

Reporter

OAK RIDGE NATIONAL LABORATORY

Managed by UT-Battelle for the U.S. Department of Energy * Issue Number 67 June 2005

Old tech, new mission

Advanced nuclear reactor concept borrows from ORNL's seasoned Molten Salt Reactor

With fossil fuel prices climbing and no new petroleum fields discovered in decades, nuclear energy is beginning to once again receive serious consideration as an energy alternative. DOE has embarked upon a program to design the next-generation nuclear reactor, drawing from a wealth of designs and ideas.

A proposed next-generation design that is attracting attention is based on a previous generation's work: ORNL's Molten Salt Reactor Experiment. Researchers in the Lab's Nuclear Technology Program Office and Nuclear Science and Technology Division are touting a design that would use hot, liquid fluoride salt, which was mixed with uranium fuel in the old MSRE but is "clean" in this concept, to cool a power generation reactor.

The NTPO's Dan Ingersoll says the idea arose as a "spare time" project for a group of the Lab's nuclear technology experts. They prefer the modifier "liquid" over "molten" to distinguish between the new concept's clean coolant and the old project's molten mixture of uranium fuel and salt.

"Gordon Michaels, who was over the NTPO at the time, lobbied an idea to use solid reactor fuel and use clean liquid salt as the coolant. Charles Forsberg picked up the ball

and ran with it, putting together a collaboration with Sandia and the University of California-Berkeley," says Dan.

Gordon later left NTPO to apply his ideas to ORNL's first homeland security science program. Charles, of the Nuclear S&T Division, is one of the nation's most-cited authorities on nuclear power.

The most accepted and common designs for power generation reactors are the water-cooled reactor the gas-cooled reactor. Both have their advantages, Dan says, but they have their drawbacks.

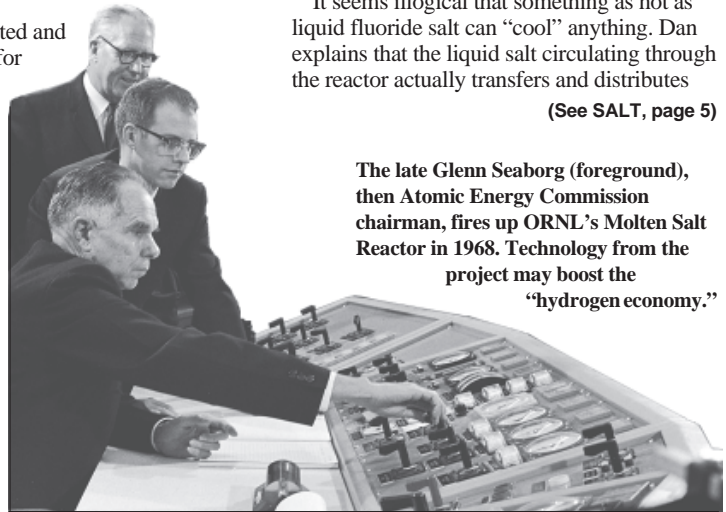
"Gas-cooled reactors are cooled with helium, which is a poor carrier of heat. With water-cooled reactors

you get boiling liquid, which you don't want, and that limits the temperature at which you can operate the reactor," Dan says.

"A typical light-water reactor is running at 350°C. You need about 850°C to generate hydrogen on a large scale (see sidebar), which is a prime objective of DOE's Advanced Reactor Program."

It seems illogical that something as hot as liquid fluoride salt can "cool" anything. Dan explains that the liquid salt circulating through the reactor actually transfers and distributes

(See SALT, page 5)



The late Glenn Seaborg (foreground), then Atomic Energy Commission chairman, fires up ORNL's Molten Salt Reactor in 1968. Technology from the project may boost the "hydrogen economy."

The wait is over: F&O drastically reduces job cycle times

If you're in the dark, the drain is slow or a breaker's thrown, the wait is over. Facilities Management Division staff have reduced the

average cycle time on routine repair maintenance orders to approximately three days. Just a few years ago the average was more than 40 days.

FMD Director Jimmy Stone says the secret of their success lies in the efforts of FMD staff members and crafts and the adoption of a scheduling tool.

"We schedule the work—it's that simple," says Jimmy. "We know what jobs need to be done and individuals are assigned to accomplish those tasks."

Complex facility managers and their teams meet and use the scheduling tool to plan resources around customers' service requests in their daily "plan of the day" meetings.

The roughly 250 workers

that FMD call on from Facilities & Operations' Craft Resources Division are completing 50,000 jobs a year. The work is referred to as grade 4 tasks—those that require no special permit or lockout procedures. They include jobs such as changing lights, unclogging drains and hanging pictures.

ORNL staff members have often expressed frustration over the long wait for certain repairs to be made. Worse, the delays often impeded research.

The gains in efficiency come just as the Lab has grown in terms of both new and old facilities and in programmatic work. ORNL's new space—mostly the new east campus facilities—doesn't require as much maintenance. On the other hand, as the older facilities get ever older, they need more upkeep. And there are more of them. Old facilities currently outnumber the new by

(See CYCLE, page 2)



Curtis Boles

Craft Resources Division's Reggie Thompson (left) and Herschel Brooks service an electrical panel. Facilities and Operations staff members have cut job request cycle times to nearly zero.

