Defense Secretary Chuck Hagel visits Labs

Impressed by Sandia’s technical know-how, dedicated people

By Sue Major Holmes

Secretary of Defense Chuck Hagel was impressed by what he saw in a recent 90-minute visit to Sandia — impressed not only by the Laboratory’s technical capabilities but also by the talent of the people who work here.

“I was impressed with the kind of people I met today, what they’re doing, how they’re doing it, the commitment that they have made to this country and to the future of the country,” Hagel told members of the national press corps who traveled with him on Jan. 8 to Sandia and the Air Force Materiel Command’s Nuclear Weapons Center at Kirtland Air Force Base.

“And they do it . . . because they understand the privilege of helping make this a better world.”

He said he wanted to look at Sandia’s work in nuclear weapons modernization and research and

(Continued on page 5)

USSTRATCOM commander spends day being briefed on Sandia’s NW mission

By Stephanie Hobby & Heather Clark

The commander of US Strategic Command (USSTRATCOM) says he has wanted to come to Sandia for years to see firsthand the Labs’ nuclear weapons program work and “to connect the dots between the missions, where we are today with the capability, and where we have to be tomorrow.”

Adm. Cecil Haney spent all day Jan. 10 touring Sandia, hosted by Sandia President and Labs Director Paul Hommert and Executive VP and Deputy Director for National Security Programs Jerry McDowell. Paul presented an overview of Sandia’s work and briefed the admiral on the Labs’ nuclear weapons mission. Haney also toured Sandia’s nuclear weapons display area, heard about its work on weapon modernization programs and the advanced hypersonic weapon, participated in discussions about the

(Continued on page 4)
That's that

The email went down yesterday in IPOS. So did the web. Access to the network. Down. All down. Something to do with a bad component. A preemptive firewall shutdown, a quick replacement of the part, and we'll be up and running again. Easy peasy. Not.

This isn’t to blame the hard-working network ops team charged with keeping the systems connected to the cloud. They sweated a classic outage, worked the problem, and 16 hours later, had us back online. To paraphrase a quote attributed to George Orwell, those of us affected by the outage were able to sleep peacefully in our beds that night only because others were alert and ready to do whatever it took to fix the problem.

So again, and emphatically, no blame redounds to the network team for thinking this would be an easier fix than turned out to be. That’s life; how many times have you started a little home improvement project, like tightening the screws on the screen door, only to end up replacing the entire door frame? Hey, it happens.

Our computer network folks are heroes as far as I’m concerned, and heroes we too often take for granted. There’s probably nothing in this world so complex as our computer systems. In their intricacy, they’re almost like the cathedrals of our age, a bringing together, in one construct, of everything we’ve learned. I’m grateful to these folks, our own team of St. Georges, who take on the dragons out there.

The thing that strikes me about these network episodes — and here at Sandia they are relatively few and far between — is their reminder of how utterly dependent we are on these tools. It’s hardly an original insight, but the fact is, the tools we rely on every day hardly existed when I joined the Labs 19 years ago and existed only in the minds of science fiction writers when we were helping the nation win the Cold War. Don’t you wonder, sometimes, how they did, those pre-computer Sandians? I do. I’m in awe of them, actually.

We worrying on line. I check my memory about that Orwell quote I cited above. How in the world would I have done that back then? But then again, would you, as the reader, have known the difference? To paraphrase TV detective Adrian Monk: The Internet — it’s a blessing. And a curse. And a curse.

If there were ever any doubts about the importance of the work we do here, a couple of high-level visits we enjoyed earlier this month should dispel them. Secretary of Defense Chuck Hagel and USAF/PACOM commander Admiral Cecil Haney came to the Labs in separate visits to get briefed on our nuclear weapons mission and other work we’re doing for the nation. These men, both of whom carry huge responsibilities for America’s security, didn’t just pop in at any old workplace. They don’t have time for that. The fact that they chose to spend some time with us speaks to the gravity of our mission. That they both went away impressed is gratifying; that they both have some very positive things to say about us is both welcomed and appreciated.

