

## Utility-in-a-box proving ground

**Cooling, Heating and Power Lab aims to help distributed-energy equipment market takes off**

As a steady energy supply has become a newsworthy topic in some parts of the country, interest has also grown in self-contained electric-power-generating units that can be used to power a small industry, business, school or almost any type of institution.

Called “distributed” or “dispersed” systems, they can be modular units that generate power for a building, or set of buildings, right on that specific site.

“Lots of people want to buy these right now,” says Energy Division’s Jeff Christian, who leads ORNL’s Buildings Technology Center. “Many industries and institutions rely on steady supplies of power. Estimated losses in revenue from power outages are \$27 billion a year.”

With such a market in mind, the BTC has just set up a new user facility, the Cooling, Heating and Power Laboratory, funded by the DOE Office of Power Technologies’ Distributed Energy Resource Program. Jeff says companies will use the CHP Laboratory to integrate small power-generation equipment, such as microturbines and fuel cells, with components that take advantage of their waste heat. It’s all toward a goal of helping the highly energy-efficient dispersed systems catch on as a power generation option.



Curtis Boles

**Enveloped in a maze of ductwork, Energy Division’s Abdi Zaltash stands in the nearly completed Cooling, Heating and Power Laboratory.**

One example of a power generation system—the microturbine generator—is a commercially sold, furnace-sized unit that uses natural-gas-fired heat to turn a turbine, which generates electricity. One \$30,000 microturbine unit can generate about 30 kilowatts of electricity, or enough to serve a small-to-mid-sized business or five energy-efficient homes.

With the distributed energy systems, which could be powered by microturbines, fuel cells, diesel generators or even solar cells, it’s possible that excess electricity can be sold back to the power system.

“If I lived in Chicago and had one of these microturbines a couple of summers ago, and if I could have sold excess power back into the grid, I could have paid for the unit in six hours!” Jeff states. Then he qualifies, “It’s obviously not that easy. There are many, many issues that concern selling electric power back into a system.”

But those are the sorts of issues—both technical and policy related—that the industries that take advantage of the new user facility may be able to work through and solve. Jeff and his BTC colleagues, including Phil Fairchild, Abdi Zaltash, Tom Rizy and Bob DeVault, believe the new user center

**(See CHP LAB, page 4)**

## ORNL volunteers spend Saturdays for a Habitat cause

Team UT-Battelle is joining the local Habitat for Humanity in establishing a home for a young couple. The structure is taking shape near the Heiskell community in Anderson County.

At the same time, another group of volunteers from ORNL are rehabilitating existing homes.

Clad in green T-shirts, a crew of about 30 Team UT-Battelle volunteers, including several Leadership Team members, showed up on the muggy Saturday morning of May 19 to start raising the new house, literally from the ground floor. The project, coordinated and assisted by veteran Habitat volunteers, will likely go on for most of the summer.

Team UT-Battelle organizers hope to have 20 volunteers on hand each Saturday. Groups representing several Lab divisions have already signed up to help on specific weekends, but all participants are welcome for tasks ranging from sure-enough carpentry to simply maintaining the work site.

Habitat crew chief Jack Day, a Y-12 retiree, started the May 19 session with an overview of what would be done that day, and followed up with a brief talk on safety. “Don’t be afraid to ask questions if you don’t know exactly what’s going on,” he said.

Habitat volunteers Paul Smith and Wes Delaney, who represent an informal Habitat club called the OFCs, joined him at the build. (“OFC” could stand for a number of things, Jack explained, but most appropriately is an initialism for “our friendly carpenters.”)

Before long, the hilltop was alive with the “phwap” of a nail gun and the whir of a power saw.

Much of the real work, however, involves tasks as mundane and effort intensive as moving large piles of lumber and roofing from one

place to another on the steep lot. “All hands are needed for those types of tasks; it’s hard to have too many volunteers on a housing site,” said volunteer organizer Brenda Hackworth, who works in the Office of Communications and Community Out-

**(See HABITAT, back page)**



**Bill Madia, like all good carpenters, always measures twice before cutting.**



## First UT-Battelle scholarship awarded

**E**ric C. Mueller, a member of Farragut High School's Class of 2001, is the recipient of the first UT-Battelle Scholarship.

The scholarship, for children of ORNL employees, is worth up to \$16,000 over a four-year period and is awarded to a graduating senior who plans to attend the University of Tennessee. The scholarship includes a summer internship working at ORNL.

Eric is the son of Donald and Jody Mueller. Donald works in the Operational Safety Services Division.

At UT, Eric plans to major in computer science and mathematics. He is a National Merit and Presidential Scholar finalist and a member of the math and science honors societies at Farragut. He also is a member of Farragut's Astronomy and Computer Club and the Scholars Bowl and Science Bowl teams. [ornl](#)

### Lots coming

Two ORNL parking lots are set for expansion.

Work on the Flagpole and 6026

South lots (in green) should begin this fiscal year.

