YEAR-END TECHNICAL REPORT

September 29, 2020 to September 28, 2021

DOE-FIU Science & Technology Workforce Development Initiative

http://fellows.fiu.edu/

FIU | **Applied Research Center**
FLORIDA INTERNATIONAL UNIVERSITY

Addendum:

This document represents one (1) of five (5) reports that comprise the Year End Reports for the period of September 29, 2020 to September 28, 2021 prepared by the Applied Research Center at Florida International University for the U.S. Department of Energy Office of Environmental Management (DOE-EM) under Cooperative Agreement No. DE-EM0005213.

The complete set of FIU's Year End Reports for this reporting period includes the following documents:

Project 1: Chemical Process Alternatives for Radioactive Waste
    Document number: FIU-ARC-2020-800012997-04b-009

Project 2: Environmental Remediation Science and Technology
    Document number: FIU-ARC-2020-800013918-04b-004

Project 3: Waste and D&D Engineering and Technology Development
    Document number: FIU-ARC-2020-800013919-04b-008

Project 4: DOE-FIU Science & Technology Workforce Development Initiative
    Document number: FIU-ARC-2020-800013920-04b-017

Project 5: Long-Term Stewardship of Environmental Remedies: Contaminated Soils and Water and STEM Workforce Development
    Document number: FIU-ARC-2020-800013922-04b-007

Each document will be submitted to OSTI separately under the respective project title and document number as shown above. In addition, the documents are available at the DOE Research website for the Cooperative Agreement between the U.S. Department of Energy Office of Environmental Management and the Applied Research Center at Florida International University: https://doeresearch.fiu.edu

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PROJECT 4 EXECUTIVE SUMMARY

Over the past decade, there has been a national need for more careers in the science, technology, engineering and mathematics (STEM) workforce. This shortage is felt not only in the private industry sector but also across many federal agencies including the U.S. Department of Energy (DOE). Within DOE Environmental Management (EM), there is a critical shortage of entry-level STEM personnel. About 60% of the workforce is eligible to retire in 5 years, average work age is 55 years and only less than 4% of the workforce is less than 30 years of age. The effects are already being felt across DOE-EM and new ways to stimulate interest in STEM are being initiated by the federal government. If this shortage is not addressed, the risks include knowledge gaps (discontinuity of lessons learned) within the department and a lack of skilled personnel to carry out its cleanup mission effectively.

Florida International University (FIU), the largest Hispanic serving research-extensive institution in the continental United States, is one of the nation's leading producers of scientists and engineers from underrepresented groups. In 1995, DOE created a unique partnership with FIU to support environmental cleanup technology development, testing and deployment at DOE sites. This partnership spawned a research center at FIU dedicated to environmental research and development (R&D). The center, now known as the Applied Research Center, has tackled and helped solve problems at many DOE sites.

The DOE-FIU Science and Technology Workforce Development Program (also known as the DOE Fellows Program) was established in 2007 to create a pipeline of minority engineers specifically trained and mentored to enter the DOE workforce in technical areas of need. This innovative program was designed to help address DOE's future workforce needs by partnering with academic, government and DOE contractor organizations to mentor future minority scientists and engineers in the research, development, and deployment of new technologies addressing DOE's environmental cleanup challenges. The main objective of the program is to provide interested students with a unique opportunity to integrate course work, DOE field work, and research work at FIU into a well-structured academic program that leads to entry into DOE EM or other career opportunities. Students selected as DOE Fellows perform research at FIU and at DOE sites, national laboratories, and DOE contractors. Upon graduation and completion of this fellowship, the students are encouraged to submit an application to join the DOE federal internship programs, apply to DOE contractors, pursue post master's or postdoctoral positions at DOE national laboratories, or apply to private industry in their field of study.

The DOE Fellows Program has inducted a total of 179 minority FIU STEM students since program inception in 2007 up to the most recent induction ceremony held in November 2020 (Virtually). The DOE Fellows induction ceremonies have been attended by DOE EM officials each year, including EM-1's Mr. Rispolli and Dr. Triay, other DOE-EM managers including Mr. Mark Gilbertson in 2007, Mr. Kurt Gerdes in 2017 and 2018, Mr. Leonard Spearman in 2019, and most recently, Ms. Nicole Nelson-Jean in 2020.

MAJOR ACCOMPLISHMENTS

- FIU conducted three recruitment campaigns during fall 2020, spring 2021 and summer 2021. A total of 12 FIU STEM students were selected to be part of DOE Fellows class of 2020 and Class of 2021.
    - Brendon Cintas, Christian Dau, Christian Gonzalez Lopez, Josue Estrada Martinez, Lorryn Andrade, and Thi Tran were selected to be part of DOE Fellows Class of 2020 from fall 2020 recruitment.
    - From spring 2021, Angel Almaguer, Aubrey Litzinger, Caridad Estrada, Desmond Sinnott and Juana Peruina were selected to be part of DOE Fellows Class of 2021.
    - FIU student Rohan Shanbhag was selected to be part of DOE Fellows Class of 2021 from summer 2021 recruitment efforts.

- Eight summer internship reports were developed based on summer 2020 internship assignments from across the DOE complex. Upon approval from the sites, reports were published online at https://fellows.fiu.edu/internships-reports/#2020.
    - **Roger Boza**: Artificial Intelligence Implementation for Object Detection in Route Operable Unmanned Navigation of Drones (ROUNDS)
    - **Michael Thompson**: Flight control systems for autonomous indoor drones
    - **Christopher Excellent**: Mobile Hot Cell for End-of-Life Source Management - Camera Control
    - **Aurelien Meray**: pyLEnM: A Python Package for Long-Term Soil and Groundwater Monitoring
    - **Juan Morales**: Investigation of Heavy Metal Biomarkers for the Assessment of Remediated Surface Waters
    - **Gisselle Gutierrez**: Processing of Time Series Data in Support of Producing a Climatological Summary of WIPP
    - **Edward Nina**: Numerical Simulation for Radioactive Waste Transfer using COMSOL Multiphysics
    - **Jeff Natividad**: Navigation and Positioning Tests for Vector Platform

- Due to the COVID-19 pandemic, FIU conducted a Virtual DOE Fellows Introduction Ceremony to welcome 15 new DOE EM Fellows instead of the traditional induction ceremony. Officials from DOE and FIU participated in a ceremony held over Zoom on November 19, 2020 to welcome the 15 FIU STEM students into the DOE Fellows Class of 2020.
    - Adrian Muino, B.S. Computer Engineering
    - Alicia Maratos, B.S. Environmental Engineering
    - Brendon Cintas, B.S. Mechanical Engineering
    - Christian Dau, B.S. Computer Science
    - Christian Gonzalez Lopez, B.S. Computer Science
    - Joel Adams, Ph.D. Mechanical Engineering
    - Josue Estrada, B.S. Mechanical Engineering

- o Lorryn Andrade, M.S. Environmental Engineering
- o Mariah Doughman, Ph.D. Chemistry
- o Phuong Pham, Ph.D. Chemistry
- o Raymond Piloto, M.S. Computer Engineering
- o Ryan Ocampo, M.S. Civil Engineering
- o Sebastian Story, B.S. Mechanical Engineering
- o Stevens Charles, B.S. Civil Engineering
- o Thi Tran, B.S. Mechanical Engineering

- Two DOE Fellows **Alejandro Koszarycz** (class of 2017) and **Christopher Excellent** (class of 2017) graduated with bachelor's degrees in computer science and mechanical engineering respectively and participated in the fall 2020 virtual graduation ceremony.

- Nineteen (19) DOE Fellows worked on preparing and submitting posters for the virtual WM2021 Symposia's student poster competition along with 5-minute videos describing their posters.
    - o DOE Fellow, **Derek Gabaldon**, won Best Undergraduate Student Poster Award
    - o DOE Fellow, **Aurelien Meray**, won Best Graduate Student Poster Award

- DOE Fellow, **Silvina Di Pietro**, successfully completed her Ph.D. defense within the Department of Chemistry at FIU on March 24, 2021, and participated in a graduation ceremony held on April 24, 2021. In the Fall of 2015, Silvina joined the DOE-FIU Science & Technology Workforce Development Initiative (DOE Fellows Program) sponsored by the DOE Office of Environmental Management. Silvina has accepted a post doctorate position within the **National Nuclear Security Administration (NNSA)** under the Defense Program and will start her career with NNSA this summer.

- DOE Fellows **Brendon Cintas and Mariah Doughman** graduated with a bachelor's degree in mechanical engineering and a master's degree in chemistry respectively, and will continue in the program while pursuing PhD degrees in their respective fields.

- Fourteen (14) DOE Fellows participated in summer 2021 internships with various national labs as well as with DOE-EM HQ. Five (5) Fellows conducted onsite internships, 3 Fellows at WRPS and 2 Fellows at SRNL. Eight (8) DOE Fellows participated in remote summer 2021 internships at LBNL (2), INL (2), PNNL (2), LANL (1) and DOE-HQ (1). One (1) DOE Fellow participated in Hybrid internship at DOE-HQ.
    - o DOE Fellow **Roger Boza** won the best poster award for the poster he presented during the INL Summer Intern poster presentations.

- DOE Fellow **Alexis Vento** successfully defended his master's thesis titled "Dolomite Dissolution and Contaminant Adsorption in the Presence of EDTA within Different Ionic Strength Solutions relevant to WIPP" on July 12, 2021.

- DOE Fellow, **Derek Gabaldon**, graduated with a bachelor's degree in Mechanical Engineering and participated in the graduation ceremonies held on August 4 - 6, 2021.

- Two (2) DOE Fellows, **Mariah Doughman and Phuong Pham**, participated in the 2021 ACS Fall meeting held between August 22-26, 2021, in Atlanta, GA and presented posters based on their remediation research to support PNNL and SRNL.

- Six (6) DOE Fellows prepared and presented their research accomplishments during the FIU Program Review held on September 14 -15, 2021.

    - AI for Soil & Groundwater Data (SRS F-Area) - **Aurelien Meray**
    - Hydrology Modeling for WIPP - **Gisselle Gutierrez**
    - Robotic Application of Coating in the SRNL H-CAEX - **Jeff Natividad**
    - Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments - **Mariah Doughman**
    - Development and Deployment of the Miniature Rover for Inspection of Hanford's Double Shell Tank (DST) - **Sebastian Story**
    - D&D support to DOE-EM - **Philip Moore**

- Below is an infographic that provides a summary of the Program, including the achievements in FIU Year 1 described in this report.
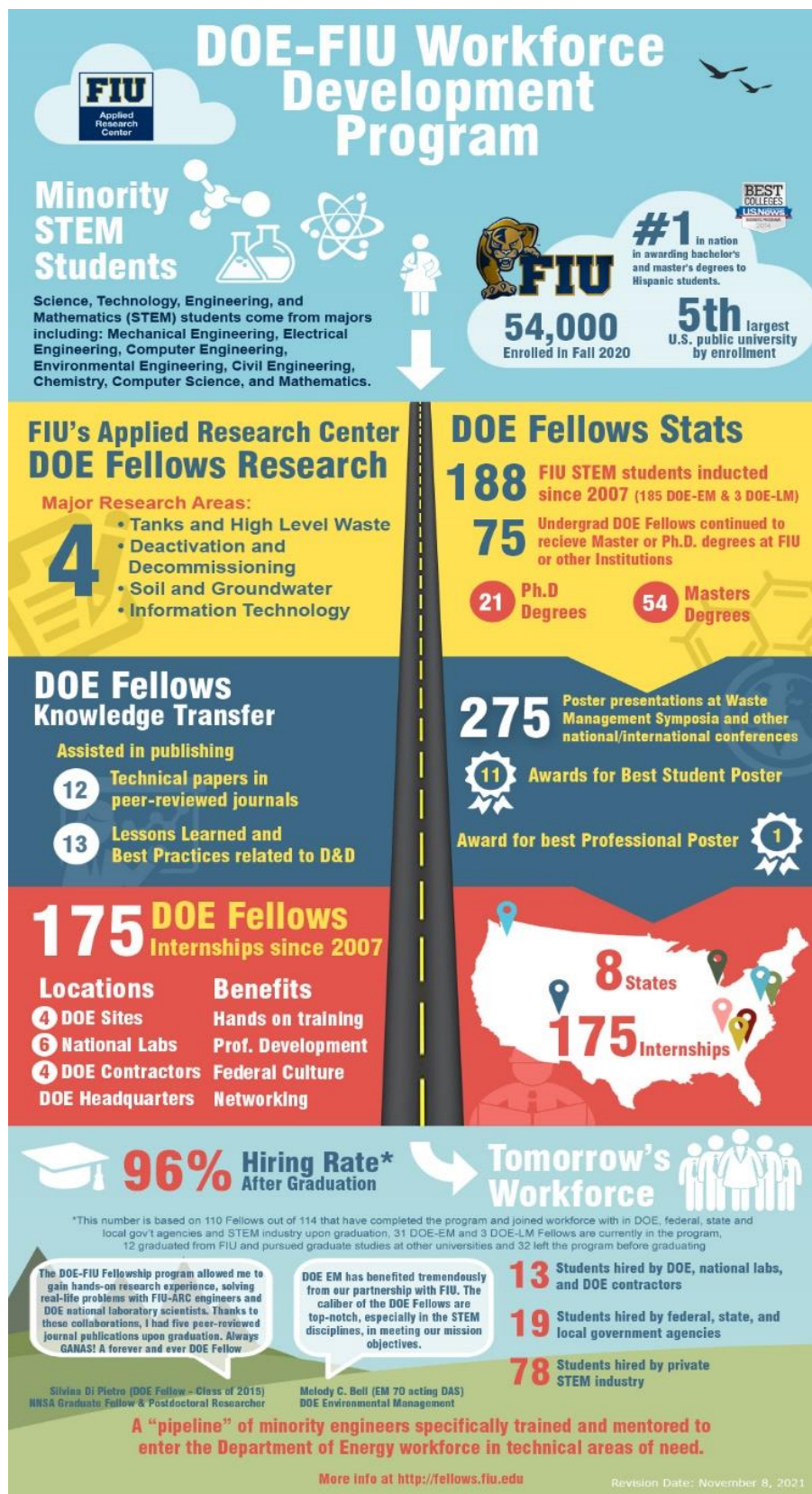
†Total DOE Fellows include 179 DOE-EM Fellows inducted since 2007 to 2020, 6 EM Fellows currently in the program (recruited during current reporting period) and 3 DOE-LM Fellows.

