THE CUMBRES & TOLTEC narrow gauge steam railroad remains a major tourist attraction in Northern New Mexico long after its working life would otherwise be over. Recently Sandia researchers, working through the New Mexico Small Business Assistance Program, helped the Cumbres & Toltec team with some critical metallurgical analysis. The railroaders needed to know the composition of certain metals before doing any welding. See Will Keener's story on **page 12.** (Photo by Randy Montoya)

Legislation takes aim at safe, secure, sustainable water supplies through technology, national policy support

$200 million a year would be spent on research; Sandia will play key coordination role

By Will Keener

Elected officials in both parties and from several states, including New Mexico and California, lined up behind a billion-dollar-plus bill last week that would direct scientists to work on new ways of providing safe, secure, and plentiful water supplies.

The bill proposes research expenditures of $200 million annually for five years to address water issues around the country. It places Sandia at the center of the effort in the role of program coordinator. Eight other national and federal laboratories would team with universities to operate regional water research centers, if the legislation is approved and funds are appropriated.

The bill also proposes $20 million annually for facility construction and $5 million for administration, bringing the five-year total to more than $1.1 billion.

Supporters say the sweeping proposal represents a major effort to revitalize water supply research and development. Federal funding of water supply R&D has been flat since the late 1960s, distributed among 17 agencies and eroded by inflation. Research to increase water supplies is currently done by only three federal agencies.

Sen. Pete Domenici, R-N.M., who introduced the bill on the Senate side, said his interests in water research reach well beyond the uncertain groundwater supplies for drinking water in Albuquerque and the dwindling flow of the Rio Grande for irrigation.

"There are water problems related to quantity and quality in the East and in the big cities," he said. "We can no longer afford to invest in water in drips and drabs when it is vividly apparent that water-related issues will create some of the most significant domestic and international dilemmas facing us this century."

A more urgent issue

Drought and population shift are two significant factors making the management and use of water a more urgent issue for the nation, said Sen. Jeff Bingaman, D-N.M., who also supports the bill. "Meeting this challenge requires an increased national commitment to water resources research. This legislation makes that commitment."

(Continued on page 4)

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Sandia National Laboratories

CMC is turning 10 next week, and you're invited

Once-revolutionary cooperative concept to relieve regional tensions now seen as good national security

By John German

The Cooperative Monitoring Center (CMC) is turning 10 next week, and you're invited to its 10th birthday bash on July 29. (See "You're invited to the CMC on July 29" on page 5.)

"We want to thank the many collaborators across the lab who have helped the CMC achieve its successes over the years and to mark the development of a new way of thinking about national security that has evolved right here at our doorstep," says Dori Ellis, Director of International Security Center 6900.

The CMC was conceived in the summer of 1993 by Arian Pregenzer,

(Continued on page 5)

Sandia research wins two R&D 100 Awards

Cantilever epitaxy for LEDs, Trilinos software framework and library honored

By Chris Burroughs

Two Sandia research teams have won R&D 100 Awards in the annual competition sponsored by the Chicago-based *R&D Magazine*.

One award is for a new process of growing gallium nitride on an etched sapphire substrate, called cantilever epitaxy, which promises to make brighter green, blue, and white light emitting diodes (LEDs) — solid state lighting.

The other is for the creation of the software framework and library Trilinos, which provides broad-ranging, robust, and high-performance capabilities for solving numerical systems at the heart of many complex engineering and scientific applications.

R&D Magazine annually gives the awards to the top 100 industrial innovations worldwide. This year, DOE labs — Sandia is one — won 34 R&D 100 awards, says Jeannette Mallozzi, the magazine's managing editor. Since the award's inception, Sandia has won 70 R&D 100 awards, according to the magazine's web site.

Winners will be presented plaques at a formal banquet in October at Chicago's Navy Pier.

"The research groups winning these awards at Sandia this year are truly

(Continued on page 4)

NNSA weapons awards

Nine individuals, 11 teams from Sandia to be honored with NNSA Defense Programs Awards of Excellence. See story and photos on pages 6-7.

What's what

The *Sandia Daily News* reported last week that Kirtland AFB security police have launched a drive to promote seatbelt use by enforcing the requirement that everybody buckle up while driving on the base. The carrot is the fact that you're less likely to be injured in a crash if you're buckled up. The stick is assessment of two points against your driving privilege on the base and a $69 fine if you're caught unbuckled.

The fine moved Dave Sparks (12610) to wonder why $69? Why not $70?

Why not, indeed? And while we're wondering about that, how about odd-numbered amounts in-general? Why $19.99 instead of the simpler $20? If you found a long longed-for Django Reinhardt CD at Krazy Kat and it was marked $20, would you say, "Nope! If it were $19.99, I'd buy it, but 20 bucks? No way!"

What's the deal with this penny stuff, anyway? Ever notice that people will pick up a dime or a nickel, but they don't even slow down for a penny?

And what if that gizmo you were looking at was $23.89 or $67.93? Would you still buy it at $24 or $68?

If we didn't have to deal with all those pennies, think of the huge saving: less labor and copper for the mint; one fewer compartment wall in cash register drawers; all that paper not used to roll all those pennies; the cost of material, thread, and time repairing pants pockets worn through by the weight of all that change.

We'd probably have to carry a little more paper money than we do now, but it's so much lighter and less abrasive. And a wad of it's far more comforting than the dead weight of a pocketful of pennies.

* * *

And speaking of money, cruising the Internet looking for bargain sailboats recently, I happened onto this website — http://tinyurl.com/5r93k — in one of those Ozian moments. After I managed to hoist my lower jaw from its sticker-shock position, I thought:

Q: If you're a boat person (on my level, at least) when is a "head" not a head?

A: When it's the "master head" on a 194-foot yacht waiting in Barcelona to be snapped up by the first sailor to show up with $57 million.

Whooo-eee!. . .

* * *

Occasional correspondent and commentator Charles Shirley (9620) e-mailed after a recent column entry about what you call someone with an inordinate love of acronyms. I had suggested acronymaly, and Charles was drawing on his now-long-gone stint as *Lab News* managing editor.

"As I recall," he wrote, "we once asked ourselves this question. (Then-editor) Larry Perrine answered it in his column. We decided people with a love of acronyms are acronymcompoops." Larry suggested a different word — one that would have raised eyebrows and blood pressure — but Charles "counseled against that term and prevailed."

I had suggested "acronymophile" — pedestrian compared to Larry's bold choice. But, then, he's still working here — on the books as working here, at least — and that would not have been a certainty if he had given way to rashness rather than reason.

— Howard Kercheval (844-7842, MS 0165, hckerch@sandia.gov)

Sandia locates floppy disk in secure area

Sandia located a floppy disk that had turned up missing in a recent inventory.

The floppy disk, which had been marked classified, was found about 1 p.m. last Friday (July 16). Sandia had reported the disk as missing June 30 in a wall-to-wall inventory.

The disk was found inside a safe in the secure area. The disk contained no weapons data or information that could have damaged national security.

"The disk was always under the control of individuals authorized to possess it," said Ron Detry, VP of Integrated Security and Chief Security Officer. "The recent inventory found it to be missing because of a procedural error in that it apparently had not been properly transferred from one organization to another."

"[I]n my mind, the nature of the near miss of this recent incident is far too close for comfort."

Labs Director C. Paul Robinson said: "We are relieved the disk has been found. But in my mind, the nature of the near miss of this recent incident is far too close for comfort. We must find better ways and procedures for ensuring the protection of such material."

In a message to all employees Friday, Paul called the incident "troublesome" and said he is asking Ron to lead a task force with membership from across the Labs' classified programs to improve the management of classified electronic information and removable media. And he asked each employee to think through how to be absolutely sure that no loss of control of any item of classified removable electronic media happens in the future.

Employee Death

David Rosenzweig of California Facilities Operations Dept. 8514 died after a long illness on July 18.

He was 55 years old.

David was a manager and had been at Sandia 17 years and seven months.

He is survived by his wife Tara and son Joshua.

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LOCKHEED MARTIN

Cost estimation process under way at Sandia

Goal is to increase quality, fidelity, and confidence in cost estimates

Sandia has recently implemented a cost estimation policy and is currently developing a process to guide estimators through their efforts to produce accurate, reliable cost estimates for Sandia's external sponsors.

The need for a policy and process gained attention with Lab management about a year ago, says Bonnie Apodaca (10500), Director of Controller and Pension Operations.

Some of the events that brought this issue to the forefront included greater customer reliance on the accuracy of the Labs' estimates, erroneous cost estimates, and the lack of an overall policy or standards to ensure consistency of independent reviews and management approvals. Other factors included the lack of tools for the variety and type of proposals, and identification of the inaccurate cost estimates as the number one financial risk by Sandia's Governance Committee.

Goals set to accomplish this task

Goals set to accomplish this task included repeatable processes based on standards and best practices, management reviews at appropriate levels, clear accountability for cost estimates, and consistent look and feel.

Achieving these goals requires developing a corporate policy including Strategic Management Units (SMUs) implementation guidance, a corporate tool with Oracle Plug-in, and training for the users.

A team of Sandians from various Sandia organizations and a consulting firm are currently implementing this process.

Successes to date include a Labs-wide policy on cost estimating (CPR 500.1.4), a successful demonstration of the tool's capability to load raw costs with Sandia's burden rates, and a working group established to develop user requirements for the cost estimation tool and processes within the individual SMUs.

For communication purposes, a cost estimation link has been created on the Indirect Financial Management's (Dept. 10508) home page. Various presentations, project updates, and newsletters are included within the link: http://cfo.sandia.gov/finan/depts/indirect_home.htm. This site informs Sandians on current team progress and SMU updates.

Bonnie says as the cost-estimating process continues to develop, the tool will be customized, the Oracle Plug-in requirements will be defined, and training will be tailored.