Speaking of nice words, the most telling, printed, challenging, and inspiring comment I’ve heard about Sandia in a long time came from another visitor, NNSA Deputy Administrator Don Cook, who in an earlier career headed up some of the most significant programs at Sandia.

Cook, who accompanied Secretary Hagel on this recent visit, spoke at Sandia several months ago about the Labs’ central role in ensuring the safety, security, and reliability of the nation’s nuclear stockpile. “In aggregate, these technical challenges [of keeping the stockpile viable] exceed anything the Sandia has ever faced,” he said. “The challenge is formidable. I think about that. That’s why what we do here is more than ‘work.’ It’s more than a job. It’s a mission. I’d even say it’s a calling.”

— Bill Murphy (505-845-0845, mso414, wtomurp@sandia.gov)

Rick Fellnerhoff named chief operating officer of NW SMU

Rick Fellnerhoff is the new director of Nuclear Weapons Planning, Operations, and Integration Center 200 and chief operating officer of the NW Strategic Management Unit (SMU), replacing Larry Walker, who retired after more than 20 years with Sandia.

The change took effect Aug. 12, and Fellnerhoff has worked in the NW program for the past 15 years — half of his career at Sandia. His portfolio includes component development responsibilities in Centers 5300 and 2600 during the development of the W76-1, served in the NNSA as weapon science and technology and Div. 1000 deputy, and was a technical advisor on assignment to NNSA. For the past several years, he directed Surety Assessment, Engineering, and Analysis Center 400.

Fellnerhoff also served as US chairman for the US/UK Joint Working Group JOWOG 4 - Safety Assurance, with participants from Los Alamos and Lawrence Livermore national laboratories, the Pantex Plant, and the UK’s Atomic Weapons Establishment and Ministry of Defence. Rick has a BS and MS in electrical engineering, both from the University of New Mexico.

In another personnel move, Gerry Steele was named to lead Group 250, the National Security Operations Office, effective Jan. 10.

Most recently, Gerry served as a Congressional Fellow, advising the House Committee on Homeland Security on issues related to national security, science and technology, and weapons of mass destruction. Before the Washington assignment, he served as acting deputy chief engineer for Nuclear Weapons and as the senior technical deputy for Div. 2000. He has been with Sandia for 27 years and has held line organization leadership roles within Divisions 2000 and 6000 and programmatic leadership roles in the NW and DS&A SMUs.

In addition, Bruce Walker, Div. 2000 VP for Weapons Engineering and Product Realization, announced that all legacy stockpile systems, control systems, and advanced & exploratory (AiE) work at Sandia/New Mexico have moved from Weapons Systems Engineering Center 200 to the US/UK Joint Working Group. AiE work at Sandia/New Mexico have moved from Weapons Systems Engineering Center 200 to the US/UK Joint Working Group and are reported through the US/UK Joint Working Group.

The NW systems engineering restructuring went into effect Dec. 20.

Sandia’s work in Life Extension Programs (LEPs) and major alterations (ALTs) has grown substantially in the past few years, and the realignment will help balance the workload, Bruce says.

The restructuring puts all LEPs and major ALTs for New Mexico weapons systems under Center 2100 and all New Mexico stockpile systems, control systems, and AiE under Center 2200. It aligns Center 2100 with NNSA/NA-19 and Center 2200 directly with NNSA/NA-12. California systems engineering was not affected by the restructuring.
A nuclear device has been detonated in the Midwest.

with specific interest in ACSO and Washington State in developing case

Sandia's role evolved from just developing the scenario to executing it as well. Donna and Stacy, along with Troy DeLano (8137) and Ann Hammer (8112), designed and ran the scenario. Numerous other Sandians and partners from LLNL and DNDO contributed to execution of the scenario.

another advantage

What isn't changing?

