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MST e NEWS

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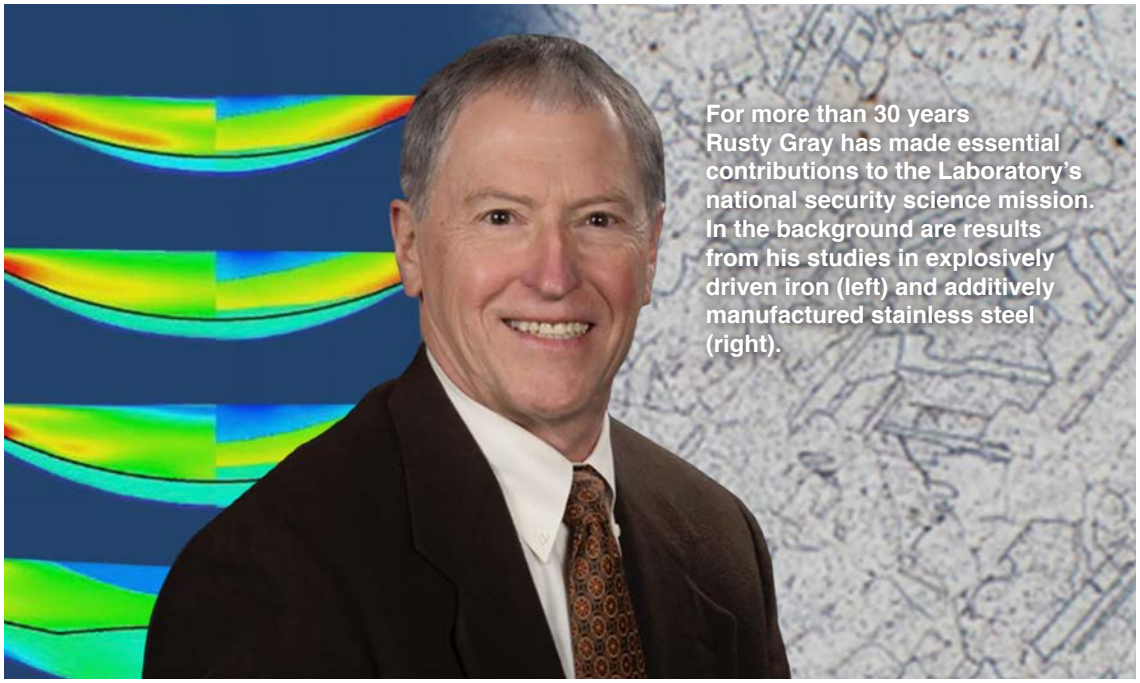
INSIDE



For more than 30 years Rusty Gray has made essential contributions to the Laboratory's national security science mission. In the background are results from his studies in explosively driven iron (left) and additively manufactured stainless steel (right).

Rusty Gray

A high-impact, hands-on materials scientist

By Kris Fronzak, ADEPS Communications

> *"I like science, engineering, and being able to lead science that helps the Lab."*

George (Rusty) Thompson Gray III is a tactile person. As a materials scientist, he uses high-powered gas guns to subject materials to dynamic forces, examining the resulting damage patterns to understand why materials fail. Outside of work, he uses his hands to modify materials, creating stained glass and woven straw baskets, and to tend the hives of thousands of bees.

Gray joined Los Alamos in 1985 to perform a combination of fundamental and applied materials research, intending to eventually become a university professor. Instead, he fell in love with the arid New Mexican mountains and the flexibility of working at the Lab.

"I sometimes wonder what my life would've been like in academia, but I wanted to defend the country and contribute to national security as well as publish papers and do research," said Gray, a team leader in Materials Science in Radiation and Dynamic Extremes (MST-8). "I like science, engineering, and being able to lead science that helps the Lab."

At Los Alamos, Gray leads critical science projects for the Lab's Stockpile Stewardship efforts and publishes Labora-

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From Jon's desk . . .

Greetings to all of the students that are here for the summer and all of the staff and post docs that are here year-round. For those students who have not met me, I am the deputy division leader of MST. The strong ties that MST has to the national security mission, the world-class science that we do, and the abundance of readily available outdoor activities in the surrounding area are a few of the things that I enjoy about living and working in Los Alamos.

With the county schools being out for the summer and nearly 1,500 students currently working at the Laboratory, there has been a noticeable up-tick in people enjoying the local outdoor activities. We also have more people riding bikes to work, walking to work, and more vehicles going through the vehicle access portals on their way to work. The increase in the volume of people arriving or departing the Laboratory at the same time and changes in our routines during the summer can contribute to risks associated with having an accident. Please recognize these contributing risk factors and have patience while performing these seemingly routine tasks to help ensure that we safely arrive at our respective destinations.