"The ultimate goal is to allow Sandia to increase the quality, fidelity, and confidence in its cost estimates so that Sandia continues to be viewed by our sponsoring organizations as outstanding and providing exceptional service of our country's highest interests," says Bonnie.

Emergency responders tell Sandia researchers their homeland security technology needs

By Nancy Garcia

A panel of emergency responders came, saw, and commented frankly upon Sandia's Homeland Security technologies last month.

"It's very unusual for technology users in the field to have direct contact with technology developers at a national laboratory; it makes a whole lot of sense, but it's hard to get it to happen in practice," says Microfluidics Dept. 8358 Manager Art Pontau, who hosted the visit. "We really learned a lot from their visit about how to develop better tools for them."

Eleven emergency responders from across the nation spent two days being briefed on MicroChemLab, the Weapons of Mass Destruction-Decision Analysis Center (WMD-DAC), and other Sandia technologies. At the conclusion of the visit, they gathered in the Combustion Research Facility auditorium to discuss what they had seen and their needs.

Sandia CaliforniaNews

"We're all about trying to make a difference," Exploratory Systems and Development Center 8100 Director Rick Stulen told the group.

The group of panelists was pulled together by a potential business partner, Smiths Detection. "Our product concepts come directly from our customers," said Safety Business Unit Manager Jim Fitzpatrick. "We have worked with these people over the last three years and value their honest opinions."

The panel was moderated by Sandia consultant Ed Southwell of Perspectives Inc., who worked with Sandia on the initial Grand Challenge Laboratory Directed Research and Development project that led to MicroChemLab.

"You've told us you have to manage the public's fear," he reminded the panelists, who agreed with that assessment.

"Anything you can do to address their fears is good," said Mike Brooks, battalion chief of the Seattle Fire Department. "We're in the unknown too; the tensions run high."

Frank Docimo of Docimo and Associates recalled the challenges of dealing with unknowns in a small fire department in Stamford, Conn.

"When I started," he said, "gas detection was two guys on the back of the truck. We would tell the people we're sworn to protect, 'I don't smell nothing. If you smell something, call us back.' And in the days of methane or propane, it was easy, the flame was in the sky when we came back."

He'd like to see a better combustible gas indicator, saying the current versions originated for mines in 1928. "How about detection on the back of the rigs," he asked, "so when I pull up, before I hit the brake I know I'm okay — or I can do some evasive action and tell the other companies [responding]."

David Matthew, from the Sedgwick County Fire Department, Wichita, Kan., is the training coordinator for its hazardous materials team. "Hazmat's done in layers," he said. "I saw some really good stuff here — I would like to see some lower-end technology. I want to know if it burns, if it's toxic, if it's corrosive. I want to know if there's something in the air that's not nitrogen, oxygen, carbon dioxide, or water."

Jaguars are cool; Chevys work

Added Jesse Ybarra, who recently retired from 25 years with the Houston Fire Department's hazmat team, "Screening, detection, and quantification tools don't all have to be in the same box."

Docimo agreed. "Don't put 200 things on the box when I only want it to do three . . . Jaguars are cool; Chevrolets work."

Panelist Ryan Nash of the Seattle Fire Department wears a few hats. An emergency medical technician, he serves on the hazmat team and other teams involved in homeland security issues.

"We didn't used to get many anthrax calls," he said. "Since 9/11, anything that's white and looks like a powder we go on, unfortunately, from something that's obviously not very credible to this could be the real deal . . . the hazmat's just one portion of what we do; if we get a fire, I'm happy."

Ybarra had just returned from spending eight months in Iraq looking for weapons of mass destruction. "Soon after we got there," he said, "we realized we weren't going to find the smoking gun sitting out on the freeway. It was a whole lot more complicated than that. We may not get answers for years."

However, the firefighters said they usually size up a scene and make decisions in seconds, comparing it to mental images of previous incidents much like consulting a carousal of slides filed away in their memory.

"We make decisions based on experience, intuition, and some analytic tools," said Malcolm Trigg, special operations chief who commands the Seminole County Hazmat Team in Orlando, Fla. Decisions are usually made in five to 10 seconds, said Livermore-Pleasanton Fire Department Division Chief Mike St. John. Hence, there is no time to wait two minutes for a gas pre-concentrator to work, Matthew commented.

Overall, Ybarra felt the MicroChemLab was "a far cry better than what we have now." Trigg felt the sophisticated detector could have a second-level role as long as the first firefighters off the rigs also had something cheap and reliable to warn them if they should protect themselves.

"The first thing we've got to decide is, 'What do we have, is it going to explode, and is there life?'" explained Capt. Vincent Doherty of the New York Fire Academy. "If there's life, we go in in full gear whether what's in there is going to harm us or not."

Capt. Kathy Fallis, a nuclear medical science officer with the 95th Civil Support Team in Hayward, Calif., called the MicroChemLab "very impressive and forward-looking." She said the gas detection capability in particular could be helpful for both warfare agents and toxic industrial chemicals.

Absolutely the way to fly

An ability to detect biotoxins or bioagents in minutes in the field was to her also an attractive feature of the MicroChemLab liquid analysis capability, since the alternative, gene-based detection (using an enzyme that multiplies gene copies) now takes more than an hour or up to three hours. MicroChemLab operates by separating complex mixtures into discrete components that are identified based on unique separation patterns. The device, easily held in the hand, miniaturizes traditional bench-top laboratory analysis apparatus.

"What was pretty cool was the way you guys shrink things down," Docimo said. "The modular design is absolutely the way to fly."

"I'm very impressed," Doherty said. "This is what we have been fighting for; this is what we have been lobbying for, since before 9/11."

Added St. John, "Your technology and your knowledge can be an incredible benefit to us and to the country. We've been asked to do a different mission now. We've become a first responder in a military operation. The consequence is bigger; the mission's different."

Major Jeff Allen of the 4th Civil Support Team in Atlanta agreed that civilian responders are now in the homeland defense engagement. "What happened on 9/11 is going to happen again," he predicted, "whether it's chemical, biological, or radiological. And we're going to have

(Continued on page 8)

Secretary Abraham visits Sandia/California

WHIRLWIND — DOE Secretary Spencer Abraham visited the Combustion Research Facility briefly on July 8. He was shown the homogeneous charge-compression ignition research lab by John Dec (8362) and Jackie Chen (8351) and a hand-held methane gas imager by Tom Reichardt and Karla Armstrong (both 8368). Here Bob Carling (8350, left) greets Abraham outside the facility as California Laboratory VP Mim John (8000) looks on. Earlier in the day, at the Stanford Linear Accelerator Center, Abraham had announced a new education initiative. After stopping at Sandia, he crossed the street to visit Lawrence Livermore National Laboratory. (Photo by Bud Pelletier)

SmartCart test spin

GET SMART — The SmartCart, a mobile unit designed by Sandia to better detect radioactive isotopes that might be concealed in shipping containers or other cargo, was demonstrated in May to the Department of Homeland Security's Science and Technology Advisory Board. Riding in the cart is Gen. Larry Welch, US Air Force (Ret.), chair of the DHS Science and Technology Advisory Board and a member of the Sandia Board of Directors. The cart was principally developed by Dean Mitchell, Gene Kallenbach, and Kevin Seager of Dept. 5935. Linda Groves (8114) and Robert Hillaire (8116) are doing operational analysis for its deployment. The demonstration took place at a radiological/nuclear testbed installed by the DHS at the Port Authority of New York and New Jersey.

R&D 100

(Continued from page 1)

innovative and on the cutting edge of science," says Sandia President and Labs Director C. Paul Robinson. "The cantilever epitaxy process offers the potential for longer-lived and better performing LEDs. Trilinos has had a major impact on Sandia's engineering modeling and simulation capabilities over the past several years, and with its public licensing we are extending that to broad national impact."

Here are brief descriptions of the two winning Sandia technologies.

Cantilever epitaxy

Colored LEDs are of interest for displays and even higher-power lamps like traffic lights. A national initiative is now under way to develop solid-state sources for high-efficiency white lighting. The cantilever epitaxy process of growing LEDs may help meet those needs.

"Our new process eliminates many of the problems that have limited the optical and electronic performances of LEDs, previously grown on sapphire/gallium nitride substrates," says Carol Ashby (11500), one of the inventors.

Over the past several years LEDs have been grown with various combinations of gallium nitride (GaN) alloys on sapphire substrates. However, the atoms of the two materials do not line up perfectly due to differences in natural lengths of the bonds in their respective crystal lattices. Regions of imperfections, called dislocations, accompany this lattice mismatch. These dislocations limit LEDs' brightness and performance.

The new cantilever epitaxy process reduces the numbers of dislocations, giving the potential for longer-lived and better performing LEDs. It also means that LEDs grown on the patterned sapphire/gallium nitride substrates can produce brighter, more efficient, green, blue, and white lights than previously accomplished.

CHRISTINE MITCHELL looks through a substrate that was made for the new cantilever epitaxy growth process. (Photo by Randy Montoya)

David Follstaedt (1111), another of the inventors, says that because of the reduction in dislocations, the cantilever epitaxy process shows "great promise for making a superior substrate for light-emitting devices" and has potential for applications to a wide variety of electronic devices and GaN integrated circuit technology.

Transmission electron microscopy and scanning electron microscopy were used to determine the number of dislocations eliminated through the cantilever epitaxy process.

The cantilever epitaxy program at Sandia was part of an internal three-year, $6.6 million Laboratory Directed Research and Development (LDRD) Grand Challenge. Funding also came from a grant from the DOE Office of Building Technologies for a collaborative project with Lumileds Lighting, a joint venture between Agilent Technologies and Phillips Lighting.

