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DEFENSE NUCLEAR NONPROLIFERATION (DNN)

DNN Sentinel

DEFENSE BY OTHER MEANS

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Anticipating Change and Building the Future

DNN SENTINEL:
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From the Acting Deputy Administrator

I continue to be amazed by the perseverance and dedication of all Office of Defense Nuclear Nonproliferation (DNN) staff amidst the many challenges and changes we have faced over the course of the pandemic. Across the board, the DNN family has remained steadfast in fulfilling its mission, upholding important relationships with our domestic and international partners, and achieving new milestones. This edition of the Sentinel features several of DNN's key recent accomplishments. To name a few:

In April, the Office of Global Material Security's (GMS) Radiological Security program launched the RadSecure 100 Initiative to enhance radiological security by providing training to law enforcement as well as incentives and security enhancement strategies to 100 additional cities with radioactive materials. The Office of Defense Nuclear Nonproliferation Research and Development (DNN R&D) sponsored research by scientists at the Nevada National Security Site and Sandia National Laboratories, which measured atmospheric conditions to improve models of how acoustic signals travel through air. The Office of Material Management and Minimization advanced its Surplus Plutonium Disposition program with the completion of the Criticality Control Overpack Characterization and Storage Pad in Savannah River Site's K-Area. The Office of Nonproliferation and Arms Control, with support from the U.S. Department of State, coordinated a virtual seminar on Strategic Trade Control Enforcements for more than 60 officials from the United States and the Philippines.

This publication also highlights the unique career paths and achievements by DNN personnel. Dr. Karen Ventura, who began her DNN journey as a NNSA Graduate Fellowship Program Fellow in the DNN R&D office, has continued her nonproliferation career with Consolidated Nuclear Security at the Pantex Plant as a Program Manager. Dr. Ventura has made notable contributions at Pantex, including the deployment of one of the plant's seismo-acoustic sensors. Dunbar Lockwood, who retired in May as a senior expert in NPAC, served in the nonproliferation field for more than three decades and supported key nonproliferation and arms control treaties, helped strengthen the International Atomic Energy Agency's safeguard regime, and trained numerous nonproliferation experts.

These programmatic and personnel achievements demonstrate DNN's diverse efforts to achieve our nonproliferation goals at home and abroad. DNN staff have shown incredible tenacity, innovation, and commitment to their work as we continue maneuvering through this unique work environment. I am proud of DNN's wide range of contributions to our national security, and truly grateful to serve alongside such a talented team. I hope you find these articles to be enlightening examples of DNN's efforts to bolster global nuclear security and keep our country safe.

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NNSA ARTICLES

Building a Vital Verification Asset During the Global Pandemic

By Tim Evans and Walter Dekin

How does U.S. Government (USG) verify that a country has stepped away from prohibited activities and dismantled a nuclear weapons program? When called upon, the NPAC's Nuclear Compliance Verification (NCV) Program has verification teams standing by and ready to rapidly deploy worldwide for high-priority national security missions. These teams provide the USG with specialized and field-tested plutonium and uranium verification capabilities to monitor and verify nuclear weapons material production in foreign countries. NCV also maintains a team of health and safety experts to deploy with the verification teams to identify and mitigate any in-field hazards the verification team members may face.

NNSA's Nevada National Security Site, where, among other locations, the TSVT will train.

The newest verification team, the Test Site Verification Team (TSVT), was created to conduct assessments as part of a transparency or denuclearization agreement related to a country's underground nuclear explosive testing activities and contribute to an integrated interagency verification evaluation of a country's nuclear weapons capabilities. Nuclear testing can be a key element of building confidence in a new nuclear weapons program. The TSVT will help the USG understand the development of a country's nuclear testing program and stop further development and nuclear proliferation. Monitoring and verifying a nuclear test site will also enable the USG to figure out the amount of nuclear material consumed by nuclear testing. By combining this information with nuclear material production estimates developed by the Plutonium and Uranium Verification Teams, the U.S. Government can better estimate the mass balance of nuclear material remaining in the country and compare this data to a country's declared fissile material production.

The TSVT's overarching objectives include verifying a country's nuclear testing history, confirming cessation of nuclear testing activities, and monitoring to ensure no testing takes place in the future. TSVT on-site activities will range from subject matter expert examination of key test site locations to targeted in-field sample and data collection for subsequent analysis. Activities can be as basic as visual observation of test signatures, such as infrastructure or ground disturbances, up to resource-intensive drilling to retrieve nuclear debris after an underground nuclear explosion. Rich Goorevich, Assistant Deputy Administrator for NPAC, noted, "I am excited that we are making the formation of the TSVT a high priority, adding verification of nuclear testing activities and sites to our robust foreign nuclear weapons material monitoring and verification capabilities."

