

Stewardship Science Today

Office of Strategic Partnership Programs

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Stewardship Science Today (SST) highlights the stewardship science and academic programs supported by the Department of Energy/National Nuclear Security Administration (DOE/NNSA). SST is published quarterly by the NNSA Office of Strategic Partnership Programs. Questions and comments regarding this publication should be directed to Terri Stone via email at terri.stone@nnsa.doe.gov.

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CALENDAR

10/17-21/2022

64th Annual American Physical Society Division of Plasma Physics Meeting, Spokane, WA

10/27-30/2022

Fall 2022 Meeting of the APS Division of Nuclear Physics, New Orleans, LA

11/7-11/2022

Nuclear Explosives Design Physics Conference (NEDPC2022), LLNL

11/13-18/2022

International Conference for High Performance Computing, Networking, Storage, and Analysis (SC22), Dallas, TX

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*Contractor Support

This issue of *Stewardship Science Today* celebrates the 20th anniversary of the Stewardship Science Academic Alliances (SSAA) program which has achieved great success and contributed significantly to recruiting top talent into the national laboratories. The SSAA was started to provide funding to academic institutions pursuing research in underrepresented areas that were—and still are—of great importance to the nuclear security enterprise (NSE) and to recruit the graduates from those programs into national security careers.

Over time, the SSAA was expanded to include specialized fellowship programs, and this issue welcomes the new classes of the Stewardship Science Graduate Fellowship (SSGF) and Laboratory Residency Graduate Fellowship (LRGF) programs. SSGF and the LRGF are highly competitive fellowships awarded to top-tier students, and the programs encourage the collaborative research and residency requirements that assist in developing a close relationship between the students and the national laboratories. These programs are essential to building the pipeline of talent needed to ensure an unmatched future workforce for the NSE.

DOE/NNSA also prioritizes equity in R&D, striving to increase the diversity of our talent pool through the Minority Serving Institutions Partnership Program (MSIPP) and the Tribal Education Partnership



MSIPP's 2022-2023 Minority Serving Institutions Internship Program interns with NNSA Under Secretary for Nuclear Security and Administrator Jill Hruby at the NNSA Summer BBQ.

Program (TEPP). These programs partner with historically Black colleges and universities, Hispanic serving institutions, and Tribal colleges and universities, and they are expanding the reach of the DOE/NNSA academic programs into the sites and plants of the NSE. This issue highlights MSIPP's new internship program.

We have come a long way in the last 20 years, and here's to another 20 years of the SSAA and continued expansion of the academic programs to bolster the NSE complex with a rich base of talent from which to build the future workforce.



Dr. Njema J. Frazier
Acting Assistant Deputy Administrator
for the Office of Strategic
Partnership Programs

20 Years of the Stewardship Science Academic Alliances Program

by Michael Kreisler (Consultant to the National Nuclear Security Administration)

It is hard to believe that it has been 20 years since the start of the Stewardship Science Academic Alliance (SSAA) Program. The SSAA program was initiated to provide funding to universities in areas that other agencies were not supporting and which were important to the nuclear security enterprise. The disciplines include low energy nuclear science, materials under extreme conditions, radiochemistry, and high energy density plasmas. An overarching goal of the program is to increase the pipeline of scientists interested in careers at the National Nuclear Security Administration (NNSA) national laboratories.



(continued on page 2)

20 Years of the Stewardship Science Academic Alliances Program *(continued)*



The success of the SSAA program truly has been remarkable. The program has funded research projects in almost all of the States, has produced a large number of scholarly articles, and has supported an enormous number of PhD candidates in their academic careers. Advanced research capabilities were developed at both universities and at laboratories that are now part of the NNSA system.

The program supports individual investigator grants and awards for Centers of Excellence involving many investigators and often multiple institutions. Each project is required to submit an annual research progress report that is reviewed by the NNSA. These reports document the efforts of the academic community to investigate extremely difficult scientific problems.

The NNSA laboratories report that students and postdoctoral fellows from SSAA-supported institutions who join the national laboratories are extremely well prepared to begin their research careers. As a result, the national laboratories are anxious

to collaborate with and recruit more individuals from the SSAA.

Over the 20 years, the SSAA program has joined with other NNSA funding efforts, including the Predictive Science Academic Alliance Program that focuses on the use of high performance computing, the Minority Serving Institutions Partnership Program, and a host of graduate fellowship programs. At this point in time, the SSAA program is very much alive and vibrant, and we are looking forward to the next 20 years.