Inventors: Carol Ashby (11500), David Follstaedt (1111), Christine Mitchell (5932), Jung Han (now at Yale University)

Developers: Andrew Allerman (1126), Katherine Bogart (1126), Karen Cross (1126), Arthur Fischer (1123), Kristine Fullmer (1123), Leonardo Griego (17421), Daniel Koleske (1126), Nancy Missert (1112), Michael Moran (1111), Adam Norman (1111), Andrea Ongstad (1742), Gregory Peake (1742), Paula Provencio (1111), Jeanne Sergeant (1763).

Trilinos

Trilinos is part of a broad effort on the part of national laboratories, industry, and academia to establish high-fidelity computational modeling and simulation as an approach to engineering and scientific understanding so it becomes an equal partner with the most basic approaches of theory and experiment.

Trilinos provides a common enabling solution to one of the most difficult problems in

(Continued on next page)

Water bill

(Continued from page 1)

"We have been fighting over a dwindling supply of fresh water in this country for a number of years," says Rep. Richard Pombo, R-Calif. He will introduce a companion bill in the House. "We have to bring in new technologies in order to meet the demand in the future."

"This program is not about research alone. The program is structured to carry applied research through technology development and testing to full commercial implementation," says Peter Davies, Director of Geosciences and Environment Center 6100. Technology transfer and partnerships with industry leading to new commercial technologies will be critical to success.

"Right now we are talking about authorization, not appropriation. We are two or three steps along in a 10-step process," says Peter. "Given that, we are very excited about the scale of the program and the opportunities it presents."

Peter and a team of Sandia researchers got the Labs' own water initiative off the ground about four years ago and have seen it grow to a major focus of research and development activity (see "Sandia's 'Team Agua' " above right.)

Policy component

The bill also recognizes that in the world of water, regulations and policies are as critical as technologies, says Peter. "This is not purely a technical problem." A proposed policy institute would help researchers understand what regulations are actually driving technology and identify policy barriers. The University of New Mexico Law School's Utton Transboundary Resources Center is named in the bill as the lead for the policy center.

As program coordinator, Sandia would be responsible for leading the development of technology roadmaps used to define R&D pathways. Sandia would coordinate research activities at the regional centers and competitive open research efforts outside the centers. The Labs would also coordinate critical technology transfer activities.

"There is a clear intent that Sandia work with industry research foundations, other labs and that we facilitate projects that connect the research to other federal agencies," says Peter. There is also an important role set out in the legislation for an advisory panel to guide the overall program. This advisory panel would include industry, universities, federal agencies, nongovernmental organizations, international water technology institutions, and the regional centers.

"We learned from our experience with the Desalination and Water Purification Technology Roadmap (*Lab News*, June 25) that our success came because we had a very strong needs-driven effort, bringing together people who are in a good position to define the needs. In this case, we need to bring together water managers, industry providers, and policy makers to define the needs. Then we will work with the R&D community to define the research and development that will meet those needs."

Recognition for Sandia

Sandia's key role in the proposal is due to several factors, including the development of a broad-based Labs water initiative over the past several years. "We have enough effective engagement and impact that people are starting to recognize the kinds of contributions that Sandia can make," says Peter. Cooperative efforts with the Bureau of Reclamation to create the desalination technology roadmap and to develop security methodologies for the nation's dams and key water systems are two examples. Sandia's vulnerability assessment methodology for water infrastructure security has now been used by more than 90 percent of the large US cities, serving more than 130 million water users, he notes.

Sandia's energy expertise also comes into play, Peter adds. Sandia began working with Los Alamos and the National Energy Technology Lab in West Virginia two years ago in an effort to look at interdependencies between energy and water. "Annually in the US, we use on the order of 136 billion gallons of fresh water for agriculture and almost the same amount for electricity generation," he notes.

"As water becomes more difficult to find, water for energy competes with water for agriculture, municipalities, industry, and the environment. New energy plants can't find the water they need and existing ones operate at reduced capacity because of water shortages." US projections call for 1,300 to 1,900 new power plants by the year 2020. "Where's the additional water going to come from?" Peter asks. The original triad investigating this issue has grown to 11 labs, he notes, and the energy-water theme will be addressed by several of the regional centers under provisions of the new bill.

Sandia's 'Team Agua'

A number of Sandia's Water Initiative team members attended a media briefing in Washington last week for the introduction of the new DOE National Laboratory Water Technology Research and Development Act of 2004. Among them were Les Shephard (VP 6000); John Merson (6100), deputy water initiative coordinator; Mike Hightower (6202), sustainability and energy-water interdependency focus area lead; and Wayne Einfeld (6233), sensors focus area lead.

In Washington to provide background and discuss key water issues, these Sandians are part of a team that has brought the initiative from a mix of high personal energy, good ideas, and strong capabilities to a research and project portfolio focused on the water themes of safety, security, and sustainability. Initiative members have forged agreements and organized cooperative projects with a number of key water agencies, including the Environmental Protection Agency, the Bureau of Reclamation, the American Water Works Association and its Research Foundation, Kirtland Air Force Base, the US Geological Survey, and numerous universities.

Other members include Tom Hinkebein (6118), who has the lead role in Sandia's treatment and desalination focus area; Ray Finley (6115) and Bob Waters (4142), security focus leads; Yolanda Fintschenko (8358), Sandia California sensor group; Mark Rigali (6822), Carlsbad Area Office water project; and Darrel Drayer and Ronald Pate (both 6143), agricultural water efficiency.

If you want to know more about Sandia's Water Initative go to www.sandia.gov/water. The site reviews the Labs' many industrial and government partners, projects under way, and key team leaders. It provides a number of publications and fact sheets on key water-related issues as well.

CMC anniversary

(Continued from page 1)

now a Senior Scientist in Cooperative International Programs (6920). She and her colleague Mike Vannoni, now of Regional Security and Multilateral Affairs (6924), and her manager, John Taylor (now Manager of SMU Support 5915), had been discussing what was then a perhaps novel, if not revolutionary, concept: Why not make available to the world — and particularly to Middle Eastern nations engaged in regional conflicts — sharable technologies and information that could become part of new arms control agreements and help reduce tensions between nations?

"The concept diverged from what had been Sandia's primary national security focus for more than four decades: supporting the United States in its unilateral efforts to overcome the threat represented by the Soviet Union and communism," says Mike.

Fear and mistrust

Arian succeeded in achieving funding to further develop the idea, was promoted to manager, and recruited Pauline Dobranich (now in Dept. 4142) and Kent Biringer (now Manager of 6924) as part of the team. They recognized that regional tensions are complicated by mistrust and fear of aggression, and that technology was an important element of implementing confidence-building measures or treaties to reduce mistrust.

They also believed, long before it was fashionable, that improving regional security around the world was integral to US national security.

"Everybody now accepts the idea that technical cooperation abroad can be part of achieving our own national security objectives," says Arian. "But then it was a new idea."

They believed establishing a demonstration facility where experts from around the world could come together to learn about sharable monitoring and transparency technologies was a fitting first step to helping improve regional security.

So in late July 1994, the CMC, a room full of technology displays in an office building in Research Park, opened its doors to its first group of visitors from five nations — literally as the paint on the walls was still drying.

"We were very excited at the very thought of having people from Israel, Egypt, Kuwait, Oman, and Qatar here to talk about issues that affected them all," says Arian.

Although several names for the facility were discussed, the word "cooperative" was the key word according to Kent.

"The purpose really was to find ways to share technologies and information to promote regional security and cooperatively reduce the motivations to acquire weapons of mass destruction," he says. "At the same time, we recognized that technology is not the solution in and of itself."

The process of gathering nations together and discussing often non-threatening issues of mutual importance — water scarcity, border security, and other issues — was and remains a key tactic.

Growing programs

Today the CMC resides organizationally within the Sandia International Security Center that is 200 employees strong and growing. Its staff works in a 65,000-square-foot, three-story building, the International Programs Building (IPB), outside the Eubank Gate to Kirtland Air Force Base.

Center 6900's work touches an additional 350 people across the Labs who are part-time contributors. They include technical experts in various centers including 4100, 4200, 6100, 6200, 6800, 9800, 15200, and others, as well as administrative specialists "without whom we literally could not function," says Dori — foreign interactions professionals who coordinate foreign travel and foreign visits, medical professionals who operate the International Travel Clinic, and procurement professionals who exclusively place international contracts, among others.

"This infrastructure support is one of the things that makes our capabilities at Sandia unique," she says. "This is one of the very few places in the world where this bridge between policy makers and technology providers exists in a systematic sense."

The IPB, occupied in 2002, was designed to serve as a forum for international collaboration, with a technology showroom, a library, and various meeting rooms "intended to make our guests comfortable," says Dori.

"Everybody now accepts the idea that technical cooperation abroad can be part of achieving our own national security objectives. But then it was a new idea. . . . At the same time, we recognized that technology is not the solution in and of itself."

International Security Programs' evolving missions

The International Security Programs' current mission includes not only supporting arms control efforts but also leading Sandia's programs to protect and account for weapons-usable materials around the world, supporting the International Atomic Energy Agency's nuclear safeguards work, and helping the former Soviet states secure and dismantle nuclear weapons.

Since 9/11 its mission has expanded to counterterrorism work, such as developing border monitoring technologies, establishing processes to inspect shipping containers in foreign ports before they depart for US destinations, and securing thousands of legal radiation sources around the world that could become ingredients for a terrorist's dirty bomb.

A growing program in biosecurity, a new field in which Sandia is playing a pioneering role and a key element of a biological weapons nonproliferation effort, is working with the Centers for Disease Control and the World Health Organization. The goal is to develop standards that will lead to improved protection of potentially dangerous pathogens at bioresearch labs in the US and around the world.