Harrison, Mezzacappa, Thundat named Corporate Fellows

Three researchers—Robert J. Harrison of the Computer Science and Mathematics Division, Anthony Mezzacappa of the Physics Division and Thomas G. Thundat of the Life Sciences Division—have been named UT-Battelle Corporate Fellows.

The Corporate Fellow designation is the highest level of recognition for career achievements in science and technology, performance and leadership. Lab Director Jeff Wadsworth says that awardees' contributions to international leadership in research, new and expanded research programs and mentoring of staff are vital to the success of the Laboratory as a whole.

Robert Harrison joined ORNL in 2002 as group leader for Computational Chemical Sciences following a distinguished career at Pacific Northwest National Laboratory where he was a Battelle Fellow. He holds a joint appointment with the University of Tennessee, where he is a professor in the chemistry department.

Widely recognized for his work in the electronic structure of molecules, computational chemistry and high performance algorithms and computing, he is chief architect of NWChem, the world's leading computational chemistry code, now used at more than 1000 sites worldwide.

Tony Mezzacappa, a leader in computational astrophysics and a pioneer in the field of supernova science, was the first to implement Boltzmann kinetic theory to model neutrino transport during supernova explosions, a theoretical and numerical feat long thought impossible. Since joining ORNL in 1996, he has conceived, proposed and now leads the Terascale Supernova Initiative, a multi-million dollar, multiyear DOE initiative involving several dozen researchers at a dozen institutions around the world. TSI is one of the world's largest

computational astrophysics initiatives.

Tony is a fellow of the American Physical Society and received the Presidential Early Career Award in Science and Engineering in 1999.

Thomas Thundat is a world leader in nanomechanical sensors. His work in biomedical engineering and biotechnology, micromechanical sensors, and nanoscale imaging and detection has been featured in *Time* magazine. His numerous national and international honors include two R&D 100 Awards, three Federal Laboratory Consortium in Technology Transfer awards, the Jesse Beams Award, the *Discover* Award, ASME Pioneer Award and the *Scientific American* Top 50 Technology Leaders Award.

The author of more than 170 scientific papers in refereed journals, Thomas has



Harrison



Mezzacappa



Thundat

received 19 patents for nanomechanical sensor technologies ranging from medical instrumentation to land mine detection. Thomas is a Battelle Distinguished inventor and a Fellow of the American Physical Society. He is also a research professor of physics at UT and a visiting professor at the University of Burgundy, France.

Cycle

Continued from page 1

about 300 to 10.

A prime example of an aging infrastructure is the 4500 complex, the 1950s era home to labs and offices that, frankly, doesn't look that bad on the outside. But the complex literally is a poster child for aging facilities: The 4500 complex's problems are outlined on a poster affixed directly across from Jimmy's desk.

The 4500 complex is a 700,000-square-foot fixer upper. For instance, nearly a third of the complex's ventilation supply fans failed during the past year. Fan failures shut down labs, which stops R&D work. In one calamitous event a few years ago, a lightning surge blew out 60 fans at once. Then there are the usual nuisances like ancient electrical panels, clogged drains, roof leaks and crumbling walls.

FMD keeps it all running despite the challenges.

In particular, although the heating and air conditioning crew is usually going at full tilt, the complex's aging ventilation system often gives problems. The building's climate control is difficult to balance, particularly when the seasons change.

Nevertheless, when President Bush visited last July on what was arguably the summer's muggiest day, a packed Wigner Auditorium was kept comfortable for several hours.

Older facilities are energy hogs. Jimmy notes that the 4500 complex uses 300 percent more energy per square foot than the energy-efficiency-certified new facilities.

The 4500 complex isn't the only set of buildings with infirmities. Building 1505 on the west end has a high-maintenance chiller system and a currently inoperable vacuum system. Many of the Lab's 350 older buildings are in similar shape.

"We have aging infrastructure that causes operational impacts with increasing frequency," Jimmy says.

Jimmy credits the FMD staff with keeping researchers happy (in a recent survey customers said things have generally improved) and doing more with less. He gives an example:

"The industry standard of square feet that janitors are responsible for is 25,000 square feet. Our janitors are responsible for an average 55,000 square feet," he says.

Eventually, a facilities upgrade plan and funding will bring many of the old facilities up to snuff with the newer ones. In the meantime, FMD is working to keep the lights on and water running.

"We need to provide world-class support for world-class research," Jimmy says. "Currently the FMD people in the field are striving to provide that support."

If you have a facilities maintenance or repair job, submit a service request via the Web, www.fo.ornl.gov/apps/prod/svcreq/. —B.C.

Reporter

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is published for employees and retirees of ORNL, which is managed and operated for the U.S. Department of Energy by UT-Battelle.

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Curtis Boles

The Physics Division's Chang-Hong Yu helped demonstrate a traditional Chinese dance during May 17th's Asian Pacific American Heritage celebration.

Lab Notes

Community Day coming in August

ORNL is planning a Community Day, its first since 1997. Outsiders who last visited then will hardly know the place.

In fact, plans are for the open house to feature the Spallation Neutron Source and the new east campus “quad,” which has been receiving finishing touches, including sod on its grassy commons area, in the past weeks. The new grass has time to take hold: The date for Community Day has been set for Saturday, August 27.

Because security has changed a lot since 1997, visiting family members and members of the public will need to preregister. Because of the expected large number of attendees, other areas of the Lab outside the SNS and quad won't be accessible to visitors. Nevertheless, the doors will be open to U.S. citizens and foreign nationals alike, as long as they sign up. Watch local media and *ORNL Today* for details on how to register friends and family members.

