Earth's core, where so much iron already exists.

A second, correlative mystery is why the moon proportionately has much less iron in its mantle than does Earth. Since the moon would have undergone the same extraterrestrial bombardment as its larger neighbor, what could explain the relative absence of that element in the moon's own mantle?

To answer these questions, scientists led by professor Stein Jacobsen at Harvard University and professor Sarah Stewart at the University of California Davis wondered whether the accepted theoretical value of the vaporization point of iron under high pressures was correct. If vaporization occurred at lower pressures than assumed, a solid piece of iron after impact might dis-

perse into an iron vapor that would blanket the forming Earth instead of punching through it. A resultant iron-rich rain would create the pockets of the element currently found.

As for the moon, the same dissolution of iron into vapor could occur, but the satellite's weaker gravity would be unable to capture the bulk of the free-floating iron atoms, explaining the dearth of iron deposits on Earth's nearest neighbor.

Looking for experimental rather than theoretical values, researchers turned to the capabilities of Sandia's Z machine and its Fundamental Science Program, coordinated by Thomas Mattsson (1641). This led to a collaboration between Sandia, Harvard, UC Davis, and Lawrence Livermore National Laboratory (LLNL) to determine an experimental value for the vaporization threshold of iron to replace the theoretical value used over decades.

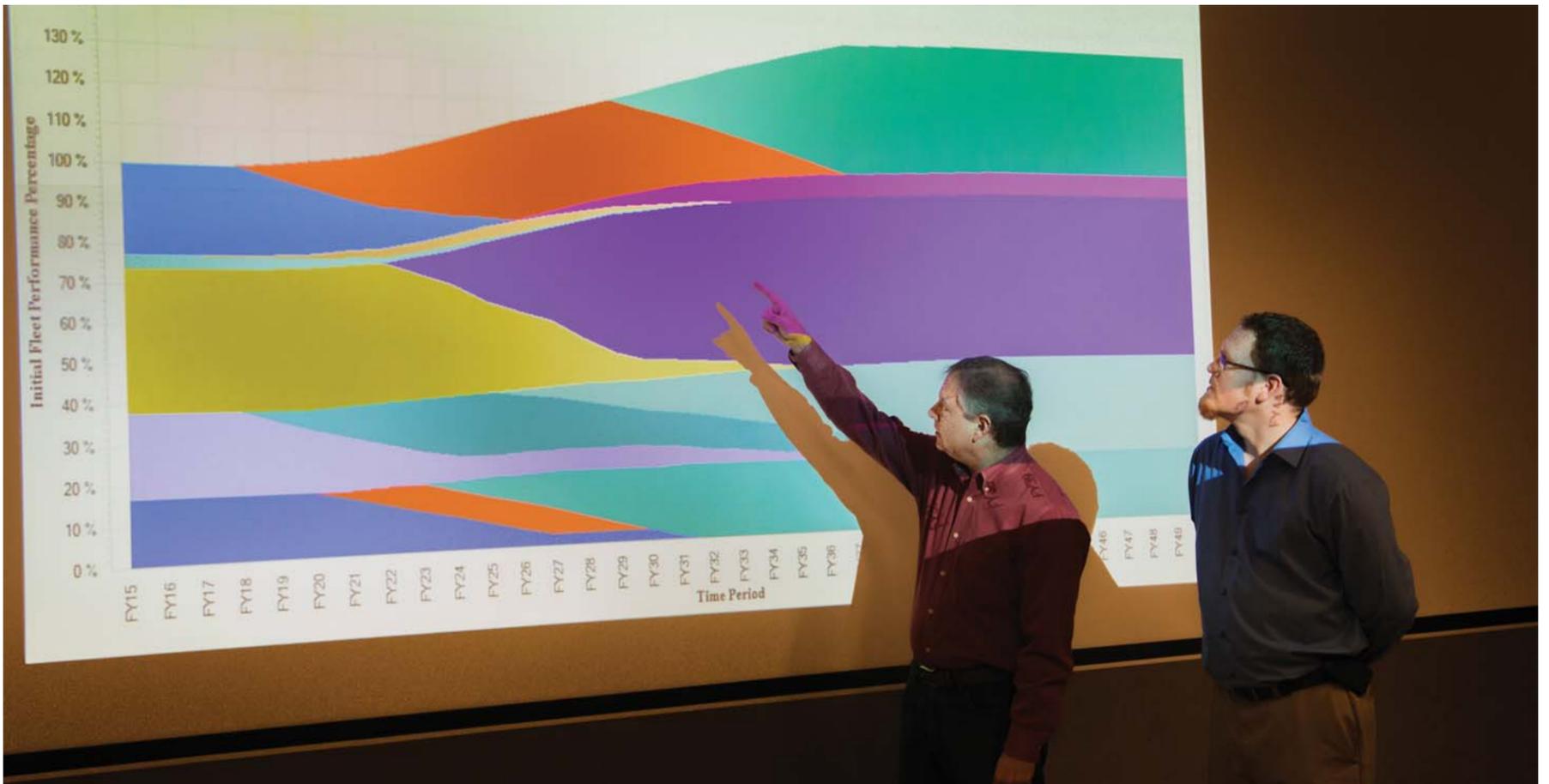
Rick Kraus at LLNL (formerly at Harvard University), and Sandia researchers Ray Lemke (1641) and Seth Root (1646) made use of Z's capability to accelerate metals to extreme speeds using high magnetic fields. The researchers created a target that consisted of an iron rectangle 5 mm square and 200 microns thick, against which they launched aluminum flyer plates travelling up to 25 kilometers/second. At this impact pressure, the powerful shock waves created in the iron cause it to