You're invited to the CMC celebration on July 29

On July 29, Sandia's Cooperative Monitoring Center (CMC) celebrates 10 years of collaboration. If you were one of the many Sandians involved in the successful development and implementation of the CMC, you are invited to its anniversary celebration at the International Programs Building, 10600 Research Road, from 1-4 p.m.

The open house includes a docent-led tour of the recently updated Technology, Training, and Demonstration Area. Please RSVP to Patricia Dickens at 284-5033 or e-mail pdicken@sandia.gov.

Some notable successes

The CMC has achieved some notable successes in its 10 years.

Its staff has developed a rapport with officials representing a broad spectrum of US federal agencies — the State Department, the Defense Department, DOE, and NNSA included — and with foreign governments that allows for unprecedented levels of collaboration, says Mike.

It has hosted visiting scholars from 16 countries to study security issues of concern to their nations' governments. Two retired admirals from India and Pakistan, for example, spent several months as visiting scholars at Sandia in 2003 developing concepts and proposals for confidence-building measures at sea.

Numerous workshops have brought officials and technical experts from around the world to Sandia. Representatives from 127 countries, ranging from senior government officials to staff-level technical experts and graduate students, have toured the technology training and demonstration area. Representatives from 12 countries have been trained in cooperative monitoring concepts, system design, and applicable technologies.

"Establishment last year of a sister CMC facility in Amman, Jordan, led by Sandia but staffed by Jordanians, was a real milestone," says Arian.

"This is a very compelling place to work," says Dori. "It's energizing to know what your job is, to understand the urgency of it, and to be able to explain to people what you do and why you do it.

"We hope Sandians will join us in celebrating this very special place."

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creating these simulations: How can one solve the massive and complex systems of equations required, and do so in a way that "scales" all the way from laptop computers to the most powerful and complex parallel computers in the world?

Trilinos has become tremendously successful at addressing this "solver problem" and has become, for example, a critical enabler for the diverse simulation codes that support almost every major engineering discipline within DOE's Advanced Simulation and Computing (ASC) program.

Trilinos, led by Mike Heroux (9214), is under development at both Sandia/New Mexico and Sandia/California, with some 24 researchers involved. Trilinos offers what is probably the largest and most complete scalable solver capability in the world, and it is freely available to the public.

Meaning "string of pearls" in Greek, Trilinos has an architecture in which object-oriented packages, each of which provides a particular solver capability, are strung together like pearls on a necklace and represent more than the sum of the parts. Trilinos began as three packages, has rapidly expanded to 20, and continues to grow. Computational researchers and software developers find Trilinos attractive because they need only focus on those aspects of development that are unique to their package.

Each Trilinos package is a self-contained, independent piece of software with its own set of requirements, its own development team, and its own group of users. Because of this, Trilinos is designed to respect the autonomy of packages. It offers a variety of ways for a particular package to interact with other Trilinos packages. It also offers developers a set of tools for building on multiple platforms, generating documentation, and multi-platform regression testing.

Trilinos team members: Michael Heroux (9214), Tamara Kolda (8962), James Willenbring (9214), Roscoe Bartlett (9211), Paul Boggs (8962), Robert Heaphy (9215), Ulrich Hetmaniuk (9214), Robert Hoekstra (9233), Victoria Howle (8962), Jonathan Hu (9214), Richard Lehoucq (9214), Kevin Long (8962), Roger Pawlowski (9233), Michael Phenow, Eric Phipps (9233), Marzio Sala (9214), Andrew Salinger (9233), Paul Sexton, Kendall Stanley (9214), Heidi Thornquist (9214), Ray Tuminara (9214), Alan Williams (9143).

Nine individuals, 11 teams to be honored with NNSA Defense Programs Awards of Excellence

Nine Sandia individuals and 11 teams will be awarded the National Nuclear Security Administration (NNSA) Defense Programs Award of Excellence during ceremonies in New Mexico and California in August and September.

The New Mexico ceremony will be Aug. 12 from 2-4 p.m. in the Steve Schiff Auditorium. Tom D'Agostino, Assistant Deputy Administrator for Program Integration in the NNSA Office of the Assistant Deputy Administrator, has been invited to be the guest speaker at the New Mexico event. California recipients will be honored Sept. 1 from 9:30-11:30 a.m. in the Combustion Research Facility Auditorium.

The NNSA Defense Programs Award of Excellence was created in the early 1980s to give special recognition to those at the laboratories and plants directly associated with the stockpile modernization program. Today the awards honor exceptional contributions to the stewardship and management of the stockpile.

Here are the nine individuals and their award citations:

Steven Burchett

Steven Burchett (9126, who died March 5) was recognized for more than 30 years of exceptional contributions to the successful qualification of neutron generator components for hostile environments. Throughout his career at Sandia, Steve provided uncounted critical contributions to Sandia's ability to qualify neutron generators for the NNSA weapons program. His analytical abilities and depth of experience provided a problem-solving capability. Steve's contributions spanned the full life cycle of neutron generators. His expertise impacted the design, manufacture, qualification, and surveillance of these critical components.

David Clauss

David Clauss (9127) is recognized for providing outstanding support of the W76-1 qualification activities as a system integrator for modeling and simulation and experimental data. His work has had a great impact on assessing the validity of models and experimental data. David's work has been crucial in promoting a coherent and consistent approach to creating the environmental specifications and qualification of hardware. His coordination role set a new standard for environmental engineering for a weapons system.

Mark Dickinson

Mark Dickinson (9724) is recognized for his leadership in optimizing people and technology in building the future vision of the Nuclear Weapons (NW) Complex. Mark rises to a position of leadership in any situation because of his extraordinary skills in developing relationships and commitment in all aspects of business. As leader of the Technical Business Practices (TBP) Systems team, he rebuilt and reenergized the significant partnerships across the NW Complex that were needed to integrate and optimize business practices throughout the nuclear weapons life cycle. His persistence and forward thinking have brought new technologies and best practices into Sandia operations and the NW Complex as a whole.

Thomas Hendrickson

Thomas Hendrickson (2137) is being honored for his passionate and effective leadership in the qualification of the MK4A/W76-1. Tom made exceptional contributions to the development and implementation of the qualification plan for the MK4A/W76-1 life extension program. His own technical expertise and ability to grasp the intricacies of a broad range of qualification technologies is extraordinary. Primary examples of his impact include:

• Leading the development of a very detailed qualification project plan for hostile, normal (structural, thermal, electromagnetic), and abnormal environments for the W76-1.

• Interacting closely and effectively with the Environmental Specification, Modeling and Simulation, and Experimental community in the NNSA Weapons Complex to ensure that all W76-1 qualification issues were addressed properly.

• Engaging component and subsystem designers to better understand design qualification in the context of the production environment to enhance quality and cost effectiveness.

Theodore Frederiksen

Theodore Frederiksen (2953) is honored for his 39 years of continuous outstanding service to the excellence of the nation's nuclear deterrent at DOE's Mound and Pantex plants. Ted has conscientiously conducted or overseen testing of components, subsystems, and systems of the nation's nuclear stockpile since 1965. During that time, first at the Mound Plant as a Monsanto employee and then at the Pantex Plant as a Sandia employee, he has championed and personified performance excellence. He is currently manager of the Sandia Weapons Evaluation Test Facility (WETL), which conducts between 500 and 1,000 tests on nuclear weapons systems and subsystems each year. His efforts were key in obtaining Sandia and NNSA support for the construction of a new WETL and then in the design and construction of that new building on schedule and below budget.

David Kestly

David Kestly (2662) is recognized for his sustained excellence in the design of Radar Digital Signal Processors for the Navy's Trident warhead W76-1 and W-88 Radars. David had responsibility for the design of the W76-1 LEP AFS Radar Digital Signal Processor (DSP). He was responsible for the architecture of the design and conceptual design of the DSP. He was primary logic design implementer for the Permafrost-1 ASIC Radar DSP design developed in CY2003 and in previous years. David provided leadership to the Radar DSP design and design verification team to meet the rigorous performance and schedule constraints of the W76-1 LEP development program. He also provided mentoring to Radar DSP design and design verification team members, which included instruction on design methodologies and radar DSP design theory applicable to the W76-1 DSP design.

Neil Lapetina

Neil Lapetina (14402) is being honored for his leadership in managing the Readiness Campaign Sandia ADAPT Process Development Program. Neil continues to provide

(Continued on next page)

Here are the team winners and their award citations:

Next Generation Electrical Subsystem Development Team

The Next Generation Electrical Subsystem Development Team is being recognized for demonstrating exceptional engineering in the implementation of a new generation of electrical subsystems. The team designed and built an electrical system given almost impossible size, weight, and power constraints. This provided WR applications with essential capabilities that were producible, cost effective, and of very high reliability.

Team Leader: Robert Kinzel (8226); Team members: (Internal) Ephraim Arquitola (17351), James Bergstrom (8226), Edwin Bochenski (8231), Christopher Boswell (8226), David Claypoole (8226), Peter Deng (17351), Edward Dutra (8224), Joshua Greegor (8226), Thomas Hafenrichter (2552), Donald Hardy (2525), Donald Herron (8224), Marian Jackson (8226), Scott Lindblom (8226), Julio Marchiondo Jr. (1734), Daniel McCormick (2553), Debra Post (8226), Richard Roy (8226), Jason Shelton (2553), Gary Simpson (8226), William Tarbell (2553), David Tobeck (8226), Philip Zablocki (8226); Team members: (External) Greg Enserro, Edward Schmidt (both Honeywell/FM&T)

Design of a CMOS 6R 3.3V Digital ASIC for WR Application Team

The Design of a CMOS 6R 3.3V Digital ASIC for WR Application Team designed, tested, and fabricated a new digital ASIC for a WR production application under very tight schedule and performance constraints. The team performed extensive and meticulous simulation using state-of-the-art CAD/CAM tools to ensure that this ASIC would work the first time (and it did!). Simulations included: VHDL level functional modeling, synthesized gate level simulation, and layout timing analysis. This simulation resulted in silicon that exceeded the project's performance goals.

