

NATIONAL NUCLEAR SECURITY ADMINISTRATION

Minority-Serving Institution Partnership Program



**Pacific
Northwest**
NATIONAL LABORATORY

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MSIPP-NNSA 2021 Annual Report

October 2021

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Jessica Snider
Mariella Lora
Maren Disney



Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Richland, Washington 99354

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1.0 Introduction

The Minority-Serving Institution Partnership Program - National Nuclear Security Administration (MSIPP-NNSA) is a research-based experience for students who are traditionally underrepresented in science, technology, engineering, and mathematics (STEM). The program is building a sustainable pipeline between U.S. Department of Energy (DOE) facilities, national laboratories, and minority-serving institutions in STEM disciplines and bringing heightened awareness of NNSA plants and laboratories to institutions with a common interest in STEM research fields.

Through MSIPP-NNSA, Pacific Northwest National Laboratory (PNNL) hires high school, undergraduate, and graduate students to work alongside a PNNL scientist and project advisor in a specific research area aligned with NNSA mission areas and capabilities. Such research areas include radiation detection, artificial intelligence/machine learning, mass spectrometry, computational science, high-energy physics, biology, and cybersecurity. At the end of their term, interns deliver a poster presentation on their internship experience.

This report highlights PNNL’s MSIPP-NNSA program management and intern activities for fiscal year 2021.

2.0 Program Management

The MSIPP-NNSA program at PNNL is administered by the National Security Professional Leadership Group (NSLP) in PNNL’s National Security Directorate. This organization has nearly two decades of experience administering the NNSA Graduate Fellowship Program (NGFP). As a result, PNNL brings to MSIPP-NNSA a reliable and replicable next-generation leadership development program management approach. This includes unmatched experience welcoming aboard early-career, limited-term employees and navigating the nuances of onboarding within the national security mission space. The MSIPP-NNSA leadership team is outlined in Figure 1 and supported by mentors and support staff from across PNNL.



Figure 1. MSIPP-NNSA Team

To promote the 2021 summer internship opportunities, PNNL launched the MSIPP-NNSA website at <https://www.pnnl.gov/msipp-nnsa>. The website provides an overview of the program, eligibility requirements, and application details. The application for 2021 internships opened in late 2020, and students were interviewed and selected in early 2021.

In June 2021, PNNL virtually onboarded 21 students ranging from high school to doctoral candidates. Students and their affiliations, class standings, and degree areas are listed in Table 1. Typically, MSIPP-NNSA interns are funded by NNSA for a period of 8-12 weeks. Depending on the work scope and project advisor, the internship can be extended 12 weeks. In late summer, the program worked with the project advisors, interns, and the sponsor to evaluate extensions and interns' interest in returning next summer. Five students were extended: Corlisa Awino, Jaidyn Bryant, Atharva Chopde, Jonathan Mills, and Jeremy Paige.

Table 1. 2021 MSIPP-NNSA Interns

Name	Major	School	Class Standing
Jared Doran	High School	Hanford High School	Graduating June 2021, University of Washington Freshman
Renee White	High School	Mercer Island High School	Graduating June 2021, Stanford Freshman 2021
Brooklyn Arroyo	High School	Chiawana High School	Graduating June 2022
Dylan Lai	High School	Cleveland STEM High School	Graduating June 2022
Fatou Ndiaye	BS: Biology	Howard University	Sophomore
Jaidyn Bryant	BS: Bio-Pre Med/Chem	Xavier University	Sophomore
Elijah Tomlin	BS: Intelligence Analysis	James Madison University	Sophomore
Yarelis Rivera	BA: Biology	Inter American University of Puerto Rico	Junior
Margareth Mbea	BS: Chemistry ACS	Xavier University of Louisiana	Junior
Grady Clopton	BS: Chemistry	Tennessee State University	Senior
Camille Aguilar	BA: English Language and Literature and Creative Writing	University of Chicago	Senior
Andria Thomas	BS: Physics	Fisk University	Graduated May 2021
Jeremy Paige	MS: Information Assurance and Cybersecurity	Gannon University	In progress
Corlisa Awino	MS Electrical Engineering	Prairie View A&M University	In Progress (Expected August 2021)
Bayasgalan Batsaikhan	MS: Information Systems, Enterprise Risk and Security	Indiana University	In Progress (Expected December 2021)