In early 2021, NCV selected three uniquely qualified individuals to serve as the TSVT leadership – Emily Schultz-Fellenz from LANL, Kim Knight from LLNL, and Stuart Rawlinson from the NNSS. The leadership team worked closely with NCV to select 10 team members from dozens of highly qualified candidates. As they move forward, the TSVT will focus on training, exercises, and other technical activities to ensure deployment readiness.

Tim Evans has been a member of NPAC's Office of Nuclear Verification (ONV) for more than 12 years and with DOE for 30 years. Currently, he is the DOE lead on U.S. support for the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization and leads the development of the Test Site Verification Team. Walter Dekin, an M&O contractor from Lawrence Livermore National Laboratory, has been a member of ONV for two years and leads the Verification Team Training and Exercise Development project for the Nuclear Compliance Verification Program within ONV. He has over 34 years of experience in nuclear weapons testing and other verification-related activities.

Attempted Theft in Phoenix Highlights Success of ORS's 2020 Cities Initiative and NNSA's Shared Mission to Prevent Radiological Terrorism

Emily Adams

The Office of Radiological Security's (ORS) 2020 Cities Initiative focused on enhancing security in the 64 most heavily populated cities in the United States by providing federally funded security enhancements, technologies, and training to users of high-activity radioactive materials. Training is also provided to city, state, and law enforcement officials. ORS' partnership with sites and law enforcement in Phoenix, Arizona is an excellent example of the success and impact of this Initiative.

Through the Cesium Irradiator Replacement Project, participating businesses were able to achieve permanent radiological risk reduction.

Cooperating with law enforcement proved effective during a recent incident in Phoenix where enforcement officials were able to successfully respond to the theft of a radiological device. The theft occurred in April 2019 when an employee of a private firm stole three radioactive sources with the intent of constructing a radiological dispersal device (RDD), delivering it to a public location, and ambushing first responders in an active shooter scenario. The individual, who had training in the use of these stolen industrial radiography cameras containing iridium-192 and unfettered access to the devices, posed a serious radiological threat to the community.

> ***"The commitment of all of our state and local community, industry, medical, and law-enforcement partners to collaborate with ORS to take strong and sustained actions to enhance radiological security has made our cities safer."***
>
> - Kasia Mendelsohn, NNSA's Acting Deputy Administrator for Defense Nuclear Nonproliferation

For law enforcement, ORS provided training and strategies to enable safe and effective response to a radiological theft along with centralized monitoring systems that integrated critical alarms and video from local facilities into operations centers.

Thanks to ORS training and support provided to the city since 2011 and the rapid response by NNSA's Office of Nuclear Incident Response and the Federal Bureau of Investigation (FBI), the Phoenix Police Department safely arrested the individual. All three sources/devices were safely recovered intact. The collective effort of the agencies that responded prevented an act of radiological terrorism from occurring in the city.

The technologies and tools provided by ORS enabled law enforcement and security professionals to effectively respond to the radiological theft. This incident demonstrates the importance of ORS's work in Phoenix and other heavily populated U.S. cities that contain the largest amounts of radioactive sources and pose

the greatest risk of radiological terrorism. Through the 2020 Cities Initiative, ORS assisted law enforcement agencies in 17 cities with establishing their own radiological response training programs, resulting in more than 2,000 officers receiving classroom training at their department facilities.

In addition to providing resources for an effective response to a radiological theft, the initiative provided federally funded security enhancements to more than 600 buildings with high-activity radioactive materials and replaced more than 100 radiological devices with alternative technologies. ORS also trained 4,000 site safety, security, and response officials through the ORS Alarm Response Training program.

The office further reduced the risk of radiological terrorism by safely disposing of disused sources and providing financial incentives to users of radioactive sources interested in removing and replacing their cesium-137 irradiators with X-ray devices through the ORS Cesium Irradiator Replacement Project.

The 2020 Cities Initiative, which was launched in 2017, was successful thanks to the support of a wide range of partners including businesses, law enforcement, city and state leaders, and federal agencies. While this initiative has resulted in tremendous progress, threats continue to evolve, and more work remains to be done across the country to keep the public safe.

ORS launched the RadSecure 100 Initiative in April 2021. It builds on the success of the 2020 Cities Initiative and expands on it by including 100 more cities with radioactive materials. In addition to offering proven incentives and security enhancement strategies, ORS will expand its efforts to achieve permanent risk reduction and continue training law enforcement officers and first responders.

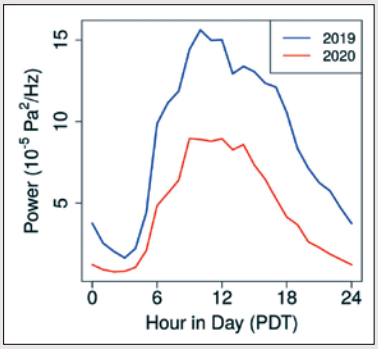
Emily Adams is the Domestic Response Portfolio Manager in ORS. Emily also manages the ORS Cybersecurity, Remote Monitoring Systems, and Strategic Outreach portfolios.