Team leader: Philip Zablocki (8226); Team members: Ephraim Arquitola (17351), Peter Deng (17351), Russell Miller (1735)

Joint Test Program Qualification Team

The Joint Test Program Qualification Team is being honored for advancing the state of the art in developing validated simulation tools used for hostile environment qualification of weapon components. The Joint Test Program was initiated to assess whether hostile shock environments in the UK Trident Reentry Body are compatible with DOE components and to demonstrate the state of the art in qualifying new hardware using massively parallel computer simulations. This work has had a high level of impact on hostile environment qualification for the W76-0 and W76-1 programs. It has directly benefited model development and validation for the W80-3 program.

Team leader: Randall Mayes (9125); Team members: Charles Adams (9125), James Allen (1769), Manoj Bhardwaj (9142), David Clauss (9127), Stephen Crowder (12323), Larry Dorrell (9125), Clay Fulcher (9127), Paul Gabaldon (12332), Jennifer Gilbride (2113), Anthony Gomez (9125), Ronald Hopkins (9125), David Kelton (9125), Jeffrey Gruda (9126), Sheryl Hingorani (2134), Scott Klenke (9125), Randall Mayes (9125), Thomas Paez (9133), Luis Paz (2113), Garth Reese (9142), Todd Simmermacher (9124)

MC4519 MCCS Encryption Translator Development and Production Team

The MC4519 MCCS Encryption Translator Development and Production Team is being honored for its excellence in the areas of engineering, product development, production, and field support for the MC4519. For more than six years, the MET team made significant contributions in supporting the MC2419 MCCS Encryption Translator (MET), Coded Switch WR production schedules. The team's diligence, professional approach, and open communications contributed to the 100 percent on-time product delivery. From June 1997 through November 2003, Honeywell FM&T Department E55 never failed to ship the MET on time. On several instances over this seven-year period, the team addressed significant design and/or manufacturing issues. Each time the team resolved the impending issue without stopping production or missing the delivery date.

Team leader: Steven Giles (2913); Team members: (Internal) Janet Bauerle (2954), Grant Bloom (2111), Mark De Spain (2116), Thomas Denman (2115), Donald Evans (12333), James Hole (2616), R. Reed Jackson (5514), Kenneth Kimball (2116), James Mangum (2111), Timothy Mirabal (17351), John Nagel Jr. (2137), Catherine Naranjo (10762), James Porter (4152), Raymond Sanchez (12336), Samuel Sevier (2111), Gregory Wickstrom (2116); Team members: (External) John Bosnak, Marvin Dechant, Karen Day , Dave Everest, Ed Friebe, Stacy Landers, Becky

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NNSA team awards

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Larson, Dean Lugenbeel, Larry Ramsey, Joe Riehle, Bill Roberts, Donnie Shepherd, Tom Tarbutton, John Taylor (all Honeywell FM&T)

NNSA Milestone Reporting Tool Development Team

The NNSA Milestone Reporting Tool Development Team is being honored for exemplary leadership, teamwork, and expertise in developing the NNSA Nuclear Weapons Complex Milestone Reporting Tool. The MRT Development Team continues to be extremely customer-focused and flexible in integrating NWC-wide issues and developing innovative solutions. This team works on behalf of the NNSA with the entire NW Complex to identify, analyze, and solve difficult issues. The aggressive schedule, combined with unclear requirements, continues to demand clear communication, innovative ideas, and proactive thinking from all team members. Because the entire NW Complex is using this system, the NNSA has been able to reduce the time it takes to conduct quarterly reviews from three days to four hours. The most recent enhancements to the MRT will enable the NNSA to conduct this review via videoconference, resulting in annual savings of at least $400,000.

Team leader: Eva Wilcox (9725); Team members: (Internal) Brian Bowen (9515), Judith Case (9725), Michelle Chavez (9725), Gerald Esch (9520), Linda Gillis (9725), Michael Hagengruber (9618), Thomas Hunter (9000), Mark Lynam (9524), Dolores Maes (9725), Judith McKinney (9725), John Merson (6102), William Mertens (9618), Melissa Murphy (9600), Beverly Ortiz (9622), Michael Procopio (6222), Carlos A. Quintana (9617), Clifford Renschler (9710), James Rice (9700), Mary Roehrig (6224), Marilyn Williams (9725); Team members: (External) Terry Bearce (NNSA), Mike Brininstool (RhinoCorps), Anthony Contri (RhinoCorps), Kevin Emig (RhinoCorps), Charlie Fitch (RhinoCorps), Robert Frazer (RhinoCorps), Chad Hill (RhinoCorps), Daniel Kuhnley (RhinoCorps), Jesse Leiker (RhinoCorps), Paula Lozar (RhinoCorps), Clint Matthews (RhinoCorps), Dan McCorquodale (RhinoCorps), Anna Nowell (RhinoCorps), Harold Olsen (RhinoCorps), Freeman Pascale (RhinoCorps), Gino Rascon (RhinoCorps)

Next Generation Red Teaming

The Next Generation Red Teaming Team developed and implemented a significantly new methodology for "Red Teaming" security designs for DP applications in the context of today's threat scenarios. The team has meticulously developed this new red teaming methodology under tight schedule and budget constraints. The team completed the first red teaming study in time for designers to incorporate hardware enhancements in an ongoing DP design project headed for production. All study inputs and results were documented so that the customer could do design trade-off studies.

Team leader: Kathleen Gee (5945); Team members: Phillip Bryson (8222), Felipe Campos (5932), Gerald Cessac (5932), Ken Hessel (5942), Robert Kinzel (8226), Frank Lucero (5932), Robert Martinez (5932), Fred Mendenhall (5945), Raphael Molle (8241), Mike Morrow (5932), Steve Neely (8221), Debra Post (8226), John Saylor (2913), Debra Spencer (5935), David Straub (5942), James Van De Vreugde (8241), Marion Wilde (5942)

NG Flame Spray Feedback Control

The NG Flame Spray Feedback Control Team is being honored for developing a new flame spray system and associated feedback control approved for WR production. The flame spray activity addressed specific aspects of the production mission at Sandia that include reduced costs, reduced risks, and improved throughput. Process risk has been greatly reduced. The old flame spray system was so variable that it could not be relied upon to routinely produce high-quality deposits. Arguably the most important effect that the new flame spray control system will have is in holding conditions constant over long periods of time. Prior to the upgrades in the flame spray system, particle temperature variations of 100° C were commonly observed. With the new software, those variations have been measured on the order 10° C. The new system yields variations of about five m/s in particle velocity. Both particle temperature and particle velocity are key parameters in determining the quality of the deposit. Prior to upgrading the spray system, jumps in particle temperature caused substantial variations in deposition rate and deposit microstructure, leading to parts that failed inspection and an expensive evaluation of the parts. According to Floyd Spencer's (12323) measurements, the uniformity of the coatings produced by the new system are comparable to those produced by the old system when it was operating correctly. By the time neutron generators are flame-sprayed, 95 percent of their value has been built in. In other words, if there is a loss of failure in the flame spray process, it is potentially a loss of $71,600 per generator.

Team leader: Richard Neiser Jr. (1833); Team members: Edward Astle (14402), John Cates (1833), Ronald Dykhuizen (9116), Dominic Martinez (14401), Andrew Mayer (1833)

PCSS Team

The PCSS Team is being honored for developing Photoconductive Semiconductor Switch (PCSS) technology from discovery to application in the W80. The team's performance, dedication to improving the switches, and drive to meet customers' expectations resulted in an effort that crossed the infamous technology valley of death that spans applied research and demonstration/validation/use. The dedication includes a ~one-year effort to obtain funding from WFO (DoD) customers, the DOE/DoD MOU on Munitions, and LDRDs to accomplish the developments that enabled the application to nuclear weapons. The most crucial aspect of the group is a clear interest in meeting nuclear weapons requirements, even when funding was obtained from other, synergistic, customers that had other applications in mind.

Team leader: Guillermo Loubriel (15333); Team members: (Internal) Joseph Armijo (15333), Albert Baca (1742), Malcolm Buttram (15330), Gary Denison (1643), Harold Hjalmarson (9235), Alan Mar (15333), Martin O'Malley (retired), Lars Roose (15333), Fred Zutavern (15333); Team members (External): Darwin Brown (contractor)

Secure IP Based Video Conferencing Team

The Secure IP Based Video Conferencing Team is being recognized for its significant contribution related to deploying a NW Complex-wide Secure IP Based Video Conferencing Capability. The significant contribution of this team, related to the capability deployment itself, was the coordination and cooperation required to produce 1) a single security plan that could be adopted by all sites and 2) a single communication and connectivity infrastructure definition that could be implemented at all sites. The secure IP-based video conferencing capability is now routinely used throughout the NW Complex with as many as 24 different locations connected at the same time. The capability is designed to be expandable to full digital collaboration capability, including data sharing, visualization, and model manipulation.

Team leader: Diane Gomes (8947); Team members: (Internal) James Berry (8947), Brian Chamberlain (8947), Annette Hoff (8947), Sandra Trujillo (8947), Betty Walker (8947); Team members: (External) Laura Armour (Y12), David Bain (KCP), John Buck (Y12), Drina Cruz (LLNL), Chris Hopson (Pantex), Donna Howe (LLNL), William Miles (SRNL), Tom Morado (LLNL), Karl Pommer (LANL), William Rogier (SRNL), Michael Shepherd (Y12), Karl Sultemeier (Pantex), Sue Toler (Y12), David Williams (Pantex)

W80-3 LEP Warhead Interface Module Application-Specific Integrated Circuit Team

The W80-3 LEP Warhead Interface Module Application-Specific Integrated Circuit Team is being honored for outstanding efforts that achieved first-pass success of an Application-Specific Integrated Circuit (ASIC) in the Warhead Interface Module. The success of this program can be attributed to the resourceful and proactive attitude possessed by the team members to solve whatever problem that arose. The result of the efforts of the team paid off. Because of the accelerated schedule and first-pass success of these units, the WIM team will be able to deliver the first ground test units with operational ASICs that are representative of the final WR product instead of a substitute unit built with alternative parts. By eliminating the need for a substitute design, reusing previously developed functional blocks and eliminating the need for a second iteration of the ASIC, the team saved the program approximately $2 million.