Happy 20th Year, SSAA!

Stewardship Science Academic Alliances Alumni *Where Are They Now?*

Nenad Velisavljevic (velisavljevi1@llnl.gov, HPCAT-Director@anl.gov)

Lawrence Livermore National Laboratory and High Pressure Collaborative Access Team, Advanced Photon Source, Argonne National Laboratory ♦ SSAA 2002-2005

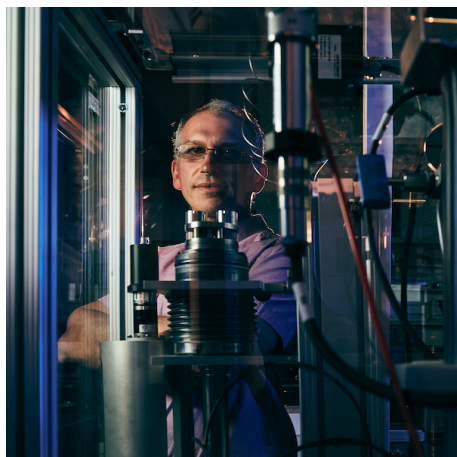
Years in SSAA Program

2002-2005, University of Alabama at Birmingham PhD: Physics (High pressure materials research), 2005



Position and Responsibilities

My current position is somewhat of a hybrid arrangement. I am a staff member at Lawrence Livermore National Laboratory (LLNL) but stationed full time at Argonne National Laboratory (ANL) near Chicago. I was hired by LLNL in 2019 to be the Director of the NNSA-funded High Pressure Collaborative Access Team (HPCAT) facility at the Advanced Photon Source (APS) at ANL. HPCAT is a dedicated high pressure experimental research facility and is part of the larger high energy, X-ray synchrotron source. My responsibilities as HPCAT Director include working with our HPCAT staff on short- and long-term strategic direction, contributing to critical mission-relevant research with our NNSA-lab partners, coordinating and collaborating with NNSA SSAA programs, and overall helping coordinate a large user group that includes numerous (700+)



Nenad Velisavljevic working in the laboratory on high pressure experimental setup and measurements.

experimental-visitors per year from national laboratories and universities.

Most Memorable SSAA Experience

My connection with SSAA began as a graduate student and, since then, I have been involved with SSAA in some capacity for the better part of the last 20 years—from graduate school to my work as a postdoc and then staff at Los Alamos National Laboratories for 13 years, and now at LLNL and as HPCAT Director—so it's somewhat difficult to choose a single experience. However, what stands out in broader

perspective is the overall number of great students that have been part of the SSAA program and seeing those individuals continue in the NNSA labs and universities and become world leaders in various research fields.

"I had the great opportunity to learn about the NNSA mission and NNSA-labs at an early stage in my graduate studies. Along the way, the SSAA program provided the platform to build collaborations/ friendships (with peers and NNSA-lab staff) and the opportunity to do some exciting research. Now, I am glad to still be connected to the SSAA program and, hopefully, in the position to contribute back by providing the next generation of students/postdocs/ early-career staff the same opportunities."

Devesh Ranjan (devesh.ranjan@me.gatech.edu)

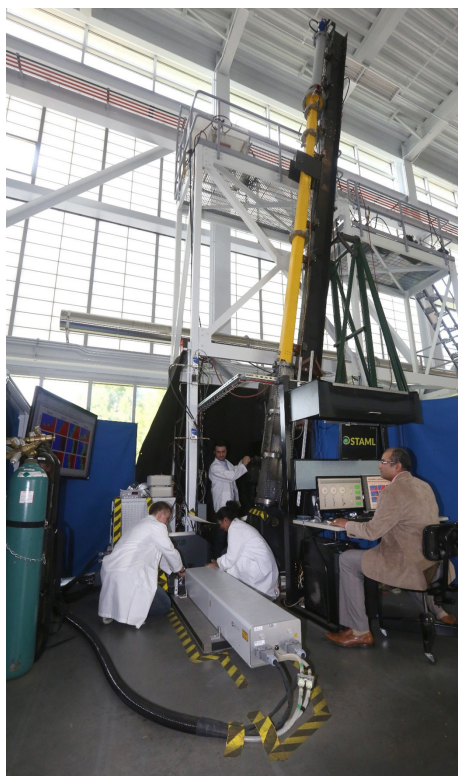
Georgia Tech Eugene C. Gwaltney, Jr. School Chair and Professor at the Georgia Tech George W. Woodruff School of Mechanical Engineering ♦ SSAA 2003-2007 (2003-Present)