Sound Science: Measuring Atmospheric State During a Pandemic

By Douglas R. Seastrand

While the world was in a state of hiatus in the first year of the COVID-19 pandemic, scientists at the Nevada National Security Site (NNSS) and Sandia National Laboratories (SNL) were using that time to make impactful measurements of atmospheric conditions to improve models of how acoustic signals travel through air.

These scientists are at the forefront of developing techniques for measuring the atmospheric state using nothing more than low frequency sounds and the intrinsic anthropogenic noise (noise originating from human activity) found in cities. These research techniques help analyze acoustic energy signals from an explosive event, and serendipitously measure other sources of acoustic energy that provide useful data to improve infrasound models.



April 2020 hourly average acoustic power versus April 2019 hourly average acoustic power (in Pa2/Hz, where Pa (Pascals) are the units of pressure recorded at sensor and Hz (Hertz) denotes sound frequency). The change between the two illustrates the decrease in human urban activity during the COVID-19 pandemic.

Researchers sponsored by DNN R&D have used pressure waves to estimate the yield (energy released) during a nuclear detonation. Knowing the yield of the detonation assists nuclear forensic scientists with reconstruction of the source device, but the temperature, moisture, and wind variations in the atmosphere can distort these waves. This can lead to the over- or underestimation of the yield.

"If a nuclear detonation occurs in an urban center, it is essential to know the atmospheric conditions in order to interpret the propagated signals," said DNN R&D Senior Program Manager Timothy Ashenfelter. "This research is a new approach to estimating atmospheric conditions without directly measuring them."

Generally, the atmospheric state is established using numerical weather prediction models. Then acoustic waves can be synthetically propagated through the derived atmospheric model to reconstruct the original signal. However, these models lack the resolution to properly capture subtle details in atmospheric structure that can have a surprisingly large impact on how sound waves travel. To deal with these effects, researchers are now attempting to estimate the acoustic velocities through minute changes in anthropogenic noise – using sound itself to capture the necessary detail.

In March 2019, a team of scientists from NNSS's Remote Sensing Laboratory launched the Las Vegas Infrasound Array (LVIA), which included the deployment of 11 infrasound stations throughout Las Vegas, NV. These stations provide continuous recording of the city's anthropogenic noise. In addition to infrasound microbarometers, the LVIA contains a city-wide atmospheric monitoring site, which includes a Fourier transform infrared spectrometer, a Doppler Wind Lidar, and a ground-based weather station. The team also gathers radiosonde data (various data collected by instrumentation carried into the atmosphere, often by weather balloon) from the local National Weather Service.

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Surplus Plutonium Disposition Program Completes Characterization and Storage Pad

By Terri Poxon-Pearson

Undeterred by the ongoing pandemic, the Office of Material Management and Minimization's (M3) Office of Material Disposition continues to make progress in its nonproliferation mission to safely and efficiently disposition 34 metric tons (MT) of plutonium declared excess to national defense needs. The latest accomplishment of the Surplus Plutonium Disposition (SPD) program was the completion of the Criticality Control Overpack (CCO) Characterization and Storage Pad in Savannah River Site's (SRS) K-Area, which was constructed in close coordination with the DOE Office of Environmental Management (DOE-EM). The pad will provide storage for over 3,800 CCO drums containing diluted plutonium.

The SPD program is implementing the dilute and dispose strategy, a technologically proven approach that involves blending plutonium oxide with a multi-component adulterant to reduce material attractiveness. After dilution, the material is packaged, characterized, and stored on the Characterization and Storage Pad, and then transported to the Waste Isolation Pilot Plant (WIPP) for permanent disposal underground.

The pad will also provide space to characterize the contents of the CCO drums, verifying that they meet the waste acceptance requirements for disposal at WIPP. In December, a Real Time Radiography (RTR) unit, which weighs over 70,000 pounds, was transferred from the SRS Solid Waste Management Facility to the pad. The RTR uses an X-ray system to inspect the contents of CCO drums without operators having to physically open the containers. In addition, new characterization equipment was installed, and the Office of Material Disposition is working to establish non-destructive assay capabilities on the pad. Following characterization, the pad is used to prepare and load characterized CCO drums for shipments to WIPP.

"The CCO pad provides essential capabilities to the SPD program," said Bill Wabbersen, the NNSA Federal Program Manager overseeing the CCO pad project. "Although the pandemic presented significant challenges during construction of the Characterization and Storage pad, safe and timely completion was critical to support NNSA's nonproliferation mission. Without the pad, there's no way for us to get this material to WIPP." Shipments to WIPP are scheduled to begin in fiscal year 2022.

Completion of the CCO pad joined the growing list of SPD program accomplishments during the COVID-19 pandemic. In June 2020, updates to the current glovebox used for plutonium downblending were completed and the program increased to two-shift downblending operations. In February 2021, SPD reached a key program milestone by downblending a portion of excess plutonium for the first time. Work to downblend 6 MT of DOE-EM material has been ongoing.