Team Leader: Susan Esfahani (2612); Team members: Richard Anderson (1739), Stephen Babicz (1736), Wilson Barnard (1736), Stephen Becker (2348), Nathan Blaine (2337), Dale Brandt (2331), William Cavanaugh (1737), Rajen Chanchani (1745), Ronald Diegle (2331), Mark Diltz (1735), Steven Dunlap (1736), Debra Ebbesen (1745), Dennis Eilers (2337), Jeffrey Farrow (2331), Thomas Fischer (1745), Richard Flores (1735), Frank Hewlett Jr. (1737), Wesley Landaker (2339), Alan Lundin (1737), Kwok Ma (1735), John McBrayer (1732), John McClendon (2337), Rick McFarland (1737), Russell Mikawa (1737), Jason Millard (2331), Russell Miller (1735), Timothy Mirabal (17351), Perry Molley (2331), Christopher Nail (2331), Sean Pearson (1736), Alejandro Pimentel (1739), Marcos Sanchez (17351), David Schultz (2331), Jerry Soden (1739), Daniel Sprauer (2348), Steve Terwilliger (2331), Adam Umpleby (2331), Kurt Wessendorf (1732), Kathleen Wilkel (1735)

W76-1 Arming Fuzing Subsystem Team

The W76-1 AFS Team successfully flew the first-ever, low-cost, highly integrated AFS assembly for the US Navy FCET-30 Flight Test. The team developed extremely creative design and packaging concepts to meet cost goals, including a hybrid, single-board radar transmitter/receiver assembly, a digital logic assembly featuring a system-on-a-chip ASIC design, and a clamshell mechanical design that greatly reduced parts count. Also, the AFS boards are designed for automated fabrication techniques, which greatly reduce production cost. When this project was conceived, many engineers said that it wouldn't succeed, given the aggressive cost goals and schedule. The team persevered and solved many intractable problems to deliver the new design on-schedule and on-cost. Team members worked long hours and continually displayed creative problem solving during this process. This team also displayed a remarkable degree of cooperation and concurrent engineering between Sandia and the Kansas City Plant. The close nature of this team has been noted by upper management at both facilities, and is held as an example of how future programs should operate.

Team leader: Douglas Weiss (2333); Team members: (Internal) David Beutler (15341), Gerald Boyd (2331), Harold Cooper (2339), Douglas Deming (2339), John Dye (2331), Lucas Feldner (2333), Christopher Gallegos (2333), Brent Guess (5702), Richard Heintzleman (2333), Donald Jelinek (2344), J. David Kestly (2662), Josh Kidd (2331), Richard Knudson (2333), George Laguna (2333), Nancy Linarez-Royce (6883), Molly McCandless (2331), Andrew McKinley (2332), Shawn Mooney (2331), Ward Patitz (2345), J. Lee Schoeneman (2341), Clifford Sharp (2331), Anthony Trujillo (2996), Susan Tucker (2338), Roger Woodrum (2333); Team members: (External) Gary Andrews, Damian Brandenburg, Rod Brown, Clinton Cohagen, John Dokos , Jason Edgar, Roggy Harnden, David Jarrell, George McCarville, Mike McHenry, David Richards, Ed Schmidt, Ernie Sydow , Krista Ott, Ken Wagner, Larry Waters, Jim Williams (all Kansas City Plant)

NNSA awards

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outstanding leadership in managing the very complex Readiness Campaign ADAPT Process Development Program. The activity requires in-depth knowledge of weapons project priorities and needs. It requires insight into the weapon technologies and their strengths and weaknesses. It also requires considerable interpersonal skills for both internal and external customers and suppliers. Neil has been a leader in applying the lean manufacturing processes to the Sandia Concurrent Design and Manufacturing and neutron generator production requirements. Neil also represents Sandia on the ADAPT process development steering committee and is noted for his leadership and contributions to that group.

Dawn Skala

Dawn Skala (8751) is being recognized for her outstanding contributions in materials science for the WR Printing Wiring Assembly (PWA) technology. Dawn is the technology expert, advocate, and contact for WR and WR/JTA PWA product to the production agency with regards to material properties and performance issues. She writes and reviews processes, specifications, and failure analyses and is Sandia's representative on the IPC (International Institute for Interconnecting and Packaging Electronic Circuits) and routinely contacts other experts in the industry. She oversees the certification program for high reliability (hi-rel) assemblers at Sandia and investigates new processes and materials. Dawn also creates and manages specific process development agreements with the production agency in Kansas City. She is a behind-the-scenes expert relied upon to monitor and evaluate the quality and performance of Sandia's WR product.

Arthur Verardo

Arthur Verardo (2900) is being honored for his leadership in assuring the vitality and quality of the SNL/NWC Engineering Information Systems. Art has demonstrated outstanding leadership in managing and supporting all aspects of our engineering information systems. These systems are the critical resource for all Sandia's product design, development, manufacture, maintenance, and disposition. They are linked to all sites in the NW Complex, and their quality and integrity are absolutely critical. Art has led efforts to assure the continued quality and availability of this critical information as well as supported activities designed to improve on these existing systems. The improved access, availability, quality, and security of this information are critical to realizing the responsive infrastructure called for in the Nuclear Posture Review.

Long-awaited Red Storm supercomputer rising at Sandia

Machine to be faster, smaller, less expensive than its competitors

By Neal Singer

The world's fastest supercomputer — Sandia's Red Storm — should be one-quarter assembled by the end of September and completely up and running by January, says Director Bill Camp (9200), who heads the effort to design and assemble the machine.

BILL CAMP

Asked precisely how fast the new supercomputer would go, Bill said: "Really fast."

Early prototypes are already running Sandia and Cray software to test functionality and performance.

The $90 million, innovatively designed machine is expected to commence performance at 41.5 teraflops and in a year reach 100 teraflops.

The upward speed projection is not pie-in-the-sky but mathematically predictable. Next June, each processor will be replaced with two processors, each running 25 percent faster.

"Do the math," Bill says.

DOE requires for its investment that the new machine run seven times as fast as ASCI Red. "We think Red Storm will run ten times as fast," says Bill.

Unusually rapid assembly

Red Storm from concept to assembly also should be completed in record time.

"Cray historically has required four to seven years from concept to first product on a new supercomputer," says Bill. "Our goal was to field a brand-new supercomputer in 23 months. We're three months behind, but we'll still be under 30 months total when completed."

Not only is the extremely fast machine to be very rapidly assembled, it is relatively inexpensive by supercomputer standards.

Less expensive and why

Japan's Earth Simulator, currently the world's fastest supercomputer, cost $400 million to build. It also uses eight megawatts of power compared to Red Storm's projected two megawatts and takes up approximately three times the space.

"Historically, Sandia has received less money than the other two [defense] labs to purchase supercomputers because in the past it wasn't considered a Sandia line of business," says Bill. "To keep at the leading edge, we haven't been able to just go out and ask vendors for prices; instead we work with them to do more for less. Red Storm is a push-the-envelope machine we — Jim Tomkins (9220) and I — helped develop to meet our unique specifications."

The machine is slated to do work for the stockpile: design new components; virtually test components under hostile, abnormal, and normal conditions; and help in weapons engineering and weapons physics.

Cray was chosen because the company was "forward-looking, flexible, willing to work with us to design a new architecture, and had the lowest cost proposal."

The commercial future

The machine, because of its uniquely inexpensive design, may become the center of Cray's future supercomputer line, says Bill. "From Cray's point of view, the approach we're pioneering here is so powerful they want their next supercomputers to follow suit."

A large part of the costs incurred for the machine are non-recurring engineering design costs that Cray will not face in the future.

"Cray is used to building 'Rolls Royces' — entirely custom-designed, water cooled, with plumbing all over it," Bill says. "We couldn't afford that. Additionally, it'd be a nightmare for us to maintain because you'd have to disconnect the plumbing to repair a board. The way Red Storm is designed, we don't have to shut down to replace a part. We just don't do computations that involve that board until we decide to pull the board and fix it — all without shutting down."

The machine itself — a few facts

The machine has 96 processors in each computer cabinet, with four processors to a board. Each processor can have up to eight gigabytes of memory sitting next to it. Four Cray SeaStars — powerful networking chips — sit on a daughter board atop each board. All SeaStars talk to each other, "like a Rubik's cube with lots of squares on each face," says Bill. "Cray SeaStars are about a factor of 10 faster than any current competing capability."

Messages encoded in MPI (the Message Passage Interface standard) move from processor to processor at a sustained speed of five gigabytes per second bidirectionally. The amount of time to get the first information bit from one processor to another is less than five microseconds across the system. Four rows of machines, with approximately 11,600 Opteron processors and a similar number of SeaStars, will be the arrangement of the major components of the machine.

The SeaStar chip includes an 800 MHz DDR Hypertransport interface to its Opteron processors, a PowerPC core for handling message-passing chores, and a six-port router. SeaStars are linked together to make up the system's 3-D (X-Y-Z axis) mesh interconnect.

IBM will fabricate the SeaStar chips using 0.13-micron CMOS technology.

Visualization will occur inside the computer itself — a capability unique to Red Storm among supercomputers.