As part of the Federal law enforcement agencies in return for the time they gave us in interviews to develop the case studies to characterize preventative radiological and nuclear (R/N) capabilities. "We wanted to do something for regional law enforcement agencies in return for the time they gave us in interviews to develop the case studies," says Donna. "We offered them an R/N awareness or as a 'front door' to Sandia/California on the eastern edge of the campus, says John Garcia (8510). The vision, he says, is for external visitors — including job candidates, academic partners, industry collaborators, and vendors — to enjoy a more inviting and welcoming introductory experience when arriving at the California site.

Another advantage of the move is that all visitor badge activities will be consolidated into one facility, providing badges for visitors, new employees, contractors, DOE and non-DOE cleared visitors, as well as GAAL/Chinese Valley Open Campus badges. Eventually, a new building, which will be called the Collaboration on Research and Engineer- ing for Advanced Technology and Education (CREATE) facility, will serve as the centerpiece of the front-facing entrance to the site. The CREATE facility will house both computer research areas, such as hydrogen and bioscience, as well as some "public interface" functions like badge office operations.

What isn't changing?

When the new Visitor Badge Office at Post 17 becomes operational, already-badged members of the workforce may still enter the California site via East Avenue and Vasco Road as part of next year's Urban Shield.

The success of our involvement with Urban Shield Exercise was truly a rare opportunity to conduct tactical operations in that environment. "We started around the question of was it worth the effort and safety concerns, but ultimately this was the biggest benefit to our scenario," says Troy. That benefit extended beyond the S.W.A.T. team to the volunteers who helped put on Urban Shield. "Some of the volunteers were Police Academy cadets or recent graduates. Others were people just interested in helping. So this was a unique training opportunity to educate the general public on radiation hazard and detection," says Stacy. The Sandia team ran the scenario 34 times over the 48-hour period. They found that each time the scenario evolved, it was different. "I was deeply impressed with how capable, adaptable, and effective the S.W.A.T. teams are in doing their job," says Troy. "I thought we'd see patterns emerge, but something different happened each time."

For the Sandia team, it was an opportune time to work directly with first responders. "We tend to do a lot of analytical work," says Stacy. "It’s critical to engage with operational stakeholders when designing products and solutions for them."

If funding is available, Sandia may work with ACSO on developing another R/N training exercise, possibly as part of next year’s Urban Shield.

The success of our involvement with Urban Shield could open a lot of doors," says Donna. "I think there could be opportunities for other groups at Sandia, whether it be in science, technology, policy, and operations, but most of us do not have operational backgrounds," says Stacy. "It’s critical to engage with operational stakeholders when designing products and solutions for them."

By Mike Janes

Visitor badging shifting to open campus

A nuclear device has been detonated in the Midwest. United States and intelligence indicates that a sec-

ded scenario for Urban Shield." Sandia's role evolved from just developing the scenario to executing it as well. Donna and Stacy, along with Troy DeLano (8137) and Ann Hammer (8112), designed and ran the scenario. Numerous other Sandians and partners from LLNL and DNDO contributed to execution of the scenario.

IN THE R/N DETECTION EXERCISE at Urban Shield 2013, S.W.A.T. teams engage with “adversaries” intended to distract them from the radiation source in a different vehicle. This scenario, which the Sandia team ran 34 times over a 48-hour period, evolved differently each time.

Sandia adds rad detection scenario to Urban Shield Exercise

By Patti Koning

A nuclear device has been detonated in the Midwest. United States and intelligence indicates that a sec-
nation's nuclear detonation detection system and space programs, joined a group of Sandia weapon engineers for lunch, and addressed Sandians at an all-hands meeting in the CNAC auditorium.

Sandia's work plays a role, Haney said in an interview with the Lab News following the all-hands session.

Just the snapshot that I got today in seeing some of the work that's being done, the chance to meet these incredible people who are behind the scenes, to me is also a part of our nation's determination.