Outside view of the completed CCO Characterization and Storage pad.

Inside view of the CCO Characterization and Storage pad, which adds the capability to store and characterize CCO drums of diluted plutonium prior to their shipment to WIPP.

Even as downblending operations continue, the Office of Material Disposition continues to look toward the future of the SPD program. Groundwork is underway to install three additional gloveboxes on site, providing the necessary capacity to complete the SPD program and achieve U.S. nonproliferation objectives.

Terri Poxon-Pearson is the Class of 2021 NNSA Graduate Fellow in the Office of Material Management and Minimization's Office of Material Disposition. She supports the surplus plutonium and highly enriched uranium disposition programs.

Signing an MOU on Nuclear Security Cooperation During a Pandemic

By Alexandra Meehan and Emily Tatton

In October 2020, the United States and Canada signed a five-year Memorandum of Understanding (MOU) on "Cooperation and Exchange of Information in Nuclear Security, Safeguards, and Nonproliferation Matters." The MOU was signed on October 16 by Dr. Brent Park, former Deputy Administrator for Defense Nuclear Nonproliferation and two Atomic Energy of Canada Limited (AECL) executives. Due to limitations on international travel during the pandemic, this MOU was signed virtually from Washington, D.C. and Ottawa.

Former DNN Deputy Administrator Dr. Brent Park giving remarks for the five-year MOU signing with Canada.

"Accomplishments like these are important to celebrate, especially when travel and face-to-face engagements are not possible during the COVID-19 global pandemic. We look forward to further cooperation with our Canadian partners," said Kasia Mendelsohn, Acting Deputy Administrator for Defense Nuclear Nonproliferation.

NNSA and AECL have a strong history of collaboration. This MOU allows further bilateral U.S.-Canada cooperation and information exchange on nuclear security, safeguards, and nonproliferation. The MOU includes deepening collaboration between NNSA and AECL to enhance knowledge sharing through cross-training, workshops, and exercises and collaboration on research and development.

MOUs like this one are important mechanisms for cooperation, and, equally as important, they serve as a symbol of strong partnerships between two nations. Reaching this milestone during a pandemic reaffirms the strong commitment by both the United States and Canada to nonproliferation and nuclear security.

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Sound Science– *Continued*

These instruments capture the atmospheric conditions every three minutes from the surface up to four kilometers above ground level.

Why Knowing Atmospheric State is Important

Seismic and acoustic signals are altered by the media of earth and air through which they propagate. Consequently, understanding these pathways is essential to characterize the original source signal. Unlike seismology, where the earth medium may vary from place to place, but remains fairly constant over time, sound waves traverse a constantly changing atmosphere. Changes in temperature, pressure, and moisture alter the speed-of-sound, leading to refraction and scattering of the acoustic signals. Wind further alters the source signal. These atmospheric distortions require an understanding of the atmospheric state at the time of the explosive event in order to reconstruct the original signal.

The LVIA provides Sandia National Laboratories (SNL) the raw data to develop speed-of-sound velocity models. SNL is examining the relationships between the "ground-truth" atmospheric properties and the recurring anthropogenic infrasound that is traversing the city that "never sleeps."

In March 2020, the LVIA was in full operation when COVID-19 lockdowns began, and the array recorded a marked reduction in anthropogenic noise during the pandemic (See Figure). This unique opportunity has allowed SNL scientists to further understand anthropogenic noise generation and led to a publication entitled, "Monitoring changes in human activity during the COVID-19 shutdown in Las Vegas using infrasound microbarometers." in the *Journal of the Acoustical Society of America* 149, 1796 (2021); https://doi.org/10.1121/10.0003777.

The LVIA is unique because infrasound researchers generally put their arrays as far away from noise sources as possible, but in this case one scientist's noise is another researcher's signal. Future work with the array may lead to noise reduction techniques when anthropogenic noise cannot be avoided.

The LVIA is also a significant asset due to its proximity to the NNSS (70-130 miles) and has been used for explosion monitoring. For now, this research is helping to tie atmospheric conditions to changes in array sound profiles, which should lead to monitoring arrays being deployed in more places to support nuclear forensics and explosion monitoring.

Douglas Seastrand is a Senior Principal Scientist at the Remote Sensing Laboratory, a division of the Nevada National Security Site (NNSS). He currently oversees a variety of programs that support U.S. national security and counterterrorism. Throughout his career, Seastrand has integrated and applied the principals of computer science, electrical engineering, mechanics, and physics to create innovative remote sensing solutions in a variety of environments.

From DNN R&D Fellow to DNN R&D Researcher

By Craig Sloan

When Dr. Karen Ventura was completing her Ph.D. in Physical Inorganic Chemistry at the University of Texas at El Paso (UTEP), she faced a decision all upcoming graduates face—what path would she take her career? Unlike students at universities with longstanding relationships to the NNSA such as the University of Michigan, Texas A&M, or the University of California, Berkeley, Ventura did not have the advantage of prior UTEP students participating in the NNSA Graduate Fellowship Program (NGFP) who could tout the program and effectively recruit current students. She stumbled across the fellowship opportunity one day while talking to a professor who had a connection at the Department of State, and she decided to apply. That decision set her career in motion.