I would like to thank all of you who participated in the 2017 review of the materials capability at the Laboratory that concluded in early May of this year. The review focused on the materials capability strategy and the manufacturing science and the integrated nanomaterials areas of leadership. In addition, the external review committee met in breakout sessions with representatives from four different sets of employees—technologists, early-career staff, experienced staff, and group leaders/deputy group leaders—in order to assess their experiences and attitudes towards the Laboratory and the materials capability. I would like to share with you that the external review committee felt that the "workforce in the materials capability at all levels of the organization is world class" and that "the quality of the R&D the committee saw this year is excellent overall." Congratulations!

> *"I would like to share with you that the external review committee felt that the 'workforce in the materials capability at all levels of the organization is world class' and that 'the quality of the R&D the committee saw this year is excellent overall.' Congratulations!"*

The external review committee provided recommendations that our materials capability committee and MST management will be focusing on during the rest of this fiscal year and beyond. Two broad areas of focus will be carrying the materials strategy to the next level and building on current efforts to enhance the workforce brought about by the Laboratory attrition model projecting that nearly one-third of the workforce is expected to turnover in the next five years. As you can imagine, mentoring and career development will be critical components of shaping the workforce of the future. I have been asked to focus on ensuring that the mentoring program in MST remains high quality and on creating career development opportunities for employees in all of our job families within MST. If you have thoughts or concerns regarding mentoring or career development improvements (or deficiencies), please stop by my office and share your ideas. If I am unavailable, please communicate your thoughts, concerns, or ideas to your team leader, group leader, or division leader.

Have a safe and productive summer and thank you in advance for your participation.

MST Deputy Division Leader Jon Bridgewater

Gray cont.

tory research on materials science advances. He advises institutions on the role of materials dynamics in defense and manufacturing applications. This year he was elected to the National Academy of Engineering, the only active Los Alamos scientist in the organization. He is a fellow of the American Physical Society; ASM International; Los Alamos; and the Minerals, Metals and Materials Society, having served as the organization's president in 2010.

Originally interested in geological engineering, Gray enrolled at the South Dakota School of Mines and Technology in part because of its geology department and proximity to the Black Hills. There, he and fellow rock hounds explored long-abandoned Gold Rush mines, finding rotting beams and collapsed tunnels about as often as they unearthed interesting stones. In his office, Gray has a fragment of an 1800's mine cart rail from those mountains.

Yet it was his study of iron shock loading as part of a U.S. Army project that determined Gray's ultimate career path. During this master's thesis research, he was drawn to the challenge of linking iron's microstructure to its shock-loading response and its post-shock structure and property behaviors.

Gray earned his PhD in metallurgical engineering from Carnegie Mellon University, studying microstructure's effects on fatigue cracks in steel. Before joining Los Alamos, he investigated cracks and stress on alloys during a three-year postdoctoral fellowship at Germany's Technical University of Hamburg-Harburg.

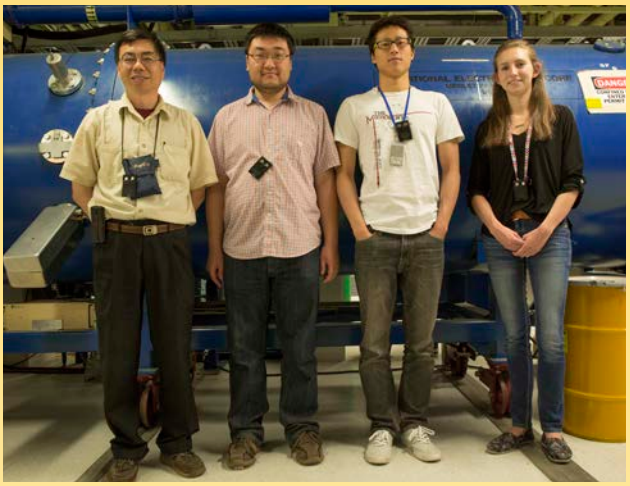
"He's an amazing person and a super dedicated scientist who's driven a lot of the research we do," said Saryu Fensin, one of his former postdoctoral researchers and a member of his Dynamic and Quasi-Static Loading experimental team. "Rusty has developed a lot of capabilities for the Lab that we're still using today and is still coming up with new science ideas. He's been critical in getting the data and physics needed to develop damage and failure models."