"We have a mature arsenal when you look at our strategic capabilities today in terms of warheads," and it's inspirational to "know we have gotten as much life as we have out of what we have today but even more to see the talented people making sure we can sustain this capability as we must, for some time to come," he said.

Haney was joined on the visit by Steve Callicutt, USSTRATCOM's director of capability and resource integration, Brig. Gen. Jim Dawkins, principal assistant deputy administrator for military applications in defense programs for NNSA; and Jim Colaco, division chief of USSTRATCOM's Global Strike Capabilities Division, Global Strike.

They came to汉和 Sandia's work with strategic deterrence in mind, but said he also was impressed by the Labs' other national security work. He mentioned seeing a display of Sandia's contributions, decade by decade. "I admire that, and I'm glad to see Sandia has taken the time to post that history so it can be a reminder to all who come to visit, but also a reminder to the workforce," he said.

He was familiar with Sandia's work before his visit, but said he wanted to put "boots on the ground" to get a more personal understanding and to talk to Sandians about their work and what motivates them. "That ultimately gives me a deeper appreciation than I came with," said Haney, who said he was struck by how passionate Sandians are about their mission.

He ended the interview with a message to Sandia's workforce: "I know I can count on them to maintain the standard of excellence that Sandia was built upon. I can't thank them enough for the support they have, and will continue to provide, for the mission areas of US Strategic Command but also for their dedicated efforts for our country at large."
Secretary Hagel

(Continued from page 1)

development because “that technological edge that we have been able to maintain is critically important, especially in the world that we’re in today.”

In R&D and such national security programs as weapons stewardship and nuclear monitoring, he said it’s especially vital “to continue to be able to recruit and keep the cutting-edge minds in the world on our team.”

Among those accompanying the defense secretary were Frank Kendall, under secretary for acquisition, technology, and logistics; Andrew Weber, assistant secretary for nuclear, chemical, and biological defense programs; Madelyn Creedon, assistant secretary for global strategic affairs; and Don Cook, NNSA’s deputy administrator for defense programs.

The agenda included briefings on the modernization, safety, and security of the nuclear arsenal and proliferation assessment, along with walk-through tours of Sandia’s nuclear weapons display area; the Microsystems and Engineering Sciences Applications complex, or MESA; and the Z machine facility. Sandia President and Labs Director Paul Hommert and Executive VP and Deputy Director for National Security Programs Jerry McConnell escorted Hagel, who also met with other Sandia officials and staff during his tour.

“It’s very important to all of us who have some responsibility for the national security of this country to pay attention to every aspect and area of that responsibility,” Hagel said as he wrapped up his day by briefing reporters at Kirtland’s 377th Air Base Wing headquarters.

The nation’s nuclear deterrent has prevented World War III, Hagel said. “We’ve had wars, but not on the scale of what we saw in the first half of the 20th century,” he said.

The defense secretary noted that presidents since Richard Nixon have advocated reducing the nuclear stockpile along with corresponding Soviet/Russian reductions. However, he described himself as both a realist and an optimist. “I also understand the reality of the kind of world we live in,” he said. “We can’t just unilaterally cash in our nuclear chips.”

“I think the reality is that we are going to continue to need nuclear deterrence for our future, but that doesn’t mean it [the number of weapons in the stockpile] can’t continue to come down and still protect our country and our security,” he said. “It is the slogan: Peace through strength. As long as we have the strongest national security system of any nation in the world and we continue to keep that modern and strong, then we should also continue to promote that de-acceleration and bringing down the threat of nuclear weapons.”

Hagel acknowledged that tight budgets will mean making choices about where resources will do the most good. “To modernize your nuclear weapons stockpile — ensure that they continue to stay secure and safe — takes resources. This country has always been willing to make that investment. I think we will continue to make it, and that Congress will be a strong partner,” he said.

EXPLAINING RESEARCH — Sandia researcher Stephanie Hansen (1684) briefs Secretary of Defense Chuck Hagel and Frank Kendall, under secretary of defense for acquisition, technology, and logistics, at the start of a tour of Sandia’s Z Pulsed Power Facility.