PROJECT 4: DOE-FIU SCIENCE & TECHNOLOGY WORKFORCE DEVELOPMENT INITIATIVE

INTRODUCTION

Florida International University (FIU), the largest Hispanic serving research-extensive institution in the continental United States, is one of the nation's leading producers of scientists and engineers from underrepresented groups. In 1995, the U.S. Department of Energy created a unique partnership with FIU to support environmental cleanup technology development, testing and deployment at DOE sites. This partnership spawned a research center at FIU dedicated to environmental R&D. The center, now known as the Applied Research Center, has tackled and helped solve multiple problems at many DOE sites. The DOE-FIU Science and Technology Workforce Development Program is designed to build upon this relationship by creating a pipeline of minority engineers specifically trained and mentored to enter the DOE workforce in technical areas of need. This innovative program was designed to help address DOE's future workforce needs by partnering with academic, government and DOE contractor organizations to mentor future minority scientists and engineers in the research, development, and deployment of new technologies addressing DOE's environmental cleanup challenges.

OBJECTIVES

The DOE-FIU Science and Technology Workforce Development Program has been designed to build upon the existing DOE/FIU relationship by creating a "pipeline" of minority engineers specifically trained and mentored to enter the Department of Energy workforce in technical areas of need. The main objective of the program is to provide interested students with a unique opportunity to integrate course work, DOE fieldwork, and research work at FIU into a well-structured academic program that leads to entry into DOE EM's Pathways Program. Students selected as DOE Fellows perform research at FIU and at DOE sites, national laboratories, and DOE contractors. Graduation and completion of this fellowship leads to employment opportunities with DOE EM, DOE contractors, DOE national laboratories, other federal agencies, and private industry as well as the pursuit of post-master or post-doctoral positions at DOE national labs.

RESULTS AND DISCUSSION

Task 1: Recruitment Efforts

Fall 2020 recruitment efforts for hiring new DOE Fellows were completed in October 2020. A recruitment flyer was prepared and distributed via the DOE Fellows website as well as via social media to attract FIU students. The DOE Fellows Program was promoted by attending Zoom classrooms to recruit new students. The DOE Fellows program selection committee reviewed the applications received and selected 8 students for interviews via Zoom. Upon completion of the interviews, the selection committee chose six (6) FIU students to join the DOE Fellows Class of 2020, bringing the total number of Fellows to fifteen (15), including four (4) Fellows hired in spring and five (5) fellows in summer.

Table 1. FIU Students Selected during Fall 2020 Recruitment
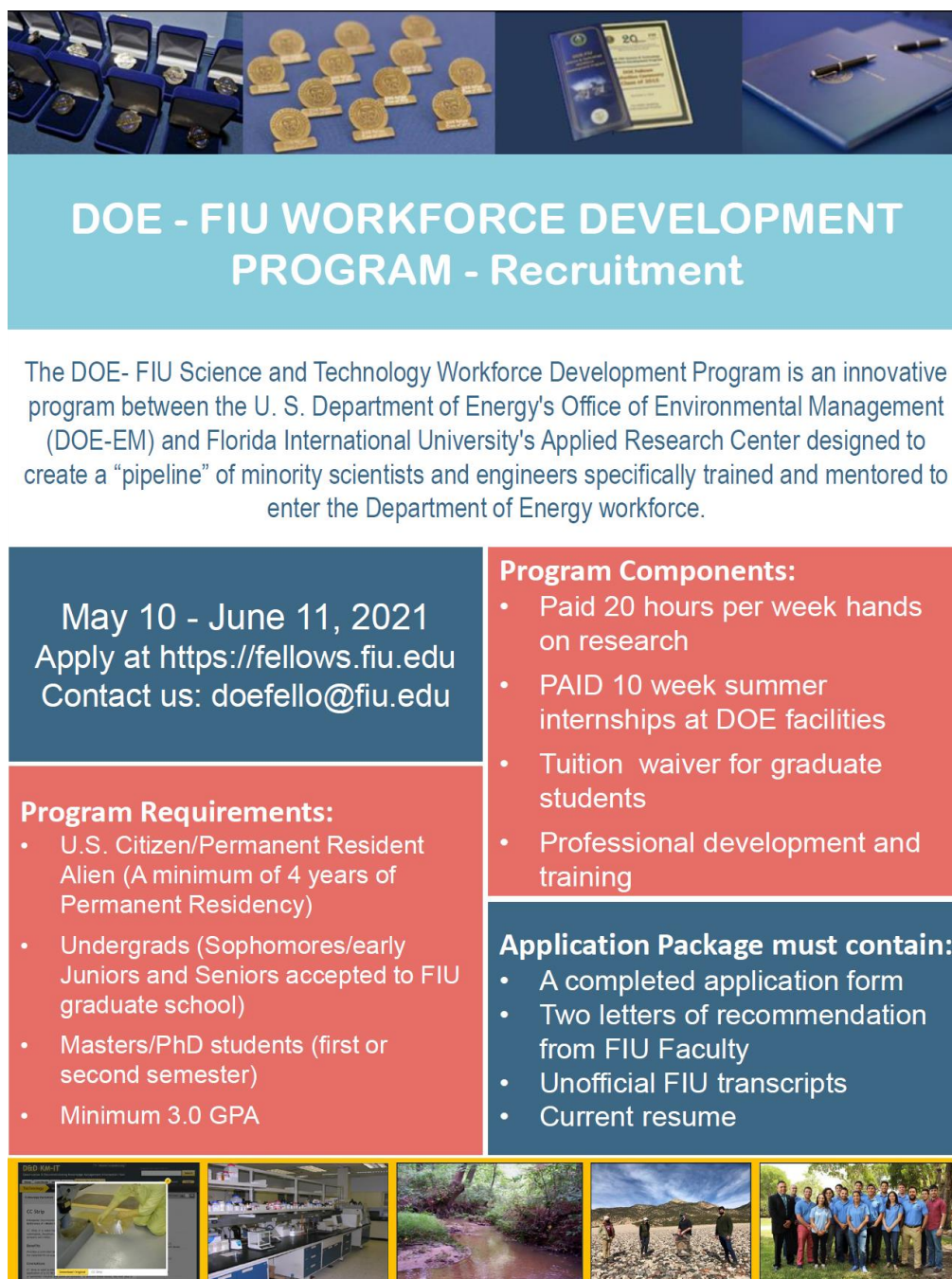
Name	Class	Major	Mentor	Project Support
Brendon Cintas	Undergrad.	Mechanical Engr.	Dr. Dwayne McDaniel	Experimental analysis of flushing criteria for waste transport operations
Christian Dau	Undergrad.	Computer Sci.	Dr. Himanshu Upadhyay	WIMS & KM-IT
Christian Gonzalez Lopez	Undergrad.	Computer Sci.	Dr. Himanshu Upadhyay	AI solution for S & GW - Chromium prediction in 100 H area
Josue Estrada Martinez	Undergrad.	Mechanical Engr.	Mr. Anthony Abrahao	Development of Inspection Tools for DST Tanks
Lorryn Andrade	Grad, M.S.	Environmental Engr.	Dr. Johnbull Dickson	The fate of actinides in the Waste Isolation Pilot Plant (WIPP)
Thi Tran	Undergrad.	Mechanical Engr.	Mr. Anthony Abrahao	Long-Term Surveillance of Nuclear Facilities and Repositories using Mobile Systems

FIU initiated spring 2021 recruitment efforts for new DOE Fellows in January 2021. As in the Fall, FIU promoted the program through distribution of recruitment flyers via the DOE Fellows website and social media, as well as attendance in Zoom classrooms. Applications from interested FIU students were accepted until February 19, 2021, after which the DOE Fellows selection committee reviewed the applications and recommended 7 students to be interviewed. Five (5) students were selected to be part of the DOE Fellows Class of 2021.

Table 2. DOE Fellows Recruited during Spring 2021

Name	Class	Major	ARC Mentor	Project Support
Angel Almaguer	Undergrad.	Chemistry	Dr. Yelena Katsenovich	Re-oxidation of Redox Sensitive Contaminants Immobilized by Strong Reductants
Aubrey Litzinger	Undergrad.	Environmental Engr.	Dr. Mayren Echeverria	Evaluation of Coatings for the H-Canyon Exhaust Tunnel
Caridad Estrada	Undergrad.	Environmental Engr.	Dr. Johnbull Dickson	Engineered Multi-Layer Amendment Technology for Hg Remediation on Oak Ridge Reservation
Desmond Sinnott	Undergrad.	Mechanical Engr.	Dr. Aparna Aravelli	Pipeline Corrosion and Erosion Evaluation
Juana Peruina	Grad	Environmental Engr.	Dr. Kexin Jiao	Multi-functional 3D Polymer Framework for Mercury Abatement

FIU conduct recruitment efforts for summer 2021 in June and accepted applications from interested students until June 11, 2021, by extending the deadline by one week from the original deadline of June 4, 2021. A flyer was prepared and distributed to eligible students, professors and program coordinators for distribution. Six (6) FIU students submitted applications along with required documentation such as resume, unofficial transcripts and two (2) letters of recommendation from Faculty. The DOE Fellows selection committee reviewed the applications and recommended two students for interviews which were held on June 23, 2021. Rohan Shanbhag, an undergraduate student pursuing a degree in Computer Science, was selected to be part of the DOE Fellows Class of 2021.

Figure 1. Recruitment flyer distributed used to promote DOE Fellows program.

FIU also initiated the Fall 2021 recruitment campaign, starting August 30, 2021, which is anticipated to run through October 1, 2021. During the recruitment period, FIU will set up tables at the Engineering Center, the Physics and Chemistry building, as well as the Computer Science building to promote the program and distribute flyers. FIU is also visiting classrooms to promote the program and encourage interested and eligible students to apply to the program. Emails were sent to students who signed up at the tables, informing them about the application deadline and providing links to the DOE Fellows website to encourage them to apply to the program. Interviews and selection of new DOE Fellows to join class of 2021 will be completed prior to an induction ceremony planned for November 11, 2021.

Figure 2. DOE Fellows promoting the program and recruiting new students.

All new DOE Fellows completed the required health and safety trainings listed below prior to engaging in the laboratory work.

- Laboratory Hazard Awareness
- Hazard Communication (HAZCOM)
- Fire Safety (online or instructor-led)
- Environmental Awareness PT 1 & PT 2
- Small Spills and Leaks
- EPA: Hazardous Waste Awareness & Handling
- Personal Protective Equipment (Lab)
- Safe Use of Fume Hoods
- Safe Use of Emergency Eyewash & Shower
- Chemical Handling Safety - Basic Principles
- Compress Gas Safety Awareness
- Safe Use of Biosafety Cabinets
- Radiation Safety PT 1 (online)

Task 2: DOE-EM Research Identification and Assignments

Fellows continue their support to the DOE-FIU Cooperative Agreement by actively engaging in EM applied research and supporting ARC staff in the development and completion of the various tasks. All Fellows also participate in a weekly meeting conducted by the program director. During

each of these meetings, one DOE Fellow presents the work he/she performed during his/her summer internship and/or the EM research work currently being performed at ARC.

During the FIU Year 1, the Fellows continued their research on the DOE EM applied research projects under the Cooperative Agreement. Each DOE Fellow is assigned to DOE EM research projects as well as ARC mentors. A list of the current Fellows, their classification, areas of study, ARC mentor, and assigned project task is provided in the table below.

Table 3. Project Support by DOE Fellows

Name	Class	Major	ARC Mentor	Project Support
Adrian Muino	Undergrad.	Computer Engr.	Dr. Himanshu Upadhyay	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies
Alejandro Koszarycz	Undergrad.	Computer Science	Dr. Himanshu Upadhyay	KM-IT Development - Enhance D&D Research Module for Multiple DOE EM Sites and National Laboratories
Alexis Vento	M.S. Grad	Environmental Engr.	Dr. John Dickson	Fate of Actinides in the Presence of Ligands in High Ionic Strength Systems
Alicia Maratos	Undergrad.	Environmental Engr.	Dr. Yelena Katsenovich	Experimental Support of Lysimeter Testing
Angel Almaguer	Undergrad.	Chemistry	Dr. Yelena Katsenovich	Re-oxidation of Redox Sensitive Contaminants Immobilized by Strong Reductants
Aubrey Litzinger	Undergrad.	Environmental Engr.	Dr. Mayren Echeverria	Evaluation of Coatings for the H-Canyon Exhaust Tunnel
Aurelien Meray	Ph.D. Grad.	Computer Science	Dr. Himanshu Upadhyay	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies
Brendon Cintas	Ph.D. Grad.	Mechanical Engr.	Dr. Dwayne McDaniel	Experimental analysis of flushing criteria for waste transport operations
Caridad Estrada	Undergrad.	Environmental Engr.	Dr. Johnbull Dickson	Engineered Multi-Layer Amendment Technology for Hg Remediation on Oak Ridge Reservation
Christian Dau	Undergrad.	Computer Science	Dr. Himanshu Upadhyay	WIMS & KM-IT
Christian Gonzalez Lopez	Undergrad.	Computer Science	Dr. Himanshu Upadhyay	AI solution for S & GW - Chromium prediction in 100 H area
Christopher Excellent	Undergrad.	Mechanical Engr.	Mr. Anthony Abrahao	Development of Inspection Tools for Primary Tanks
Daniel Martin	Undergrad.	Electrical Engr.	Dr. Shervin Tashakori	Development of Inspection Tools for Primary Tanks
David Mareno	Undergrad.	Computer Engr.	Dr. Himanshu Upadhyay	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies
Derek Gabaldon	Undergrad.	Mechanical Engr.	Ms. Melissa Komninakis	Innovative Technologies for D&D Activities
Desmond Sinnott	Undergrad.	Mechanical Engr.	Dr. Aparna Aravelli	Pipeline Corrosion and Erosion Evaluation

Name	Class	Major	ARC Mentor	Project Support
Gisselle Gutierrez	M.S. Grad	Environmental Engr.	Ms. Angelique Lawrence	Digital Elevation Model and Hydrologic Network
Jeff Natividad	M.S. Grad	Mechanical Engr.	Mr. Mackenson Telusma	Evaluation of coatings for H-Canyon Exhaust Tunnel
Joel Adams	Ph.D. Grad	Mechanical Engr.	Mr. Anthony Abrahao	Long Term Surveillance of Nuclear Facilities and Repositories
Josue Estrada Martinez	Undergrad.	Mechanical Engr.	Mr. Anthony Abrahao	Development of Inspection Tools for DST Tanks
Juan Morales	Ph.D. Grad	Environmental Health Sciences	Ms. Angelique Lawrence	Contaminant Fate and Transport Modeling in the Tims Branch Watershed
Juana Peruina	Grad	Environmental Engr.	Dr. Kexin Jiao	Multi-functional 3D Polymer Framework for Mercury Abatement
Katherine De La Rosa	Undergrad.	Environmental Engr.	Dr. Ravi Gudavalli	Humic Acid Batch Sorption Experiments with SRS Soil
Lorryn Andrade	M.S. Grad	Environmental Engr.	Dr. John Dickson	The fate of actinides in the Waste Isolation Pilot Plant (WIPP)
Mariah Doughman	Ph.D. Grad	Chemistry	Dr. Yelena Katsenovich	Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments
Nathalie Tuya	Undergrad.	Environmental Engr.	Dr. Ravi Gudavalli	Re-oxidation of Redox Sensitive Contaminants Immobilized by Strong Reductants
Philip Moore	Undergrad.	Mechanical Engr.	Ms. Melissa Komninakis	Innovative Technologies for D&D Activities
Phuong Pham	Ph.D. Grad	Chemistry	Dr. Ravi Gudavalli	Environmental Factors Controlling the Attenuation and Release of Contaminants in the Wetland Sediments at Savannah River Site
Raymond Piloto	M.S. Grad	Computer Engr.	Dr. Aparna Aravelli	Pipeline corrosion and erosion evaluation
Roger Boza	Ph.D. Grad	Computer Science	Dr. Himanshu Upadhyay	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies
Ryan Ocampo	M.S. Grad	Civil Engr.	Dr. Mayren Echeverria Boan	Evaluation of coatings for the H-Canyon Exhaust Tunnel
Sebastian Story	Undergrad.	Mechanical Engr.	Mr. Anthony Abrahao	Development of Inspection Tools for Primary Tanks
Silvina Di Pietro	Ph.D. Grad	Chemistry	Dr. Yelena Katsenovich	Remediation Research of Ammonia Gas for Uranium Treatment
Stevens Charles	Undergrad.	Civil Engr.	Dr. Yan Zhou	Model Development for the Fourmile Branch and/or Lower Three Runs Watersheds
Thi Tran	Undergrad.	Mechanical Engr.	Mr. Anthony Abrahao	Long-Term Surveillance of Nuclear Facilities and Repositories using Mobile Systems

DOE Fellow, Silvina Di Pietro, successfully completed her Ph.D. defense within the Department of Chemistry at FIU.