compress, heat up, and — in the zero pressure resulting from shock waves reflecting from the iron's far surface — turn to vapor.

The result, published in *Nature Geosciences* on March 2 under the title "Impact vaporization of planetesimal cores in the late stages of planet formation," shows the result: The shock pressure experimentally required to vaporize iron is approximately 507 gigapascals (GPa), undercutting by more than 40 percent the previous theoretical estimate of 887 GPa. Astrophysicists say that this lower pressure is readily achieved during the end stages of planetary accretion.

Emailed principal investigator Kraus, "Because planetary scientists always thought it was difficult to vaporize iron, they never thought of vaporization as an important process during the formation of the Earth and its core. But with our experiments, we showed that it's very easy to impact-vaporize iron. This changes the way we think of planet formation, in that instead of core formation occurring by iron sinking down to the growing Earth's core in large blobs (technically called diapirs), that iron was vaporized, spread out in a plume over the surface of the Earth and rained out as small droplets. The small iron droplets mixed easily with the mantle, which changes our interpretation of the geochemical data we use to date the timing of Earth's core formation."

## Sandia's CPAT a finalist for prestigious international Edelman Prize



PROJECT MANAGER Craig Lawton, left, and Matt Hoffman (both 6133) demonstrate one part of the Capability Portfolio Analysis Tool. Sandia and the US Army are among six finalists for the Institute for Operations Research and Management Sciences 2015 Franz Edelman Prize. (Photo courtesy of Stephanie Blackwell)

### By Heather Clark

Sandia analysis capability developed and applied for the US Army is one of six finalists for the Institute for Operations Research and Management Sciences 2015 Franz Edelman Prize, a prestigious international honor that recognizes outstanding analytics and operations research projects that have transformed organizations, industries, and people's lives.

The Capability Portfolio Analysis Tool (CPAT) was first developed under Department Manager Alan Nanco (6114) and Project Manager Craig Lawton (6133).

Over the past four years, CPAT has been further developed and used in more than 40 high-visibility decision-support studies to inform the Army's Program Executive Office Ground Combat Systems' (PEO GCS) fleet modernization decisions. The analyses have

helped prioritize the investment of billions of taxpayer dollars planned over the next 25-35 years.