(Photo by Randy Montoya)

DISCUSSING SANDIA’S WORK — Sandia President and Labs Director Paul Hommert and Secretary of Defense Chuck Hagel talk during the secretary’s Jan. 8 tour of the Labs. Hagel said he was impressed by Sandia’s people and their commitment to the nation.

(Photo by Randy Montoya)

SECRETARY OF DEFENSE Chuck Hagel and Sandia President and Labs Director Paul Hommert listen as Center 1700 Director Gil Herrera leads a tour of the Microsystems and Engineering Sciences Application complex, part of the secretary’s Jan. 8 visit to the Labs.

(Photo by Randy Montoya)
recognized later this year at a ceremony in Washington, D.C., for their work in advancing the nation’s science and engineering.

**Matthew Brake**

Matt, a graduate of Carnegie Mellon University’s mechanical engineering program, joined Sandia in early 2008 after earning his PhD. One aspect of his work focuses on understanding interfacial mechanics, or how two objects interact when they impact and rebound. “You want to be able to predict how a joint will perform in different shock environments. You could build a mesh and have thousands and thousands of degrees of freedom, but to simulate that with the necessary number of elements to get convergence for your contact models, it’s going to be prohibitively expensive. There’s no way to actually do that in a feasible amount of time and get the correct answer,” Matt says. “So the whole philosophy behind this modeling effort is rather than having the extremely large number of elements needed to get convergence, why don’t we use a course mesh, but have a very high fidelity representation of contacts, so we can very quickly and accurately do these simulations of how a strong link will respond in different environments.” Shrinking the models means an analyst can now understand in a few days with a desktop what would have otherwise taken years on a supercomputer.

Matt is currently studying friction and energy dissipation between two bodies and has become involved with the global community of joints researchers, taking on several leadership positions. He is the secretary of the American Society of Mechanical Engineers and is also organizing the 2014 Sandia Nonlinear Mechanics and Dynamics Summer Research Institute, which will bring researchers from around the world to Sandia to study some of the biggest challenges of predicting the behavior of jointed structures.

**Adrian Chavez**

Adrian, an Albuquerque native, started at Sandia in 2000 as an intern in the Center for Cyber Defenders while a student at the University of New Mexico. He spent four years there, learning about computer security. In 2004, he took advantage of Sandia’s Master’s Fellowship Program to pursue his master’s degree at the University of Colorado, Boulder and returned to Sandia in 2006. Since that time, he has focused on cybersecurity for critical infrastructure systems and adding security to systems like the power grid, oil and gas refineries, and water pipelines to make sure that responses and protections are in place in the event of a cyberattack. Adrian has worked on several projects focused on securing these systems.

“The vision of each project is to secure the hardware and software of critical infrastructure systems that harness our nation’s most critical assets. My research focuses on retrofitting new security protections into an architecture that supports both the legacy and modern devices,” Adrian says. “There are millions of devices in these systems that need to be made more secure for an adversary to locate and attack a specific system.”

“I am honored to receive this award. It has been a great day to showcase all of the work we do at Sandia be recognized at such a high level,” Adrian says. He is working on his doctorate in computer science at the University of California, Davis and is interested in continuing research to help secure critical infrastructure systems.

**Seth Root**

Seth earned his bachelor’s and master’s degrees in physics at the University of Nebraska and his doctorate in physics from the Institute of Shock Physics at Washington State University. He joined Sandia in 2008 for the opportunity to work on the Z machine, the world’s largest pulsed-power facility. “We are working on a platform that can generate pressure and temperature regimes that few else in the world can access or understand material behavior at extreme conditions,” he said. “The opportunity to do research at extreme conditions at a facility like Z is really exciting.”

Seth has been involved in a team combining theoretical and experimental methods. The team is applying density functional theory, a method of calculating properties of materials, to systems like the power grid, oil and gas refineries, and water pipelines to make sure that responses and simulations.