Atharva Chopde	MS Computational Linguistics	University of Florida	In progress (Expected December 2021)
La'Darius Thomas	PhD Electrical and Computer Engineering	Georgia Institute of Technology	Completed May 2018
Jonathan Mills	PhD Applied Physics	Alabama A&M University	In Progress
Guddi Suman	PhD Electrical Engineering	Prairie View A&M	In Progress
Omari Paul	PhD Engineering and Computational Sciences	Tennessee State University	In Progress
Preston Niter	PhD Chemistry	Washington University	In Progress

3.0 Professional Development

Upon onboarding, MSIPP-NNSA interns participated in a two-day virtual orientation where they learned about PNNL and sponsor expectations and resources (Figure 2).

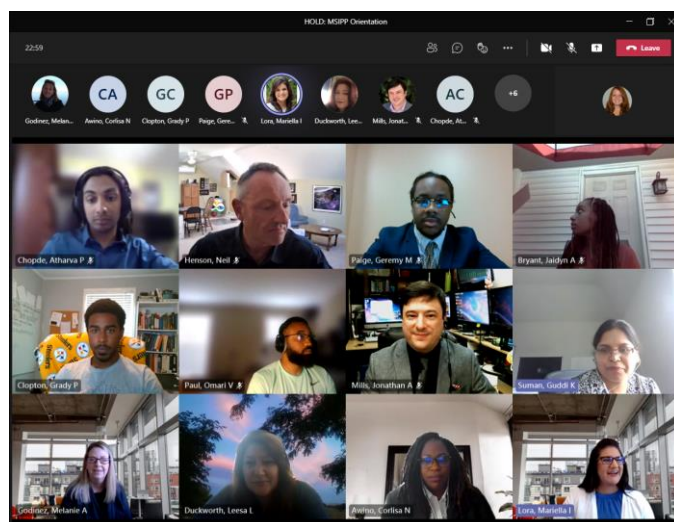


Figure 2. MSIPP-NNSA Intern Virtual Orientation

Throughout the summer, interns participated in a range of professional development, networking, and training events. Key events included:

- PNNL's National Security Publishing Workshop by Maren Disney and Mary Frances Lembo. This four-part series introduced students to publishing tools and best practices, with a focus on navigating the nuances of publishing in the national security mission space.
- Succeeding in a Teleworking Environment presented by Bethany Lavelle. Students learned about resources and best practices for working virtually, including tips for networking, communicating, and professional development in the virtual environment.
- Communications and Social Media presented by Maren Disney. Students learned about PNNL communications resources and best practices, including how to best represent themselves on social media.

- Radiation Detection Nuclear Security Summer School. This multi-day course offered an up-close look at why and how radiation detectors are used in national security missions.
- Consortium for Enabling Technologies and Innovation Summer School. This four-day program highlighted radiation detection and nuclear fuel cycle monitoring.
- Dr. Marcus Huggans spoke with interns about the National GEM Consortium. Several fellows noted the presentation inspired them to consider doctoral programs and the GEM opportunity.

In August, the interns began delivering their final projects—a virtual presentation that summarizes their internship experience and outcomes (Figure 3).

Dive into Diversity, Equity, and Inclusion through Data Analysis

Overview

Working alongside many professionals managing recruitment of NGFP (National Nuclear Security Association Graduate Fellowship Program) and divisions under Data Analytics, I engaged in a research assignment with a focus for lab wide demographics and the impacts demographics have on a workplace.