Sandia was nominated in partnership with the US Army. Other finalists include IBM and the Saudi Arabia Ministry of Municipal and Rural Affairs.

"Being selected as a finalist highlights the impact CPAT has had on the Army's modernization planning as well as the technical excellence and dedication of the Sandia team and partners," says Bruce Thompson (6133), who leads DS&A's Military Systems Analysis subprogram.

CPAT dramatically improves upon the Army's traditional methods for fleet management and modernization planning. The tool uses an innovative four-phase mixed integer linear programming model to help Army leaders answer questions like: What is the optimal modernization plan that maximizes fleet combat capability through time while respecting schedule and cost con-

straints or how do program delays, budget cuts, and schedule restrictions combine to impact fleet performance and overall cost?

CPAT's success has paved the way for Sandia to support other major acquisition portfolios, such as PEO Enterprise Information Systems' network infrastructure portfolio and PEO Combat Support and Combat Service Support's fleet of tactical wheeled vehicles.

The Edelman Prize winner will be announced April 13 at the INFORMS Conference in Huntington Beach, California.

In addition to Sandia and the Army, partners included Booz Allen Hamilton and Teledyne Brown Engineering. The Labs' current and former project team members are: Stephen Henry; Matthew Hoffman, the project lead; Lawton; and Frank Muldoon (all 6133); Liliana Shelton (421); Darryl Melander (9525); and Gio Kao (5629).

## Staying safe: identify and control energy sources

### By Sue Major Holmes

Sandia's High Voltage Pulse Facility tester does critical work, both for problem-solving and basic research and development. It's impractical to perform Lockout/Tagout procedures between each operation, but operators must be protected from high-voltage contacts when changing samples in the test-device tank.

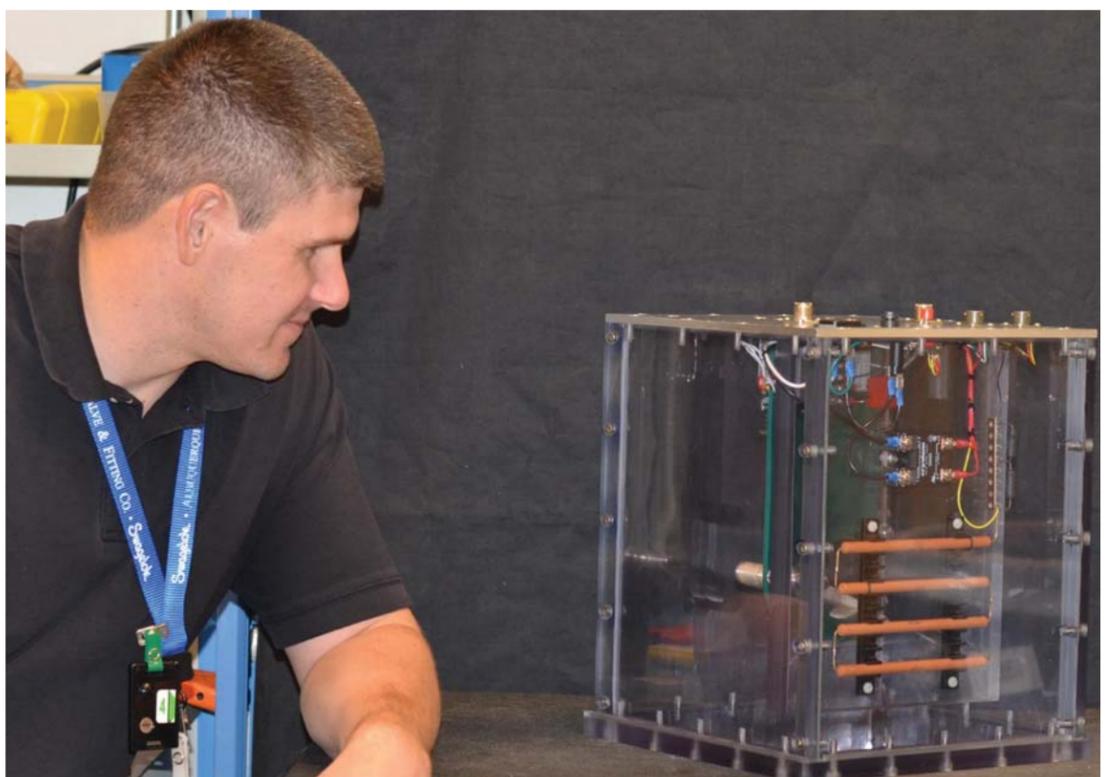
The most serious hazard is high voltage associated with the pulse-forming network (PFN) and step-up transformer. A PFN accumulates electrical energy, then quickly releases it for pulsed-power applications.