Seth says the PECASE was more than just an individual award, but rather a recognition of the many people involved. “We have a really good team at Sandia. The award shows that the work we do in understanding material properties at high pressures is greatly appreciated on a national level,” he says.

**Daniel Stick**

Dan earned his undergraduate degree in physics from the California Institute of Technology and his PhD at the University of Michigan. He was nominated for his development and demonstration of miniaturized ion traps for quantum computing. Monroe’s Law predicts that about every 18 months the processing power of classical computers doubles, but as devices shrink, they will run into fundamental physical limits at which transistors start behaving unpredictably. Quantum computing is one strategy to circumvent these limitations, but there is a lot of work to be done. “For these devices to be a viable platform for quantum information processing, they have to be made more reliable and engineered to eliminate particular sources of noise that make quantum computing extremely difficult,” Dan says. “Quantum computing is something that is usually talked about in terms of its promise for exceeding classical computing, but everyone realizes that the technical challenges for actually realizing such a device are extraordinary.”

Dan came to Sandia as a postdoctoral researcher in 2007 and was hired on as a staff member two years later. With his background in experimental atomic physics, he worked with Sandia’s microfabrication experts to design and fabricate novel trap geometries. “My main contribution is the experimental demonstration of these traps. They’ve become really successful in that a lot of the leading ion-trapping groups across the world use Sandia-fabricated ion traps for their quantum experiments,” Dan says. “This award is a wonderful recognition, and I’m honored to receive it. There are so many people at Sandia who deserve some of the credit for this as well.”

Three of the four winners, Matt, Dan, and Adrian, were or are supported by LDRD funding. The awards were established by President Bill Clinton in 1996 and coordinated through the Office of Science and Technology Policy in the Executive Office of the President. Awardees are selected for their pursuit of innovative research at the frontiers of science and technology and their commitment to community service as demonstrated through scientific leadership, public education, or community outreach.
MISCELLANEOUS

TREMBULL, NordicTrack A2150, $450, Box 8300, mail pick-up or must call, $450. Cheek, 934-6837.

GE WASHER, model GFW500ASFMWW, 1,100 rpm, front loading, 14-cu. ft., Very good condition, $150. Muckelroy, 505-384-9611.

CHAR, La-Z-Boy recliner, fabric, must go, $150. No trade. Call at 785-9220 or 883-3024.


WHEELBARROW, like new, $10. Wacek, 384-2360.

STORM DOORS, w/frame & garage door opener, $200 OBO. Martin, 934-8796.

HOUSEMATE, 1,067-sq. ft., detached, 3-BDR. HOME, 2 baths, 1,420-sq. ft., SW area, $600/mo. available Feb. 1, $10. Martindale, 792-2310.

GREAT POOL MAN, experienced in pool & spa cleaning. $10/hr. Call 505-626-2482 for more info.

JACK RUSSELL TERRIER, male, ~1 yr. old, $75-$150. Gonzales, 505-363-7101.

OVER-THE-STOVE EXHAUST FAN, white, electric, used, in good working condition, $39. Hryniewicz, 915-241-8634.


CAMPING TRAILER, Class C, w/2 slides, w/tin, very well maintained, $18,000. Johnson, 934-8796.

2-STORY HOME, Ventana Ranch, built in ’04, 1,742-sq. ft. Salmon, 899-8749.

WANTED

HOUSEMATE, 1,067-sq. ft., detached, 3-BDR. HOME, 2 baths, 1,420-sq. ft., SW area, $600/mo. available Feb. 1, $10. Martindale, 792-2310.

DOE employees.

The nuclear race may have ended, Edwards said, at least partly because cli-
mate change models were able to dramatically graph the catastrophic effects
resulting from so-called nuclear winter — the darkening and cooling of Earth by
airborne carbon compounds in raising Earth’s temperature that seemed strik-
ingly similar to the pro and con discussions of today.