Community Outreach Manager Brenda Hackworth says Lab divisions will be invited to set up displays and activities for the event, which will run from from 9 a.m. to 3 p.m.

“Other national labs who have had open houses recently have drawn huge crowds, and with our new campus and new facilities like the SNS, we expect droves,” Brenda says.

Mark August 27 on your calendar and stay tuned for details.

Busy summer on BVR

Jeff Wadsworth slipped in a bombshell in a recent Director's Message that focused on safety: Six-foot-wide shoulders will be paved alongside Bethel Valley Road in both directions this summer. The whoops of joy that reverberated across the Lab were from joggers and bicyclists who have cursed the rough and unfriendly roadside for years.

Facilities and Operations' Norm Durfee says the paving will likely take a couple of months this summer. Initially the six-foot-wide twin pathways will extend between the east and west vehicle entrances.

Bruce Siefken of the Research Reactors Division used to bicycle to work often before heavy morning traffic and loose gravel dissuaded him. “I'm looking forward to that

getting done; it'll be a big improvement,” Bruce says, speaking for the Lab's small cadre of two-wheel commuters.

Bethel Valley Road will also gain its roundabout, or traffic circle described in *Reporter* No. 66, this summer at the Visitor Center entrance. Construction will require a temporary rerouting of Visitor Center access, probably after July 4, back to the old route down Fifth Street and along Central Avenue through the currently closed portion of Central to the Research Support Center.

Commuters will also witness the installation of a new security barrier just past the portals. The barrier—a net—is designed to pop up and snare any intruding vehicle that has gotten past the entrances. Motorists needn't worry: There are plenty of alarms that sound before the net deploys, if it ever needs to.

Norm says planners will try to keep impact on commuter traffic to a minimum. For instance, work on the roundabout might be conducted mostly in the evenings. But expect the occasional lane closing and flagmen on the road.

“Please drive carefully during this summer's road work,” Norm says, which goes without saying.

And on the west end...

Except for the new Mouse House, the Lab's west end has escaped much of the construction activity. That is about to change.

Preliminary work on the Joint Institute for Biological Sciences has begun, which has necessitated closing the parking lot on the east side of Building 1505. Work on that new state-funded facility probably won't begin until later.

However, another nearby landmark's days are numbered. Residents

of Building 1000 have been moving out in preparation for that rustic facility's demolition this summer.

The place has some history behind it. The H-shaped structure was moved, says ORNL history buff Steve Stow, in three pieces from the old K-25 plant in 1948. More recently it's been famous for its homesteading wildlife, including raccoons that have tumbled through the ceiling and skittered down the hall.

Residents are being dispersed to various temporary locales, including Commerce Park near town and Building 4500-North. The target date for demolition, says Facilities Development's Lance Mezga, is September 30.

Answering the call again

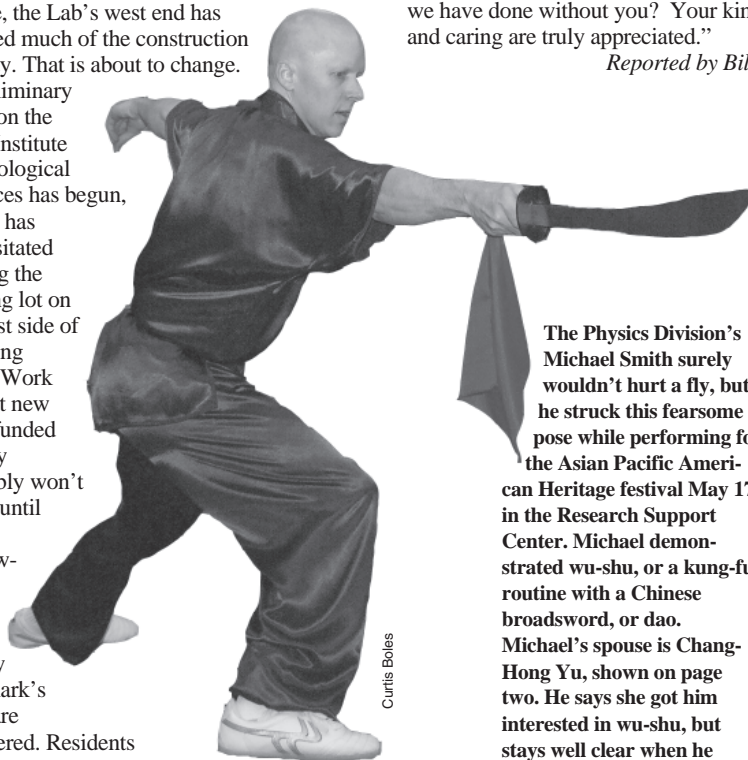
Earlier this year ORNL staff members opened their hearts and wallets for tsunami relief. It wasn't long before a need hit closer to home.

One evening in April, Chemical Sciences Division staff member Linda Pyles, her husband and grandson were awakened by a smoke alarm. They managed to get out of their home safely before the blaze destroyed all their possessions, which were uninsured.

An account was established in the ORNL Federal Credit Union, similar to the one set up for the tsunami effort. Lab employees again rose to the occasion, contributing more than \$10,000 to the Pyles' recovery from their plight.