The facility has long had an interlock safety system, requiring multiple interlock conditions before the system could be charged. However, operators had no access to the enclosed PFN tank to verify the stored energy was discharged when the system was disabled.

So Joseph Howard (2735) devised an Engineered Safety system of checks on checks, using a relay box to provide redundant interlock conditions, a secondary discharge route, and a visually verifiable disconnect for the charge supply. The relay box also provides voltage monitoring in the disabled state, activating a buzzer and flashing lights if the PFN voltage is above 50V. Operators can engage a known low-voltage source with the simple push of a button to verify the meter, lights, and buzzer function.

As is customary in pulsed-power laboratories, operators also always use a grounding stick and grounding strap as a final control for high-voltage terminals before beginning work.

"I don't think anyone felt unsafe before, but everyone feels safer because the new interlock system provides confirmation of both source removal and zero energy," Joe says.



JOE HOWARD (2735) looks over a relay box that provides an Engineered Safety system of checks on checks for Sandia's High Voltage Pulse Facility tester. (Photo courtesy of Org. 2735)

**Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads**

**MISCELLANEOUS**

DVD PLAYER, Sony, w/remote, \$20. Hennessey, 505-269-6243.  
 VACUUM, Kirby G3, self-propelled, w/attachments & carpet shampoo feature, great condition, \$200 OBO. Diaz, 505-821-0868.  
 MATTRESS, king, Tempurpedic Contour Allura, new condition, must sell, \$3,000 or make offer. Tapia, 505-263-1680.  
 LED SMART HDTV, Samsung, 65-in., 1080p, tilting wall mount hardware, w/extended warranty, \$1,500. Martinez, 615-1442.  
 RECEIVER HITCH, Class III, for Chevy pickup, 2-in. receiver, good condition, \$175 OBO. Barreras, 604-8671.  
 ELECTRIC STOVE, Kenmore, cream color, black glass front, \$225; microwave, black, \$25; TV cabinet, adjustable shelves, \$50; oval coffee table, glass top, \$60. Willis, 505-304-5034.  
 BABY GRAND PIANO, Brodmann, polished ebony, like new condition, \$6,000 OBO. Harris, 505-459-2823.  
 MITRE SAW, Rockwell International 34-010, 9-in. blade, excellent physical & operating condition, \$50. Mileskosky, 463-9468.  
 FILE CABINETS, 1 legal, 1 letter, 2-drawer, \$25 ea.; pickup bed extender, for Nissan, \$25. Fenimore, 298-8052.  
 THORNLESS BLACKBERRY PLANTS, freshly dug, 52 Molina Rd., Peralta NM, 5/5\$20 or 10/\$35; garden mulch, \$3.50/bale. Greenwood, 869-0153, ask for Bill.  
 VACUUM, Kirby, rug shampooer, used only 3 times, w/owner's manual & CD, extra bags, retail \$1,700, asking \$1,350 OBO. Weber, 235-1583.  
 GOLF CLUBS, Wilson, left handed, w/caddy bag, 5 irons, 3 drivers, wedge, putter, balls/tees, used once, \$200. Cocain, 281-2282.  
 FORD SUPER DUTY GRILLE, '05-'07, chrome, w/grey honeycomb insert, new-in-box, Amazon #5C3Z8200BAA, \$95. Brothers, 505-296-5980.  
 DINING ROOM SET, Ethan Allen, Queen Anne, 6 side & 2 end chairs, extensions & pads, \$500. Shaw, 980-7491.  
 BEAGLE PUPPIES, located in Corrales, w/1st shots, tricolored, females \$325, males \$275. Stirrup, 377-0406, leave message.