Years in SSAA Program

2003-2007, University of Wisconsin-Madison
 PhD: Mechanical Engineering, 2007
 Director's Postdoctoral Fellow, 2008
 PI of SSAA-funded Grants:
 Texas A&M University, 1/2009-6/2014
 Georgia Tech, 7/2014-Present

**Position and Responsibilities**

I serve as the Eugene C. Gwaltney, Jr. School Chair of the Woodruff School of Mechanical Engineering at Georgia Tech. In this role, I am responsible for the leadership of the school as well as the administration and financial management (annual budget of \$100M) of the department. The Woodruff School is the largest school of mechanical engineering in the country with 2,700 students, 97 tenured/tenure-track faculty, and 81 staff, operates the largest student-run makerspace, and has faculty involved in leadership in a number of major interdisciplinary activities.



Ranjan with students in front of the Inclined Shock Tube.

Most Memorable SSAA Experience

I will never forget the email I received in May 2009 regarding the selection of my first SSAA proposal. Apart from that, it was a great experience to have former U.S. Department of Energy Secretary Ernest Moniz visit our lab and discuss research funded by this program.

"I owe my success, from Assistant Professor in 2009 to School Chair of the largest mechanical engineering program in the country, to the SSAA program. I would not have been able to develop a dynamic research program without the support I received and the connections I built through the program. The students supported by the program now are faculty members (who also are funded by SSAA) and working at the national labs."

Jonathan King (jonathan.king@nnsa.doe.gov)

National Nuclear Security Administration, Livermore Field Office ♦ SSAA 2012-2018

Years in SSAA Program

2012-2018, Oregon State University
 PhD: Nuclear Chemistry, 2018

**Position and Responsibilities**

As a Senior Defense Programs' Liaison in NNSA's Livermore Field Office, I work on a small team that oversees all domestic nuclear weapon activities conducted at Lawrence Livermore National Laboratory (LLNL). This broad mission includes surveillance of the existing U.S. nuclear stockpile, designing the next generation of nuclear weapons, and the large body of scientific and engineering work necessary to certify to the President of the United States on a yearly

basis that the U.S. nuclear deterrent remains safe, secure, and militarily effective.

Most Memorable SSAA Experience

Support from SSAA allowed me to collect the data that I published in my dissertation and provided for my first exposure to the nuclear security enterprise (NSE). Looking back a decade later, it is stunning how influential those opportunities were in enabling my future career in the NSE.

SSAA's support of my PhD was pivotal in my ability to pursue a career in nuclear weapon design agency oversight, and for that I am eternally grateful.



King oversees the LLNL stockpile stewardship activities that ensure the continued reliability of the Air Launched Cruise Missile (ALCM) warhead, the W80-1.

Sakun Duwal (sduwal@sandia.gov)
Sandia National Laboratories ♦ SSAA 2014-2018

Years in SSAA Program

2014-2018, Washington State University
PhD: Chemistry, 2018



Position and Responsibilities

I am a Senior Member of Technical Staff at Sandia National Laboratories. I currently am leading plate-impact shock experiments on pre-compressed H₂-He gas-mixtures (inside a diamond anvil cell) using Sandia's Z Machine and hypervelocity gas-guns. I also am a principal investigator for several experiments using world class platforms such as the OMEGA laser facility, Dynamic Compression Sector, and the High Pressure Collaborative Access Team. I perform a wide-range of experiments from static to dynamic time scales on various materials with geo-physical and programmatic interests.

Most Morable SSAA Experience

My best experience while being a part of SSAA was being able to meet

"Collaborations and connections built through the Stewardship Science Academic Program (SSAP) while I was a PhD student at Washington State University under the supervision of Prof. Choong-Shik Yoo, significantly contributed to the privilege I now enjoy of working on this world-class and unique platform. ... I was able to establish connections with people in various national labs which resulted in interviews for a postdoctoral position at three NNSA national laboratories.... The opportunity to choose from three of the best laboratories is the outcome of the exposure I gained through SSAP."