Dr. Ventura with one of the seismo-acoustic sensors deployed for the DNN R&D project at Pantex.

It was an easy decision for Defense Nuclear Nonproliferation Research and Development (DNN R&D) to select Ventura as its top candidate. "She had clearly done her homework and asked excellent questions about how DNN R&D funds projects at the National Laboratories. Plus, we saw it as an opportunity to recruit someone into the nuclear nonproliferation mission space, who had an outstanding academic background, but likely wouldn't go into this field without the fellowship opportunity" said Dr. David LaGraffe, Associate Assistant Deputy Administrator for DNN R&D.

That decision has paid off for both Ventura and NNSA. After a year of working in DNN R&D, gaining substantial knowledge and experience related to the nuclear nonproliferation mission, and participating in DNN R&D's proposal selection process, Ventura decided to begin her nuclear nonproliferation career with Consolidated Nuclear Security (CNS) at the Pantex Plant, where she is a Program Manager within the Nonproliferation and Arms Control (NPAC) R&D group.

Ventura spent her first year at the Pantex Plant leading a project for NPAC's Office of Nuclear Verification and supporting a Plant Directed R&D project. Following on the success of those efforts,

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Nuclear Smuggling Detection and Deterrence: Reflecting on a Transformational Year

by Yesenia Vergara

After more than a year of working in the COVID-19 environment, the Office of Global Material Security's (GMS) Office of Nuclear Smuggling Detection and Deterrence (NSDD) continues to adapt and forge ahead within the new realities of the world. NSDD has concentrated its mission on establishing partnerships with countries around the world for over 22 years. Its exclusive international focus has made it vulnerable to the various policies put in place to blunt the impact of the pandemic as it works with international partners to detect, disrupt, and investigate the smuggling of nuclear and radioactive material before it can be used in an act of terrorism.

Although counter nuclear smuggling may not be the most tangible security threat for international partners, the potential for security vulnerabilities throughout the pandemic has made NSDD's mission even more critical. Its work overseas often takes place in remote and poorly controlled areas that may become nexuses for nuclear smuggling and terrorist activities. NSDD's ability to work in these regions has allowed it to successfully assist with detecting and interdicting dangerous material far from the shores of the United States. Since NSDD's work is often in high-risk areas, pre-planned evacuation routes are standard elements of its health, safety, and security planning. At the beginning of the pandemic, this contingency planning aided NSDD in ensuring staff supporting the program, who were dispersed in almost 30 countries, were able to safely return home as international borders were closed.

"The COVID-19 pandemic has impacted us and our partners significantly and , has required us to find ways to adapt and ensure that programs can continue to carry out their important national security missions in a safe manner," said Kasia Mendelsohn, Acting Deputy Administrator for the Office of Defense Nuclear Nonproliferation.

To meet the challenges presented by the pandemic, the NSDD team rapidly redesigned its training, workshops, and exercises for virtual operations and developed remote oversight plans. This included innovative solutions such as establishing procedures to maintain oversight of ongoing overseas projects while continuing to meet its national security objectives under the pandemic's constraints. The procedures allowed projects to continue using in-country teams and technology platforms. NSDD's ability to remotely facilitate maintenance and operations support significantly aided the operability of numerous radiation detection systems

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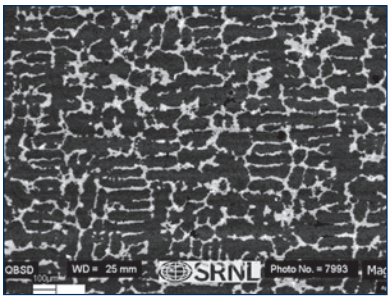
M3's Mobile Melt-Consolidation System

By Ian Kapuza

M3 works to minimize civilian inventories of highly enriched uranium (HEU) and separated plutonium globally through the conversion of research reactors from HEU to low-enriched uranium (LEU) fuel and, when possible, by removing or confirming the disposition of excess weapons-usable nuclear material. To date, the Office of Nuclear Material Removal has removed or confirmed the disposition of more than 7,200 kilograms of HEU or plutonium, but there remain thousands of kilograms of weapons-usable material stored at civilian locations around the world.

Much of the remaining material does not currently have a viable disposition pathway. This is due to a variety of political, economic, and technical factors – and often a combination of the three. While a willing partner is a prerequisite, even this may be insufficient if there is no technical capability to dispose of material (whether in the United States, the partner country, or elsewhere) or if it costs too much to dispose. To overcome these hurdles, M3 is working to develop a mobile system that will enable DNN and its partners to process material at the location where it is stored into a more proliferation resistant form ready for disposal.