For example, Gray developed an 80-mm gas gun and a Taylor cylinder facility essential for the Lab's materials dynamics experiments. His research has improved a range of strength, damage, and failure models including for mechanical threshold stress, Preston-Tonks-Wallace strength, and tensile elastic plastic damage.

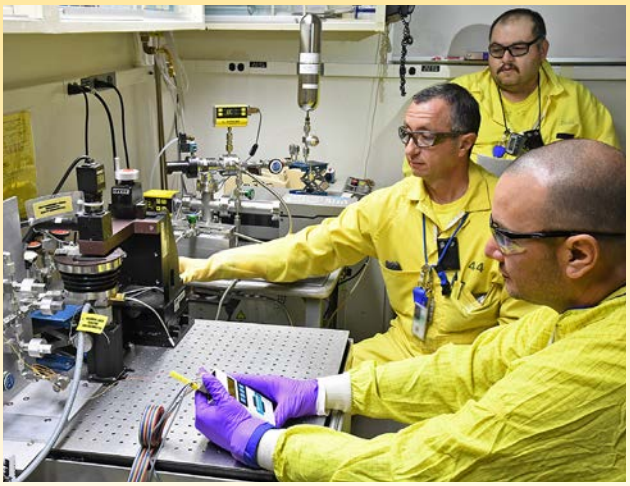
When asked what he's most proud of in his career, Gray cites his research on the structure and property behavior of materials subjected to dynamic and shock-wave deformation—the science that brought him to the Laboratory and a field that is especially critical in the absence of underground nuclear testing. "I've brought a lot of insight into why materials respond the way they do under high strain rate and high shock loading," he said. "I've been very blessed in my career."

Out and about in MST

MST-7 technologist Stephanie Edwards uses a load frame to test the stress/strain properties of a silicone foam.



Yongqiang Wang, Di Chen (both MST-8), Tim Jen, and Katey Thomas (both University of Michigan) take a break from research in the Ion Beam Materials Laboratory.



MST-16 technicians (from front) Jesse Salazar, Richard Salazar, and Ernesto Gallegos monitor gas sampling equipment used in support of the pit surveillance and life extension programs.

Teamwork brings quick resumption of MST-16 programmatic activities

On April 19, a small pyrophoric event, during which an injury was incurred, forced Nuclear Materials Science (MST-16) into an organizational pause of programmatic operations. The event initiated when the contents of several vessels containing an active metal/metal-hydride powder were exposed to air, triggering a pyrophoric reaction. The on-site workers went to great lengths to contain the incident and minimize potential catastrophic effects to the facility. Although certainly regrettable, MST-16 (with the support of many additional organizations) was able to come together quickly, and with purpose, in order to have all programmatic operations fully resumed within 45 days from the date of the incident. The actions taken are detailed below:

Initial pause of operations: Shortly after the event, MST-16 management made the decision to pause all programmatic operations under its jurisdiction. The many precursors leading up to the fire were latent, and not location specific. Therefore, it was felt that taking a step back to take a hard look at both laboratory conditions and laboratory procedures needed to be performed in order to ensure that the conditions for a similar event were not present in any MST-16 laboratory space.

Communicating expectations: MST-16, the MST Division Office, and Experimental Physical Sciences management met with the group through a series of meetings held at the team level. The goal of the meetings was to communicate information regarding the event, as well as communicate expectations regarding the programmatic pause. These meetings provided a forum for MST-16 employees to come together and contribute to the methodology for the resumption of work activities. An all-hands group meeting was held the following week to update the group concerning both the status of the event, and the preliminary approach to resuming work.

Developing the path forward: Paths to resumption were developed and agreed upon by all stakeholders of a particular workspace. Involving stakeholders from the onset proved to be a key element to the success of the resumption

continued on next page

MST-16's research combination is one-of-kind in the DOE complex. The group plays a critical role in evaluating the static and dynamic properties of new and aged plutonium. At right, from top: MST-16 researchers perform a surface analysis study using a scanning Auger microscope; MST-16 employees discuss job-specific work tasks as part of a pre-job brief; MST-16 research technicians work on the Plutonium Facility's 40-mm gun glovebox, a key research tool for understanding the dynamic properties of plutonium; members of the MST-16 Metallography and Microscopy Team gather for a photograph. The team's efforts are vitally important to the success of the pit surveillance and life extension programs.