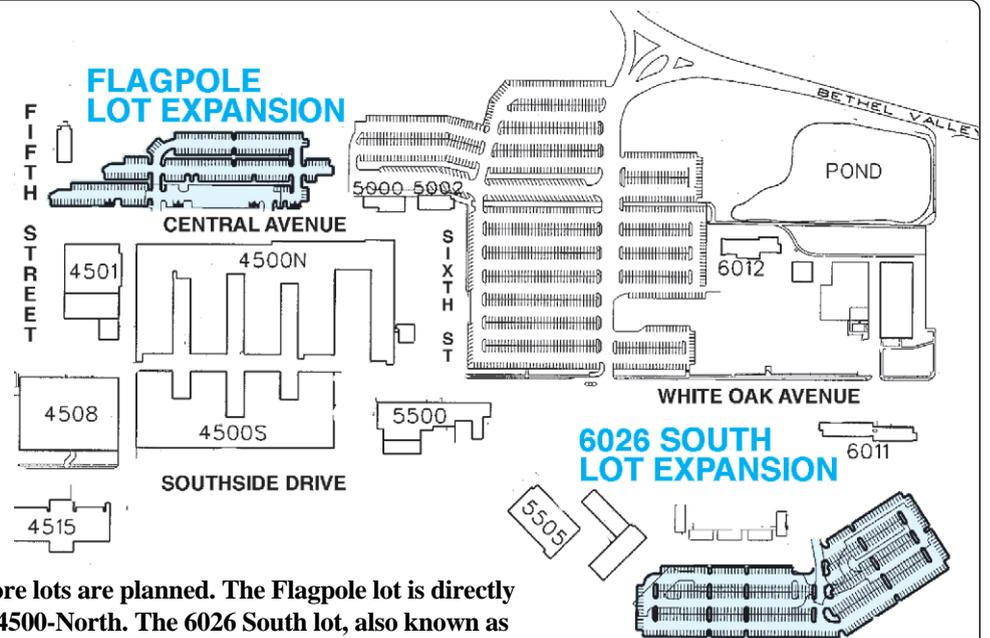
About 600 added spaces will help

alleviate the parking crunch

when new buildings are started on the

site of the east parking lot, shown

in the upper right. More lots are planned. The Flagpole lot is directly across from Building 4500-North. The 6026 South lot, also known as the "hill" lot, sits atop the rise directly behind the 6026 trailers.



Fred Strohl

**Dave Berry, an Oak Ridge High School senior who will be attending Rice University this fall, demonstrates some of the new science lab equipment.**

## Oak Ridge High School receives \$10,000 from UT-Battelle for science lab equipment

**U**T-Battelle has provided \$10,000 to Oak Ridge High School for new science laboratory equipment.

The equipment purchased for the lab includes digital scales, a special microscope and computer-based data acquisition hardware and software that will be used in the physics and biology areas.

Donna Farmer, chairman of the Science Department at Oak Ridge High School, expressed the high school's gratitude for the lab equipment.

"The support we receive to purchase needed equipment makes the difference in what we can provide our students," Farmer said.

Peggy Bertrand, a physics teacher at the school,

said the computer equipment will enable her to elevate her level of teaching physics.

"You can actually demonstrate physics experiments with this system that you might not be able to otherwise," Bertrand said.

"UT-Battelle has focused on improving science and math education in the Oak Ridge region," Billy Stair, director of the Office of Communications and Community Outreach, said. "Our goal is nothing short of helping Oak Ridge High School provide the best science program in the country."

The donation to ORHS is part of a UT-Battelle initiative to fund five school science labs per year at \$10,000 each. Another such school is Coalfield High School, which re-equipped its science lab. Other schools that have been identified for the grants include Vine Middle Magnet School in East Knoxville, Clinton Middle School and Midway High School in Roane County. —Fred Strohl [ornl](#)

### Team seeks ideas on organization

**T**he Organizational Review Task Team would like to hear from you. On April 30, Bill Madia announced the creation of the Organizational Review Task Force, which will recommend how the Lab might improve its current management structure.

A Web page ([home.ornl.gov/leadership/org\\_review/](http://home.ornl.gov/leadership/org_review/)) has been established both to provide information related to the progress of the task force and to collect suggestions and input from staff. Focus groups will be formed to obtain ideas from all segments of ORNL staff.

"A more efficient management structure is critical to our ongoing effort to reduce the cost of doing business at the Lab," says Bill. The Web site is where you can put in your two cents.

**ornl** reporter

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Curtis Boles

Summer's here, which means the grass is green and growing. The Plant and Equipment Division's Donnie Green has the hardware to keep it clipped.

# Lab Notes

## From the sports desk

The softball arced high in the air, nearly grazing a passing sparrow, before it plopped down with a “thunk” just in front of home base.

“Stee-rike!” bellowed umpire Frank Kolski.

That was the sort of game played on May 17 when ORNL’s Leadership Team went up against a pickup squad of employees and suspected ringers at Clark Center Park. It was all to benefit the Juvenile Diabetes Research Foundation.

But pride was at stake, as well. Observers and even some LT members predicted the managers would get blown out.

It didn’t turn out that way. The “other guys” jumped in front, powered by Dave Foster’s home-run batting. But they then seemed to wilt under an unrelenting afternoon sun, further stymied by some fearless third-base play by Billy Stair, whose duct-taped shoes revealed his East Tennessee roots.

Or maybe it was the LT’s four-out innings, as Other-Guys manager Frank Kornegay rather sourly pointed out.