AMP, Hafler 500, \$400; Hafler DH-101 pre-amp, \$150; Adcom tuner GFT-555II, \$75; all original manuals. Howarth, 505-270-4485.  
 DESK, Pottery Barn Ava, espresso wood, glass top, photos available, \$150 OBO. Homeijer, 205-0480.  
 GAS DRYER, Maytag Neptune, easy front-load door, you pick up, \$85. Vigil, 575-386-6377.  
 SMART PHONE, HTC One mini, highly rated, barely used, \$100. Jorgensen, 977-3184.  
 SHARK STEAM MOP, slightly used, w/4 new pads, \$25; Black & Decker dust buster, new, 14.4-V, still-in-pkg., \$35. Colgan, 344-3776.  
 SOFA, La-Z-Boy recliner, \$850; medium brown recliner chairs, \$350 & \$450; \$1,500/all; marble-top tables, \$350 & \$450. Drebing, 293-3335.  
 TIMESHARE, vacation in Winter Park CO, July 24-31, sleeps 6, Grandby Lake, 45 mins. away, \$600/wk. Buck, 353-2667.  
 WALL DESK, maple w/oatmeal stain, 12'6", 4 lower cabinets & drawers, 2 upper cabinets & bookcases, writing surface, \$750. Witt, 991-1878.  
 GARDEN CART, plywood side/aluminum frame, \$70; Rubbermaid compost bin, \$50; flagstones, ~80-lbs., \$40. Eager, 299-6874.  
 DINING TABLE, cherry wood, 42" x 42" x 37"H, 4 chairs w/cushions, photo available, \$100. Wagner, 858-922-9471.  
 WOOD TABLE, 3'x 4', sturdy wooden legs, w/faux synthetic granite-like top, never used, \$100. Thompson, 292-2877.  
 CAMERAS, Nikon & Minolta, tripods & accessories; power tools & 2 tool chests; 5 Kachina dolls. Allen, 286-2162 or 250-1961.  
 CHINA CABINET, 70"H x 5'W x 14"D, paid \$1,800, asking \$300 OBO. Garcia, 280-5815.  
 MEDIA/COMPUTER CABINET, dark wood, \$560; dining table, dark wood, 6 chairs, \$500; china hutch, dark wood, framed glass doors, \$500. Nichols, 505-239-6842, ask for Gloria.  
 HIGH-PERFORMANCE GLIDER FLIGHT, 30 mins., w/Sundance Aviation in Moriarty, promo value expires June 22, \$90 Groupon, asking \$70. Willis, 286-1937.  
 BATHROOM VANITY, wood cabinet, 36-in wide, sink faucet, mirror combo, \$110 OBO; white ceiling fan, \$30 OBO. Villegas, 480-6290.

**How to submit classified ads**

**DEADLINE: Friday noon before week of publication unless changed by holiday. Submit by one of these methods:**  
 • EMAIL: Michelle Fleming (classads@sandia.gov)  
 • FAX: 844-0645  
 • MAIL: MS 1468 (Dept. 3651)  
 • INTERNAL WEB: On internal web homepage, click on News Center, then on Lab News link, and then on the very top of Lab News homepage "Submit a Classified Ad." If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.