“Thank you so much to all my ORNL friends who have been and continue to be so kind, generous and caring to my family and me since the fire,” Linda says. “What would we have done without you? Your kindness and caring are truly appreciated.”

Reported by Bill Cabage



Curtis Boles

The Physics Division's Michael Smith surely wouldn't hurt a fly, but he struck this fearsome pose while performing for the Asian Pacific American Heritage festival May 17 in the Research Support Center. Michael demonstrated wu-shu, or a kung-fu routine with a Chinese broadsword, or dao. Michael's spouse is Chang-Hong Yu, shown on page two. He says she got him interested in wu-shu, but stays well clear when he rehearses.

SEAs

ORNL employees cited in latest round of Significant Event Awards

ORNL recently distributed its latest batch of Significant Event Awards. Congratulations to the following recipients, who are identified with their accomplishment and host division.

A major proposal win that established ORNL at the forefront of ecosystem genomics and the use of molecular information to forecast ecosystem change. Team: Stephen P. Difazio, Stan D. Wullschleger, Timothy J. Tschaplinski and Christopher W. Schadt of Environmental Sciences

Annotated genomes prepared for initial release of Integrated Microbial Genome database. Team: Miriam L. Land and Frank W. Larimer of Life Sciences

Supported tsunami disaster humanitarian relief efforts by providing up-to-date, high-resolution population distributions using ORNL's LandScan Global population database. Team: Budhendra L. Bhaduri, Edward A. Bright and Phillip R. Coleman of Computational Sciences & Engineering

Center for Computational Sciences' initial installation of RSA Security's token-based access for computing platforms. Team: James W. Simmons and Sally A. Silvia of Networking & Computing Technologies, Don E. Maxwell and Kenneth D. Matney of Computer Science & Mathematics and Suzanne W. Willoughby of Networking & Computing Technologies

TeraGrid milestone: Transition to operations for the Neutron Science TeraGrid Gateway for the ORNL TeraGrid Project. Team: Susan E. Hicks of Networking & Computing Technologies and Gregory G. Pike of Computer Science & Mathematics

New USEC modified eddy current balance probe performance certification. Team: Marcus L. Simpson, Michael S. Emery and Charles R. Schaich of Engineering Science & Technology

Successful completion of methods development and validation for the Nuclear Regulatory Commission. Mark D. Dehart of Nuclear Science & Technology

Development of advanced operating scenarios for the ITER fusion experiment. Team: Masanori Murakami and Mickey R. Wade of Fusion Energy

Rapid resumption of vital classified computing operations under new A-CREM rules and dramatic reduction of classified media inventory. Daniel S. Clark of Nuclear Science & Technology

Completion of a 200-page document to meet a DOE joule milestone. Team: Richard L. Schmoyer and Lorena F. Truett of Engineering Science & Technology

Capturing a lead role for ORNL to evaluate the use of cost-effective cementitious material

in the Yucca Mountain Repository. Leslie R. Dole of Nuclear Science & Technology

Development of extraordinary two-company, co-sponsored project in diesel emission controls. John F. Thomas of Engineering Science & Technology

Successful design and deployment of an ORNL Radio Frequency Identification system at the Defense Logistics Agency's two main distribution centers to meet the specified capabilities and ambitious schedule of the Department of Defense's RFID policy. Team: Teresa A. Rose of Computational Sciences & Engineering and Bobby R. Whitus, Kathy W. Hylton, Regina K. Ferrell, Richard W. Jones, Richard I. Crutcher, Simon D. Rose and Kenneth S. Weaver of Engineering Science & Technology

Provided technical leadership and support to upgrade the HFIR electrical distribution system. Team: Tommy J. Ledford, Mark E. Mathews and Richard H. DeCosta of Research Reactors

Completion of the HB-4 HFIR Shield Tunnel. Team: John A. Ellis and Donald L. Garrett of Facilities Development and Young S. Kwon and Joan T. Muecke of Research Reactors

Developing and successfully deploying the Spectrometer Instrument Control Environment, thereby enabling a new generation of neutron scattering experiments. Team: Mark D. Lumsden, J. Lee Robertson and Mohana Yethiraj of Condensed Matter Sciences

HFIR Instrument Air Upgrades to modify and improve the instrument air supply. Team: Dave G. Davenport and Mark E. Mathews of Research Reactors

Exceptional contribution to Weigh-In-Motion program. Richard M. Davis of the National Security Directorate

For receiving the Presidential Early Career Award for Scientists and Engineers for his pioneering approach to the study of magnetism in nanostructure materials synthesis. Jian Shen of Condensed Matter Sciences

Discovery and first experimental demonstration of strong polarization enhancement in asymmetric three-component ferroelectric superlattices. Ho Nyung Lee of Condensed Matter Sciences

Production of 125 clad vent sets for NASA. George B. Ulrich of Metals & Ceramics

Breakthrough research based on advanced electron microscopy of polymer-based membrane-electrode assemblies. Team: Karren L. More and Kimberly S. Reeves of Metals & Ceramics

Power coupler conditioning in support of critical path schedule for the SNS linac. Team: Yoon W. Kang, Dale A. Heidenreich, Sheng Peng, Debra L. Douglas, Mark P. Cardinal, Bryan R. Gross, Mark T. Crofford, Jimmy D.