Outcomes

The project began with a broad focus on the general idea of Diversity, Equity, and Inclusion within professional workplaces and, more specifically, laboratories. Overtime, specific demographical trends in gender, race, and workplace comfortability were seen.

DE&I Evaluation Pillars

- Pillar #1: Diversity Demographics (Quantitative)
- Pillar #2: Inclusion Demographics (Qualitative)
- Pillar #3: Development Demographics (Qualitative)
- Pillar #4: Environmental Feedback (Mixed Method)

The diagram developed to better organize means of important DEI demographics.

The conclusions showed a lack of uniform data collection and evaluation, making it easy for misleading statistics and a lack of legitimate good change in DEI. A workplace DEI Index is to be made and proposed, most effectively, through a White Paper.

"This internship provided me with new experiences, knowledge, and understanding. I gained these through the lens of something I am passionate about, DEI, and learned you can be technically prepared for critical conversations."

Brooklyn Arroyo
Chiawana High School

Melanie Godinez, Christian Perry

pnnl.gov/msipp-nnsa
PNNL-SA-165862

Figure 3. In her final presentation, intern Brooklyn Arroyo highlighted her research into workplace diversity, equity, and inclusion demographics.

All interns are assigned a PNNL mentor to guide their experience. The following are staff at PNNL who served as mentors for the 2021 cohort:

- Anne Arnold
- Melissa Barona
- Jonathan Barr
- Robert Brigantic
- Anne Chaka
- Court Corley
- Leesa Duckworth
- Ethan Farquhar
- Leo Fifield
- Jonathan Forman
- Bojana Ginovska
- Melanie Godinez
- Alex Hagen
- Neil Henson
- Janine Hutchison
- Aaron Luttmann
- Christine Noonan
- Christian Perry
- Amanda Sayre
- David Sheen
- Cheslan Simpson
- Eric Smith
- Mychal Spencer
- Lucas Sweet
- Mohammad Taufique
- Karen Taylor
- Karen Wahl

4.0 Mission Impact

MSIPP-NNSA interns provided meaningful contributions to diverse projects applying cutting-edge research to national security mission challenges. Below are highlights from interns' 2021 assignments. Detailed posters and intern biographies are [available online](#).

- **Camille Aguilar** produced a report on machine tools, a high-interest commodity group commonly used for numerically controlled, precision machining. As a part of this effort, she performed a literature review, conducted quantitative analysis of trade data, and prepared an interview with a subject matter expert.
- Working alongside many professionals managing recruitment of NGFP and PNNL divisions under Data Analytics, **Brooklyn Arroyo** engaged in a research assignment with a focus for laboratory-wide demographics and the impacts demographics have on a workplace. The project began with a broad focus on the general idea of diversity, equity, and inclusion within professional workplaces and, more specifically, national laboratories. The conclusions showed a lack of uniform data collection and evaluation, making it easy for misleading statistics.
- **Corlisa Awino** worked on a project advancing data-driven methods for accelerating materials development and characterization. Awino worked with her team to develop simulation tools for x-ray diffraction characterization of bismuth telluride and catalog published data on aluminum alloy 7075 processing.
- **Bayasgalan Batsaikhan** supported the NNSA Office of Nuclear Smuggling Detection and Deterrence with developing the Sustainability Planning Tool. Batsaikhan supported the implementation and updates on structural components to improve the tool's user friendliness based on early user feedback.
- Interns **Jaidyn Bryant** and **Atharva Chopde**, working with Jonathan Forman, received full internal funding for their proposal, "The Scheduling Stone: A Key to Unlock the Mysteries of the Chemical Weapons Convention (CWC)." The interns came up with a way to decipher "Schedule Speak" and determine whether a chemical is covered by the schedules of the CWC using components ("chemical syllables") of chemical names. Their project focuses on creating tools to enable non-chemists to use chemical identifiers, determine whether a chemical is scheduled under the CWC, and if so, determine under which specific schedule it falls.
- **Grady Clopton** participated in a project to investigate a novel Fourier-transform infrared technique for measuring atmospheric hydrogen fluoride (HF) levels. These efforts will help improve understanding of the atmospheric chemistry of HF clusters and the impact of elevated HF levels on the environment.
- **Jared Doran** created a spreadsheet with information that links chemical warfare agents and their surrogates. This will be used as part of a sponsor's lexicon. Doran used a variety of databases to obtain information on agents/surrogates and then transcribed the data into a spreadsheet.
- **Dylan Lai** worked on PNNL's VitalTag, a wearable sensor designed to remotely monitor patient vital signs in a mass casualty event. Lai identified and classified physiological waveforms of patients with circulatory diseases to train VitalTag to identify and evaluate these patients.
- **Margareth Mbea** worked on a project analyzing the reactivity of a manganese metal complex for ammonia oxidation. The project explored how renewable energy can be