**Ad rules**

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

**TRANSPORTATION**

'02 TOYOTA COROLLA LE, AT, PS, PL, CC, new battery, front brake pads, struts, spark plugs, tires, 99K miles, 32/38-mpg, NADA average trade, \$3,300. Dwyer, 271-1328.  
 '02 SILVERADO 2500 HD, 4x2, 8.1 L V8, tow pkg., much more, 158K miles, excellent condition, \$8,500. Pritchard, 299-3543.  
 '14 CADILLAC SRX, luxury pkg., repaired to factory specs after accident, 4,070 miles, NADA \$41,775, asking \$37,775. Rogulich, 298-5261.  
 '89 MERCEDES BENZ 300E, white/tan interior, alarm, AM/FM/CD, new tires & battery, 155K miles, \$3,000 OBO. Holt, 505-350-7868.  
 '02 FORD WINDSTAR, 7 passenger, 88K miles, generally good condition, needs tires, \$3,000 OBO. Shirley, 883-3210.  
 '10 TOYOTA TACOMA TRD, 4x4, off-road, double cab, AT, Snugtop shell, 67K miles, excellent condition, \$24,900. Smith, 505-269-1211.  
 '06 CADILLAC DTX LUXURY II, loaded, gold exterior, 100K miles, excellent condition, parked near Credit Union/Wyoming, \$9,500 OBO. Crenshaw, 440-3433.

**RECREATION**

'10 AEROLITE ZOOM TRAVEL TRAILER, 23-ft., new tires, 1 owner, very good condition, \$14,500. Anderson, 505-459-7781, Maj910@aol.com.  
 SHARE AIRPLANE CO-OP, 12-member, w/2 well-equipped high-performance airplanes, great club, \$13,500. Prevost, 505-350-2882.  
 TANDEM BICYCLE, Nashbar 9000T CR-MO, drum & cantilever brakes, hybrid tires, call for more info, \$450. Hanks, 249-1931.  
 MOUNTAIN BIKE, Haro men's, 27-spd., 17-1/2" aluminum frame, 26-in. tires, heavy-duty tubes, excellent condition, \$220. Fromm-Lewis, 220-5772.  
 '10 COLEMAN COBALT POP-UP CAMPER, 8-ft., 1,300-lb. dry, furnace, stove, extras, great condition, \$5,500. Vaughan, 291-9857.  
 '10 BASS TRACKER PONTOON, 21-ft., fishing barge, 60-hp Mercury engine, canopy/covers, like new, \$17,500. Garner, 328-1272, ask for Jane.

'03 APRILIA ATLANTIC SCOOTER, 500 cc, 18K miles, great condition, photos available, \$2,300 OBO. Fonseca, 505-400-5784.

**REAL ESTATE**

2-BDR HOME, 2 baths, 1,018-sq. ft., SW Albuquerque, 1-1/2 miles from freeway, \$118,000. Hidalgo, 505-269-7795.  
 4-BDR. HOME, 3 baths, separate in-law quarters, swimming pool, http://tinyurl.com/m7alqkc, \$419,900, \$429,900 w/realtor. Ramos, 972-951-0290.  
 3-BDR. HOME, 2,360-sq. ft., 3-car garage, built in '12, 5 mins. from KAFB, MLS#835145, \$299,900. Shelland, 303-514-2298.  
 3-BDR. HOME, 1-3/4 baths, 1,990-sq. ft., 2-car garage, large lot, Constitution/Wyoming, time-crunched seller, bargain, \$185,000. Fullmer, 505-730-7474.  
 3-BDR. HOME, 1-3/4 baths, 1,600-sq. ft., hardwood floors, remodeled kitchen/baths, NE Heights, Roberson home, \$180,000. Parker, 505-453-4531.  
 2 WOODED ACRES, Woodlands at Sedillo Hill, flat lot, all utilities underground, paved roads, great views, 20 mins. to SNL, \$140,000. Duncan, 271-2718.  
 1-BDR. CONDO, 900-sq. ft., 55+ community in Rio Rancho, MLS#829765, \$68,000. Philippsen, 220-3528.  
 4.98 ACRES, farm, mini-ranch, building lot, w/electric, good investment, retirement or hobby ranch spot, \$19,000 on contract, discount for cash. Mihalik, 281-1306.  
 3-BDR. HOME, 2 baths, 2,235-sq. ft., Cedar Crest, glorious views, steps from open-space trails, 20 mins. to KAFB, MLS#834419, \$275,000. Evans, 221-9892.