Thus, climate was seen as a sibbling field for nuclear thinkers. John von Neu-
mann, the famous mathematician who helped develop the early ENIAC com-
puter, “settled on weather forecasting as the thing to do because it was very simi-
lar,” said Edwards, in an interview with Slate magazine in 2000, in which he said,
“[Computer] models made by Russian and American scientists showed that a
nuclear war would result in a nuclear winter that would be extremely destruc-
tive to all life on Earth; the knowledge of that was a great stimulus to us, to
people of honor and morality, to act in that situation.”

To support his assertion, Edwards quoted former Soviet premier Mikhail
Gorbachev, who said, “We need to realize that the threat of nuclear war is not
just an issue of military security, but also of ecological security.”

Nuclear tests drive need for better climate models

Nuclear tests measured in 1955 showed carbon traveling across the equa-
tor into the southern hemisphere. “But was it bomb radiation or natural
radioactivity?” Edwards asked aloud rhetorically.

Such questions drove the need for more intricate models, requiring data to fill
empty grid points depicted horizontally and vertically as a series of boxes, to
which atmospheric circulation models. Also, the earliest global cli-
mate models involved numerical methods similar to those developed by
nuclear weapons designers for solving the fluid dynamics equations needed
to analyze shock waves produced in nuclear explosions.

By Neil Stargent

University of Michigan professors have been named to two climate research initiatives.

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Another explanation was offered by University of Michigan professor Paul
Edwards in his talk, “Cold War and Carbon Knowledge: The Strange Relations of
Nuclear tests, climate science, and weapons research,” presented Dec. 17 as part of
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Mike Cuneo, Igal Brener selected as IEEE Fellows

By Neal Singer

Two Sandians, Mike Cuneo (1650) and Igal Brener (1712), have been elected Fellows of the Institute of Electrical and Electronics Engineers (IEEE) as of Jan. 1. Igal was selected “for contributions to terahertz science and technology,” and Mike for “developments in inertial confinement fusion with magnetically driven implosions and electrode cleaning.”

The number of fellows chosen annually for the selective honor is restricted to less than one-tenth of 1 percent of the organization’s voting membership, which totals 400,000 in 160 countries. The well-respected organization has developed more than 900 active industry standards and sponsors or co-sponsors nearly 400 international technical conferences each year. Its members participate in subjects ranging from aerospace systems, computers, and telecommunications to biomedical engineering, electric power, and consumer electronics.

IEEE Fellow Mike Cuneo

Over the course of his 25-year Sandia career, Mike has pursued the goal of pulsed power-driven thermonuclear fusion. He worked first with ion beam diodes (1989-1997), and subsequently with wire array X-ray sources (1998-2008). The research efforts for which he contributed include power flow, ion diodes, ion sources, electrode plasma characterization, and mitigation, z-pinch-driven direct and indirect-drive capsule implosions for Inertial Confinement Fusion (ICF), wire array z-pinch physics of soft X-ray sources, magnetically-driven direct-drive implosions for ICF, and synergies of ICF work to cold and warm X-shield X-ray sources (which are the most energetic) for radiation-effects science testing on Z.

In magnetically driven inertial fusion, Mike made two contributions. He experimented with novel concept, the double-ended hohlraum (DEH) radiating source, for Sandia’s Z pulsed power facility. (A hohlraum is the equivalent of a small oven for containing and focusing X-ray radiation onto an ICF target.) Subsequently, his experiments with wire-array z-pinch X-ray sources used for the DEH led to a comprehensive understanding of the physics of single and nested wire-array implosions at the National Ignition Facility.

The work served as an organizing principle for a broadly influential area of pulsed power, stimulating more than 45 refereed journal and conference papers from other researchers that have been cited more than 1,000 times.