Hicks, Eddie R. Tapp and Mark W. Wezensky of the Spallation Neutron Source

Successful design, development, deployment and commissioning of high-level applications software in support of SNS linac beam commissioning. Team: John D. Galambos, Chungming Chu, Thomas A. Pelaia, Andrei P. Shishlo, Jeffrey G. Patton, Mariehelene S. Cousineau and Viatcheslav V. Danilov of the Spallation Neutron Source

Proactive implementation of National Fire Protection Association 70E. Team: Samuel P. McKenzie, Ronnie J. Cornwell, Kevin P. Norris and Paul S. Holik of the Spallation Neutron Source

Obtaining Department of Commerce clearance for waiving import duties for scientific equipment and apparatus procured for ORNL staff. Team: Nicole E. Porter of the Legal Directorate and Clinton D. Rash and Joel E. Pearman of Contracts

Handled complex procurement of commercially available and specially equipped vehicles from the International Armoring Corp. Jason W. Piller of Contracts

Exemplary performance and leadership in relocating the excess and sales operations to an off-site facility. Team: Cheri L. Cross and Marcia D. Whitson of Asset Management & Small Business Programs

Achievement of internationally recognized National Voluntary Laboratory Accreditation Program accreditation for the ORNL Metrology Laboratory. Team: Robert P. Effler, Gerard F. Payne, William E. Wright, Gregory A. Strickland and Carol D. McNelly of Quality Services

Preparation of regulatory documentation required for Multiprogram Research Facility land transfer. Team: Terry M. Bonine and David D. Skipper of Environmental Protection & Waste Services

Operation and maintenance cost savings and infrastructure improvements associated with ORNL's electrical power supply. Joseph G. Whedbee of Facilities Management

Exceptional support for HFIR 402A and 402B outage. Team: James E. Buchanan, Edwin R. Blackburn, Hugh T. Christie, Bruce G. Walker of Facilities Management

Support of programming and preliminary design efforts on the Multiprogram Research Facility project. Team: Richard C. Griffin, Deborah B. McCarter, Peter R. Kulesza and Bart A. Hammontree of Facilities Development

Consolidation and integration of facilities-related information into a Computer-Aided Facilities Management system that will enable all staff to have easy access to information related to operations of facilities at ORNL. Team: Ricky C. Stephens of Networking &

(Continued on next page)

Computing Technologies, David A. Kennard of Integrated Operations Support and Daniel G. O'Connor of Facilities Management

Improvements to Building 1506 and the addition of two state-of-the-art research greenhouses for the Environmental Sciences Division. Team: Owen W. Hale and Jeffrey S. Harrison of Facilities Development, Steven R. Cline of Environmental Sciences, Wayne S. Underwood of Operational Safety Services and Elizabeth M. Schilling of Contracts

Renovation and transformation of Building 7601. Team: Ann R. Bryant of Integrated Operations Support and Steffon C. Riser of Facilities Management

Planning and managing for the continuity of operations of the Visitor Services Center during the move to a new state-of-the-art facility. William J. Manuel of Laboratory Protection

Development and delivery of californium-252 products. Team: Robert R. McMahon and Edward H. Smith of Nonreactor Nuclear Facilities and Leslie K. Felker of Nuclear Science & Technology

International Motor Selection Survey and Analysis Technical Committee Meeting preparation. Susan S. Johnsen of Engineering Science & Technology

Exceptional support for Transportation Security Project. Kristi L. Seal of Nuclear Science & Technology

Outstanding administrative support as a team during a period of significant change and transition. Team: Vicki M. Mayfield and Shirley A. North of Environmental Protection & Waste Services

Sustained performance and support to the Facilities Development Division during a time of significant change in staff and job assignments. Judith M. Noe of Facilities Development

Installation of the cold neutron guide sections in the HB4 shield tunnel. Scott A. Moore of Condensed Matter Sciences

Don't GET locked out

As of May 31, the building proximity cards of employees whose General Employee Training has expired will be deactivated until the required training is completed. Employees with expired prox cards will need an escort to access buildings in controlled areas—which include most of the Lab.

"ORNL has buildings as well as outdoor and off-road locations designated as 'controlled areas' with the posting of signs around campus," says Operational Safety Services Division Director Carol Scott. "While accessing our controlled areas does not mean you will encounter radiation or radioactive materials, it is important that we ensure hazards and rules are communicated to personnel entering controlled areas. In addition, it's the law."

Salt

Continued from page 1

the heat from the low-enriched uranium-235 graphite-coated fuel particles, delivering more heat to the job to be done. Liquid salt boils at 1400°C, which is well above its operating temperature, and it operates at low pressure, which trumps another disadvantage of a gas-cooled reactor, which operates at high pressures.

Once powered up and operating, the heat from the reactor would keep the salt melted and flowing. At higher temperatures, the salt has the same look and feel as water.



Ingersoll

"Because liquids carry heat much better than gases, a liquid salt-cooled reactor can run at three times as much power," Dan observes. "It looks like a pretty attractive system."

The liquid-salt idea was proposed too late for the Advanced Reactor Program's lead concept roadmap, but it attracted enough attention to receive funding for a viability study last year. No viability issues arose, and funding for more studies arrived this year. Dan's NTPO group is putting together a collaboration with Idaho National Laboratory, which is the lead DOE lab for nuclear tech (and is a sister Battelle lab to ORNL), and other labs and universities.

There are, of course, some concerns and technical hurdles to overcome.