In the Fall of 2015, Silvina joined the DOE-FIU Science & Technology Workforce Development Initiative (DOE Fellows Program) sponsored by the DOE Office of Environmental Management. That same year, she initiated her doctoral studies titled *"Uranium Fate and Mineral Transformations upon Remediation with Ammonia (NH₃) Gas"* at FIU's Applied Research Center with the Soil & Groundwater Remediation Group under the supervision of Drs. Hilary Emerson and Yelena Katsenovich. This research project, conducted in collaboration with the Pacific Northwest National Laboratory (PNNL), focused on NH_3 gas injection as a potential remediation method for uranium stabilization at the Hanford Site's vadose zone.
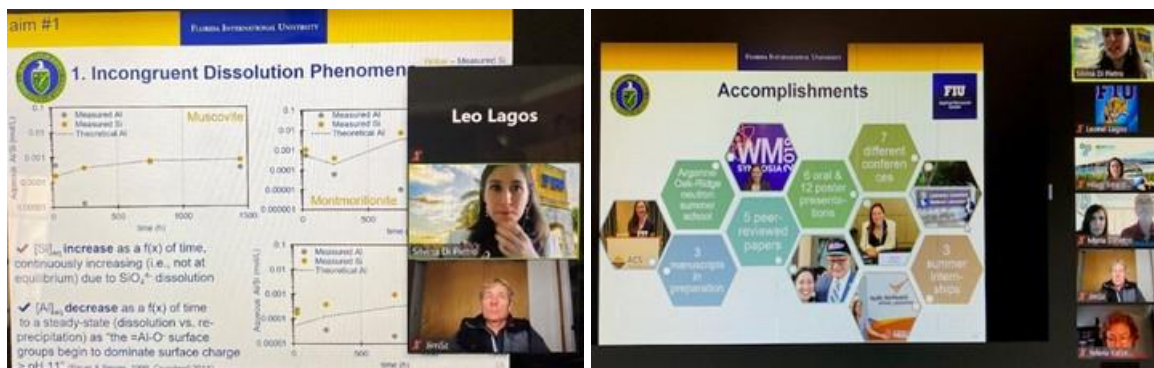
Figure 3. DOE Fellow Silvina Di Pietro defending her Ph.D. defense virtually.

Silvina has presented her research findings at numerous conferences, including the Waste Management Symposia, the American Chemical Society, and eMerge, and has written her scientific discoveries in five peer-reviewed publications (Journal of Environmental Radioactivity, Journal of Environmental Management, and Applied Clay Science). In 2018, Silvina won the Innovations Award in Nuclear R&D Program sponsored by DOE and she also won 3rd place at the DOE Fellows Poster Competition. More recently, Silvina was selected as the U.S. delegate to the International Younger Chemists Network within the International Union of Pure and Applied Chemistry (IUPAC). IUPAC is considered to be the "United Nations of Chemistry".

As part of the DOE Fellows program, Silvina completed a total of 3 10-week summer internships at DOE facilities across the country. She spent two summers (2016 and 2018) at PNNL working on batch mineral dissolution experiments and she also spent the summer of 2019 working at the Glenn T. Seaborg Institute at Lawrence Livermore National Laboratory (LLNL). At LLNL she learned new experimental methods on neptunium (IV) diffusion through bentonite clay.

Silvina has accepted a post doctorate position within the National Nuclear Security Administration (NNSA) under the Defense Program. She will start her career with NNSA this summer.

DOE Fellows performing research at FIU have been preparing and presenting oral presentations at the weekly DOE Fellows meetings. The schedule of these presentations is provided below.

Table 4. Research Presentation Schedule for DOE Fellow Meetings

DOE Fellow	Date
Sebastian Story	Jan 28
Alexis Vento	Feb 4
Derek Gabaldon	Feb 11
Silvina Di Pietro	Feb 18
Brendon Cintas	Feb 25
David Marreno	Mar 18
Stevens Charles	Mar 25
Raymond Piloto	Mar 30
Stevens Charles	Apr 1
Alicia Maratos	Apr 15
Joel Adams	May 6
Philip Moore	May 13

DOE Fellow Alexis Vento successfully defended his master's thesis *titled "Dolomite Dissolution and Contaminant Adsorption in the Presence of EDTA within Different Ionic Strength Solutions relevant to WIPP"* on July 12, 2021. Alexis will graduate in Fall 2021 with a master's degree in Environmental Engineering.

DOE Fellows participated in the annual FIU Program Review held on 9/14 - 9/15 with DOE-HQ and site POCs. Six (6) DOE Fellows prepared PowerPoint presentations and presented their research accomplishments during this review. Below is the list of DOE Fellows and their presentation titles.

- AI for Soil & Groundwater Data (SRS F-Area) - **Aurelien Meray**
- Hydrology Modeling for WIPP - **Gisselle Gutierrez**
- Robotic Application of Coating in the SRNL H-CAEX - **Jeff Natividad**
- Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments - **Mariah Doughman**
- Development and Deployment of the Miniature Rover for Inspection of Hanford's Double Shell Tank (DST) - **Sebastian Story**
- D&D support to DOE-EM - **Philip Moore**
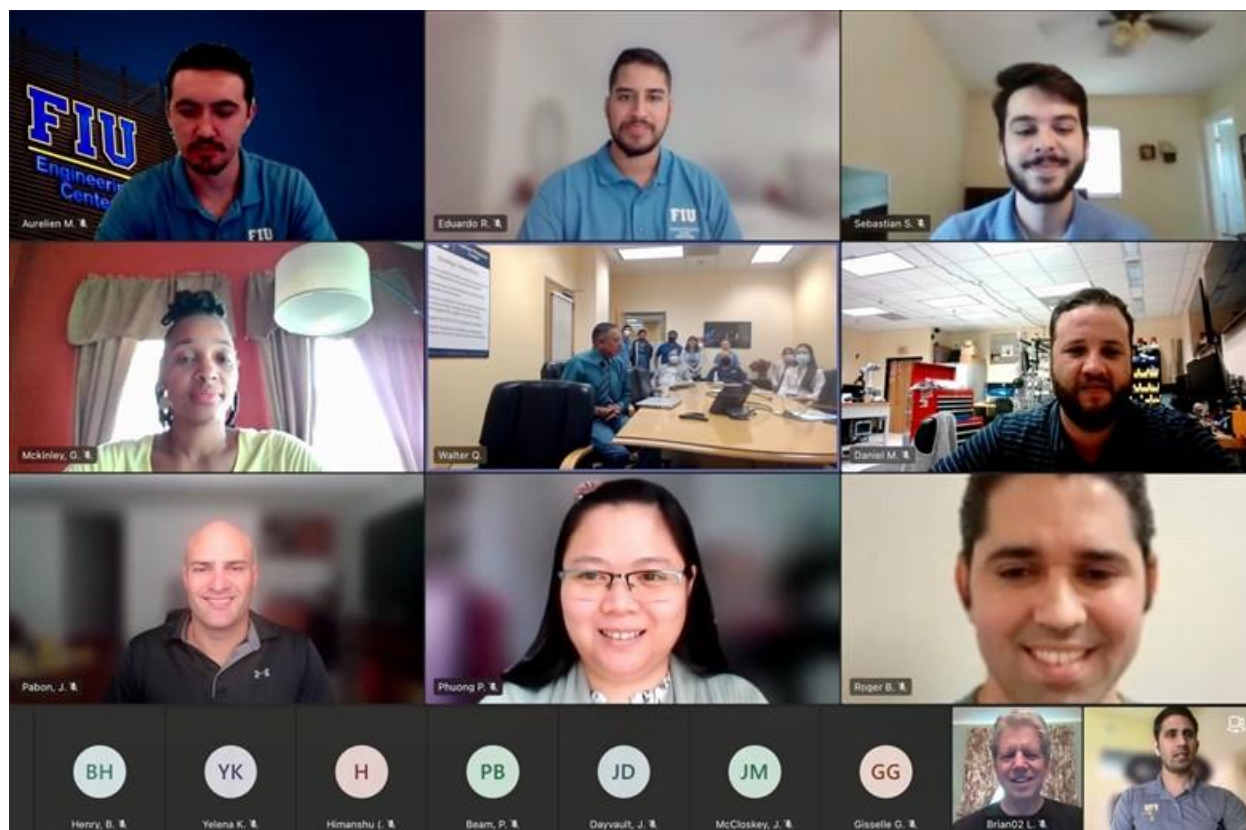
Figure 4. DOE Fellows and FIU-ARC staff during the annual research review with DOE Officials.

Task 3: DOE-EM Fellows Poster Exhibition & Competition

The DOE-EM Fellows annual Poster Exhibition & Competition has been scheduled for November 9, 2021. One undergraduate and one graduate poster session is planned and winners will be announced during the induction ceremony scheduled for November 10, 2021.

Task 4: DOE-EM Fellows Induction Ceremony

Undergraduate and graduate minority STEM students at FIU are usually inducted into the program annually in November in a ceremony hosted at FIU's Modesto Maidique campus. During FIU Year 1, however, due to health and safety concerns in the wake of the coronavirus pandemic, it was decided to host a virtual event to welcome the new Fellows.

Officials from DOE gathered with FIU leaders in a virtual ceremony on November 19, 2020 to introduce 15 Florida International University (FIU) science, technology, engineering, and math (STEM) students as the DOE-EM Fellows Class of 2020, joining 15 current fellows in FIU's Science & Technology Workforce Development Program, also known as the DOE Fellows Program.

During the ceremony, the new Fellows were addressed via Zoom by DOE EM's Assoc. Principal Deputy Assistant Secretary for Field Ops, Ms. Nicole Nelson-Jean, who reflected on her experience in a similar mentorship program, which helped steer her on the path to a successful career with the federal government. She also mentioned how important these programs are to both

DOE-EM's and DOE-LM's environmental mission and commended the program's success stories highlighting some of the former DOE Fellows who have been hired by DOE and its national laboratories, including Rosa Elmetti-Ramirez and Edgard Espinosa with EM, and more recently Hansell Gonzalez-Raymat and Tristan Simoes-Ponce with Savannah River National Laboratory (SRNL). Gisselle Gutierrez-Zuniga who was inducted into the Program last year delivered a message to the new Fellows highlighting her personal experience, which she found very fulfilling both academically and professionally. Mr. Carmelo Melendez, Director of Office of Legacy Management also gave an inspiring keynote to the new DOE Fellow inductees. Other DOE EM and LM colleagues included Mr. Kurt Gerdes, Mrs. Genia McKinley, Mr. Jean Pablo Pabon, Mrs. Jalena Dayvault, and Mr. David Shafer.

Table 5. DOE Fellows Class of 2020 Introduced during Virtual Ceremony

DOE Fellow	Degree & Major	Mentor
Adrian Muino	B.S. Computer Engineering	Dr. Himanshu Upadhyay
Alicia Maratos	B.S. Environmental Engineering	Dr. Yelena Katsenovich
Brendon Cintas	B.S. Mechanical Engineering	Dr. Dwayne McDaniel
Christian Dau	B.S. Computer Science	Dr. Himanshu Upadhyay
Christian Gonzalez Lopez	B.S. Computer Science	Dr. Himanshu Upadhyay
Joel Adams	Ph.D. Mechanical Engineering	Mr. Anthony Abrahao
Josue Estrada	B.S. Mechanical Engineering	Mr. Anthony Abrahao
Lorryn Andrade	M.S. Environmental Engineering	Dr. Johnbull Dickson
Mariah Doughman	Ph.D. Chemistry	Dr. Yelena Katsenovich
Phuong Pham	Ph.D. Chemistry	Dr. Ravi Gudavalli
Raymond Piloto	M.S. Computer Engineering	Dr. Aparnal Aravelli
Ryan Ocampo	M.S. Civil Engineering	Dr. Mayren Echeverria Boan
Sebastian Story	B.S. Mechanical Engineering	Mr. Anthony Abrahao
Stevens Charles	B.S. Civil Engineering	Ms. Angelique Lawrence
Thi Tran	B.S. Mechanical Engineering	Mr. Anthony Abrahao

In addition, DOE EM Fellows presented their research either being conducted at FIU or during their summer internships at the various national laboratories. Ceremony participants and guests heard research presentations by Program Director, Dr. Leonel Lagos and EM Fellows Daniel Martin, Gisselle Gutierrez-Zuniga and Aurelian Meray.

- DOE Fellow Daniel Martin presented his research on Miniature Rover Deployment Efforts for Deployment at Hanford. This involves the development of a small inspection tool for surveying the Double Shell Tanks (DSTs) at Hanford Site to provide information on the tanks' integrity.

- DOE Fellow and master's student, Gisselle Gutierrez-Zuniga, presented her work on developing a groundwater model for the WIPP using the DOE-developed Advanced Simulation Capability for Environmental Management (ASCEM) modeling toolset to improve the current understanding of regional and local groundwater flow at the WIPP site.