Duwal at the Z Pulsed Power Facility at Sandia National Laboratories.

and network with the people, whom I knew only from their papers, and to be able to put faces to those names while taking part in the annual SSAP Symposiums. I was able to build and foster strong, life-long collaborations because of those meetings.

Kathryn Jinae Harke (harke1@llnl.gov)
Lawrence Livermore National Laboratory ♦ SSAA 2015-2019

Years in SSAA Program

2015-2019, University of Alabama at Birmingham
PhD: Physics, 2019



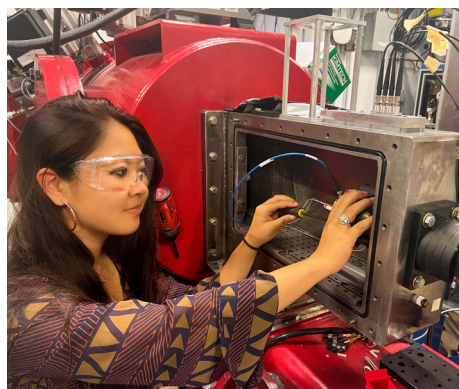
Position and Responsibilities

I am a staff scientist at Lawrence Livermore National Laboratory in the Nondestructive Evaluation Group. I am the principal investigator of a project to design, fabricate, and commission a 3-ring, flash X-ray system that utilizes fifteen 450kV flash X-ray sources and digital detectors along with few-view reconstruction algorithms to produce three-dimensional movies of dynamic events.

Most Memorable SSAA Experience

In May 2018, I was one of eight U.S. graduate students selected to participate in the NNSA-CEA/DAM Postdoctoral Workshop in Paris, France. Through this experience I was

able to share my graduate research, learn about career opportunities at the NNSA, its national laboratories, and CEA, and make important networking connections. I am grateful for this opportunity and the new perspective it provided me regarding future career paths.



Harke setting up for a dynamic radiography, powder gun experiment at Argonne National Laboratory, The Advanced Photon Source, Beamline 35-ID-D.

"At the 2019 SSAA general meeting, I spoke with the Lawrence Livermore National Laboratory representative and shared my graduate research background and hopes for a future career at a NNSA laboratory. She put me in contact with my current group leader which led to a visit to the laboratory, an interview, and selection as a postdoctoral researcher (postdoc) in the Nondestructive Evaluation Group. After a two-year postdoc, I was converted to a staff scientist in the group where I continue to lead a programmatic project for the laboratory."

New Classes of the DOE/NNSA Stewardship Science Graduate Fellowship and Laboratory Residency Graduate Fellowship Programs

by Krell Institute

Six students will join the Department of Energy/National Nuclear Security Administration (DOE/NNSA) Stewardship Science Graduate Fellowship (SSGF) program and four will join the Laboratory Residency Graduate Fellowship (LRGF) program this Fall, as they pursue doctorates at institutions across the country. SSGF fellows research high energy density physics, nuclear science, materials under extreme conditions, and hydrodynamics and serve a 12-week practicum at an NNSA laboratory. LRGF fellows study engineering and applied sciences, physics, materials, mathematics, and computational science. Their program revolves around research during a minimum of two practicums, and they're encouraged to collaborate on their thesis subject with national laboratory scientists. All fellows receive tuition, a stipend, and other benefits. Here are summaries of the new fellows' research statements.

Stewardship Science Graduate Fellowship

The University of Notre Dame's **Kelsey Anderson** studies the properties of actinide materials using diamond anvil cells with X-ray absorption spectroscopy and X-ray diffraction, focusing on uranyl peroxide nanoclusters, naturally occurring uranium minerals, and uranium compounds under pressure. By combining these methods with others, she hopes to provide local geometric and electronic structure information and expand her research to other actinide compounds. Anderson also applies multiple diagnostics to determine if and how thorium and hafnium coordinate with or trigger aggregation of pyrophosphate-functionalized uranyl peroxide nanoclusters that form at locations like the Hanford Site. Amy Hixon is her advisor.



Sophia Gomez and her University of Texas at El Paso advisor, Yirong Lin, focus on polymer matrix syntactic foams. These porous composites have desirable weight, strength, and other properties and are gaining wider use thanks to additive manufacturing (AM). Using density functional theory and machine learning, Gomez will study polymer microballoons, also called hollow polymer microspheres, in syntactic foam fabrication, helping clarify the theoretical polymerization process under varying conditions. Computer vision algorithms will capture cross-sectional micrographs of AM-produced syntactic foams, training an artificial neural network to predict properties of a printed foam from a single image.