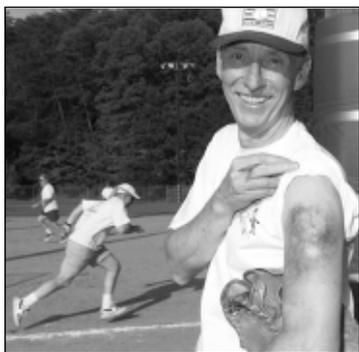
Or maybe it was those devastating five-yard delay-of-game penalties.

At any rate, before anyone knew it the LT had pushed back and the score was knotted at 10. Then the Other Guys awakened, rallied and claimed an unexpectedly close 15-10 victory.

Bill Madia, who went the distance on the mound—had there been one—for the LT, summed up their game: “No one was hurt (much) and no one was totally embarrassed.”

The game raised more than \$600 for the JDRF, combined with more than \$10,000 raised by a UT-Battelle team of volunteers the preceding Saturday at the JDRF’s Walk for the Cure.

Good game.



Curtis Boles

**With base runners in the background, sliding Lee Riedinger sports a battle scar.**

## Smalley: Nature’s nanotube hints

Richard Smalley shared the Nobel Prize for Chemistry in 1996 for the discovery of buckminsterfullerenes, or buckyballs, the carbon-60 molecule with those very promising properties.

In terms of their appeal to the young, “there’s been nothing like it since Sputnik,” Smalley told a standing-room-only Distinguished Lecture crowd in Wigner Auditorium May 15. Following

C-60’s 1985 discovery, the 1990s turned out to be a decade of frustration and discovery, prodded by “hints” from Mother Nature, he said, that led from buckyballs to nanotubes and on to crystals.

“I used to think diamond was the most interesting form of carbon, with its bonds in all three dimensions,” Smalley said. Carbon nanotubes have taken diamond’s place—“the strongest of fibers, stronger than steel, the electrical conductivity of copper (at least), and the thermal conductivity of diamond, a waveguide for electrons.”

Smalley envisions the development of nanotube production technologies—at least a meter an hour—that would lead to advanced flat-panel displays, batteries, molecular electronics, sensors and actuators—any scenario that involves the movement of electrons—all out of a material stronger than steel but as light and bendable as wood or plastic. He urged scientists to “get serious” about producing single-crystal C-60 materials.

“I think this is gonna happen,” he said, adding that DOE labs should be a major player in the effort.

Smalley’s talk was followed by a symposium on ORNL nanotech projects that included talks by Jacob Barhen, Doug Lowndes, Dave Geohegan, Eli Greenbaum, Mike Ramsey, Dave Wesolowski, Bill Butler and George Wignall.

## Maienschein: Use simple language

Jane Maienschein grew up in Oak Ridge. She’s gone on to become a biologist and philosopher of science who researches how science is communicated to the larger public. She has also worked with Congress as a staff aide.

She came home from Arizona State University to speak on May 23 as part of the Friends of ORNL’s Community Lecture Series. Her talk was titled “How Should We Tell the Stories of Science? Who Knows, Who Says and Who Cares?”

Scientists, she says, if asked to explain what they do and how it works, often lose the “big picture” and miss the opportunity. That’s bad, because the policymakers who make decisions that affect science usually aren’t well versed in scientific matters themselves.

“Scientists need to communicate better,” she says. She suggests an exercise.

“Why not have every research team at the Lab make a nice one-pager summarizing and explaining, in simple language, what they are doing, how it fits the Lab mission and explain significance of the work—why we should care?”

A collection of those could make a very useful portfolio for marketing the Lab, she says. Who’s up to the task?

*Reported by Bill Cabage*

## ***fuelconomy.gov*. Money in your pocket instead of the gas tank**

With gasoline prices soaring in the U.S., most car buyers recognize the general value of driving a more fuel-efficient car. But some may wonder just how valuable fuel efficiency can be in terms of dollars and cents.

According to *www.fuelconomy.gov*, extremely valuable, says Energy Division’s Bo Saulsbury. “For example, the 2001 vehicle with the highest gas mileage, Honda’s gasoline/electric hybrid Insight, has a fuel cost of about \$382 per 15,000 miles—assuming a gasoline price of \$1.63 per gallon,” says Bo. “At the opposite end of the spectrum is a gas-guzzler whose fuel consumption is nearly eight times as high, the Ferrari 550 Maranello/Barchetta. Like its price tag, the Ferrari’s fuel cost per 15,000 miles gets up there—a whopping \$2,715.”

The *fuelconomy.gov* site is maintained for DOE by the Energy Division’s Center for Transportation Analysis. It has recently enjoyed the notoriety that accompanies being mentioned on the popular radio show *Car Talk*. Meanwhile, rising gasoline prices for the second summer in a row have put miles-per-gallon back on the wish-list for car buyers.

“But most car buyers are looking for something in between an Insight and a Ferrari,” says Bo. “So for compact cars, the 2001 vehicle with the lowest fuel cost is the Toyota Prius’ \$509, which costs less than one-fourth as much to drive as the worst in its class, the Bentley Continental R, at \$2,088.”

For those in the market for an SUV, the 2001 gasoline model with the lowest fuel cost is the Toyota Rav4 (\$906), while that with the highest is the Land Rover Range Rover (\$2,088). Pickup truck fuel costs per 15,000 miles range from the Chevrolet S10/GMC Sonoma (\$1,019) to the GMC K1500 Sierra 4WD (\$2,038).