Los Alamos researchers highlight Lab advances in predicting materials damage through coupled experimental and computational studies

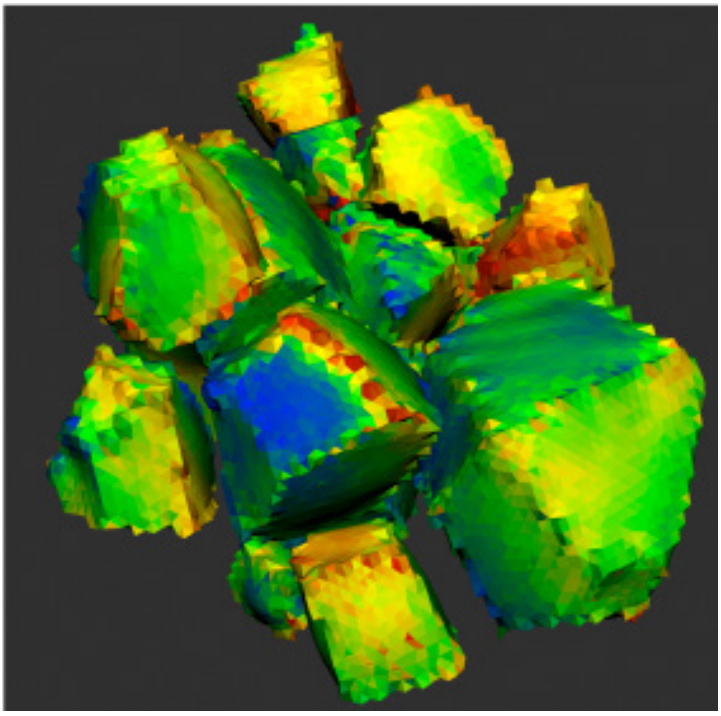
A Los Alamos materials scientist, theorist, and statistical scientist authored an overview of Laboratory efforts at developing a method to predict materials damage through a coupled experimental and computational methodology. The article, by Veronica Livescu (Materials Science in Radiation and Dynamics Extremes, MST-8), Curt Bronkhorst (Fluid Dynamics and Solid Mechanics, T-3), and Scott Vander Wiel (Statistical Sciences, CCS-6), appeared in *Advanced Materials & Processing.*

Predicting macroscale failure in polycrystalline metallic materials is challenging due to the complex physical processes involved and a lack of models that consider microstructural effects.

At Los Alamos, researchers are coupling experimental and computational methodology to improve predictive damage abilities. Turning materials into digitally generated microstructures allows scientists to study the actual distributions of microstructural features. Furthermore, structure-property information can help link microstructural details to damage evolution under various loading states.

The article discusses Los Alamos's use of open-source software to create an unlimited supply of three-dimensional synthetic microstructures statistically similar to the original material that can be exported for use in a variety of models and simulations allowing comparisons to be drawn. Examples of this technique for investigating ductile damage and evaluating a material's response to loading are given.

The long-term goal of this advanced research is to discover reliable phenomenological connections relating the time



An expanded view of simulated von Mises stress hot spots on grain surfaces in polycrystalline tantalum

evolving spatial distribution of stress hot spots to loading conditions, material properties, and spatial distributions of grain morphology and texture. Such research will in turn lead to better simulation models to predict macroscale behavior of materials under extreme loadings and, eventually, to a principled understanding of how these materials fail when subjected to shock.

Reference: "3D Microstructures for Materials and Damage Models," *Advanced Materials & Processing*, February/March 2017.

Technical contact: Veronica Livescu

Teamwork cont.

endeavor. In the case of the workspace where the event occurred, an event-specific recovery plan was drafted, and would be required to be executed prior to going through the process of resuming programmatic activities in the area. The location-specific resumption approach was documented and approved, and would lean heavily on MST-16 group efforts as well as support from a variety of other organizations (including Process Equipment Maintenance and Decontamination Services, NPI-3; Hazardous Materials Management, NPI-7; and Facility Systems Engineering TA-55, ES-55).

Execution: Once approved, MST-16 personnel, with the appropriate support, began working tirelessly towards the goal of resumption. The effort entailed an extensive, wall-to-wall evaluation of all MST-16 laboratory space. In the Plutonium Facility (PF-4) these evaluations involved the area work coordinator. NPI-3 personnel took the lead towards clean-up efforts in the room of the event, and with numerous volunteers from MST-16, were able to release return the room to service in a relatively short amount of time.

Ultimately, the success of this resumption effort was predicated on MST-16 employees coming together to work towards a common goal. By being transparent and communicative throughout the process, MST-16 was able to resume operations in a direct manner, and the outcome will contribute to safer and more consistent programmatic operation for years to come.