Fellow **Lansing Horan**

plans to study core-collapse supernova evolution with advisor Jack Hare at the Massachusetts Institute of Technology. Working with two- and three-dimensional models, Horan hopes to help understand how these massive explosions progress—in particular, the role of neutrino heating in reenergizing the outbound shock front that arises as in-falling matter rebounds from the collapsing core. With the DOE/NNSA SSGF, he writes, he'll "have the freedom to accomplish my desired change in direction—switching disciplines from nuclear engineering to astrophysics."



At the Colorado School of Mines, **Christopher Jasien** and advisor Amy Clarke probe metastable beta-titanium under additive manufacturing conditions. Engineers must understand how process parameters influence production of repeatable, defect-free parts using this alloy. Jasien will use *in situ* X-ray radiography of laser powder bed fusion rasters and spot-melts to track melt pools and solidification. That data will help



calibrate models to predict thermal gradients in the solidifying melt pools and the as-built microstructure. Post-mortem microscopy will help validate predictions and identify parameters for defect-free parts. The research also will investigate post-build heat treatments to produce the desired material properties.

To advance technology such as fusion energy and pulsed thrusters, Stanford University's **Derek Kuldinow** and advisor Kentaro Hara will develop a 10-moment, multifluid model to investigate the dynamics and stability of magnetized and high energy density plasma systems. With this model, Kuldinow hopes to bridge the gap between microscopic (kinetic) and macroscopic (fluid) plasma descriptions. He'll benchmark the code against results from previous studies done with lower-order models, investigate fundamental instabilities, and validate the results against experimental observations via collaborations with other groups and institutions.



Elyse Schriber worked with James Hohman at Lawrence Berkeley National Laboratory and now pursues her PhD with him at the University of Connecticut, where she advances and applies small-molecule serial femtosecond crystallography (smSFX) via an X-ray free electron laser. The goal: determining nanocrystal structure for metal-organic chalcogenolate assemblies and similar materials. She'll develop sample delivery apparatuses and testing tools to boost compatibility with standard serial femtosecond crystallography beamlines and overall sample delivery stability. Schriber also will optimize software tools to support smSFX experiments. By combining those two objectives, she hopes to use smSFX to probe atomic-resolution ultrafast dynamics in microcrystalline materials.



Laboratory Residency Graduate Fellowship



The University of New Mexico's **Maren Hatch** plans residencies at nearby Sandia and Los Alamos national laboratories to explore acceleration-driven magneto-Rayleigh-

Taylor instabilities (MRTI) in z-pinch liner implosions. With advisor Mark Gilmore and Sandia's Thomas Awe, Hatch will develop a platform to probe a possible MRTI source: electrothermal instability (ETI)-driven perturbations. At Sandia, she will study target designs to examine how varying surface perturbations, via engineered defects, affect ETI growth. At Los Alamos, Hatch will use the multiphysics FLAG code to compare calculations with her experimental data, working to "address the role of dominant, localized Joule heating and ETI in plasma formation in high-current conductors."



With Daniel Casey on a Lawrence Livermore National Laboratory residency, MIT's **Justin Kunimune** will broaden his research into two National Ignition Facility and OMEGA laser inertial

confinement fusion diagnostics, the magnetic recoil spectrometer for time-resolved measurements of the neutron spectrum (MRSt) and the three-dimensional (3D) knock-on deuteron imager (KODI). MRSt is expected to capture time-evolution data for the fuel assembly, hotspot formation, and nuclear burn for the first time. KODI is analogous to NIF's neutron imaging system (NIS). Collaborating with LANL's Verena Geppert-Kleinrath, Kunimune will combine 3D NIS and real-time neutron activation diagnostic data to reconstruct NIF implosion shell morphology.



Jazmin Ley, at the University of Nebraska, Lincoln, focuses on using and validating new nondestructive evaluation techniques to characterize the complex microstructures metal additive manufacturing (AM) produces, assuring that products have the desired properties. She has developed wave-scattering models, and her group has used synthetic microstructures to calculate predicted experimental values from such diagnostics. Under advisor Joseph Turner and with LANL mentor Christian Pantea, Ley plans to learn new inspection techniques, such as resonant ultrasound spectroscopy and nonlinear acoustics.