"Liquid salt distributes heat so well that the vessel becomes very hot, so we would need to engineer very good thermal insulation, which is a materials problem," Dan says. "And although liquid salt's high boiling temperature is an advantage, it also has a high freezing temperature, turning to a solid at 350–500°C. This presents a refueling challenge because the reactor must be kept very hot, which has perplexed some vendors who have been interested. Instrumentation also will have to be designed to withstand the heat."

None of that sounds particularly insurmountable, and ORNL, which once enjoyed the reputation as the center of the Earth for nuclear technology, has a trove of data from the MSRE project, which started out with the nuclear aircraft program of the 1950s.

Dan notes that the MSRE itself ran for two and a half years and that salt test loops ran for up to nine years. The Atomic Energy Commission, which oversaw ORNL's operations at the time, went instead with a sodium breeder reactor, which was never built. The Clinch River Breeder Reactor, slated for Oak Ridge and killed in the 1970s, would have been a sodium-cooled breeder.

The MSRE, forlorn in Melton Valley, has been relieved of its fuel and is now an environmental management project. The knowledge from that project, however, may help provide a critical source of energy in the future.

"This concept brings together everything ORNL is good at—high-temperature materials, coolant and fuels. It will take all of those to make that reactor work," Dan says.—B.C.

Forsberg: Need for hydrogen is now

Replacing gasoline with hydrogen as a transportation fuel is a long way off, but producing gasoline from low-grade, heavy oil itself requires hydrogen.

"There is an immediate need for hydrogen production," says the Nuclear S&T Division's Charles Forsberg.

Charles is a leading member of the ORNL team that has produced an attention-getting proposal for a liquid-salt-cooled reactor that would function at the high temperatures that hydrogen production requires.

He explains that the quality of crude oil is dropping, requiring the increasing insertion of hydrogen.

"In a very simplified manner, if you take coal or any hydrocarbon and add hydrogen, you get an increasingly liquid substance that can be converted to gasoline," Charles explains. "And as the crude oil sources get dirtier, such as shale oil or tar sands, you need more hydrogen."

Charles notes that hydrogen for these processes now comes from natural gas. In fact, approximately five percent of the U.S. natural gas consumption is used to make hydrogen.

"There is a very large hydrogen industry that most of us don't notice. It sort of gets swallowed up inside the big refineries," he says.

The liquid-salt-cooled reactor would be powerful enough to make hydrogen on an economical scale by using the reactor's heat to break water down into hydrogen and oxygen, or by using electricity, or both.

And there wouldn't be that double-dependency on fossil fuels.—B.C.



Forsberg



UT-Battelle Scholarship winner Kellen O'Connor (left) is congratulated by ORNL Director Jeff Wadsworth.

O'Connor wins UT-B Scholarship

Kellen Daniel O'Connor of Farragut High School, son of Dan O'Connor of the Facilities Management Division, has received the 2005 UT-Battelle Scholarship worth up to \$20,000.

Kellen has a 4.23 grade point average and has earned numerous honors and accolades, including the Tennessee Volunteer Scholarship and the Farragut High School Pride Award for all A's. He is a member of the Latin Honor Society, was nominated for the National Society of High School Scholars and for Who's Who among U.S. students. He is also a member of the Latin Club, Mu Alpha Theta and the National Junior Classical League and participated in the American Mathematics Competition.

On another level, Kellen is regarded as an excellent problem solver and is especially adept at rebuilding computers, setting up network communications and writing computer programs. In the community, Kellen is a Habitat for Humanity volunteer, performs with a church choir at nursing homes and missions and serves dinner at the Volunteer Ministry Center.

The UT-Battelle scholarship is a competitive award presented annually to the child of an ORNL employee. The scholarship is awarded in \$5,000 annual increments over a four-year period to an outstanding graduating high school student who plans to study science, mathematics or engineering at UT.

Retirements

Dave O'Kain has retired from the Engineering S&T Division with more than 37 years of service. Dave most recently worked at the National Transportation Research Center, but his career also covered flywheel and gas centrifuge research. Dave resides in Oak Ridge.



O'Kain

Climate conundrum

Progress against certain pollutants, resulting in Earth's brightening, poses environmental dilemma

Three recent papers' report that the Earth's surface has brightened during the past 15 years poses an environmental dilemma for human societies, according to Lianhong Gu of ORNL's Environmental Sciences Division.

The papers, published in the May 6 issue of *Science*, indicate that sunshine reaching the surface has been increasing since 1990, and this brightening trend erased a 30-year dimming of the Earth's surface that had been observed from 1960 through 1990.

Gu—a member of his division's R&D staff who has studied environmental and atmospheric issues related to solar radiation over the past 10 years—says the brightening is likely a result of implementation of clean air policies and the application of better energy-use technologies in many countries throughout the world, which has reduced atmospheric particulate pollutions.

"The cleaner air policies that began in the 1970s have helped generate the progress that began to take effect around late 1980s and made the Earth's surface brighter," Gu said. "When the air was dirtier, the surface of the Earth was not as bright. One can see this clearly when the two periods from 1960 to 1990 and from 1990 to present are compared."

Gu said this should be good news. However, this is only one side of the story.

"The human societies have been putting all kinds of stuff into the atmosphere," Gu said. "Broadly speaking, they can be grouped into two categories of fine particles or pollutants—also



Lianhong Gu

called aerosols—and greenhouse gases such as carbon dioxide."