**WANTED**

MOVING BOXES, wardrobe, small, medium, large, liquid, will pick up if local. Bauck, 366-8669.  
 GOOD HOME, Chow mix, female, 4 yrs. old, sweet, playful. Gonzales, 463-0331.  
 DORM-SIZE REFRIGERATOR/FREEZER, & microwave, for soon to be NM-SU college student in August. Padilla, 328-1264.

**Mileposts**

New Mexico photos by Michelle Fleming



Nick Durand 35 4822



Dorthie Carr 30 5563



Dave Kuntz 30 1515



Craig Furry 38 2244

**Recent Retirees**



John Noe 30 9328



Marc Polosky 30 2153



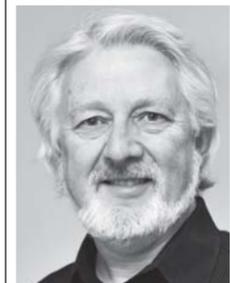
Don Small 30 5348



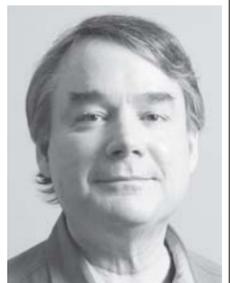
Jill Wheeler 30 1816



Mark Ackermann 25 155



David Dell 37 5956



Doug Doerfler 29 1422



John Cochran 25 6234



Laura Draelos 25 4879



David Leong 25 9539



Ro Malcomb 25 4254



Howard Walther 25 2991



David Yocky 25 5962



Andrew Allerman 20 1126

# Daughter's rare illness draws Sandian into a world of support

By Nancy Salem

Kivrin Hopkins had her first seizure on Super Bowl Sunday 2003. She was 4 months old.

It didn't last long, but her terrified parents rushed Kivrin to a hospital emergency room packed with injured football revelers. They waited four hours.

"The doctor said she looked fine and that babies have seizures for lots of reasons," says Kivrin's dad Matt Hopkins (1118). "She was our first child and we didn't know what was normal. We were told it was probably nothing to worry about and to make an appointment with a pediatrician if we were concerned."

They were, and saw their pediatrician the next day. She said the same thing, that seizures are not uncommon in babies and it was probably not serious.

A week later Mary Hopkins was at the grocery store when Kivrin had another seizure. Mary and Matt took her straight to their pediatrician's office at the hospital, bypassing the ER. "Clearly something was really wrong," Matt says. "We were told to go to the ER but we insisted on seeing a pediatrician. The ER couldn't do anything for us."

The pediatrician first checked Kivrin's blood glucose, or sugar, level. Normal is between 75 and 110. Kivrin's was 32. Matt and Mary pushed for answers, and the pediatrician said the only thing that came to mind was a condition so rare she had only seen it in a textbook. "It later turned out that's what it was," Matt says.

Kivrin was rushed by ambulance to the University of New Mexico Children's Hospital. The Hopkins' lives would never be the same.

"I have a memory of holding down my screaming 4-month-old daughter so nurses could put in an emergency IV of dextrose," Matt says. "No parent wants that."

## The rarest of conditions

Kivrin spent a week in pediatric intensive care, where she underwent test after test to find out why her glucose was so dangerously low. "We lived in the hospital," Matt says. "It was a traumatic, intensive, and bizarre experience."

Kivrin was diagnosed with congenital hyperinsulinism (HI), which Matt describes as "anti-diabetes." HI sufferers produce too much insulin, which drives glucose out of the blood. "The brain runs on glucose, burning about 60 to 70 percent of the blood glucose in the body as an energy source," Matt says. "The brain stops working if blood sugar is too low, leading to seizures. If left untreated, it can cause death."

Kivrin was treated with the drug diazoxide, which raises blood sugar in some of the cases of HI. The others move on to stronger medications and, sometimes, surgery to remove the pancreas.