- DOE Fellow Aurelian Meray also presented research on the use of AI for long-term environmental monitoring at Savannah River Site. Meray is assisting with the development of a transferable/scalable data analytics framework to optimize monitoring well networks, while identifying master variables that are indicators of the presence of major contaminants of concern in order to forecast/predict the presence of contaminants in the subsurface.
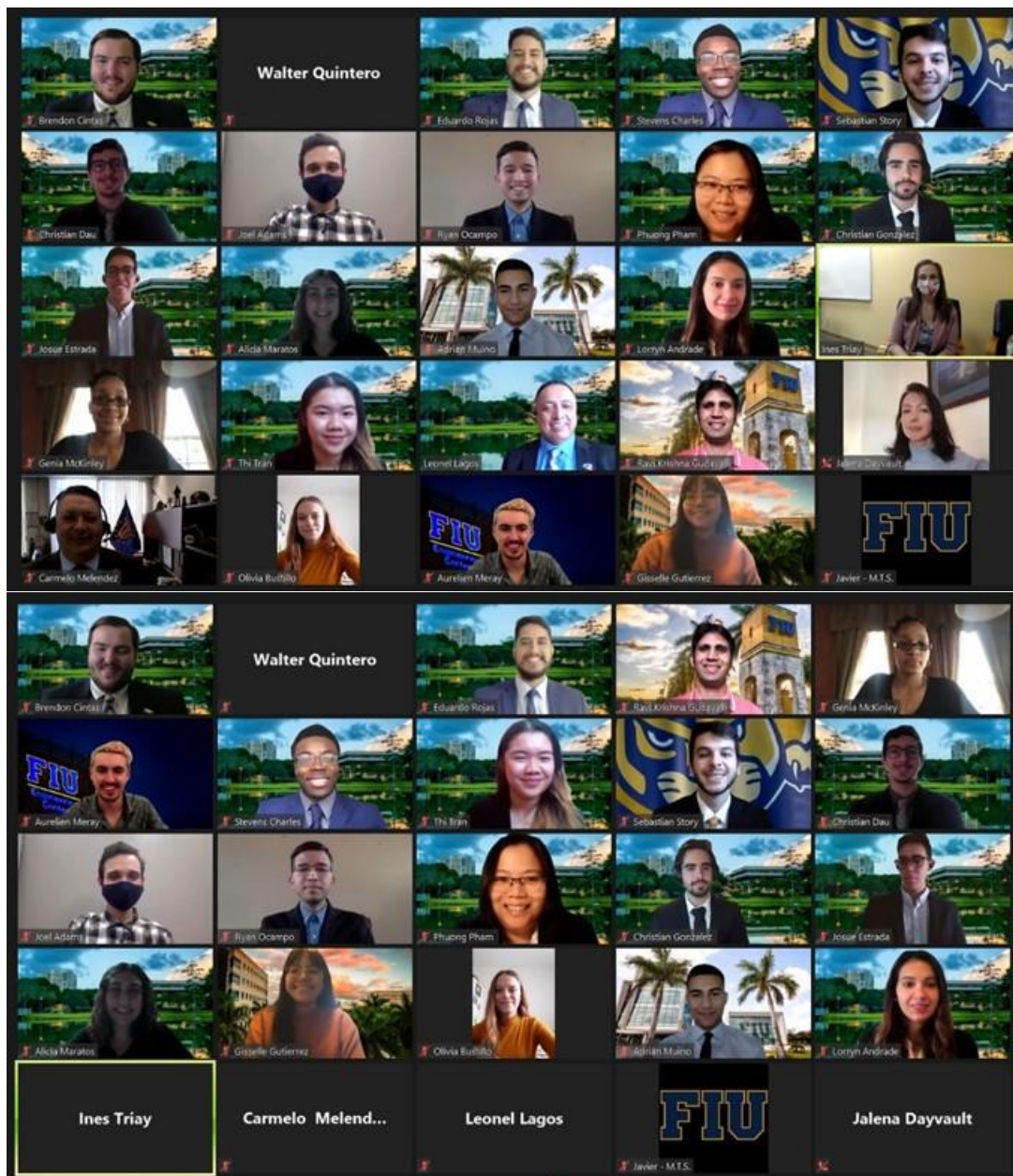
Figure 5. DOE and FIU officials with DOE Fellows Class of 2020 during a virtual induction ceremony held on November 19, 2020.

Task 5: Summer Internship Program (SIP)

During the summer of 2020, a total of eight (8) DOE Fellows completed summer internships. Six DOE Fellows participated in 10 week summer internships, while DOE Fellow, Jeff Natividad's

internship was extended until October 31, 2020 (14 weeks) and DOE Fellow, Michael Thompson's internship was extended at INL until November 20, 2020 (19 weeks).

Table 6. DOE Fellows Summer Internships 2020

DOE Fellow	Internship Location	Mentor(s)
Roger Boza	INL (remote)	Ahmad Al Rashdan, Mike Griffel
Michael Thompson	INL (remote + on site)	Ahmad Al Rashdan, Mike Griffel
Christopher Excellent	INL (remote + on site)	Christopher Wright, Steven Egan
Aurelien Meray	LBNL (remote)	Haruko Wainwright
Juan Morales	PNNL (remote)	Katrina Waters
Gisselle Gutierrez	WIPP (remote)	Anderson Ward
Edward Nina	WRPS	Trent Fullmer
Jeff Natividad	WRPS	Alexander Pappas

DOE Fellow summer interns prepared and delivered oral presentations at the weekly DOE Fellows meeting. The schedule of these presentations is provided below.

Table 7. Research Presentation Schedule for DOE Fellows Meetings

DOE Fellow	Date	Status
Juan Morales	9/17/2020	Completed via Zoom
Aurelien Meray	9/24/2020	Completed via Zoom
Gisselle Gutierrez	10/02/2020	Completed via Zoom
Christopher Excellent	10/15/2020	Completed via Zoom
Roger Boza	12/03/2020	Completed via Zoom
Jeff Natividad	12/10/2020	Completed via Zoom

The DOE Fellows Program Director and Program Manager coordinated with DOE-HQ, DOE sites, DOE national laboratories, and DOE contractors for placement of the DOE Fellows at various locations for their summer 2021 internships. Fourteen (14) DOE Fellows are confirmed to participate in 2021 summer internships as part of the DOE-FIU Cooperative Agreement. During the month of May, DOE Fellows Jeff Natividad, Joel Adams and Thi Tran started their 12-week internship with WRPS, and DOE Fellows Phuong Pham and Philip Moore started their 10-week internship with SRNL. During the month of June, DOE Fellows Brendon Cintas (DOE-HQ), Roger Boza (INL), Christian Dau (INL), Mariah Doughman (PNNL), Christian Gonzalez (PNNL), Gisselle Gutierrez (LANL), Aurelien Meray (LBNL) and Stevens Charles (LBNL) started their 10-week remote internships. DOE Fellow Josue Estrada's hybrid internship with DOE-HQ Germantown office was initiated on July 12, 2021, as shown in Table 8.

<div align="center">**Table 8. DOE Fellows 2021 Summer Internships**</div>

Name	Site	Dates	Modality	Mentor
Jeff Natividad	WRPS	May 17 - Aug 6, 2021	On-Site	Alex Pappas
Joel Adams	WRPS	May 17 - Aug 6, 2021	On-Site	Alex Pappas
Thi Tran	WRPS	May 17 - Aug 6, 2021	On-Site	Alex Pappas
Philip Moore	SRNL	May 24 - 30 Jul, 2021	On-Site	Connor Nicholson
Phuong Pham	SRNL	May 24 - 30 Jul, 2021	On-Site	Hansell Gonzalez-Raymat
Brendon Cintas	DOE-HQ	Jun 1 - Aug 6, 2021	Remote	Larry Perkin
Josue Estrada	DOE-HQ	Jul 12 - Aug 20, 2021	Hybrid	Genia McKinley
Roger Boza	INL	Jun 1 - Aug 6, 2021	Remote	Ahmad Al. Rashdan
Christian Dau	INL	Jun 7 - Aug 13, 2021	Remote	Ahmad Al. Rashdan
Mariah Doughman	PNNL	Jun 1 - Aug 6, 2021	Remote	Nikolla Qafoku
Christian Gonzalez	PNNL	Jun 7 - Aug 13, 2021	Remote	Xuehang Song
Gisselle Gutierrez	LANL	Jun 1 - Aug 6, 2021	Remote	David Moulton
Aurelien Meray	LBNL	Jun 1 - Aug 6, 2021	Remote	Haruko Wainwright
Stevens Charles	LBNL	Jun 1 - Aug 6, 2021	Remote	Haruko Wainwright

Summer internship Highlights

DOE Fellow, Jeff Natividad, returned to Richland, WA to participate in his second summer internship with Washington River Protection Solution's (WRPS) Chief Technology Office under the mentorship of Alexander Pappas. During his 12-week internship, Jeff is supporting CTO with robotic development programs to increase safety and efficiency within the Hanford Mission by developing and testing semi-automated and automated robotic protocols and routines. His primary task is to support the development efforts of an existing Clearpath Robotics Husky robot for autonomous radiation mapping. Jeff is mainly responsible for the integration of hardware consisting of a sensor suite, additional single board computers, and a new auxiliary power system in addition to supporting other CTO robotics work. Upon completion of internship, Jeff will return to Miami, FL and continue his Master of Science in Mechanical Engineering at Florida International University (FIU) while

conducting research work under the DOE Fellows Program at FIU's Applied Research Center (ARC).

Figure 6. Clearpath Husky with new power and sensor package integrated.

DOE Fellow Gisselle Gutierrez-Zuniga is conducting a 10-week summer internship with Los Alamos National Laboratory (LANL) under the mentorship of Dr. David Moulton. Gisselle is working on developing an integrated hydrology model of Basin-6 near the Waste Isolation Pilot Project (WIPP) site to investigate groundwater recharge. Basin-6 is within the Nash Draw, which was developed through erosion of upper Permian rocks creating an array of surface features, such as sinkholes, swallets, and karst valleys. Gisselle is studying the impact of these surface features, in conjunction with soil properties and vegetation types, on the groundwater recharge over a range of storm events. She will generate meshes from digital elevation model (DEM) data, set up meteorological forcing data, and develop input files for the Advanced Terrestrial Simulator (ATS) to perform a series of simulations. She will first study the impact of mesh resolution and refinement around streams on surface flow and ponding for moderate and intense storms. Using the most efficient mesh configuration, she will then configure the integrated hydrology simulations to study recharge. She will perform these simulations with a range of soil properties (e.g., permeability, porosity). With improved estimates of the spatial and temporal patterns of recharge, predictions of halite

dissolution and propagation of the shallow dissolution front will be made possible and provide the DOE an understanding of how it can impact the post-closure repository performance.
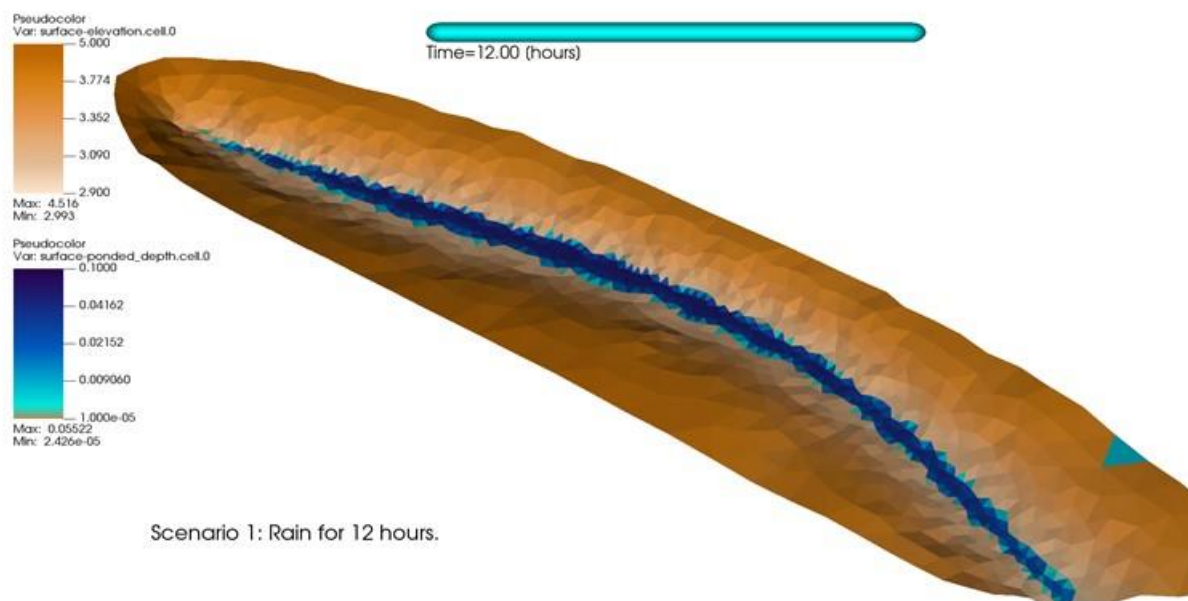
Figure 7. Simulation of overland flow with a rainfall event of 12 hours using ATS.

Philip Moore, DOE Fellow, is participating in a 10-week summer internship at Savannah River National Laboratory (SRNL), working with Dr. Jennifer Wholwend (sp) and her environmental science team. Dr. Wholwend is collaborating with Florida International University (FIU) evaluating polyurethane foams for use as fixatives in 3D void spaces. While Philip's research at FIU is focused on the mechanical properties of foams and their response to specific stressors, at SRNL he is evaluating the ability of polyurethanes to cure outside of ideal conditions (generally considered to be 75°F and 40% RH). These tests will be performed inside an environmental chamber that will accurately simulate a variety of conditions ranging from 20°F to 110°F at different humidity levels. Cure times will be evaluated using ASTM D1640, which outlines the procedure for identifying set to touch, dust free, and dry to touch times. Ultimately, this research will help identify optimum conditions for application of foam fixatives.

While circumstances have prevented the initiation of experiments, the team has remained busy by completing safety trainings, reviewing the relevant literature, preparing paperwork and assisting on other projects as SRNL requires. Dr. Wohlwend, Dr. Nicholson and other team members from

SRNL have also reached out to collaborate with FIU's Applied Research Center (ARC) to coordinate a cold demo of the technology in 2022.

Figure 8. DOE Fellow Philip Moore with Drs. Hansell Gonzalez-Raymat (left) and Jennifer Wholwend (right) at SRNL.