First NIF experiment with a double shell capsule target configuration

MST-7 researchers contribute essential expertise to fabricate target

Los Alamos scientists completed the first experiment with a double shell capsule target shot on the National Ignition Facility (NIF). This experiment was the initial laser shot in the second experimental phase of Los Alamos's Double Shell campaign, intended to examine the dynamics of the inner and outer shell interaction, which is part of the greater quest to achieve fusion ignition in the laboratory.

Researchers in Engineered Materials (MST-7) fabricated the double shell, which offers an exciting alternative path to ignition on the NIF as compared to conventional single shell target designs. The double shell design holds promise, as it allows the energy of the burning plasma to be trapped by the high-Z inner shell, whereas that radiation can be lost in low-Z single shell designs. Double shells can also use a much simpler laser pulse shape than single-shell platforms and are predicted to ignite and burn at relatively low temperatures.

Specifically, this experiment examined shape transfer from the outer to the inner shell during the implosion. The double shell capsule (Figure 1) consisted of an aluminum (Al) outer shell assembled from two hemi-shells, the first Al ablator used on NIF, a low-density (38 mg/cc) plastic foam cushion, and a glass inner shell with a plastic tamper.

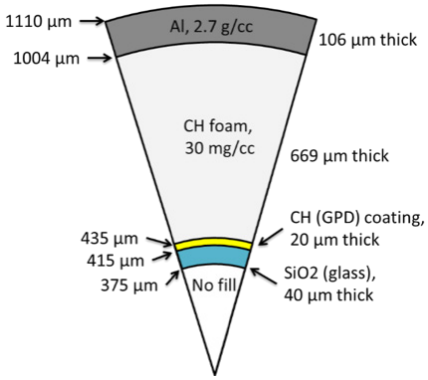


Figure 1: Double shell "imaging" capsule design using an aluminum ablator and mid-Z material (glass) inner shell.

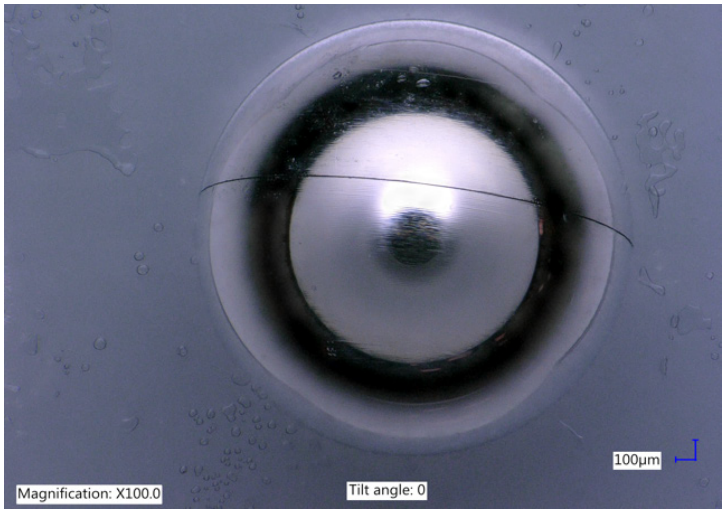
Additionally, this experiment tested the researchers' ability to image a double shell with current NIF diagnostic capability, both through the use of a mid-Z material inner shell ("imaging" design) instead of a high-Z material and using the first test of a zirconium (Zr) backlighter (> 10 keV) with a NIF 2D convergent ablator (ConA) platform.

The goal of the NIF, located at Lawrence Livermore National Laboratory, is to focus the intense energy of 192 laser beams on a millimeter-sized spherical target filled with hydrogen fuel, fusing the hydrogen atoms' nuclei and potentially releasing many times more energy than it took to initiate the fusion reaction. Fusion ignition holds the promise of producing immense, abundant energy.