A proud moment

"One of the proudest achievements in my life was to help make supercomputing a line of business at Sandia," says Bill. "Look at where we are today. We've revolutionized the way we do business. I would claim that more than any other technology, computing affects everything we do at the Labs."

Security technologies

(Continued from page 3)

to fight it together."

Training and its expense was an area in which some panelists thought the WMD-DAC might be modified to bring virtual practice sessions into the firehouse for the rank-and-file responders who might find a similar challenge to playing a compact video game. Brooks said any new detection technology will need to be engineered for use by the lowest-trained person. St. John estimated that when employees are pulled into a day of training while backups fill in at overtime pay, it costs taxpayers some $100,000 to cover 10 fire stations.

Nash advised getting the technology out into the field for beta testing, and making sure it's touted as such. "I'm not going to rely solely on one piece of equipment," he cautioned. "We live with false positives every day."

Art Pontau said he found the emergency responder decision-making process fascinating and heard again the need for equipment that is robust and reliable but sometimes rudimentary. "The first people on the scene need to make initial safety decisions extremely rapidly. Support teams can rely on more complex tools that might take more time for a more reliable or more specific characterization. We at the national labs also need to push our birds out of the nest sooner." He remarked afterwards, "We learned an awful lot from them during the past two days; the emergency responders also expressed that they really appreciated us asking their opinions. We'll be building on our new personal relationships with these extraordinary people in coming days."

This monthly column highlights Sandia Lab News *items from 50, 40, 30, 20, and 10 years ago, but each column does not necessarily include items from each decade.*

50 years ago . . . "In response to numerous requests from club members," Coronado Club President Charlie O'Keefe clarified the club's dress requirements in the July 16, 1954, issue . . . at least for men: "At stated functions," he said, "a shirt and tie, or jacket will be required in the ballroom area. Naturally, when you're bowling [the club had bowling alleys then], or in the bar, a sport shirt and slacks will be correct." He made no mention of any dress requirements for women. . . . The July 30 issue featured Labs employees and families occupying on-base living units. At the time, 97 dorm rooms, 72 efficiency apartments, 136 two-bedroom apartments, and 269 houses were available for Sandians and families. The efficiency apartments rented for $55 a month, all utilities included.

40 years ago . . . Although Sandia was not involved in this study, a July 31, 1964, story reported that the Atomic Energy Commission (predecessor to today's DOE) was funding a Kentucky laboratory to investigate the possible effects of ionizing radiation on tobacco. The idea was that "massive irradiation of tobacco in cigarettes prior to smoking might modify some of the compounds that are thought to produce harmful products in the smoke...." Nice idea, but it obviously didn't pan out as hoped. . . . A July 17 story reported that "pert Gail Barton," a recent graduate from Arizona State, would be the first woman ever to enter Sandia's Technical Development Program (TDP) that fall at UNM, along with 44 men. TDP employees worked part time at Sandia and attended university classes part-time.

GAIL BARTON, first woman to enter Sandia's Technical Development Program, in 1964.

20 years ago . . . The July 6, 1984, issue reported that 93 percent of Sandians were buying U.S. Savings Bonds through the payroll deduction plan, making Sandia tops in the nation for buying bonds for a company its size. Savings bonds were paying 9.95 percent interest at that time. . . . The July 20 issue reported that electricity had begun flowing into a New Mexico utility grid from "the nation's newest solar central receiver system" — the Molten Salt Electric Experiment — at Sandia's Central Receiver Test Facility. The system used solar-heated nitrate salt to generate steam to drive a turboelectric generator.

10 years ago . . . The Labs' new Knowledge Preservation Project to videotape interviews with early-day nuclear weapon designers before they left the Labs (or the Earth) was reported for the first time in the July 8, 1994, issue. The first five interviewees were retirees Max Newsom, Jack Wirth, and Charlie Burks, and soon-to-retire Henry Street and T. J. Williams. . . . A Sandia-developed robotic vehicle, RETRVIR, was the star in a ground-breaking ceremony reported in the July 22 issue for the new 73,000-square-foot Robotic Manufacturing Science and Engineering Lab, now home to the Intelligent Systems and Robotics Center. — *Larry Perrine*

A Sandian in Jeopardy

Sandia intern Ryan McClarren recounts brush with Jeopardy *phenom Ken Jennings*

When we heard that Sandia graduate student intern Ryan McClarren had gone mano a mano *with Ken Jennings, the greatest* Jeopardy *player in the popular TV game show's 20-plus-year history, we invited him to tell* Lab News *readers first-hand about his adventure. Here is Ryan's story.*

It seems as though *Jeopardy* hotshot Ken Jennings is becoming something of a cultural icon. [Through Tuesday Jennings had won 35 consecutive contests, amassing $1.165 million in winnings.] My name is Ryan McClarren; I am a graduate student in nuclear engineering at the University of Michigan and a Sandia intern working with the high energy density physics group (org. 1674) on my PhD research. A few months ago I had the opportunity to engage Ken in the sweet science of quiz show combat, under the watchful eye of Alex Trebek and a live studio audience. (The shows are taped several months in advance; mine was broadcast June 29.) After all the answers were read and the questions correctly identified, Ken remained champion, but remaining true to the maxim "There is no shame in being beaten by the best" here is my story.

Dreams of *Jeopardy* glory

When I arrived at the *Jeopardy* studio in Culver City, Calif., on that sunny morning, my head was awash with dreams of *Jeopardy* glory. I imagined what it would be like to "make it a true daily double" or wager it all in Final Jeopardy. In those fantasies I also made it to the Tournament of Champions, where the best of the best vie for a spot in *Jeopardy's* pantheon — and some serious cash. The other contestants who were there with me conjured up similar images in their heads, too.

All the studying and toiling over the marginalia of American and world culture was packed into our heads. I could have told you the origin of the word ketchup (it comes from the Malay word *kechap*, which means fish sauce) or list the works of Heinrich von Kleist.

I was ready, or so I thought. Here I am with all the new contestants doing our pre-show miscellany (forms, makeup, etc.), when in walks an unassuming, foppish towhead by the name of Ken Jennings. We are told he is the returning champion, which to me was not a big deal — every show has a returning champion. Then, it was revealed to us that he was the winningest *Jeopardy* contestant ever.

ALEX TREBEK AND RYAN McCLARREN

Now for a quick aside regarding the secret to *Jeopardy* success. There are two components every effective contestant must have. The first is obvious to even the casual observer: a good player will have a voluminous knowledge of the sort of facts most people refer to as trivia. Almost all *Jeopardy* contestants have this from studying prior to appearing on the show. Ken was no exception to this rule and in fact he is better in this area than most.

Buzzer speed is vital

The second *sine qua non* is what I shall call buzzer speed. Most people do not realize this, but on the *Jeopardy* set there is a string of lights on the bottom of the gaming board, just outside of the area shown on TV. These lights come on when Alex is done reading the question. A player cannot ring in until those lights go on. A contestant pressing the button early is penalized (locked out from ringing in) for some fraction of a second. Because Alex does not read every question with exactly the same cadence, the ringing in is more of an art than a science. As Michelangelo is to Renaissance art, Ken Jennings is to the art of *Jeopardy* ringing in. This is what makes Ken so difficult to play against: not only does he know most of the answers, but when he does know, he is almost always the one buzzing in first. Watch a game that he plays in — rarely does he get beat to a question that he knows. You will also see the other two contestants ham-fistedly trying to ring in before him.

Now to the match I played in. Five episodes were being taped that day, and for each game two new contestants were selected at random. My number came up for the third game. I had just watched Ken maltreat his opponents in two games and I was determined not to allow that to happen to me.

Who is Admiral Farragut?

When the show began I was understandably nervous, but once I heard announcer Johnny Gilbert say my name, time somehow sped up. What is a half-hour on TV felt like it took five minutes to tape. In the beginning Ken jumped out to a trifling lead on the low dollar figure questions, but then I stole a few questions from him and hit a Daily Double. I bet the farm and was correct ("Who is Admiral Farragut?" was the correct response). I was sitting on a lead against Ken; I could taste victory.

The first round finished off with Ken taking the lead again, but only slightly. I thought Double Jeopardy would hold good things for me. One of the categories was classical music, a topic I had studied extensively. What I didn't know is that it was one of Ken's specialties, and he proceeded to get most of those questions. Another category was food, but it should have been called "types of food Ryan has never heard of." The other contestants nailed most of those.

In the process of this round Ken hit both Daily Doubles and went into Final Jeopardy with a sizable lead. In Final Jeopardy my only hope was to put my money where my electronic pen was and bet almost all of it, hoping Ken would misstep. He answered correctly, I didn't, and I ended with one dollar. (Luckily, all *Jeopardy* contestants get a cash prize based on what place you finish, so I walked away with more than a buck.) I shook Ken's hand and that was the last I saw of him — in person that is.

Management promotions

New Mexico

Michael Prairie from Manager, Thermal, Fluid, and Aero Experimental Sciences Dept. 9112, to Level II Manager, Power Sources Dept. 2520.

MICHAEL PRAIRIE

Mike joined Sandia's Solar Thermal Technology Department in January 1990. He worked on photocatalysis R&D for his first five years and then became project manager for Sandia's Contribution to the 10MW Solar 2 demonstration near Barstow, Calif.

In 1998, Mike was promoted to Manager of Geothermal Technology Dept. 6211, where he helped develop, among other things, the concept of Diagnostics-while-Drilling, a revolutionary approach to controlling damaging drill bit dynamics in real time.

Mike moved in 2001 to the Engineering Sciences Center, where he took over the Thermal, Fluids, and Aero Experimental Sciences Department, managing experimental research in aerodynamics, heat transfer, and fluid mechanics. The department's emphasis was on diagnostics development, discovery experimentation, and collecting high-fidelity data for validating Sandia's ASC computer models.