The Mobile Melt-Consolidation (MMC) system is an adaptation of the melt-dilute process developed for the treatment of spent research reactor fuel of U.S. origin at the Savannah River Site (SRS). MMC is based on mature science wherein a high-temperature furnace is used to melt dissimilar elements and compounds to create a homogeneous, chemically stable end-product. This approach is attractive for multiple reasons. First, it enables HEU to be isotopically diluted to LEU or natural enrichment levels without first separating out the HEU. Second, it is flexible enough to accommodate a wide variety of input materials and to tailor the output product to the waste acceptance criteria of local facilities. Third, it is simple. Fourth, it involves no sensitive nuclear technology. Finally, it eliminates the need to bring material to the United States to be dispositioned.



Ingot microstructure following processing. Uranium and thorium in white; stainless steel in black.

Given high process temperatures and the presence of fission products in irradiated materials, Savannah River National Laboratory has developed a robust off-gas system featuring multiple redundant and backup trains of sorbent and High Efficiency Particulate Air filters to capture the primary fission products of concern (cesium, iodine, and technetium) and any other particulates that may volatilize during a melt, building on the approaches used at various large-scale fuel cycle facilities at SRS.

Despite COVID-19 restrictions, M3 has made significant progress towards the completion of the MMC system. When its fabrication is completed at the end of fiscal year 2021, MMC will provide M3 with the capability to address a range of unirradiated and irradiated materials that have proven difficult to remove, including HEU-thorium mixtures.

"We are very excited about this capability," said Jessica Halse, Assistant Deputy Administrator for M3. "Once ready to deploy, MMC will be yet another tool we can use in cooperation with our partners to eliminate challenging inventories of HEU around the world."

Ian Kapuza is a Foreign Affairs Specialist in M3's Office of Nuclear Material Removal. In this role, he works with international partners to minimize inventories of weapons-usable nuclear material.

MOU– *Continued*

The signing of a MOU requires meticulous planning to ensure that the event goes smoothly. The COVID-19 pandemic added additional logistical challenges to signing this MOU, which were overcome using a virtual platform.

While these unprecedented circumstances have impacted the ability to hold in-person engagements, meaningful progress can be made by using virtual engagements and cooperative arrangements to strengthen bilateral relationships for international nuclear security purposes.

DNN has adapted by hosting numerous virtual engagements in 2020 and 2021. Despite the challenges of the pandemic, the focus on enhancing nuclear security, safeguards, and nonproliferation initiatives continues. DNN remains committed to fulfilling its national security mission by leveraging technology and existing international relationships while continuing to strengthen and build new relationships. This MOU for the "Cooperation and Exchange of Information in Nuclear Security, Safeguards, and Nonproliferation Matters" is a strong example of DNN's commitment to advancing nonproliferation and nuclear security.

Alexandra Meehan is a Foreign Affairs Specialist in GMS's Office of International Nuclear Security (INS). Emily Tatton is the Class of 2020 NNSA Graduate Fellow in INS.

NPAC Goes to Space Camp

By Sarah Dickerson and Gillian Gayner

On March 23, 1983, President Reagan announced to the nation the commencement of the Strategic Defense Initiative, also known as "Star Wars," a landmark in U.S. space policy. Thirty-eight years later, the world is once again witnessing a rapid expansion of space capabilities. On March 22-23, 2021, the Office of Nonproliferation and Arms Control (NPAC) gathered virtually to answer the question: How can NPAC plan for emerging opportunities and threats in outer space? The event, known as "Space Camp," was designed to provide NPAC with a better understanding of U.S. space policy, the future of space, the intersection of space with NPAC programs, and emerging opportunities and threats. NPAC brought together space experts from across the U.S. Government and non-governmental organizations (NGOs) to discuss these topics and more.

Presenters and Panelists

On day one of Space Camp, key experts gave presentations on the foundations of space policy. Presenters included Dr. Joel Mozer from the U.S. Space Force, Dr. James Vedda from Aerospace Corporation, Andrew Hood from the Department of Energy, Dr. Nancy Hayden from Sandia National Laboratories, and Marc Kippen from Los Alamos National Laboratory. On day two, Space Camp consisted of a panel discussion with experts from the NGO community. Experts came from a wide variety of NGOs, including Harvard's Belfer Center, the Center for Strategic and International Studies, the Nuclear Threat Initiative, George Washington University, the Carnegie Endowment for International Peace, and the Secure World Foundation. The panelists discussed emerging threats and opportunities in space, how the Biden Administration should respond, the future of the Trump Administration's space policies, the possibility of additional space treaties, and – most importantly – what NPAC can do now to prepare for the future.

Space Camp agenda

Lessons Learned

What lessons did NPAC learn from Space Camp? Key takeaways include:

1. ***The "Space Renaissance."*** We are now entering a new era in space – a "Space Renaissance" – with accelerating innovation, surging commercial investment, and increased interest in deep space exploration. NPAC, a key player in developing innovative ways to address nonproliferation and arms control issues, must consider the space domain in its mission to advance U.S. national security interests.