transportable and more easily accessible and how this work can aid in reversing damage in the Earth's ozone layer.

- Intern **Jonathan Mills** received an Outstanding Performance Award for his work on a task related to the MAGE project. His work involved evaluating code and briefing senior project leadership from PNNL, the U.S. Air Force, and other agencies. Mills was also featured in a web story highlighting intern support to the Airport Risk Assessment Model. Over three years, more than 30 PNNL interns worked on developing the web-based tool that helps airport security stakeholders prioritize the use of their limited resources based on evolving threats and risk. Read more in "[Computing and Analytics Interns Aid Development of Airport Risk Assessment Model.](#)"
- **Fatou Ndiaye** supported a research project exploring bioinks and the materials used to create these 3D-printed structures. Ndiaye was tasked with gathering information on bioinks in support of an effort to eventually create more advanced bioinks that can be viable for longer periods of time.
- **Jeremy Paige's** research focused on artificial intelligence applications such as machine learning, honeypots, fuzzing, and generative adversarial networks. He contributed to a research report on the future threats of artificial intelligence.
- **Omari Paul** supported PNNL's Disruptive Technology Group on a project that leveraged machine learning to analyze in-reactor behavior of specific materials pertinent to the nuclear reaction process. He assisted in investigating the training and inference steps of a deep convolutional neural network to identify statistical methods of determining pixel-level predication uncertainty.
- **Yarelis Rivera** worked on a series of tasks to calculate infrared spectra of a molecule used to build an artificial enzyme. Rivera read a series of articles related to energy application with artificial enzymes and worked with the platforms Avogadro and MobaXterm. Rivera helped use the MobaXterm platform to interface with high-performance computers and ran calculations using NWChem computational chemistry codes to optimize the molecular structure and calculate the infrared spectra.
- **Guddi Suman** supported efforts to develop a system to monitor environmental parameters in real time. Her team used an Arduino Nano-based system connected to temperature and humidity sensors to monitor data in real time. The online monitoring technologies are expected to revolutionize aging management programs.
- **Andria Thomas** worked on a comparison of handheld radioisotope identification devices. The project sought to understand the response of radioisotope detectors by comparing different units of the same models of detectors. In this effort, Thomas gained experience with PeakEasy, Tidy Data, and Python.
- With modern technology, the need for more secure and protected power utilities becomes apparent due to vulnerabilities such as spoofing, jamming, interference, and denial-of-service attacks. **La'Darius Thomas** contributed to a project investigating the vulnerabilities in the power grid as a result of distributed energy resources being supplementary and how wireless communication technology can detect and mitigate the malicious and accidental disturbances.
- **Elijah Tomlin** worked on projects regarding domestic extremism and insider threat mitigation for the Office of Radiological Security and the Program for International Nuclear Security. He conducted case study research on incidents of stolen radiological and nuclear materials to help organizations understand and combat insider threat.
- **Renee White** worked on a project involving the intersection of nuclear safeguards and artificial intelligence. Her work included surveying the current literature and subject matter experts to elicit a set of possible use cases to apply ethical autonomous/intelligent system principles.

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