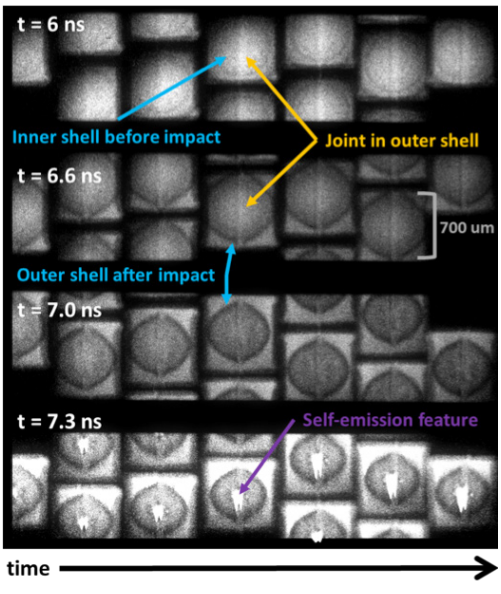
Figure 2 shows a 100X-mag, high-resolution picture of the target. The imaging platform was a success, with the images of the inner shell implosion (Figure 3) showing good signal. Researchers were able to capture images of the inner shell pre-impact to measure a baseline for their backlighter performance and characterize the presence of the joint in the outer shell, which they also observe in the late-time implosion images. They have high-quality images of the outer-shell shape after impact and high-enough contrast in the images to distinguish some post-impact inner shell features as well. Finally, the initial test of the Al ablator showed low backscatter, making it feasible for future experiments.

Los Alamos researchers include Principal Investigator Eric Loomis (Plasma Physics, P-24) and Target Engineer Tana Cardenas (MST-7). The work was funded and supported by the Inertial Confinement Fusion program (C-10).

Target engineering technical contact: Tana Cardenas



Above, figure 2: High-resolution picture of the double shell capsule.



Left, figure 3: Backlit images of the capsule implosion. The top strip shows the inner shell before impact of the outer shell, while the bottom three strips show the outer and inner shell post-impact. The outer shell joint is obvious in the first two strips.

HeadsUP!

Electrical safety 101

Electrical safety isn't just for field employees. Office, meeting rooms, and group spaces can present hazards too. Rather than making your next meeting a shocking experience, familiarize yourself with the following precautions:

Office electrical checklist

- Is the electrical equipment you use UL listed or approved by an electrical safety officer (ESO)?
- Are cords and wires neat and organized so they do not present a tripping hazard?
- Are cords and plugs in good condition and ground pins intact with no frayed or cracked insulation?
- Do space heaters have automatic shutoffs? Are they located three or more feet from combustible material?
- If you use a window air conditioning unit, is it plugged into a dedicated circuit (i.e., the unit is the only load on that circuit), and if plugged into an extension cord is the cord properly sized?
- If you use an uninterruptable power supply (UPS) has it been properly maintained with the battery replaced per the manufacturer's recommendation? (Note: the LANL Electrical Safety program strongly discourages the use of UPSs.)

Make sure

- electric cords are not run through openings in doors, walls, ceilings, or under carpets;
- extension cords or multi-outlet strips are not plugged into other extension cords or multi-outlet strips;
- your multi-outlet strip is not overloaded;
- electrical devices show no signs of overheating; and
- electric fans are protected with mesh guards to prevent fingers getting inside the guard.

If you have questions about electrical safety in your work environment, an ESO is the best resource for guidance. Other resources include the Electrical Safety Program website, Center of Excellence for Electrical Safety, Electrical Safety Foundation International, and the Consumer Product Safety Commission.

Celebrating service

Congratulations to the following MST Division employees celebrating recent service anniversaries:

Lola Sandoval, MST-7	20 years
Joseph Anderson, MST-16	15 years
Wanda Duncan, MST-16	15 years
Karl Krenek, MST-16	15 years
Derek Schmidt, MST-7	15 years
Anders Andersson, MST-8	10 years
Andrew Nelson, MST-7	10 years
Miguel Santiago Cordoba, MST-7	5 years
Joshua White, MST-7	5 years

Success in excess

The haul from an electronics collection day organized by Nix Mattson (ASM-PM).

Representatives of Acquisition Services Management–Property Management (ASM-PM) recently coordinated two "Excess Days" for employees from Materials Science and Technology, Materials Physics and Applications, Sigma, Bioscience, Chemistry, and Earth and Environmental Sciences divisions and their support organizations to drop off unwanted electronics, computers, and computer-related gear. The equipment was sorted, delivered to the excess yard, and removed from custodian accountability statements.

In total, the two excess days resulted in 153 active property numbered items—from desktops to laptops, phones, and cameras, as well as 84 monitors, about 50 printers and scanners, 25 boxes of cables, keyboards, speakers, computer mice, and other peripherals—to be salvaged or recycled.

MST e-NEWS

Materials Science and Technology

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To submit news items or for more information, contact Karen Kippen, ADEPS Communications, at 505-606-1822, or adeps-comm@lanl.gov.

For past issues, see www.lanl.gov/org/padste/adeps/mst-e-news.php.

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