“Best of all, *www.fuelconomy.gov* gives car buyers who care about fuel costs easy access to information about all the other 1985–2001 model year cars, trucks, and SUVs in between these highs and lows,” Bo says. The site also provides useful fuel-saving tips for driving and maintaining new and used cars.

“If buyers opt for the most fuel-efficient vehicle that still suits their needs, and follow the fuel-saving tips, they will definitely see the value at the pump,” Bo says.

will be where companies establish the baseline performance standards for distributed-energy resources; fully integrate them with other heating, ventilation and air-conditioning (HVAC) equipment; and develop and test the new technologies.

A microturbine without waste-heat recovery can generate power at only about 22-percent efficiency, Jeff says. In comparison, the Bull Run Steam Plant generates at up to 34-percent efficiency.

“DOE doesn’t want to see people generating electricity at less efficiency. That’s the last thing we want,” says Jeff. “We’ve got to capture more of the waste heat that’s generated and use it to provide additional building services.”

A microturbine’s exhaust is pretty hot—up to 500°F. The hot gas can be routed through a heat exchanger and easily used in the winter.

“But what about the other three seasons?” Jeff asks. “How do we use the waste heat for air conditioning and ventilation?”

Those are the types of questions that could be answered at the CHP Lab. The challenge, he says, is in developing modular “green boxes”—Self-contained systems that can be easily located at any airport, school, hospital, office or retail center. “How do we integrate a heat-pump absorption chiller or desiccant system to it?”

The idea of putting recovered waste heat to use to generate power is not a new one. What’s new is the effort to develop a marketable, portable package of generator systems.

“People have been doing combined heating and power facilities for a long time, particularly in Europe,” Jeff says. “In fact, President Bush recently unveiled his energy policy at a cooling, heating and power facility that ORNL helped establish up in St. Paul, Minn., about 20 years ago.”

The BTC is betting that utilities, private industries and building owners will use the CHP Laboratory to develop those green-box systems, which could approach 70-percent overall resource efficiency. In time, the new systems may lead to efficient, compact units with a presence not much more imposing than chillers or heat-pump units currently have on their surroundings.

“This is a facility we hope utility industries will use to develop those types of systems,” Jeff says.

In the meantime, there are several ORNL technologies in line for research at the user center.

“Our very first project is to baseline commercial heat-exchanger performance and then see how much better we can do with a heat exchanger made with the Metals and Ceramics Division’s carbon foam,” Jeff says. Carbon foam has thermal conduc-



**Bob DeVault switches on the CHP Lab’s gas-fired microturbine.**

tivity properties that could be applied to numerous energy technologies.

High-temperature materials from the M&C Division, including turbine blades, will also get a look. Another ORNL technology planned for study is a thermal-chemical-heat exchanger being developed in the Energy Division.

Jeff also points to the need to develop integrated control systems for dispersed power generation, coupled with year-round waste-heat recovery for space heating, cooling and ventilating. The new facility is versatile enough to accommodate a number of dispersed-energy-generation approaches.

Once on the market, the new distributed-energy-resource technologies have an economic potential beyond power generation. Pointing to a chiller, Jeff notes that it’s made overseas.

“The United States lost the commercial absorption chiller market. I believe ORNL’s ongoing research on the GAX heat pump and triple-effect chiller design can bring that market back to the U.S.,” he says.

The CHP Lab currently takes up the ground floor of an entire building. A network of ducts connects a microturbine, which is located just outside the building’s back entrance, with a number of instruments and test units inside. Nothing the microturbine produces appears to go to waste, including cool air-conditioned air, which can be channeled into the microturbine intakes during hot weather, improving its efficiency.

Eventually, Jeff says, the approaches that prove to be the best for efficient power generation will be designed to fit in a “green-box” container, and users will essentially “plug in and play.”

The units likely will continuously help serve a

## Thinking inside the box

Jeff Christian envisions utility-in-a-box: Modular, portable power generation units with integrated heating, cooling and ventilating components that can be hauled to a site by truck, dropped off, plugged in and switched on. ORNL’s new Cooling, Heating and Power Laboratory could be where the technologies are refined, tested and honed for the market.

In the meantime, Jeff thinks he knows of a good source of boxes.

Bulk goods that are shipped overseas are packed in ISO containers: large metal boxes that are filled with commodities and then loaded onto ocean-going freighters.

“These boxes are usually made overseas and unloaded here. But because we import more bulk goods than we export, they tend to stack up near shipping centers such as Charleston, Seattle and Chicago.”

Jeff says some of the surplus shipping containers are about the right size to contain a microturbine-based power generation system.

If true, it would amount to a huge victory for recycling. Jeff’s vision is “to reverse our ‘balance of boxes.’ We import the bulk goods and ship back made-in-the-U.S.A. distributed-generation systems, with a little bit of ‘ORNL inside.’”



building’s power demand, but could also be called upon when power supplies are disrupted or when demand has driven the price up enough to make microturbine generation economical to sell to the central electric grid.

“It’s conceivable that many hospitals, factories, school or airports will have the microturbine systems for power generation only,” Jeff says.