Also studying AM is Georgia Institute of Technology's **Taylor Sloop-Cabral**. She and advisor Joshua Kacher, working with LANL's Saryu Fensin, want to develop a method to determine how AM-caused

microstructural heterogeneities influence dynamic compressive strength and spall failure in powder-bed fusion-produced 316L stainless steel. Sloop-Cabral will use multiplexed photon doppler velocimetry to measure particle speed at the free surface, helping determine the spall strength. She hypothesizes that controlled internal porosity can boost spall failure resistance as it disrupts shockwaves moving through the pore structure. Sloop-Cabral will test that idea with plate-impact experiments on AM steel samples built with controlled porosity levels, analyzed with a range of diagnostics.

New Minority Serving Institutions Internship Program: Inaugural Cohort Class of 2022-2023

The NNSA Minority Serving Institutions Partnership Program (MSIPP) is excited to announce a new internship program, the Minority Serving Institutions Internship Program (MSIIP). The official MSIIP website launched in December 2021 for the inaugural Class of 2022-2023 cohort, with applications for the second cohort, the Class of 2023-2024 opening in August 2022 and closing on October 9, 2022. MSIIP supports the NNSA's management and governance framework to have a diverse world-class workforce by enabling succession planning, knowledge preservation, ongoing training, and workforce development to ensure the future of the nuclear security enterprise.

This program offers summer or year-round internship opportunities with the NNSA Headquarters offices, national laboratories, and site offices to talented undergraduate and graduate students from Minority Serving Institutions (MSI). Opportunities involve projects focused on engineering, science, research, technology, policy, business, and government relations. Internship benefits include stipends, paid summer housing for in-person/ hybrid participation, commuting supplements, inbound/outbound transportation reimbursement, travel and training budgets, paid time off, and Federal holidays.

The inaugural cohort group of 87 interns joined on June 6. Please promote and share this internship opportunity with MSI students. A flyer is available to share. Visit orise.orau.gov/NNSA-MSIIP/ or contact Alexander Godinez-Robinson, MSIIP Program Manager, at msiip@nnsa.doe.gov for more information.

MINORITY SERVING INSTITUTIONS INTERNSHIP PROGRAM (MSIIP)

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- JUMPSTART YOUR POTENTIAL FOR OPPORTUNITIES WITHIN THE FEDERAL GOVERNMENT AND NUCLEAR SECURITY ENTERPRISE (NSE).
- WORK SIDE-BY-SIDE WITH LEADING SCIENTISTS, ENGINEERS, AND OTHER TOP PROFESSIONALS.
- DEVELOP PROFESSIONAL SKILLS AND ENHANCE LEADERSHIP CAPABILITIES.
- OPEN TO ALL EDUCATIONAL FIELDS/DEGREE PROGRAMS.



INAUGURAL MSIIP CLASS OF 2022-2023 COHORT

APPLICATIONS DUE:
Sunday, October 9th,
2022, by 11:59pm EST

Questions:

 NNSA-MSIIP@orise.orau.gov

Website:

 <https://orise.orau.gov/nnsa-msiip/>



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FOR SCIENCE AND EDUCATION



REQUIREMENTS:

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- MUST HAVE A 3.0 GPA
- MUST BE 18 YEARS OLD BY THE APPOINTMENT START DATE

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| <ul style="list-style-type: none"> • STIPENDS: <ul style="list-style-type: none"> ◦ UNDERGRADUATE - \$750 PER WEEK ◦ GRADUATE - \$950 PER WEEK • ADDITIONAL HOUSING, TRAVEL, AND TRAINING SUPPLEMENTS | <ul style="list-style-type: none"> • SUMMER (12-WEEKS) <ul style="list-style-type: none"> ◦ JUNE 5, 2023 - AUGUST 25, 2023 • YEAR-LONG <ul style="list-style-type: none"> ◦ JUNE 5, 2023 - MAY 31, 2024 <p><small>*OPPORTUNITIES TO EXTEND MAY BE AVAILBLE</small></p> |
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CLASS OF 2022-2023 MSIIP INTERNS WITH ADMINISTRATOR JILL HRUBY AT THE NNSA SUMMER BBQ.