2. ***The Nuclearization of Space.*** In 2020, a Presidential policy directive was signed to put a nuclear reactor on the moon and to develop nuclear propulsion for space. NPAC staff can expect to inform government agencies about potential export controls, safeguards, and security considerations.

3. ***Antisatellite (ASAT) Technologies.*** NPAC staff learned how the advancement of ASAT technologies could adversely impact the mission to verify safeguards and arms control treaty compliance. NPAC will need to consider the possible impact of ASAT technologies in its planning.

4. ***Export Control Considerations.*** In recent years, export controls have been streamlined to make U.S. commercial entities, such as SpaceX, more competitive in space. NPAC will need to ensure that it balances the need to protect our national security while supporting the competitiveness of the domestic space industry.

Next Steps

Now that Space Camp is over, where does NPAC go from here? In an internal "hot wash," staff discussed how Space Camp could be expanded upon, for example with deep dives into other countries' space programs, planetary defense, and space law. Staff also expressed interest in camp sessions about other topics, such as artificial intelligence, machine learning, drones, and blockchain. Stay tuned for Space Camp 2.0 and more!

Sarah Dickerson is currently on detail to NPAC as a Senior Advisor. Sarah has worked at DNN for over 15 years on a diverse set of issues including nuclear security, material management and minimization, and nonproliferation. Gillian Gayner is a Policy Analyst in the NPAC Office of Nonproliferation Policy, supporting the Regional Analysis and Engagement program. She previously worked in the NPAC Front Office as an NGFP fellow, where she led coordination of official correspondence and taskings for NPAC. Before Joining NNSA, Gillian worked as a Research Associate in the South Asia Program at the Stimson Center, where she focused on nuclear stability on the subcontinent.

U.S., Philippines Collaborate Virtually to Strengthen Strategic Trade Controls

By Caterina Fox, Heidi Hamling, and Stacie Jones

Interagency collaboration and a good internet connection were key to an engaging and productive Strategic Trade Control Enforcements (STCE) Investigations seminar held earlier this year with 64 officials from the United States and the Philippines.

NPAC, with support from the U.S. Department of State's Export Control and Border Security program, coordinated the virtual seminar which took place over several days between January 11 and February 1, 2021. The event was part of the U.S. Government's ongoing effort to strengthen international export control systems and guard against the proliferation of weapons of mass destruction.

Philippine officials from a variety of agencies attended, including the Department of Trade and Industry, Department of Justice, Anti-Terrorism Council–Program Management Center, National Bureau of Investigations, Bureau of Customs, Philippine National Police, Bureau of Immigration, National Intelligence Coordinating Agency, National Coast Watch Center, and the Anti-Money Laundering Council Secretariat. More than a dozen officials from the U.S. interagency, including subject matter experts from the U.S. Departments of Commerce, Homeland Security, and Justice, also participated in the seminar.

"The current health crisis has forced us all to find new and creative ways of doing business," said Kasia Mendelsohn, Acting Deputy Administrator for Defense Nuclear Nonproliferation. "The broad interagency involvement– from both the United States and Philippines – in this fully virtual seminar demonstrates that, with a little innovation, we can continue to collaborate effectively with foreign partners across borders, seas, and time zones to achieve our shared nonproliferation goals, even during these challenging times."

The multi-day seminar featured presentations by subject matter experts on enforcement procedures, criminal and administrative investigations, prosecutions, as well as interagency coordination and communication. Attendees participated in daily breakout sessions to evaluate the roles, responsibilities, needs, and next steps for a strong national strategic trade control system in the Philippines.

The event highlights the importance of a whole-of-government approach to nonproliferation and underscores the value of international collaboration and partnerships in the effort to combat the illicit cross-border movement of strategic goods and materials.

"This was more than a training event – this was a joint opportunity for the deep exchange of ideas, perspectives, and expertise," said Rich Goorevich, Assistant Deputy Administrator for NPAC.

Experts from the United States and the Philippines discuss how to effectively investigate possible violations of export control laws)

"The event provided a useful framework for our partners to discuss their priorities for developing processes and procedures to achieve an effective strategic trade enforcement system in the Philippines."

Caterina Fox is a program manager for DNN's International Nonproliferation Export Control Program. Heidi Hamling is a senior analyst at Pacific Northwest National Laboratory (PNNL). She works on export control-related issues, primarily in Southeast Asia. Stacie Jones is a senior communication specialist at PNNL. She works in project communications supporting PNNL's National Security Directorate.

NSDD– *Continued*

around the world. While the pandemic disrupted NSDD's work at large, the office leveraged creative plans, technology, and excellent relationships with international partners to remodel its approach and fulfill its national security mission.

"I commend NSDD's proactive attitude as they adapted operations to successfully meet our national security obligations. The creativity of our teams and their drive to solve problems in support of their mission is one of our greatest strengths," Mendelsohn said.