“ORNL’s new CHP Laboratory user facility is where the industry can come, take advantage of the national laboratory’s resources, and develop fully optimized integrated modular package systems.”—B.C. [ornl](#)

## Recycling at ORNL: Ten years, ton and tons

The Office of Pollution Prevention’s David Wasserman notes that ORNL has marked a decade of recycling.

“Ten years ago (in May) ORNL began recycling its white paper, cardboard and aluminum cans,” David says. “The amount of material recycled during this time is astounding: 1640 tons of white paper, 1270 tons of cardboard, and 46 tons of aluminum.”

“During the past eight years, we have also recycled 420 tons of mixed paper and 25,000 toner cartridges. It is estimated that by recycling this material, 20,000 cubic yards of landfill space was saved at a cost savings of over \$1 million. Tens of thousands of trees did not have to be cut down because of our efforts,” says David.

“But, like a long journey beginning with the first step, the next decade of recycling begins now with each of us deciding to put that piece of paper—or file cabinet of paper—into a recycling bin and not a trash bin.”

David and his colleagues in the OPP challenge Lab staff to do even better over the next 10 years. [ornl](#)

# Understanding the invader

## ORR researchers seek to understand *Microstegium* and other exotic plant pests

Just about everyone in the southern United States is familiar with the infamous “miracle vine” kudzu. This pervasive plant blankets the landscape with such haste that southerners have claimed to close their windows at night just to keep the kudzu out.

The profusion of kudzu might make it seem like a native plant to the area, but it is actually a foreign species—brought from Japan early last century to control erosion.

Another plant from Japan and its surrounding regions has enjoyed widespread dominion in East Tennessee and the entire eastern United States:

*Microstegium vimineum*, also known as Japanese stilt grass or wire grass.

*Microstegium* is an annual grass with tall stems and sparse, alternating leaves. It is not nearly as conspicuous as kudzu, but it could present greater ecological concerns. In fact, it has become one of the major environmental management problems in the Great Smoky Mountains National Park.

There are various claims regarding the evils of non-native grass species like *Microstegium*, but very little definitive data have been gathered to support these assertions. This is why Michael Huston of ORNL’s Environmental Sciences Division has teamed up with Patrice Cole from the University of Tennessee to shed some light on this grass. Patrice is a doctoral student working with Jake Weltzin in UT’s Department of Ecology and Evolutionary Biology.

At this point, understanding is the main research goal, not eradication. “We are trying to understand its habitat requirements and how it responds to variations in environmental conditions,” says Patrice. “We need to know these fundamental things before we can develop any kind of control strategies.”

One major concern is the crowding-out of native species. *Microstegium* usually grows sparsely along roadsides or trails, where it poses little threat. However, it has also been observed in large patches covering several acres of land. “When you see it growing in a virtual mono-culture, it’s hard to imagine that it’s not displacing natives, because surely something would be growing there if it weren’t,” says Patrice.

*Microstegium* grows abundantly throughout the Oak Ridge Reservation, but it is present in unusual

patterns. “In some places it is very dense; some places it is sparse; some places you don’t see it at all,” says Patrice. “We are looking for any particular patterns that might help us understand where we would expect to find it and why we don’t see it everywhere. The natural question is: ‘Why isn’t it where it isn’t?’”

The main thrust of the experimentation revolves around a theory referred to as the “light/water trade-off hypothesis.” It suggests that plants can’t simultaneously adapt to low-moisture and low-light conditions. They are either drought-tolerant or shade-tolerant, but they can’t be both. Therefore, plants

grown in low light should do better when supplied with excess water, and vice versa. Two experiments—one in the field and one in a greenhouse—have been designed to test this hypothesis.

How will knowledge of this interaction between light and water aid in the understanding and control of *Microstegium*? “It has implications for whether the *Microstegium* is going to be there forever,” says Michael.

“A lot of the places we

see *Microstegium* now are places that have been disturbed fairly recently. But, as natural forest succession proceeds you are going to get a deeper and deeper shade, which is likely to just eliminate the *Microstegium*.”

This process has also been observed in other weeds. “This whole area used to be farm fields,” says Michael, referring to the ORR. “We had all the weeds you could typically find in fields, but they aren’t there now. That’s because the forest has come up and shaded them out.”

For now, it appears that both kudzu and *Microstegium* are here to stay—so why not make the most of them? Some resourceful people have been putting the kudzu vine to good use. It has been employed in making baskets, paper, jelly, syrup and even kudzu quiche. In fact, kudzu has been a common cooking ingredient in China and Japan for hundreds of years.

So what about *Microstegium*?

“One apparent use of *Microstegium* is as a packing material for chinaware,” says Patrice. The first discovery of *Microstegium* in North America was actually made in Knoxville, in 1918. One theory proposes that someone received a shipment of china that was packed in the wiry grass, then they just tossed the seed-bearing packing out the back door.



Patrice Cole

This bucolic lane on the ORR is actually an invasion site. The tall roadside grass is *Microstegium vimineum*.

Patrice contemplates the potential of *Microstegium* in today’s environmentally conscious marketplace: “Maybe it will replace Styrofoam peanuts. We could market it as a biodegradable, totally organic packing material. But, you would want to make sure that it’s seed-free, because we don’t want to facilitate its propagation. It is getting around quite well on its own.”—Jason Gorss

University of Tennessee student Jason Gorss is working at ORNL this summer on a science-writing internship in the Office of Communications and Community Outreach.