Aerosols and greenhouse gases have nearly opposite effects on our climate, according to Gu.

"Aerosols tend to reflect more sunlight back to space and cool the earth surface whereas greenhouse gases tend to trap the heat inside our earth system and thus warm the surface," Gu says. "When they are both present in our atmosphere, they help keep the effects of each other on our climate in check."

The ORNL researcher said this is probably the reason little warming was observed before the 1980s even though the greenhouse gas concentration increased.

"Because of health concerns, governments have been trying to control emissions of pollutants into the air," Gu says. "Yet the effort of curbing greenhouse gas emissions lags much behind, and atmospheric greenhouse gas concentrations have been continuously climbing. This creates an imbalance for our climate system, which probably explains the sharp warming trend observed more recently."

The authors of the three papers in *Science* view potential impacts of global brightening on the climate as important issues that require additional research. Gu agrees with that assessment, emphasizing ORNL has an important role to play in that research.

"All of this is related to many projects we're doing in the Environmental Sciences Division," Gu says. "We concentrate a lot of our research on looking at the effects on ecosystems, including the study of plants, soil, the water and carbon cycles. All of these tie in with global brightening issues because the energy from the sun drives everything in ecosystems."

Gu says a two-pronged strategy is needed in future research into global brightening and greenhouse issues.

"You're dealing with a chain of reactions," Gu says. "This is an ecological issue as well as an atmospheric issue. We need to increase collaborative research in both the areas of greenhouse effects and reducing pollution. It is a complicated process, but the research needs to be done together. The national labs—especially ORNL—can make great contributions in this important issue."—Fred Strohl

The presence of greenhouse gases, which trap heat, and particulate pollution, which reflects the sun, created a balance. Success at removing particulates, and the lack of progress with greenhouse gases, may explain the recent sharp warming trend.

ORNL establishes Shull fellowship for studies in neutron science

ORNL has announced the establishment of the Clifford G. Shull Fellowship, a two-year postdoctoral appointment similar to ORNL's Wigner Fellowship. A maximum of 10 appointments, sponsored by the Spallation Neutron Source and High Flux Isotope Reactor, will be made over several years.

The Shull Fellowship is open to fields of science and engineering that foster further advances in neutron science.

"The fellowship's goal is to attract new scientific talent to ORNL and its neutron science programs, making it possible for these outstanding new scientists to continue on the path to excellence while substantially contributing to ORNL and DOE missions and goals," says SNS Director Thom Mason.

Shull fellows will be expected to provide valuable stimuli to the research efforts of the Laboratory, make available the most recent developments of university science and engineering departments and represent the Laboratory to its sponsors and collaborators in the scientific community.

The fellowship is named for Clifford Shull, co-recipient of the 1994 Nobel Prize for physics, who began his work in 1946 at what is now ORNL. He has been called the "father of neutron scattering," and the fellowship has been established in recognition of his pioneering work in the field.

For more information on the fellowship, contact Bob Martin, (865) 241-2950, martinrg@ornl.gov.

New Staff Members

Gregory Lynn Capps, Jerry Lee Stockton, Timothy Daniel Crisp, John Mary DeBaca, Spallation Neutron Source
Norman Cleveland Couts, Office of Counter-intelligence

Colby Allen Earles, Creative Media
Daniel Scott Franklin, William "Brence" Gilley, Douglas Allen Harrill, Steve Warner Samuelson, Timothy Neal Taylor, Sandra Lee Wry, Charlene Vanessa Hardaway, Stephanie Michelle Layden, Steve Wayne Malone, Jeffrey Clay Clower, Christopher Wayne Duncan, Janice Elaine Giles, Timothy Michael Ingram, Jamie Ray Seeber, Michael Edward Bowling, Andy Wayne Crass, William Mack Seals, Craft Resources

Leslie Leon Morgan Jr., Human Resources
Daniel James Getman, Tracy Anne Warren, Computational Sciences and Engineering
Christopher Michael Hayes, Bruce Wayne Patton, Brigham Thomas, Nuclear S&T
Otis Earl (Bronson) Messer II, Computer Science & Mathematics
Ricky Lynn Bullock, Quality Services
Calvin Josaphat, Facilities Management
Bruce Matthew Walker, Research Reactors
Nathan Lee Wood, Engineering S&T
Diana Renee Lowery, Health Services

Retirement plans? John Sheffield publishes his 30-year labor of love

ORNL retiree John Sheffield, who once led the Fusion Energy Division and is currently a senior fellow at UT/ORNL's Joint Institute for Energy and Environment, has published a novel, set in modern times but based on, and intertwined with, Greek mythology.

The book, *Marienna's Fantasy*, published by iUniverse, is the product of 30 years of off-and-on writing, revision and review.

The book is about a Greek-Texan scientist playing out the fantasies of his godmother, who has written four plays about Greek gods with family members in established roles. The godmother, Marienna, becomes convinced the roles may be real and persuades her scientist godson, Festus, to repeat a version of the so-called Labors of Heracles.

The labors include a search for the Loch Ness monster, translating the Phaestos Disk and a battle with an oil-eating bug that fouls machinery. As Festus becomes selfishly immersed in one labor after another, his wife and daughter leave him.

"Like many scientists, he focuses single-mindedly on his work, neglects his wife and daughter, and they leave him. He struggles to get them back while still doing the labors,"

John says.