Mike also developed electrode-cleaning techniques to mitigate anode and cathode plasma formation in pulsed power devices. Such formation places fundamental limits on electron-beam and ion-beam diode performance, as well as on other high-voltage devices. Mike did seminal research that showed that the effects of gas formations formed by reactions on ion-beam performance could be significantly reduced using in-situ electrode cleaning techniques. Sensitivity to electrode contamination and mitigation by electrode cleaning are now part of the broader tool kit of all pulsed power scientists.

Mike authored or co-authored more than 150 refereed papers, including three invited topical reviews, with 18 in the premier physics journal Physical Review Letters. He was manager of radiation and fusion experiments from 2007-2013, significantly improving the foundations for radiation-effects source development and testing on Z, and for intra-lab collaborations on radiation effects. He is currently senior manager of the Pulsed Power Accelerator Science and Technology group.

Says Mike, “The award is ultimately a recognition of the research environment, talented people, and two decades of achievement of Sandia’s entire pulsed power center, which depends on the collaboration of large teams of scientists, engineers, and technicians.”

IEEE Fellow Igal Brener

Igal joined Sandia in 2004, Projects on which he has worked include chem-bio sensing, terahertz (THz) science and devices, plasmonics, metamaterials, and semiconductor physics. In 2008 he became NanoPhotonics Thrust Leader at the Center for Integrated Nanotechnologies (CINT), a joint Sandia-Los Alamos DOE user facility. A distinguished researcher in the Applied Photonics Microsystem Department and CINT, he holds 14 US patents and has authored more than 180 peer-reviewed journal and conference papers.

Since coming to Sandia, Igal has expanded his research to include passive and active THz metamaterials and new techniques to extend THz time-domain spectroscopy to even higher frequencies. He was a team member of the Tenahite MicroElectronics Transceiver and Metamaterial Science and Technology Grand Challenges. His work continues to be highly cited and presented in peer-reviewed journals and invited talks at conferences.

IGAL BRENER

Two of Igal’s most notable contributions were the invention of high-efficiency photodetecting THz antennas and generators and the development of THz imaging technology.

The development of high-efficiency THz photodetecting antennas resulted from the discovery in 1996 by Igal and his team that biased singular-metallic elements in gallium arsenide grown at low temperatures would emit strong THz radiation upon optical excitation. This increase in emission power was between one and two orders of magnitude. The extrapolation with collaboration from a bright THz emitter to an efficient THz detector didn’t take long, and this effect was later harnessed to produce the most efficient photodetecting THz antennas of that time.

Paralleling those activities was Igal’s search for a way to enhance the spatial resolution of THz imaging. Near-field visible imaging was an active area of research at Bell Labs and Igal and colleagues joined forces to develop the basis for near-field imaging at THz frequencies. The initial work used conventional THz emitters and detectors with the addition of near-field coupling but resulted in very low power throughput. Igal’s team then used an ingeniously combined collection of those same efficient THz antennas and processing to develop a near-field THz detector orders of magnitude more efficient and with superb spatial resolution. These probes enabled THz spectroscopy and imaging to operate at a frequency response comparable to regular time-domain spectroscopy systems and with spatial resolutions of the order of single- to double-digit microns. This technique was later patented and, with other patents, licensed to industry, impacting areas of homeland security, industrial production, and NASA missions.

In his near-field imaging work, essentially started by Igal’s work, now has several groups worldwide active in this area. His groundbreaking work also made possible the expansion of THz near-field imaging to include other techniques. “Overall,” he says, “there are now probably hundreds of papers with exciting scientific breakthroughs that use THz near-field imaging.”

Most of his activities today are in the areas of metamaterials, nanophotonics, and solid-state lighting. He says, “He was elected a Fellow of the Optical Society of America in 2007, and is principal investigator for both a Research Challenge at the Solid-State Lighting Science Energy Frontier Research Center and for the LDRD project “Electrically Tunable Metamaterials for Agile Filtering in the Infrared.”

Igal has also mentored PhD students and postdocs, and is proud that some of his graduates went on to pursue successful careers and become leaders in their fields.