## ORNL people

The Environmental Sciences Division’s **Pat Mulholland** coauthored a paper published in *Science* (292), p. 86, titled “Control of Nitrogen Export from Watersheds by Headwater Streams.”

**Jizhong Zhou** received ESD’s 2000 Scientific Achievement Award for his diverse research in molecular microbial biology. He came to ORNL in 1997 as a Hollaender Fellow. “Joe,” his wife and daughter recently became U.S. citizens recently.

**Hank Cochran** has been appointed a fellow of the American Institute of Chemical Engineers. Hank leads the Fluid Structure and Properties group in the Chemical Technology Division.

The local AIChE chapter named Chem Tech’s **Ron Canon** “Engineer of the Year,” for “excellence in the practice of chemical engineering, including the recent success in establishing the Heavy Isotope Management Group at ORNL.”

The Metals and Ceramics Division’s **Phil Maziasz** is serving a three-year term on the ASM-International and TMS Joint Commission for Metallurgical and Materials Transactions. Phil was also reappointed to a three-year term as a member of the *Advanced Materials and Processing* editorial committee.

**Will Minter**, who heads ORNL’s Small Business Program office, has received a Small Business Advocacy Award from the Tennessee Department of Economic and Community Development. Commissioner Alex Fischer praised Will for his “continued contribution to foster the growth and expansions of small and minority business” in the community.

The Computing, Information and Networking Division’s **Ann Wilson Buttram** has been named an associate fellow of the Society for Technical Communication.

Engineering’s **Melissa Madgett** placed 10,169th in this year’s Boston Marathon, which she ran with husband Donnie, who coaches track at Knox County’s South Doyle High School. About 15,000 entered the famous event and 13,395 finished, including the Madgetts, side-by-side.

# Music and science

## Tuned-In Lab staff members ponder the link between lab notes and quarter notes

**O**RNL Reporter received a phone message recently from an employee of the city of Palm Springs, Calif., asking us if we knew of “anything that would support the notion of a link between great scientists and great musicians.”

We were a little puzzled as to why someone in Palm Springs, which enjoys ample proximity to both science labs, leading universities and high culture, would call East Tennessee to ask about a science-music relationship. Lee Husfelt’s follow-up e-mail, which explained that the city was exploring the idea of establishing a center on the subject, revealed the link. Wrote Lee:

“For example, Waldo Cohn was a biochemist involved in building the world’s first nuclear bomb who also founded a symphony orchestra. Do great scientific minds also tend to be great musical minds?”

The late Waldo Cohn, famous in the scientific community for his pioneering work at ORNL in chemical separation and biochemistry, apparently is as famous for his role in founding the Oak Ridge Symphony Orchestra. Scientists who streamed into the area in the forties found a lot of mud and not much else, culturally. Cohn and others fixed part of that problem by forming an orchestra, which continues to perform.

Lots has been written about the science-music link, no doubt. We passed the question on to staff members via *ORNL Today*, the Lab’s internal Web news.

Gerald Scott, a retiree who serves as treasurer of the Oak Ridge Civic Music Association, the orchestra’s organizational body, notes studies “claiming various connections between the study of music by young children and their ultimate intellectual accomplishments. There have been studies, or at least rumors of studies, supposedly linking listening to Mozart (specifically!) with success in problem solving or accomplishing various types of intellectual work.

“Executions of studies with the intent of discovering a specific relationship between abilities to perform various activities are highly susceptible to logical errors, the most common of which is to mistake

a correlation for a cause-effect relationship. In the case of science and music, I would speculate that very strong correlation might be found which would indicate that a person who is talented at music might have a high probability of being a successful scientist and vice versa,” says Gerald.

“However, it also seems highly likely that such a person might be capable of success in a number of other areas as well, so the demonstration of such a correlation would not define a cause-effect

relationship.”

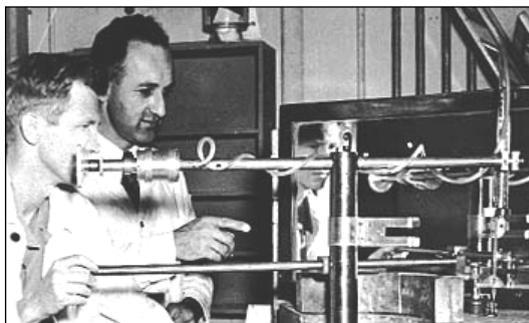
In fact, the so-called “Mozart effect” has been pretty much debunked—other scientists have been unable to reproduce the results of the initial claims. But it sold a lot of Mozart CDs, including performances of the Rondo from *Eine Kleine Nachtmusik* on accordion.

Joe Marasco, Lab patent attorney whose sonorous voice has graced many a Lab ensemble, including Yuletide carolers and barbershop quartets, says, “Science and music are truly similar in the following ways:

1. Both require discipline.
2. Both have empirical, tangible qualities that can be defined.
3. Both have abstract, intangible qualities that defy the limitations of a definition.
4. Both have their masters and their quacks.
5. Science can be ‘music’ and music can be ‘science.’”