During summer 2021, DOE Fellow Roger Boza is participating in his third 10-week summer internship (2nd remote internship) at Idaho National Lab (INL). Roger is under the direct mentorship of Dr. Ahmad Al. Rashdan who is a senior research and development scientist in the nuclear science and technology directorate at INL. The team is composed of Dr. Ahmad Al. Rashdan (Principal Investigator), Brian M. Wilcken (Data Scientist), Roger Boza (Machine Learning, Deep Learning, and Computer Vision), Christian Dau (Data Curator and 3D Environment Modeling), and Blake R. Cecil (Computer Vision). He is working on two projects, both of which require the use Artificial Intelligence (AI) to tackle computer vision tasks with Deep Learning (DL) algorithms and techniques. The first project focuses on detecting smoke in images and video stream in real-time. The neural networks for this project will predict whether there is smoke present in the imagery data. The second project tackles the obstacle avoidance problem present in the previous year's research for Route Operable Unmanned Navigation of Drones (ROUNDS). The goal for this task is to determine if there is an obstacle in front of the drone during its flight path. Both projects will help with the modernization efforts of Nuclear Power Plants (NPP) through the Light Water Reactor Sustainability Program (LWRS).

Joel Adams, DOE Fellow, is a graduate student at Florida International University (FIU) pursuing a Ph.D. in Mechanical Engineering. This summer, Joel is participating in an in-person internship with the Chief Technology Office at Washington River Protection Solutions (WRPS) in Richland, WA. During this internship, he is working together with his mentor, Alexander Pappas, and his coworkers on a project to develop a semi-autonomous robotic platform that performs radiation mapping of outdoor facilities. The purpose of this project is to enhance both the safety and efficiency of the Hanford Mission by developing technology to aid in the radiation surveillance of different areas. Joel's work focuses on integrating sensor devices such as LiDAR's and depth cameras, and developing the software for the Husky platform by Clearpath Robotics. Upon completion of his summer internship at WRPS, Joel will continue his research work on the development of mobile robotic platforms at FIU's Applied Research Center (ARC) while continuing his Ph.D. in Mechanical Engineering.

Figure 9. DOE Fellow Joel Adams with a robotic platform system for radiation mapping.

During this summer, Stevens Charles was given the opportunity to participate in an internship with Lawrence Berkeley National Laboratory (LBNL) in collaboration with Savannah River National Laboratory (SRNL) and joined the ALTEMIS group, which has a vision of creating a new paradigm of monitoring to ensure long-term environmental protection at DOE's legacy sites. His focus is on surface water stations being monitored at Fourmile Branch, a watershed located within Savanah River Site (SRS), South Carolina. Prior experience gained at FIU-ARC working on surface water analysis in Fourmile Branch enabled him to make accelerated progress working with his summer mentors Drs. Haruko Wainwright and Hansell Gonzalez-Raymat.

Stevens is focused on understanding iodine-129 and other contaminants' behavior/mobility in the environment. Knowledge of the surface water parameters near the F-Area seepage basins of Fourmile Branch is essential to understand the contaminant transport from subsurface to surface, and its migration in surface water. Some of these parameters include flow rate, precipitation, temperature, and chemistry. By understanding these controlling variables, he will be able to discover the linkages between the parameters and the contaminants within Fourmile Branch. A particular focus will be on the spatiotemporal (both where and at what time) distribution of several controlling variables. For example, Stevens was able to compare the temporal distribution of the flow rate and specific conductance at one of the stream gauges within Fourmile Branch and was able to conclude that these two controlling variables were inversely proportional. He was also able to understand the relationship between nitrate and specific conductance by observing the trends of both in an eighteen-year time span.
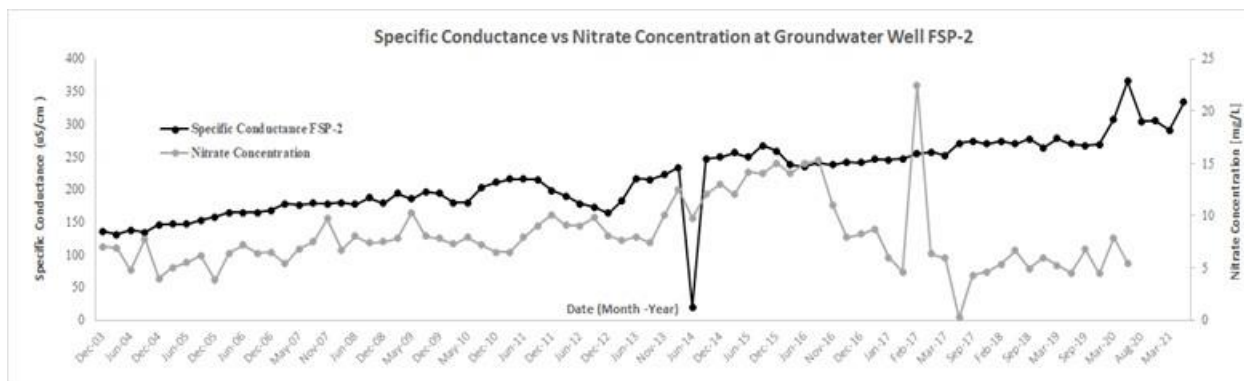
Figure 10. Graph representing the relationship between nitrate and specific conductance. Nitrate, a prominent TDS at most waste sites, is usually related to specific conductance. In Fourmile Branch the relationship is valid until 2016.

By graphing the data to show relationships like the one above, it is possible to pinpoint certain periods where more in-depth analysis of the data is needed. Nitrate and specific conductance are usually correlated, however in this analysis a deviation from this relationship was observed after 2016. As such further research can be pursued to determine the reason for this anomaly. Stevens will continue comparing the controlling variables in the hope of finding linkages with the contaminants that exist within Fourmile Branch and finding any unique events that may need to be further investigated. By the end of the internship Stevens should have a better understanding on how each controlling variable affects the movement of contaminants within Fourmile Branch.

Brendon Cintas (DOE Fellow), a recent graduate with a bachelor's degree in mechanical engineering from Florida International University (FIU), is participating in a 10-week summer internship at the Department of Energy - Office of Environmental Management (DOE-EM)'s Office of Field Operations: Safety, Security, and Quality Assurance. DOE-EM highlighted a need for monitoring the Authorized Limit (AL) of DOE sites across the complex, which restricts the amount of residual radioactive material on surfaces or within DOE property that has been derived consistent with DOE directives, including ALARA (as low as reasonably achievable). During his remote internship performed from Miami, FL, Brendon developed a comprehensive, easy-to-use Microsoft Access database that can be accessed through EM's intranet within the DOE network to monitor, recall, and modify the Authorized Limit of any DOE complex in accordance with DOE Order (O) 458.1. The database must follow all quality assurance (QA) standards in accordance with DOE O 414.1D, which establishes acceptable methods for implementing safety software quality assurance requirements of DOE O 414.1C and must also comply with all cybersecurity requirements highlighted in DOE O 205.1C, which establishes minimum requirements for cybersecurity and software-related risk management. Upon completion of his summer internship, Brendon will start his Ph.D. degree in mechanical engineering at FIU and will continue to engage in DOE-related research evaluating pipeline flushing requirements through development of an experimental pipe loop to study the flushing of non-Newtonian slurries and sediment beds.

Christian Gonzalez Lopez, DOE Fellow, is participating in a 10-week summer internship at Pacific Northwest National Laboratory (PNNL). During his summer internship at PNNL, Christian is investigating a gap-filling approach that can be used to fill incomplete datasets under the mentorship of Drs. Mark Rockhold and Xuehang Song. He is focusing on the contaminated waste sites and groundwater in the 100 Area at the U.S. Department of Energy (DOE) Hanford Site. The main contaminant is hexavalent chromium [Cr(VI)], which was used as a corrosion inhibitor in cooling water for nuclear reactors that formerly operated along the shoreline of the Columbia River. The ultimate goal of his research is to find a relationship between inland groundwater Cr(VI) concentrations and shoreline concentrations within the 100 Area. However, to effectively analyze and investigate a relationship there must be data to analyze. In these areas there is no consistent sampling with huge gaps in the dataset at times. The outcome of these studies will be the discovery of ways to improve the quality of the data, and having higher quality data will help the DOE conduct more accurate analyses.

Phuong Pham, DOE Fellow, is participating in a 10-week summer internship at Savannah River National Laboratory (SRNL). During her summer internship at SRNL, Phuong is studying the sorption of iodide and iodate on wetland sediments under various environmental conditions via batch experiments under the mentorship of Dr. Hansell Gonzalez-Raymat of the Environmental Sciences and Dosimetry Group. Iodine-129 still poses a substantial clean-up problem due to its perceived high mobility in the environment, toxicity (tendency to concentrate in the thyroid), long half-life (~16 million years), and one of the lowest maximum contamination levels (1 pCi L^{-1}) of all radionuclides. Wetlands at the F-Area have been an important sink for I-129 and other contaminants. The complex and diverse physical and biogeochemical processes within the wetlands are mainly responsible for retaining these contaminants. However, these areas are sensitive to changing boundaries and geochemical conditions, resulting in the release of pollutants into surrounding areas. The goal of this study is to elucidate the attenuation and release mechanisms of iodine species occurring at the wetlands. The outcome of these studies will improve understanding of the factors that contribute to the attenuation of iodine-129 at the F-Area wetlands and will provide SRS and the DOE with the ability to remediate I-129 from the F-Area more effectively.

Figure 11. Dr. Hansell Gonzalez-Raymat and Phuong Pham performing a sorption experiment.

Aurelien Meray, DOE Fellow, participated in his second remote 10-week summer internship at Lawrence Berkeley National Laboratory (LBNL) under the mentorship of Dr. Haruko Wainwright. He worked on adding more complex functionality to the python package he developed during his first internship with LBNL. The python package called pyLEnM (Python for Long-term Environmental Monitoring) is meant to provide scientists with data science and machine learning tools for analyzing contaminated groundwater datasets. Although the goal of the project is for the package to be easily adaptable to a variety of datasets from different sites, the Savannah River Site (SRS) F-Area historical dataset was used as the testbed. During the summer internship, Aurelien developed a handful of functions for data analysis but primarily focused on creating a spatial interpolation algorithm to estimate a contaminant plume based on data collected at different wells. The interpolation algorithm takes advantage of external information such as elevation to increase the accuracy of the estimation. An overview of the estimation algorithm can be seen in Figure 12. Lastly, Aurelien worked on a sensor placement algorithm to help scientists strategically place new sensors for long-term monitoring. A visual description of the optimization function in action can be seen in Figure 13.
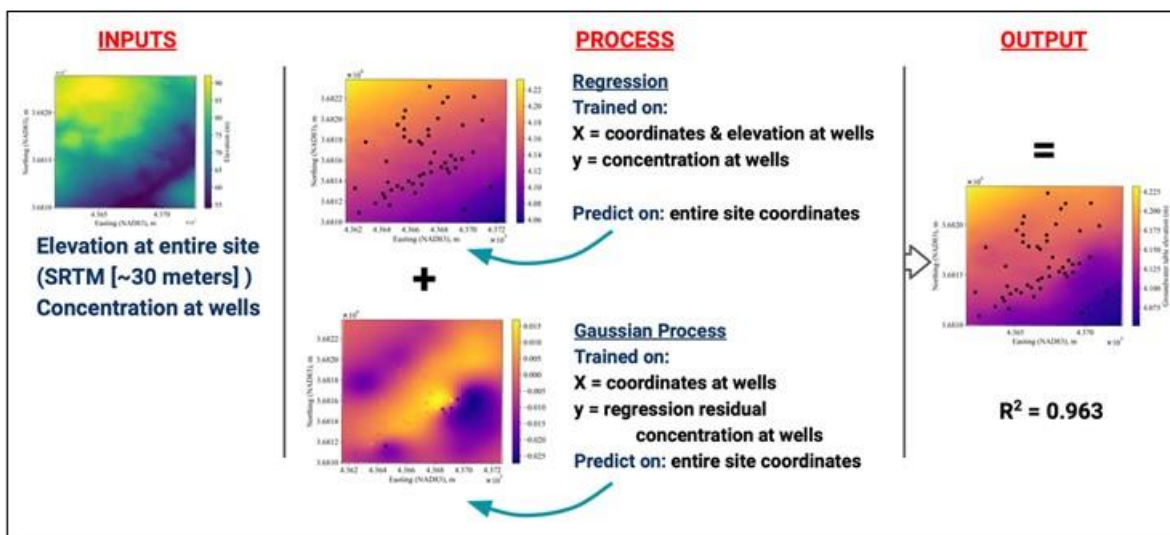
Figure 12. Overview of the spatial interpolation algorithm in pyLEnM.
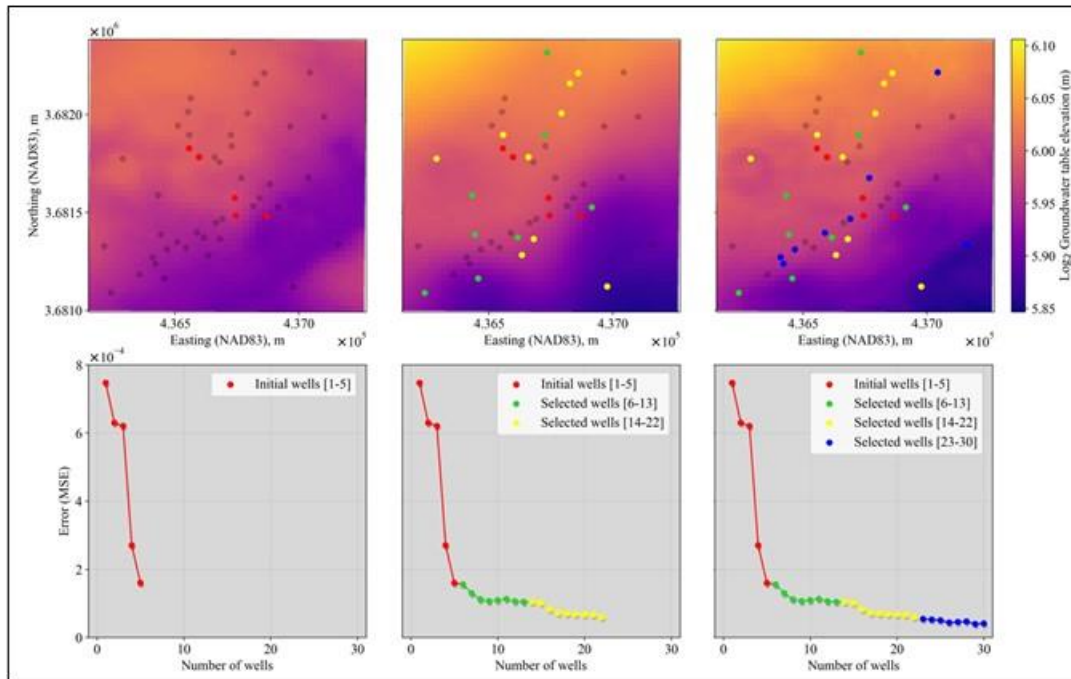
Figure 13. Sensor placement optimization algorithm selecting the best set of wells for the average 2015 groundwater table.