Diazoxide worked for Kivrin but in the few years after she was diagnosed in 2003 worldwide shortages of the drug twice nearly sent her back to the hospital. "The manufacturer simply ran out. We said, 'What do you mean you ran out?' We couldn't believe it," Matt says. "Both times we got down to fractions of the last bottle. We were calling all around the world. We rode it out by reducing the dosage to the minimum needed to keep Kivrin safe. It was stressful and exhausting."

"I was mad. I wondered who was looking into these things. I looked around and saw that nobody was."

## A significant organization

Frustrated by the lack of information and support for HI sufferers, Matt and a handful of other parents met online and in 2005 founded Congenital Hyperinsulinism International (CHI), a nonprofit designed to expand awareness and medical understanding of all cases of HI ([www.CongenitalHI.org](http://www.CongenitalHI.org)). The organization has members worldwide and a Facebook presence with more than 1,400 followers from around the globe.

"There was immediate interest from everywhere," says Matt, who was CHI board president for 10 years, stepping down last year but remaining a board member. "It's turned into a very significant organization."

CHI holds conferences and events around the world, bringing together medical professionals and HI families to share information on the latest treatments and research. "We are in contact with all the specialists in Europe and the United States," Matt says. "We work international networks and influence medical guidelines. We even fund research programs."



THE HOPKINS FAMILY, Matt, Mary, Kivrin and Orion, enjoy travelling to places like Costa Rica. Kivrin is holding her well-worn stuffed companion Multiphase, a gift from Matt's Sandia colleagues when she was 4 months old. Kivrin sleeps with Multiphase every night. (Photo by Randy Montoya)

Matt received an award at a CHI event last month in Austin, Texas, recognizing his impact and leadership. "It was a very emotional moment for me," he says. "This has been a big adventure."

His advice to families dealing with rare diseases is to reach out and not be shy. "If you think something isn't right, push until you get resolution. Get to a specialist. Don't let it sit," he says. "If I hadn't pushed, Kivrin might not have been diagnosed for six more months, or ever, and suffered very severe neurological damage. It's better to be a jerk than to have your kid misdiagnosed or diagnosed late."

Kivrin is now 12 years old. She is home-schooled and loves to play Minecraft with her brother Orion. She is brave and optimistic.

And she has a friend by her side. When she went to the hospital after her second seizure, Matt's friends in the Multiphase Transport Processes group bought the 4-month-old a stuffed puppy. "We named it Multiphase," Matt says. "Only a Sandia family would have a stuffed animal named Multiphase. But I tell you what, to this day Multiphase travels everywhere with us and Kivrin sleeps with her every night."

## You're not alone



Congenital  
Hyperinsulinism  
International

Matt Hopkins (1118) wants to raise awareness and offer support to Sandians who deal with rare diseases. "It can be pretty overwhelming," Matt says. "You feel alone."

A rare disease is also referred to as an orphan disease and is defined in the United States as a disorder that affects fewer than 200,000 people at any one time. More than 6,000 rare diseases have a broad range of symptoms that vary from patient to patient, and are often misdiagnosed.

For example, the congenital hyperinsulinism (HI) that Matt's daughter Kivrin suffers from is frequently mistaken for epilepsy. Anti-seizure medications for epileptics can aggravate HI and delay the correct diagnosis and treatment.

"Everyone dealing with rare diseases has different circumstances," Matt says. "But we share a need for more scientific knowledge and information. There are overlapping issues around insurance, services, and treatments."

Eighty-four countries participate in Rare Disease Day, held annually on Feb. 28 to raise awareness among the general public, policy-makers, government authorities, industry, researchers, and health professionals. Since the effort was launched in Europe in 2008, thousands of events have been held around the world reaching hundreds of thousands of people.

Matt has helped organize Rare Disease Day events in Albuquerque, and he and others have worked to form a rare disease support group. "These diseases have a huge impact on people and their families," Matt says. "Efforts around the world have led to more research, better treatments, and advances in national and medical policies."