The I&C Division’s John Munro also thinks the correlation is there:

“I do not know about the number of people one could identify who would rank as both great musician and great scientist, but numerous studies have shown a high correlation (in the range of 0.8–0.9) between mathematicians, physicists and astronomers with high levels of musical ability as evidenced by the number and types of instruments these people not only can play, but can play well. Our own home-grown Oak Ridge native Edgar Meyer, who is a world-class bass player, at one time struggled with the choice between being a mathematician and a professional musician,” says John.



**The late Waldo Cohn (right) was an Oak Ridge pioneer in both science and music.**

“Another aspect of the correlation between music and science is the type of music often preferred, most often by composer: Bach and Mozart usually top the list.”

John notes a number of scientists who also played.

“The opera singer Jerome Hines was also a mathematician. The physicist Richard

Feynman had the uncanny ability to beat two different rhythms simultaneously and independently with each hand, such as 13 beats per measure with the right hand against 17 beats per measure with the left,” John says.

“Recent MRI and PET imaging studies of the brain show high correlation’s between response to music and solving logical/mathematical problems. So it appears the brain is wired so that a high correlation will be there,” he concludes

The Fusion Energy Division’s Bill Schwenterly

also can think of many examples of people who were talented in both science and music.

“The composer Alexander Borodin was a professor of chemistry at the St. Petersburg Military Academy and worked hard to establish a medical school for women in Russia. Einstein was an amateur violinist. Mozart was always interested in mathematics and wrote some very interesting pieces incorporating mathematical symmetry. One of these was a reverse retrograde canon for two players, where the second player used the exact same music as the first player, but turned upside down!

“The former principal horn player of the Boston Symphony, Charles Kavelovski, had a long career as

a nuclear physicist before he went on to a brilliant career as a professional hornist,” says Bill, who has played principal horn in the Oak Ridge

Symphony for many

years. He is a physicist himself, but apparently plans no such career change.

Bill’s colleague Mike Cates has offered to help survey the ORNL and Y-12 population for science-engineer-musicians.

Finally, Trey White, who works in the Computer Science and Mathematics Division, put us in touch with Steve Gadbois, a consultant for the city of Memphis who has also taught math and computer science. Gadbois also noted the “many connections” between music, science and math.

“Some are obvious to any student of physics—the dependency of a vibrating string’s frequency on its tension, length, and composition (and the analog for a vibrating air column and a vibrating membrane), etc. Some are based only on relatively simple math—why certain musical intervals are pleasant while others are dissonant, why the octave divides ‘naturally’ into 12 parts, why no division of the octave (even into 12 parts) can be ‘perfect,’ etc. Some depend on more sophisticated math—wave forms as seen and heard by Fourier analysis, etc.”

Gadbois has done a number of presentations on music and math to audiences ranging from annual meetings of professional mathematicians to fifth-grade science classes. He’s taught college courses on the subject and is currently compiling a textbook.

So, obviously, many scientists, including ORNL’s, take an interest in music. There are probably others who can’t carry a tune in a beaker. But the relationship is likely there. And it probably spans the multiplicity of genres.

For instance, one of the original members of Commander Cody’s Lost Planet Airmen, singer/guitarist John Tichy, went on to become chair of aeronautical engineering and mechanical engineering at Rensselaer Polytechnic Institute.

That’s proof enough for us.—*B.C. ornl*



*Science can be ‘music’ and music can be ‘science.’*

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BY JILL FREEMAN

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## Reinvest LMC Stock by April 30, 2003

The Human Resources and Diversity Programs directorate sends out this reminder for staff members who are still holding Lockheed Martin Corporation Stock in their savings plan: This investment must be redirected into another investment option in the Savings Program by close of business on April 30, 2003.

If instructions are not issued by that date, your stock will be sold for you and the proceeds invested in the Stable Value Fund.

"While you may not wish to sell in today's market climate, we would like to urge you to begin consideration of your long-term strategy for the transfer of your balance from the LMC Stock Fund," says HRDP Director Darryl Boykins.

The entire balance does not have to be transferred at one time. However, the final date to complete all transfers will be April 30, 2003.

Oak Ridge National Laboratory

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*Jill Freeman is manager of Benefits Delivery Services*

## Uppuluri wraps up FORNL series

Environmental advocate and policy veteran Ram Y. Uppuluri is the speaker for the last talk in this year's Friends of ORNL Community Lecture Series. His talk, "Easier Said than Done! Science Policy, Politics, and the Ongoing Debate Over Global Climate Change," starts at 7 p.m., Tuesday, June 19, at the American Museum of Science and Energy.

Uppuluri, an Oak Ridge native who lives in Washington, D.C., was an advisor on environmental issues for the Clinton administration.

### Retirees: Changing address?

To change an address, retirees should call 574-1500 or 1-877-861-2255 and request a "change of address form." Once returned, Benefits Delivery will make the change in its database. *ORNL Reporter* and other mailing lists (except the savings plan) use this database for addresses. However, completed "change of address" forms are forwarded to CitiStreet Bank, so the savings plan record will be updated as well.