Christian Dau (DOE Fellow Class of 2020) participated in a remote summer internship at Idaho National Lab, under the mentorship of Dr. Ahmad Al Rashdan. During this internship, Christian worked on two different tasks related to the field of Artificial Intelligence (AI). The first task involved the use of computer vision in AI to monitor rooms with cameras and try to detect smoke in the images to pre-emptively predict fires. The second task was to develop an autonomous drone that could scan QR codes from multiple different equipment; the goal of the drone is to autonomously fly throughout an industrial environment in order to check on the equipment. These tasks are meant to increase safety for plant personnel as well as reduce the amount of operating costs.

The smoke detection task involved creation and curation of a dataset in which multiple classifications were made to attempt to differentiate smoke from things that are visually similar, such as fog. This dataset was used to train a model that will be used in the future to help detect the smoke in images. For the autonomous drone task, Christian was involved in the creation of a virtual environment, using a 3D robotics simulator, which could simulate the drone flying through and scanning the QR codes. The purpose of this task was to make this environment tricky enough to catch any potential issues, as well as make the environment look relatively similar to a regular industrial plant setting.

"My internship with Idaho National Lab was very fruitful and I learned many new and exciting things about the field of Artificial Intelligence" - Christian Dau.

DOE Fellow Josue Estrada conducted an onsite internship with DOE-HQ in Germantown office, where he worked directly with the Office of Environmental Management's Technology Development Office (DOE-EM 3.2). The main task during this internship was the design of a Dashboard for the Technology Development Office, as an interactive data visualization tool for upper management. This project was aimed at increasing the transparency and efficiency of reporting, as it will immediately and visually provide information on the budget and performance status for each of the projects managed by DOE-EM 3.2, and flag DOE Officials where their attention is required. This interactive Dashboard will serve as a strawman model that can be applied for other EM offices in the future.

Figure 14. Interactive data visualization tool developed by DOE Fellow Josue Estrada during his internship.

Mariah Doughman, DOE Fellow, participated in a 10-week remote summer internship with Pacific Northwest National Laboratory (PNNL). During this internship, Mariah studied the sorption of uranium on Hanford Formation sediments via batch experiments under the mentorship of Dr. Nikolla Qafoku of the Environmental Subsurface Science Group. Vadose zone U contamination at the Hanford Site resulted from past U and plutonium enrichment activities and the intended or unintended release of 202,703 kg of uranium to the ground surface. Once active remediation (pump and treat technology) is completed at the site, a transition to a more passive approach such as monitored natural attenuation (MNA) is needed. To develop effective MNA, adsorption isotherms and kinetics were explored for U (at relevant aqueous concentrations) in artificial groundwater onto Hanford Formation Sediment. These results will be compared to speciation modelling and solid phase characterization of post treated sediment to understand the adsorption capacity of sediment at the Hanford Site. This research effort will provide (i) a better understanding of the species-dependent mechanisms of U interaction with sediments in the absence and presence of co-contaminants; (ii) the necessary parameters to predict U mobility in the vadose zone; and (iii) the technical basis for MNA at the site.

Figure 15. Mariah Doughman presenting at the PNNL Summer Research Symposium.

DOE Fellow Thi Tran had an opportunity to participate in a summer internship at Richland, WA with Washington River Protection Solution's (WRPS) Chief Technology Office (CTO). Under the mentorship of Alexander Pappas, she supported CTO with its robotic development program, along with two other DOE fellows on her team. Her primary task was to support the development of autonomous radiation mapping through the use of an existing Clearpath Robotics Husky robot. Thi was mainly responsible for the development of the radiation sensor package. The package has capability to communicate with and publish data to the onboard computer. Different methods to operate the radiation sensor such as using different embedded computers (Jetson Nano and Raspberry Pi) and microcontroller (Arduino Nano) were tested for its robustness and stability. Upon completing her internship, Thi will return to Florida International University to continue her Bachelor's degree in Mechanical Engineering.

Figure 16. DOE Fellow Thi Tran working with Clearpath Robotics Husky robot at WRPS.

DOE Fellow Roger Boza, at the end of his summer internship, participated in the 2021 INL intern poster session and won the best poster award. The project he worked on is titled "Obstacle Detection for Drones Using Machine Learning".

A technology called Route Operable Unmanned Navigation of Drones (ROUNDS) has been developed by Idaho National Laboratory to enable drones to autonomously navigate in GPS-denied environments. A key element to the success of ROUNDS is that drones should not run into fixed objects (e.g., pipe) or dynamic obstacles (e.g., person or ladder) in the environment. During the summer internship, Roger was able to research and evaluate multiple Machine Learning techniques to assist in the obstacle detection for drones. The first method analyzes a sequence of video frames and the variation from one frame to the next is used to infer the relative depth of objects in the camera view. The second method is based on a mathematical model for depth estimation based on the regression of custom-design datasets. The results of applying the second method yielded accurate estimations for depth and allowed the capability to detect obstacles.

Figure 17. DOE Fellow Roger Boza received the best poster presentation award during the 2021 INL intern poster session.

Task 6: Summer Internship Technical Reports

DOE Fellows drafted summer internship reports summarizing their activities & research accomplishments during summer 2020. Draft reports were shared with summer mentors for review and approval for submission to OSTI and publishing on the DOE Fellows website. Approved internship reports were published online at https://fellows.fiu.edu/internships-reports/#2020.

Table 9. DOE Fellows 2020 Summer Internship Technical Reports

DOE Fellow	Internship Location	Internship Mentor	Report Title
Roger Boza	INL	Mike Griffel	Artificial Intelligence Implementation for Object Detection in Route Operable Unmanned Navigation of Drones (ROUNDS)
Michael Thompson	INL	Ahmad Rashdan	Flight control systems for autonomous indoor drones
Christopher Excellent	INL	Steven Egan	Mobile Hot Cell for End-of-Life Source Management - Camera Control
Aurelien Meray	LBNL	Haruko Wainwright	pyLEnM: A Python Package for Long-Term Soil and Groundwater Monitoring
Juan Morales	PNNL	Katrina Waters	Investigation of Heavy Metal Biomarkers for the Assessment of Remediated Surface Waters
Gisselle Gutierrez	WIPP	Anderson Ward	Processing of Time Series Data in Support of Producing a Climatological Summary of WIPP
Edward Nina	WRPS	Trent Fullmer	Numerical Simulation for Radioactive Waste Transfer using COMSOL Multiphysics
Jeff Natividad	WRPS	Alexander Pappas	Navigation and Positioning Tests for Vector Platform

DOE Fellows initiated drafting of internship reports based on their summer 2021 internships. The reports will be sent to summer mentors for review and approval, and will be submitted to DOE and published on the DOE Fellows website once approved.

Table 10. DOE Fellows 2021 Summer Internship Technical Reports

DOE Fellow	Internship Location	Internship Mentor	Report Title
Aurelien Meray	LBNL	Haruko Wainwright	pyLEnM Update: A Machine Learning and data analysis python package for long-term soil and groundwater monitoring
Brendon Cintas	DOE-HQ	Larry Perkin	Development of an Authorized Release Limit Database
Christian Dau	INL	Ahmad Al. Rashdan	Dataset Curation and Virtual Environment Creation for Machine Learning Tasks
Christian Gonzalez	PNNL	Xuehang Song	Gap-filling time series using Direct Sampling in the Hanford 100-areas
Gisselle Gutierrez	LBNL	David Moulton	Exploration of Toolsets for Development of an Integrated Hydrology Model of Basin-6 near the Waste Isolation Pilot Plant (WIPP)
Jeff Natividad	WRPS	Alex Pappas	Autonomous Navigation and Radiation Mapping Platform - Hardware Updates and Integration

DOE Fellow	Internship Location	Internship Mentor	Report Title
Joel Adams	WRPS	Alex Pappas	Development of Semi-Autonomous Robotic Platform for Mapping Radioactive Hanford Farms
Josue Estrada	DOE-HQ	Genia Mckinley	Contributing to the DOE EM 3.2, Office of Technology Development: Dashboard/Wearable Technologies Database
Mariah Doughman	PNNL	Nikolla Qafoku	Adsorption of Uranium to Hanford Formation Sediment in the Vadose Zone
Philip Moore	SRNL	Connor Nicholson	Environmental Testing of Polyurethane Foams for use as 3-Dimensional Fixatives
Phuong Pham	SRNL	Hansell Gonzalez-Raymat	Sorption of iodine species on SRS wetland soils
Roger Boza	INL	Ahmad Al. Rashdan	Implementing Machine Learning and Deep Learning Algorithms to Facilitate and Automate Nuclear Power Plant Operations
Stevens Charles	SRNL	Haruko Wainwright	Characterization of Surface Water Dynamics within Fourmile Branch and its linkages with groundwater and I-129 geochemistry
Thi Tran	WRPS	Alex Pappas	Autonomous Navigation and Radiation Mapping Platform - Radiation Sensor Package Development

Task 7: Conference Participation and Presentations

Abstracts on the research that DOE Fellows have performed at ARC and during their summer internships were submitted to WM2021 and were accepted for presentation during the student poster sessions. Nineteen (19) student abstracts (listed below) were submitted to the conference. The Fellows completed their posters and 5-minute videos describing their posters, which were presented virtually in March 2021.

- **Adrian Muin**o: Cyber Analysis of the Deactivation & Decommissioning Knowledge Management Information Tool (21434)
- **Alexis Vento**: The Impact of Ethylenediaminetetraacetic acid on Actinides Adsorption onto Dolomite Mineral in WIPP-relevant Environment (21431)
- **Aurelien Meray**: pyLEnM: Machine Learning and Analytics Toolkit for Long-term Water Quality Monitoring Using a Remote Sensing Network (21420)
- **David Mareno**: Knowledge Base for Environmental Management (21429)
- **Derek Gabaldon**: Assessing the effects of vibrational forces on the performance of fixative materials in mitigating risk during D&D activities (21427)
- **Gisselle Gutierrez**: Evaluation of Vegetation Removal Methods for UAV-Based Photogrammetry within the WIPP Land Withdrawal Act Boundary, NM (21416)

- **Jeff Natividad**: Collaboration for Improving Safety and Efficiency: Guidance for Autonomous Robotics Use at Hanford (21438)
- **Joel Adams**: Autonomous Surveillance of Nuclear Facility and Repositories (21435)
- **Juan Morales**: Investigation of Heavy Metal Biomarkers for the Assessment of Remediated Surface Waters (21424)
- **Katherine Delarosa**: Effect of modified-HA on the Sequestration of Uranium in acidic groundwater at the Savannah River Site (21433)
- **Mariah Doughman**: Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments (21432)
- **Nathalie Tuya**: Influence of Environmental Factors on Iodine Attenuation and Release in Savannah River Site Wetlands Sediments (21422)
- **Philip Moore**: Evaluation of Fixatives for Three-Dimensional Voids (21430)
- **Phuong Pham**: Characterization of KW-15 modified humic acid - a potential in-situ technology for uranium remediation at the SRS (21447)
- **Raymond Piloto**: Flow-Induced Erosion Detection in Stainless-steel Coupons from SRNL (21423)
- **Roger Boza**: Robust Anomaly Detection of Nuclear Facility Structures with Convolutional Autoencoder (21425)
- **Sebastian Story**: Inspection rover for Leak Detection Channels within Double-Shell Tanks at the Hanford Site (21436)
- **Silvina Di Pietro**: Solid phase characterization of physicochemical mineral phase alterations upon NH_3 gas treatment (21419)
- **Stevens Charles**: Examining the Variation in the Sediment Transport process under different Erosion and Precipitation Criteria (21421)

DOE Fellows Aurelien Meray and Derek Gabaldon won the graduate and undergraduate student poster competition at the Waste Management 2021 (WM2021) Virtual Conference.

In situ sensors prove to be a powerful alternative to traditional groundwater sampling and laboratory analysis; particularly for monitoring master variables that are often leading indicators of changes prior to plume movement. Aurelien's research is supporting an Advanced Long-Term Environmental Monitoring Systems (ALTEMIS) project at the Savannah River National Laboratory (SRNL) in collaboration with Lawrence Berkeley National Laboratory (LBNL) that is focused on the development of a machine learning python package (pyLEnM) to analyze groundwater datasets effectively. The title of his poster is *"pyLEnM: Machine Learning and Analytics Toolkit for Long-term Water Quality Monitoring Using a Remote Sensing Network"*. Aurelien joined the DOE Fellows Program in November 2019 and is pursuing a Ph.D. in computer science at Florida International University (FIU).