Mike has a BS in chemical engineering from the University of New Mexico and a PhD in the same field from Caltech.

Before coming to the Labs, he did two-and-a-half years postdoctoral work in Lausanne, Switzerland, where he focused on in-situ measurements of adsorbed species during heterogeneous catalytic reactions.

* * *

Tim Berg, from PMTS, Microsystems Partnerships Dept. 5944, to Manager, Microsystems Partnerships Dept. 5944.

Tim began work at Sandia in October of 1994 at the California site Exploratory Systems Group where he had a variety of assignments. As leader of the Virtual Reality Laboratory, he worked on developing virtual environments with realistic, real-time physical and material properties for complex systems design, analysis, and assessment. He also led research efforts on parallel information fusion for chemical, biological, and nuclear sensing to aid the development of microsensor technologies for biomedical discovery and national security applications.

Transferring to New Mexico in September of 2000, Tim continued LDRD work on information flow in decentralized systems at the Intelligent Systems and Robotics Center. He also participated in the Business Development Scholarship Program and Advanced Sales Training Program, performing program development in the areas of microsystems technologies for robotics and systems studies. Tim's matrix involvements leading vulnerability assessments for 5900 grew, and in May 2002 he transferred to 5900.

TIM BERG

Before hiring on at Sandia, Tim was a visitor in Multisensor Data Fusion at the Department of Electrical Engineering of the University of Melbourne in Australia. Prior to that, he studied international manufacturing competitiveness and adaptive control theory at Lund University in Sweden as a Fulbright Scholar. Tim's education includes a BS from the University of Minnesota with internships at 3M emphasizing biomedical devices, a master's from the Massachusetts Institute of Technology in advanced materials processing, and a DPhil. from Oxford University (United Kingdom) in Engineering Science. Tim was also awarded two US patents before coming to Sandia.

Sympathy

To Regina (14409) and Patrick Jaramillo (14401), and Alfred Sanchez (14113), on the death of their father, Elfego Sanchez, who was also the grandfather of Kathryn Avila (14115).

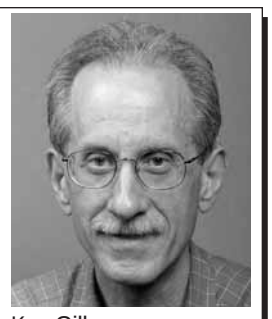
Mileposts

New Mexico photos by Michelle Fleming


James Anastasio
40 14402


Preston Herrington
40 5736

Recent Retirees


Ken Gillen
30 1811


Ron Detry
35 4000


Roger Goode
35 4117


Paul Hatch
35 9123


Galen Puls
35 2111


Evelyn Loretta Tuttle
30 10848


Jean Marie Prusak
25 2552


Rodney Shear
30 15322


Gary Shepherd
35 9335


Vincent Dandini
30 6864


Anne Louise Hodges
30 9905


Ray Patteson
20 6117


Fran Phipps
19 5901


David Werling
30 2431


Alice Starcher
25 2994


Thomas Stueber
25 5733


George Vernon
25 2614


Jack Wise
25 6211


Kit Colman
20 2550


Paul Justice
20 59201


Clinton Landron
20 2664


David Muron
20 1744


Thomas Pratt
20 9338


William Cordwell
20 5943


Richard Craft
20 5511


Manuel Prieto
20 9335


Gregory Sjaardema
20 9143


Clara Gallegos Chacon
15 10507


David Harding
15 12333


Shawn Leslie
15 2346


Jane Carroll Marbach
15 3332


Kimball Merewether
15 12333


Deborah Mulligan
15 3522


Darell Rogers
15 4154


Gary Simmons
15 2564


Katherine Simonson
15 5531


Christopher Strome
15 6323

Sandia 'Working on the railroad'

By Will Keener

Sandia has been working on the railroad — on the Cumbres & Toltec Scenic Railroad. That's the one that huffs and puffs its way across the mountains along the New Mexico-Colorado state line with loads of tourists aboard.

In response to a request from Lt. Gov. Diane Denish, Ted Borek (1822) and Don Susan (1861) traveled to Chama to help with an important project this spring. "We got a call from our small business group and they said the railroad needs some help," says Ted. "We said 'sure.'"

"The railroad isn't permitted to weld on trains unless they know the composition of the metals," explains Ted. With a train yard of 10 steam locomotives and only two running, railroad officials needed to move forward with repair and maintenance schedules. Lacking a way to determine the composition of several key locomotive components, they asked New Mexico for help.

COLD CHISEL — A Cumbres & Toltec railroad worker hammers away on this massive locomotive driving rod to get a few tiny scraps of metal for Sandia to test. (Photos by Ted Borek)

Lt. Gov. Denish's office passed the request to Sandia. "I love doing these small business projects," says Ted, who has been involved in several others.

Ted traveled to Chama in late March and returned with drill borings from several key parts and slivers of metal removed from a massive locomotive driving rod with a cold chisel. "This was a routine analysis for us, but they were thrilled we could help them out and provide a quick turnaround."

"The metallurgy was required to determine a safe and suitable welding procedure for the main driving rod on the locomotive," explains Kim Smith Flowers, long-time Chama resident and general manager of the Rio Grande Railway Preservation Corp., which operates the narrow gauge. "We had to make that determination before we could approach repairing the rod in a way that would be acceptable to the Federal Railroad Administration.

Ted's team — Jeanne Barrera, Jeff Reich, Christine White, Polly Wilks, and Steve Meserole (all 1822) — performed the analysis. They dissolved the metals in acid and ran them through

WRAPPER PLATE — Without the engine cab, the large plate surrounding this steam locomotive's boiler is revealed. This was one of several key components sampled by Sandia to help keep repairs on

instruments to determine iron, chromium, and nickel content. "It was routine carbon-steel, probably considered state of the art in 1925," says Ted. Don Susan returned to Chama with Ted a week after the samples were collected to test the materials for hardness.

Information on the metals was submitted as a part of a package to the railroad administration, to get needed welding permits and keep the repairs on schedule.

"We are always looking for principal investigators to work on projects like these," says Mariann Johnston (13021) of the Labs' Small Business Assistance program. "It's an opportunity for technical staff to work with small businesses outside the normal everyday projects they do and make a difference for New Mexico. In some cases, it can be technically challenging."

Funded by a special state tax credit, amounting to $1.8 million annually, Sandia helps about 300 businesses each year with a variety of problems. Any New Mexico for-profit business can apply for help not otherwise available at a reasonable cost through private industry through the program. Sandia researchers have found themselves investigating other issues such as plastic irrigation ditch liners, applying new technologies for bar-scanning cattle, automating chile harvesting/cleaning, and a wide variety of consulting and testing for small businesses. "We earn a tax credit to cover the costs of labor hours the principal investigator puts toward the problem. Currently, we are fully allocated for calendar year 2004 and have other businesses on a waiting list," Mariann says. (Sandia hopes to increase the $1.8 million limit with the state in the future.)

"This is another example of how we can give back to the state we live in," says Sandia's Jerry Hanks (12100), who works on special assignment as a scientific advisor in the Lt. Governor's office. "This is the tip of the iceberg, really." Jerry sees many possibilities for Sandia involvement in the Cumbres & Toltec Scenic Railroad, specifically, and for New Mexico small business in general.

Los Alamos National Laboratory is also helping the railroad operation by donating some equipment it no longer needs to the railroad's machine shop, he notes.

A related project under consideration would create a historic railroad Center of Excellence in northern New Mexico, with an annex in Chama, Jerry says. Such a center would rebuild steam engines and machine parts, providing expertise transferable to other historic railways around the country.

"You can't buy parts off the shelf for a 125-year-old railroad," says Jerry. "The train needs high-tech solutions and right now the machine shop is 1950s at best."

Such a center would teach technical skills to young people and help them find employment in the area. "We envision this to expand beyond machine shop skills to drafting, welding, and perhaps into other related industries that the hospitality and tourism industry might benefit from," Flowers says.

Some observers believe such a center could provide a significant economic impact to the Chama area, turning the railroad into a year-round operation instead of the seasonal attraction it is now. (A steam engine overhaul costs roughly $1 million.)

A first step toward this vision involves a new welding and metallurgy certification program and training center at the railroad's machine shop. This would be done in collaboration with the railroad, Northern New Mexico Community College, the two New Mexico national labs, and the Regional Development Corporation.

In all, $31 million is needed for the five-year plan to bring the Cumbres & Toltec to year-round operation with modern communications, a 21st century repair shop, and other needed upgrades, rail officials estimate.

"The goal is to make the railroad self-sustaining," says Jerry. Currently, the states of New Mexico and Colorado contribute most of the narrow gauge's capital improvement and operating income.

Sandia shows SAR technology at 50th anniversary radar symposium

RADAR SYMPOSIUM — Sandia's synthetic aperture radar (SAR), mounted on the NNSA's DeHavilland DHC-6 Twin Otter aircraft, was exhibited June 23 at the 50th Anniversary Tri Service Radar Symposium. Some 300 people, representing Sandia, US military organizations, Department of Defense (DoD), industry, and universities, attended the classified conference hosted by Sandia. The Twin Otter and other aircraft were part of an unclassified display at the NNSA Aviation Facility on Kirtland Air Force Base. NNSA and KAFB personnel were part of the operational and security support team that made the symposium successful. Sponsorship of the symposium rotates among the three military services — Navy, Air Force, and Army. This year the sponsor was the Army. Sandia's VP for DoD Programs, Jim Tegnelia, welcomed the symposium attendees. Pictured above is Darrell Kirby (2342) at the control station where SAR images are displayed. Below is Steve Reber (2342) with a SAR antenna. (Photos by Bill Doty)