## Service Anniversaries

June

**44 years:** L. E. McNeese, Chemical Technology; Robert W. Swindeman, Metals & Ceramics; Robert T. Santoro, Computational Physics and Engineering

**41 years:** Frank R. O'Donnell, Environmental Protection & Waste Services; Margaret B. Emmett, Computational Physics and Engineering

**40 years:** James M. Corum, Engineering Technology

**35 years:** Clarence Murrin, Plant and Equipment; S. Ram Raman, Physics; Hollis G. Hodge, Life Sciences; Richard J. Colchin, Fusion Energy; James D. Drischler, Computational Physics and Engineering

**25 years:** C. Y. Horton and Karen H. Galloway, Operational Safety Services; A. J. Boatwright, Cecil L. Gilliam, Ronald E. Shorter, Ronald D. Edgemon, Michael W. Humphreys, Ernie L. Scruggs and Hoa C. Burlingame, Plant and Equipment; Chung H. Chen, Guy D. Griffin, Steve J. Kennel and Charles F. Baes III, Life Sciences; Rebecca A. Lawson, SNS Project Director's Office; Bessie F. Davis, Contracts and Procurement; Patricia M. Trentham, Chemical & Analytical Sciences; Leroy Sims and Michael T. Huie, Business & Information Services Dir.; John R. Kirkpatrick, Johnny S. Tolliver, Bennett R. Bass and D. M. Kelleher, Jr., Computational Physics and Engineering; Philip W. Watts and Robert T. Jubin, Chemical Technology; D. L. Beshears, Engineering Technology; Michael A. Karnitz, Energy & Engineering Sciences Dir.; Raymond C. Juras, Physics; Benjamin E. Lewis, Jr., Robotics and Process Systems; Eddie McReynolds, Logistical Services

**20 years:** Faye S. Brewer and Lewis D. Gourley II, Plant and Equipment; Larry R. Baylor, Fusion Energy; Ross J. Toedte, Deryl A. Steinert and E. L. Frome, Computer Science & Mathematics; James W. Simmons, Computing, Information, and Networking; Rebecca J. Moses, Engineering Technology; Gary A. Armstrong, Robotics and Process Systems

## Deaths

Bill Clapper, 46, who worked in the Computing, Information and Networking Division, died on May 23 as a result of a traffic accident. Among his contributions to the Lab, termed "unmatched and priceless" by coworkers, was the programming and maintenance of a number of highly used information systems.

He is survived by his wife, Barbara, and children, Anna and Douglas, who live in Oak Ridge.

# Habitat

Continued from page 1

reach and also serves on the Anderson County Habitat for Humanity board.

Lab Director Bill Madia stayed busy measuring and lining up the bases for the floor joists. Deputy Director Lee Riedinger ran a power saw. Office of Independent Oversight Director Jan Preston proved herself handy with a drill and ALD Jim Roberto sunk several nails. Also on hand were Office of



Bill Cabage

**From left: Lab Director Bill Madia, Habitat OFC member Paul Smith, and Office of Independent Oversight Director Jan Preston work on the Habitat house's floor trusses.**

Tech Transfer's Jan Haerer, Audit and Management Services Director Scott Branham and Chief Legal Counsel Steve Porter.

By the end of the day, just as an afternoon storm rolled in, most of the house's floor trusses were in place.

Jerry and Ellen Goodman, currently of Oliver

Springs, will occupy the home. They were on hand that Saturday morning and will invest their own "sweat equity" in the project during the coming months.

UT-Battelle's \$15,000 contribution, half of which goes to build the 1,200-square-foot home and the rest to rehabilitate existing homes, came as the result of a "challenge" by Tim Myrick and his wife Teresa to match their like contribution to the projects. In addition to the Habitat project, existing homes are being rehabilitated through the Aid to Distressed Families of Appalachian Counties program.

Tim, who leads the Lab's modernization program, is a Habitat regular, and he was at the Heiskell site on May 19. Tim and another set of Lab volunteers with the Lab's modernization program—including Deputy Director for Operations Jeff Smith and Facilities and Operations Director Herb Debban—are also helping to rehab the other homes with the ADFAC program.

"The concept driving this is that we want to do both new homes and rehabs to reflect the new buildings and rehabs that we will be doing under the Lab's facilities modernization effort," Tim says.

The Myricks' and UT-Battelle's contributions add up to \$30,000 toward better living space for area residents.

Divisions that have so far signed up to be represented by volunteers in the Heiskell project include Environmental Sciences, Logistical Services, Quality Services, Facilities and Operations, Metals and Ceramics and Robotics and Process Systems.

Team UT-Battelle was recently established as a clearinghouse for projects as organized as a Habitat for Humanity build or as informal as a roadside litter pickup. Almost any sort of community-related cause or project, charitable or cultural, can be considered.

"It's a way for Lab employees who serve worthy causes to attract attention to them, get support and



**Volunteers for an Aid to Distressed Families of Appalachian Counties home rehabilitation project install vinyl siding. Their work is captured by a local TV station.**

earn recognition both for the projects and the volunteers who do them," says Bill Pardue, who heads up the Team UT-Battelle organizing effort.

If you'd like to participate in the Habitat build, contact Brenda Hackworth at 574-4160. If you have a cause or project that you think is suited to Team UT-Battelle's participation, call Bill Pardue at 576-0235.—B.C. [oml](#)

## Use deferred vacation by June 30

If you are a salaried employee who has remaining 2000 "deferred" vacation that was to be taken during the first half of calendar year 2001, take it before June 30 or it will be lost. As provided in HR006, "Deferred vacation must be taken prior to June 30 of the following year or taken continuously beginning on or before June 30." Contact your HR generalist if you have questions about the vacation deferment policy or process.

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