The title of Derek's poster is *"Assessing the Effects of Vibrational Forces on the Performance of Fixative Materials in Mitigating Risk During D&D Activities"*, and focuses on assessing the viability of intumescent materials as a fire resistant "plug" to possibly immobilize residual contamination in 3-dimensional voids found in Department of Energy

(DOE) nuclear sites, addressing the potential for release of radioactive contamination which is a major concern during decontamination and decommissioning (D&D) activities. He is studying various stressors including impact, water submersion, and thermal. Derek also joined the DOE Fellows Program in 2019 and is pursuing a Bachelor of Science degree in mechanical engineering at FIU.
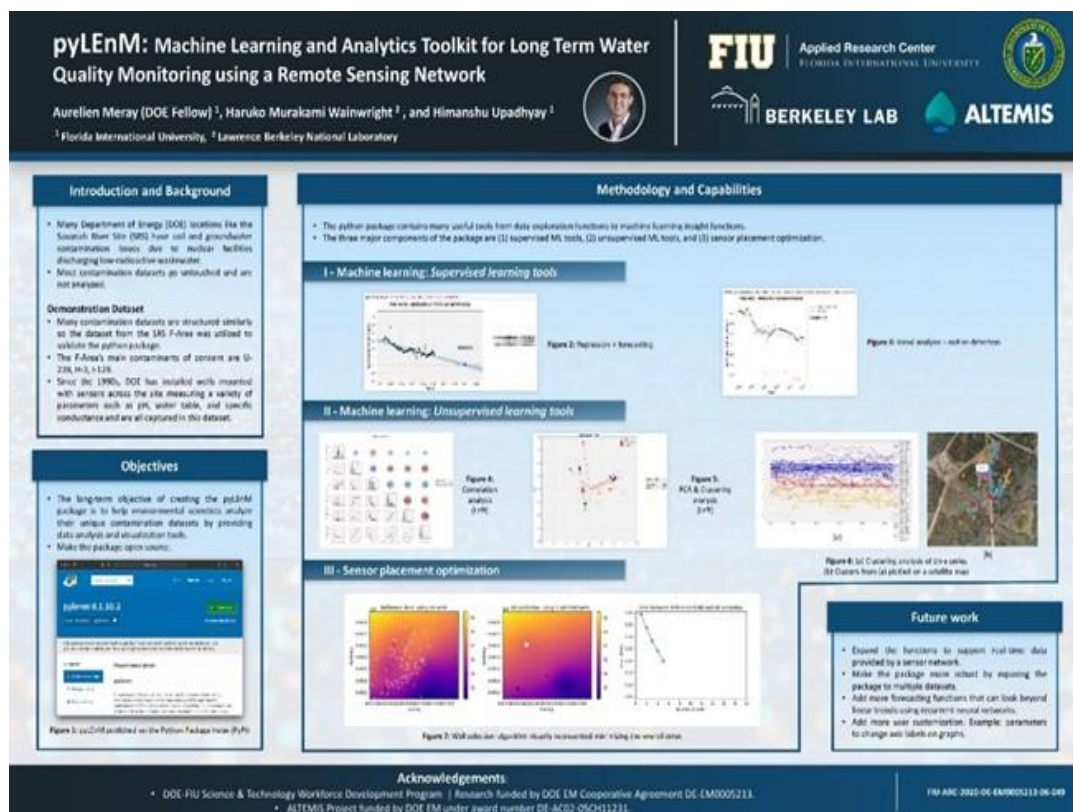
Figure 18. DOE Fellow Aurelien Meray's poster presented at WM21.
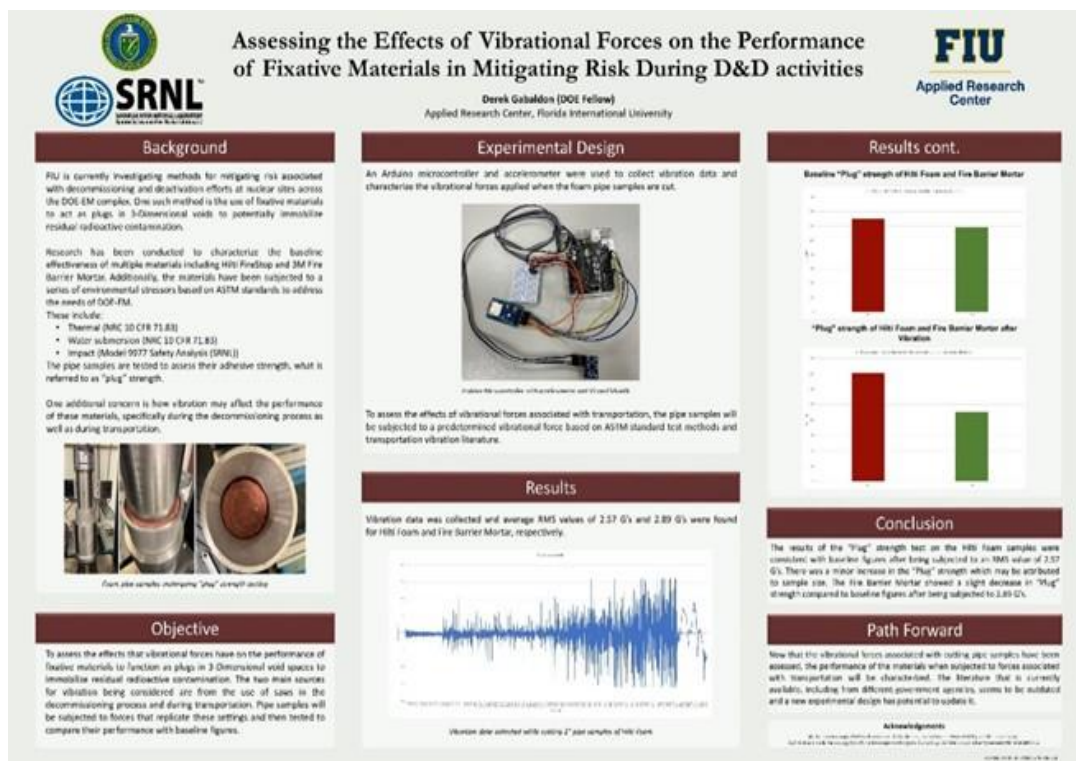
Figure 19. DOE Fellow Derek Gabaldon's poster presented at WM21.

DOE Fellows Mariah Doughman and Phuong Pham prepared posters to the ACS Fall meeting, and attended the conference held between August 22-26, 2021 in Atlanta, GA. Below are the titles and contributing authors of these research posters.

- "Effective removal of iodine species by organoclays MRM and PM-199", P. Pham, H. Gonzalez-Raymat, and R. Gudavalli.
- "Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments", M. Doughman and Y. Katsenovich.

Additionally, Phuong's abstract was selected to be part of Sci-Mix session, a large poster session and mixer held at each ACS national meeting. The poster session consists of abstracts selected by division program chairs and represents the most exceptional abstracts submitted to participating divisions.
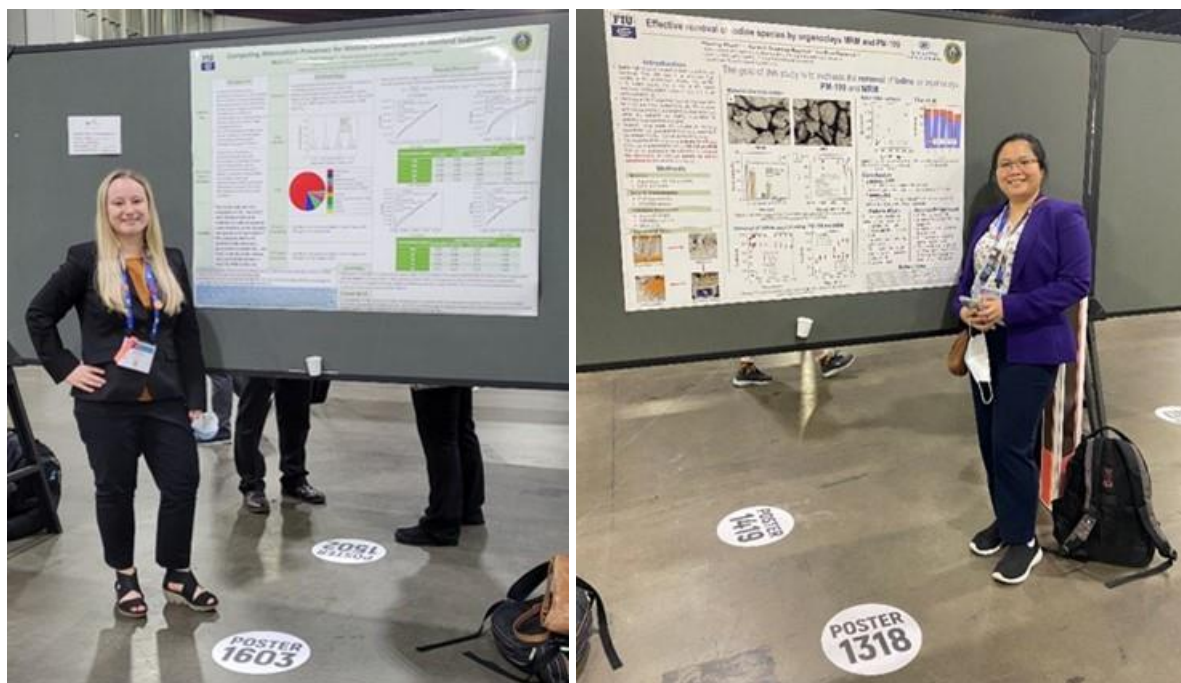
Figure 20. DOE Fellows Mariah Doughman and Phuong Pham presenting posters at ACS Fall meeting 2021.

DOE Fellows prepared abstracts for the Waste Management Symposia 2022 (WM2022) student poster session. A total of 15 abstracts have been submitted. The abstracts that the DOE Fellows prepared and submitted are based on work performed at FIU and/or during their summer internships.

Table 11. Abstracts Submitted by DOE Fellows for the WM2022 Student Poster Session

DOE Fellow	Abstract ID	Title
Aubrey Litzinger	22485	Standard Aging of Concrete for the Study of Protection Systems at Savannah River Site
Aurelien Meray	22483	AI Approach to Predict Tritium Concentrations Using Specific Conductance as a Proxy Variable at the SRS F-Area
Brendon Cintas	22484	Evaluation of Pipe Length on Flushing Requirements for High-Level Waste at Hanford and Savannah River
Caridad Estrada	22493	Sustainable Sorbent Technology for Mercury Remediation in a Freshwater Aquatic System
Gisselle Gutierrez	22488	Development of an Integrated Hydrology Model of a Sub-Basin within Basin-6 near the Waste Isolation Pilot Plant (WIPP), NM
Jeff Natividad	22482	Mechanical Updates on the Robotic System for Coating Application in Savannah River Site H-Canyon Exhaust Tunnel
Joel Adams	22499	Development of Intelligent Mobile Robot Platforms for Performing Nuclear Surveillance
Juan Morales	22487	Analysis of Uranium Transport Under Extreme Storm Events in the Tims Branch Watershed
Mariah Doughman	22486	Impact of Major Groundwater Components on the Adsorption of Uranium (VI) to Hanford Formation Sediment

DOE Fellow	Abstract ID	Title
Phuong Pham	22491	Study of Iodine-129 Removal by Organoclays MRM and PM-199 at Savannah River Site Wetlands
Raymond Piloto	22343	Corrosion Detection in Nuclear Waste Transfer Pipe Components Using Caustic Simulants
Roger Boza	22481	Surface Crack Detection of Nuclear Facility Structures Using Deep Learning and Knowledge Transfer
Sebastian Story	22480	Retrofitted Pneumatic Pipe Crawler for Transfer Line Inspection of Double Shell Tanks at Hanford Site
Stevens Charles	22490	Surface Water Dynamics within the F-area of Savannah River Site and its Linkages with Groundwater and I-129 Geochemistry
Thi Tran	22489	Intelligent Data Management to Produce Digital Twins from Autonomous Robotic Platforms

Task 8: DOE-EM Fellows Lecture Series Forum

There is no progress to report on Task 8 for this reporting period. FIU will host a DOE-EM Fellows Lecture Series Forum where DOE-EM staff (sites and HQ) and national lab personnel can discuss important DOE-EM topics with DOE-EM Fellows and FIU students. It is hoped that via this forum, DOE-EM Fellows will learn about DOE-EM environmental issues directly from DOE scientists and engineers. FIU will work with DOE HQ and national labs to identify potential speakers.

Task 9: DOE-EM Fellows and DOE-EM HBCU Collaboration/Integration

There is no progress to report on Task 9 for this reporting period. FIU will expand communication and engagement with DOE-EM HBCU STEM programs to promote collaborative synergistic research and STEM development efforts between FIU and HBCU universities related to EM technical issues and challenges. Out of these relationships, FIU hopes to identify qualified STEM students interested in pursuing graduate STEM degrees at FIU.

Task 10: Promote Career Opportunities

A Vacancy Announcement for Contract Specialists (Recent Graduates), GS-7-9, Announcement number TN-21-CC-RL-00160-RCG, was shared with recent graduates. DOE Fellow Christopher Excellent has submitted an application.

Two DOE Fellows Alejandro Koszarycz (class of 2017) and Christopher Excellent (class of 2017) graduated with bachelor's degrees in computer science and mechanical engineering respectively and participated in the Fall 2020 virtual graduation ceremony.

Five DOE Fellows graduated from FIU this spring semester and participated in a graduation ceremony held on April 24, 2021. DOE Fellow Silvina Di Pietro graduated with a Ph.D. in Chemistry and has accepted a post doctorate position within the National Nuclear Security Administration (NNSA) under the Defense Program. She will start her career with NNSA this summer. DOE Fellow Mariah Doughman graduated with a Master's degree in Chemistry and is continuing her education by pursuing a Ph.D. in Chemistry at FIU. DOE Fellows Katherine Delarosa and Nathalie Tuya graduated with Bachelor's degrees in Environmental Engineering. DOE Fellow Brendon Cintas graduated with a Bachelor's degree in Mechanical Engineering and will start his Ph.D. in Mechanical Engineering at FIU in the fall semester. He will be participating in a summer internship with DOE-HQ during this summer.

Figure 21. DOE Fellows spring 2021 graduation pictures; Silvina Di Pietro (top left), Mariah Doughman (top center), Katherine Delarosa (top right), Nathalie Tuya (bottom left) and Brendon Cintas (bottom right).

DOE Fellow, Derek Gabaldon, graduated from FIU this Summer 2021 semester and participated in the graduation ceremonies held on August 4 - 6, 2021. Derek graduated with a Bachelor's degree in Mechanical Engineering and is currently pursuing employment opportunities.

Figure 22. DOE Fellow Derek Gabaldon (right) at graduation ceremony with DOE-LM Fellow Olivia Bustillo (left).

DOE Fellows Mariah Doughman and Phoung pham participated in the Goldschmidt 2021 Virtual Workshop "An Introduction to the GWB Community Edition" held from June 29 through July 1, 2021.

CONCLUSIONS

This innovative workforce development program was officially established in March 2007. This project is successfully meeting its objectives by providing research training and mentoring for students from underrepresented groups on environmental problems at DOE sites, in addition to providing several new formal recruitment and retention mechanisms for qualified students from underrepresented groups to pursue advanced studies, research training, and eventual career placement at DOE sites. One hundred and seventy-nine (179) FIU STEM students have been inducted into the program and have completed 173 internships since 2007. Twelve (13) DOE Fellows were hired by DOE EM, DOE national labs and contractors. Ninety-three (97) DOE Fellows have been hired by private industry and government agencies. Additional information about the entire program and the DOE Fellows can be found on the website http://fellows.fiu.edu/.

ACKNOWLEDGEMENTS

APPENDIX A: FIU YEAR 1 ANNUAL RESEARCH REVIEW PRESENTATIONS

The following documents are available at the DOE Research website for the Cooperative Agreement between the U.S. Department of Energy Office of Environmental Management and the Applied Research Center at Florida International University: https://doeresearch.fiu.edu

FIU Year 1 Annual Research Review Presentations:

1. FIU Research Review - Project 1
2. FIU Research Review - Project 2
3. FIU Research Review - Project 3 – D&D
4. FIU Research Review - Project 3 – IT ML
5. FIU Research Review - Project 4 & 5
6. FIU Research Review - Project 4 - DOE Fellow Aurelien Meray
7. FIU Research Review - Project 4 - DOE Fellow Gisselle Gutierrez
8. FIU Research Review - Project 4 - DOE Fellow Jeff Natividad
9. FIU Research Review - Project 4 - DOE Fellow Mariah Doughman
10. FIU Research Review - Project 4 - DOE Fellow Philip Moore
11. FIU Research Review - Project 4 - DOE Fellow Sebastian Story
12. FIU Research Review - Project 5 - DOE Fellow Eduardo Rojas
13. FIU Research Review - Project 5 - DOE Fellow Olivia Bustillo
14. FIU Research Review - Wrap Up - Project 1
15. FIU Research Review - Wrap Up - Project 2
16. FIU Research Review - Wrap Up - Project 3 – D&D
17. FIU Research Review - Wrap Up - Project 3 – IT ML
18. FIU Research Review - Wrap Up - Project 4
19. FIU Research Review - Wrap Up - Project 5

APPENDIX B: DOE FELLOWS GRADUATE PROGRAMS

DOE Fellows in STEM Graduate Programs - Ph.D.