As NSDD continues to successfully navigate this remote environment, the office has been able to proceed with its engagements and execute planned projects at nearly the same pace as before the pandemic. The office will continue incorporating lessons learned and adapt its approach to support sustainable counter nuclear smuggling solutions to detect, disrupt, and investigate the illicit trafficking of nuclear and radioactive material through critical pathways.

Yesenia Vergara is an Action Officer in NSDD and has supported the office for over two years. As the liaison to the GMS front office, she provides direct support to senior management with the office's official responses to request for information.

DNN's Titan of Nuclear Safeguards

By Ashley Curtis

Dunbar Lockwood is the type of professional every organization seeks: deeply knowledgeable, eager to find solutions to seemingly intractable challenges, and unyieldingly committed to the mission. In May, Lockwood retired as a senior expert in NPAC after working in the field for over three decades. During his lengthy career, Lockwood supported major nonproliferation and arms control treaties, led efforts to strengthen International Atomic Energy Agency (IAEA) safeguards, and trained generations of nonproliferation experts. He leaves a legacy of outstanding contributions to the field of nuclear nonproliferation.

Presenting on the Next Generation Safeguards Initiative's Human Capital Development program during a workshop for U.S. citizens working in international organizations in Vienna, Austria, in October 2011.

Lockwood's path to public service began as a student at Bowdoin College, where his courses in international law and organizations piqued his intellectual curiosities. In the early 1980s, with the Cold War in full swing, he began his graduate studies and professional career in Washington, D.C. The risk of full-scale nuclear war, coupled with his desire to work for the common good, drew Lockwood to the field of arms control. His early work at NGOs, the U.S. Arms Control and Disarmament Agency, and the Department of State centered on nuclear arms control treaties with the Soviet Union. As the Cold War receded, he moved into nonproliferation work, specializing in IAEA safeguards issues at DOE and NNSA.

Lockwood's professional accomplishments in nuclear nonproliferation are diverse. He worked on Comprehensive Nuclear-Test-Ban Treaty negotiations, countered Russian objections to the State Level Concept approach to safeguards, and advocated for new methods to improve the effectiveness and efficiency of IAEA safeguards. He also reflected fondly upon his contributions to a report that helped launch the Next Generation Safeguards Initiative, a foundational document that guides DNN's safeguards work today.

Beyond these notable accomplishments, Lockwood has found the greatest fulfillment in helping young professionals advance their careers and make contributions to the nonproliferation field. His mentorship philosophy is to play to people's strengths and provide them with opportunities to make substantive contributions. "I've been fortunate to have had opportunities to mentor bright, hardworking, and motivated individuals," Lockwood said. In addition to mentoring, he has helped build nonproliferation expertise by assembling multi-laboratory, multi-disciplinary, multi-generational teams to analyze critical nonproliferation and arms control issues.

After retiring, Lockwood plans to spend more time on the tennis court and the ski slopes. He looks forward to enjoying time with his family and is eager to explore new travel destinations with his wife. Lockwood leaves a legacy of not only substantive contributions to the field of nuclear nonproliferation, but also indefatigable and contagious enthusiasm for the work. His lengthy career exemplifies public service and is marked by significant contributions to the international safeguards system. Lockwood's DNN colleagues celebrate his years of dedication to the office's mission and wish him well in his next chapter.

Ashley Curtis is an NNSA Graduate Fellow in NPAC's Office of International Nuclear Safeguards.

Ventura– *Continued*

she joined researchers from Oak Ridge National Laboratory and Los Alamos National Laboratory in submitting a proposal to DNN R&D that would take advantage of high explosive detonations that routinely occur at Pantex to better understand the seismic and acoustic signatures of that activity. This research could lead to improvements in the United States' ability to detect similar activity occurring in other countries related to nuclear weapons development. The project launched in April 2021 and Ventura will be responsible for deploying the seismo-acoustic sensor at Pantex, coordinating with the firing site to collect data, and contributing to the data analysis. "Even though Karen has only been at Pantex for a relatively short time, she has already made significant contributions to a range of challenging nonproliferation problems by leveraging her technical expertise and problem-solving skills," said Dr. Martin Williamson, Director of the NPAC R&D group at CNS.

"This is exactly what we hope for," LaGraffe said. "Our goal is to get outstanding individuals into the NNSA workforce after their fellowship, so they can begin working nuclear nonproliferation problems." As for Ventura, she is excited to be working on her first DNN R&D-funded project and looks forward to the opportunities that lie ahead. "I love working on these nonproliferation projects as they enable me to contribute to making the world a safer place. I look forward to continuing to do cutting-edge research into the future."

Craig Sloan is the Director of the Office of Proliferation Detection within DNN R&D. Before being selected as Office Director, Craig led DNN R&D's Nuclear Test Detection portfolio, where he directed R&D efforts involving several large field-testing programs designed to improve the U.S.'s capabilities to detect, identify, and characterize low yield, underground nuclear tests.