Writing the novel was an epic in itself. Interested in Greek and Norse mythology since childhood, he began the book as a short story in 1974, when he worked on the Joint European Torus project, and got two-thirds through before setting it aside around 1988 because of work commitments, "until the turn of the century."

John's family has contributed to his own labors by reviewing his drafts of both *Marienna's Fantasy* and a second book, called *Roseland*, that he hopes to have published within the year.

"My wife and son and daughter-in-law provided important critical commentary and I rewrote [*Marienna*] a number of times," John says.

"Interestingly, and I bet this happens to most or all authors, the characters began to take over: The story evolved up to the time I published it."

John currently lives north of Atlanta and comes to Oak Ridge about once a month. *Marienna's Fantasy* is available in hardback, soft cover or download from iUniverse, www.iUniverse.com. —B.C.



Image: The "Phaestos Disk" looms large in Sheffield's plot.

Service Anniversaries

June

45 years: Margaret B. Emmett, Nuclear Science & Technology

30 years: William J. Allington, Bill Bryan and John C. Rowe, Engineering Science & Technology; Nermin A. Uckan, Fusion Energy; Gary A. Hampton, Asset Mgt & Small Business Programs; Willie J. Allen, Integrated Operations Support; Rickey Darnell Madison, James M. Ellis and Raymond T. Cox, Craft Resources; David P. Vogt, Environmental Sciences

25 years: Betty A. Lawson, Logistical Services; John K. Mongar, Facilities Management; Joel C. Lewis, Boyd Hallman and Joseph Franklin Walker, Jr., Nuclear Science & Technology; N. L. Hardin, Craft Resources; Wilfred M. Post and Gail Robinson Hamilton, Environmental Sciences; Tammy Sue Darland, Computer Science and Mathematics; Teresa D. Ferguson, Paul D. Ewing and M. S. Emery, Engineering Science & Technology; Stephen E. Burnette, Research Reactors; S. N. Murray, Jr., SNS Accelerator Systems; Susan D. Patty, Computational Sciences & Engineering; Dorothy J. Tate and Benjamin A. Carreras, Fusion Energy; Tammy K. Hill, Business & Information Services Dir.; LeJean M. Hardin, Communications & External Relations Dir.; Paul F. Becher, Metals & Ceramics

20 years: Brian H. Davison, Life Sciences; Gerald Alan Seymour, Craft Resources; Samuel J. Henley, Research Reactors; Steven J. Zinkle, Metals & Ceramics

Knoxville, ORNL, SNS at best for May's PAC05 visitors

The world, almost literally, of particle accelerator physics came to Knoxville last month for the 2005 Particle Accelerator Conference. Conferees left, says conference chair Norbert Holtkamp, with a tremendous impression of Knoxville and of their first look at the Spallation Neutron Source.

"It was a perfect conference," Norbert says. "We've gotten a lot of e-mails from many attendees who say that it was a great scientific meeting and enormously appreciated. Many were impressed with the governor's remarks. [Nobel laureate] Carlo Rubbia had a great time."

Many attendees, who came from all over the globe, went away with a very real impression of the Spallation Neutron Source, which sponsored this year's PAC05 with Jefferson Lab. Nearly 500 attendees toured the SNS during the week, including nearly 300 who stayed an extra day after the conference.

"The SNS tours were a phenomenal success—they wondered how we had gotten all that done," Norbert says.

Gov. Phil Bredesen, who owns a degree in physics, welcomed the conference on Monday, May 16, and stayed for the morning plenary sessions. ORNL Director Jeff Wadsworth and a host of top particle physicists joined the governor for an extended lunch.

In his remarks, Bredesen stressed the importance of government's role in science and scientists' role in helping the public understand what they are supporting.

"Regardless of whether the next president or the next Congress is Democrat or Republican, the reality is that resources are scarce, the reality is that big science needs resources that

only the government can supply, and the reality is that those scarce resources will go to those things that ordinary citizens think are important to themselves and to their children and to our nation. That's our job, to remake that connection in the 21st century," he said.

The particle accelerator community may be far flung, but it is a close group. The conference was marked by numerous hallway conversations among colleagues who likely rarely gathered except at the biannual conference. Anywhere there were two chairs, there was a discussion going on.

The PAC05 organizers joined the city of Knoxville for May 18's Einstein in the City event on the World's Fair site. Attendees and locals mingled for music and one of the surprise hits of the conference: a panel discussion and question and answer session led by Battelle's Bill Madia and featuring Rubbia, the National Science Foundation's Michael Turner, former AT&T executive Morris Tanenbaum and Norbert.

Organizers were unsure how sandwiching a



Curtis Boles

Fielding questions from the Einstein in the City audience May 18 are, from left, Bill Madia, Morris Tanenbaum, Norbert Holtkamp, Michael Turner and Carlo Rubbia.

panel discussion on science between sets of music would play with the crowd, but the audience packed the stage and peppered the panel with science questions.

Rubbia was a crowd favorite. One of his most enlightening observations was that Peter Higgs, who first theorized the Higgs boson, is a bit chagrined over his namesake because "he doubts it exists."

The conference was a major event for the city of Knoxville and its new conference center. PAC05 was the first big conference booked for the Knoxville Convention Center, and with a crowd filling the corridors, the place is a showpiece. Conference crowds packed lunch spots downtown. The city clearly would like to experience more weeks like May 16–20.—B.C

Reporter

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