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Charles Castello	Electrical Engineering	Ph.D.	Soil/Groundwater - Sensor Development for Field Measurement of Mercury	2011
Claudia Cardona	Environmental Engineering	Ph.D.	Remediation of the uranium-contaminated subsurface in the deep vadose zone via NH_3 gas injection	2017
Hansell Gonzalez-Raymat	Chemistry	Ph.D.	Unrefined humic substances as a potential low-cost remediation method for groundwater contaminated with uranium in acidic conditions	2018
Sebastian Zanlongo	Computer Science	Ph.D.	Multipurpose All-Terrain Robotic Platform for D&D	2018
Roger Boza	Computer Science	Ph.D.	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies	2023 (anticipated)
Silvina Di Pietro	Chemistry	Ph.D.	Ammonia Gas Treatment for Uranium Immobilization at DOE Hanford's Site	2021 (anticipated)
Juan Morales	Public Health	Ph.D.	Accumulated Metalloestrogens Analysis for Health Risk Assessment and Watershed Toxicology Management in Tims Branch, SRS	2021 (anticipated)
Cristian Acevedo	NA	Ph.D.	*Note[1]*	NA
Emma Lopez	NA	Ph.D.	*Note[1]*	NA
Reiner Hernandez	NA	Ph.D.	*Note[1]*	NA
Eric Inclan	NA	Ph.D.	*Note[1]*	NA
Bryant Thompson	NA	Ph.D.	*Note[1]*	NA
Alejandro Garcia	NA	Ph.D.	*Note[1]*	NA
Orlando Gomez	NA	Ph.D.	*Note[1]*	NA
Alejandro Hernandez	NA	Ph.D.	*Note[1]*	NA
Joel Adams	Mechanical Engineering	Ph.D.	Long Term Surveillance of Nuclear Facilities and Repositories	2023 (anticipated)
Mariah Doughman	Chemistry	Ph.D.	Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments	2023 (anticipated)
Phuong Pham	Chemistry	Ph.D.	Interaction of iodine species with Organo Clays and Granulated Activated Carbon	2022 (anticipated)
Aurelien Meray	Computer Science	Ph.D.	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies	2024 (anticiapted)

| Brendon Cintas | Mechanical Engineering | Ph.D. | Experimental analysis of flushing criteria for waste transport operations | 2025 (anticiapted) |

[1]*Note: student is pursuing graduate level degree at another academic institution/department.*

DOE Fellows in STEM Graduate Programs - Masters

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Jose Vazquez	Environmental Engineering	Masters	Effects of temperature and pH on volatilization of mercury after chemical reduction	2009
Amy Pahmer	Engineering Management	Masters	Non-Thesis Option	2010
Duriem Calderin	Biomedical Engineering.	Masters	Modeling of Loose Contamination Scenarios to Predict the Amount of Contamination Removed	2010
Leydi Velez	Industrial Engineering	Masters	Decision Modeling Tools D&D Surveillance & Maintenance	2010
Serkan Akar	Biomedical Engineering	Masters	Design and Development of an Enzyme-Linked Biosensor for Detection and Quantification of Phosphate Species	2010
Amaury Betancourt	Environmental Engineering	Masters	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	2011
Denny Carvajal	Biomedical Engineering	Masters	Soil/Groundwater – Bacteria Interaction due to Polyphosphate Injection at Hanford	2011
Edgard Espinosa	Mechanical Engineering	Masters	Waste Processing - CFD Modeling of NuVison's Power Fluidic Technology/Process Remote Stack Characterization System	2011
Elsa Cabrejo	Environmental Engineering	Masters	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	2011
Melina Idarraga	Environmental Engineering	Masters	Dissolution rate of natural meta-autunite: effects of aqueous bicarbonate, pH and temperature	2011
Merlin Ngachin	Environmental Sciences	Masters	Waste Processing - Baltman-Lattice Method to Model HLW	2011
Stephen Wood	Mechanical Engineering	Masters	Modeling of Pipeline Transients: Modified Method of Characteristics	2011
William Mendez	Engineering Mngmt.	Masters	Development of Remote Stack Char. System	2011
Eric Inclan	Mechanical Engineering	Masters	Mesh adaptation for use in Lattice Boltzmann code	2012
Kanchana Iyer	Biomedical Engineering	Masters	Non-Thesis Option	2012
Lee Brady	Mechanical Engineering	Masters	Non-thesis option	2012
Lilian Marrero	Environmental Engineering	Masters	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	2012
Mario Vargas	Mechanical Engineering	Masters	Kinematic Control of Remote Stack Characterization System	2012
Melissa Sanchez **	Environmental Engineering	Masters	Non-thesis option	2012

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Yulyan Arias**	Environmental Engineering	Masters	Non-thesis option	2012
Elicek Delgado-Cepero	Electrical Engineering	Masters	Structural Health Monitoring Inside Concrete and Grout Using the Wireless Identification Sensing Platform	2013
Heidi Henderson	Environmental Engineering	Masters	Surface water and contaminant transport within the Oak Ridge National Laboratory	2013
Jaime Mudrich	Mechanical Engineering	Masters	Development of a Coupling Model for Fluid-Structure Interaction using the Mesh-free Finite Element Method and the Lattice Boltzmann Method	2013
Janty Ghazi	Electrical Engineering	Masters	Control, through Sensors and LabVIEW, of the Asynchronous Pulsing Unit	2013
Jose Matos	Mechanical Engineering	Masters	Development of improved Bodies for a Peristaltic Crawler for Radioactive Pipeline Unplugging	2013
Mariela Sliva	Engineering Management	Masters	Non-Thesis Option	2013
Joel McGill*	Environmental Engineering	Masters	Non-Thesis Option	2014
Paola Sepulveda	Biomedical Engineering	Masters	Investigating the Role of a Less Uranium Tolerant Strain, Isolated from the Hanford Site Soil, on Uranium Interaction in Polyphosphate Remediation Technology	2014
Revathy Venkataraman	Computer Science	Masters	Performance Evaluation of Mobile Applications with KMIT Technology Web Services	2014
Valentina Padilla	Environmental Engineering	Masters	Non-Thesis Option	2014
Andrew De La Rosa*	Computer Science	Masters	Non-Thesis Option	2015
Dayron Chigin*	Electrical Engineering	Masters	Non-Thesis Option	2015
Maximiliamo Edrei	Mechanical Engineering	Masters	Investigation of Mixing Times of Sparged Bingham plastic type fluids as applied to the Pulse Jet Mixing Process	2017
Natalia Duque	Environmental Engineering	Masters	Non-Thesis Option	2017
Robert Lapierre*	Chemistry	Masters	Mineral characterization after uranium sequestration by pH manipulation using NH_3 gas	2017
Alejandro Garcia	GeoScience	Masters	The influence of biofilm formation on the SIP response of Hanford vadose zone sediment	2018
Mohammed Albassam	Water resource Engineering	Masters	Effect of Frequent Atmospheric Events on Flow Characterization in Tims Branch and its Major Outfalls	2018
Joseph Coverston	Mechanical Engineering	Masters	Evaluation of Pipeline Flushing Requirements for HLW at Hanford and Savannah River	2019

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Joshua Nunez	Mechanical Engineering	Masters	The applications of intumescent technologies in support of D&D activities across the DOE complex	2019
Ryan Cruz	Cyber Security	Masters	Non-Thesis Option	2019
Amanda Yankcoskie*	Environmental Engineering	Masters	Non-Thesis Option	2020
Jason Soto	Mechanical Engineering	Masters	Design of Robotic Inspection Platform for Structural Health Monitoring	2020
Ron Hariprashad	GeoScience (Hydrogeology)	Masters	Modeling of Surface Water Flow and Contaminant Transport in the Tims Branch Ecosystem	2020
Tristan Simoes-Ponce	Mechanical Engineering	Masters	D&D Technology Demonstration & Development and Technical Support to SRS's 235-F Facility Decommissioning	2020
Edward Nina*	Mechanical Engineering	Masters	Non-Thesis Option	2020
Michael Thompson	Electrical Engineering	Masters	Structural health monitoring of pipelines in radioactive environments through acoustic sensing and machine learning	2020
Alexis Vento	Environmental Engineering	Masters	Fate of Actinides in the Presence of Ligands in High Ionic Strength Systems	2021
Jeff Natividad	Mechanical Engineering	Masters	Evaluation of Coatings for the H-Canyon Exhaust Tunnel	2022
Gisselle Guiterrez	Environmental Engineering	Masters	Digital Elevation Model and Hydrologic Network	2022
Lorryn Adnrade*	Environmental Engineering	Masters	Fate of Actinides in the Presence of Ligands in High Ionic Strength Systems	2022
Ryan Ocampo*	Civil Engineering	Masters	Evaluation of Coatings for the H-Canyon Exhaust Tunnel at the Savannah River	2022
Raymond Piloto	Electrical Engineering	Masters	Pipeline corrosion and erosion evaluation	2022

*This student left the DOE Fellows program before completion of their master's degree.
**This student left the DOE Fellows program but completed their master's degree at FIU.
† This student left the DOE Fellows program before completion of their doctoral degree.

APPENDIX C: DOE FELLOWS EMPLOYMENT

DOE Fellows hired by DOE-EM, contractors and National Laborotries

First Name	Last Name	Employer
Edgard	Espinosa	DOE EM Office of Nuclear Materials Disposition
Merlin	Ngachin	Argonne National Lab
Rubymir	Romero	Bechtel Power
Lee	Brady	DOE EM office of Deactivation and Decommissioning
Duriem	Calderin	Pacific Northwest National Lab (PNNL)
Charles	Castello	ORNL – Energy & Transportation Science Division
Rosa	Ramirez	DOE EM International Programs
Stephen	Wood	ORNL
Nicole	Anderson	National Energy Technology Laboratory (NETL)
Hansell	Gonzalez	Savannah River Nuclear Solutions
Adamandios	Manoussakis	Sandia National Laboratory
Silvina	Di Pietro	NNSA
Tristan	Simoes-Ponce	Savannah River Nuclear Solutions

DOE Fellows hired by private industry

First Name	Last Name	Employer
Serkan	Akar	Department of Commerce
Denisse	Aranda	NASA
Danny	Brenner	General Electric
Ramon	Colon	Bouygues Civil Works Florida
Henry	Diaz	Lockheed
Raul	Dominguez	Kimley-Horn and Associates, Inc.
Alex	Henao	Internal Revenue Services
Erica	McKinney	Boeing Company
William	Mendez	Boeing Company
Amy	Pahmer	Mount Sinai Medical Center
Giancarlos	Pena	Caribe Utilities of Florida, Inc
Jose	Rivera	FIU's Applied Research Center
Jose	Vazquez	Department of State
Leydi	Velez	PriceSmart Inc
Sandra	Zapata	Johnson & Johnson
Amaury	Betancourt	Florida Department of Environmental Protection
Cindy	Cerna	Naval Sea Systems Command
Melina	Idarraga	Nova Consulting Inc.
Dasney	Joseph	General Electric
Victor	Uriarte	Intel Corporation
Jennifer	Borges	Florida Department of Transportation
Elsa	Cabrejo	Dade County Environmental Department (Miami, Fla)

First Name	Last Name	Employer
Denny	Carvajal	Mount Sinai Medical Center
Rinaldo	Gonzalez Galdamez	Crane Aerospace and Electronics
Nadia	Lima	HJ Foundation
Jose	Matos	Beckman Coulter
Alessandra	Monetti	Department of Defense – Office of the Secretary of Defense, Army Corp of Engineering
Mario	Vargas	Boeing Company
Yulyan	Arias	CH2M Hill
Maite	Barroso	Sikorsky Aircraft
Givens	Cherilus	Florida Power & Light
Elicek	Delgado	Motorola
Janty	Ghazi	Kiewit Power
Heidi	Henderson	CPH Inc.
Kanchana	Iyer	Department of Health & Human Services
Alexander	Lopez	Florida Department of Transportation
Sheidyn	NG	Regeneron Pharmaceuticals
Shina	Rana	Florida Power & Light
Melissa	Sanchez	Florida Department of Environmental Protection
Claudia	Cardona	STEM
Nel	Ciurdar	Burns & McDonnell
Lilian	Marrero	MWH Global
Joshua	Midence	Creativity, Value, Logic
Carol	Moreno-Pastor	Cummins
Jaime	Mudrich	Beckman Coulter
Ximena	Prugue	BRG Sports
Paola	Sepulveda	StryKer
Frank	Silva	Department of State
Jennifer	Arniella	Permasteelisa North America
Francisco	Bolanos	Beckman Coulter
Dania	Castillo	HDR
Dayron	Chigin	Florida Power & Light
Joel	McGill	BND Engineers
Lucas	Nascimiento	Raytheon
Raul	Ordonez	Texas Instruments
Valentina	Padilla	Brown & Caldwell
Mariela	Silva	Conoco Phillips
Gabriela	Vazquez	Florida Power & Light
Revathy	Venkataraman	TradeStation
Michael	Abbott	Magic Leap Inc
Michelle	Embon	Kimley-Horn and Associates, Inc.
Mariana	Evora	King Engineering Associates, Inc
Eduardo	Garcia	UTC Aerospace Systems
Steve	Noel	Goldman Sachs

First Name	Last Name	Employer
Sasha	Philius	HaikuTech Europe B.V.
Brian	Castillo	StryKer
John	Conley	Florida Power & Light
Andrew	De La Rosa	Lockheed
Jorge	Deshon	Lockheed
Maria	Diaz	Nova Consulting Inc.
Maximiliano	Edrei	Huntington Ingalls Newport News Shipbuilding Company
Janesler	Gonzalez	Velossa Tech
Kiara	Pazan	U.S. Corps of Engineers
Meilyn	Planas	Florida Power & Light
Ryan	Sheffield	Applied Physics Laboratory
Aref	Shehadeh	Nova Consulting Inc.
Jesse	Viera	U.S. Marine Corps
Christine	Wipfli	U.S. Dept of Defense
Sarah	Bird	U.S. Dept of Defense
Alexis	Smooth	Nexant
Christopher	Strand	FAA
Sebastian	Zanlongo	Johns Hopkins University, Applied Physics Laboratory
Mohammed	Albassam	City of Coconut Creek
Michael	DiBono	Microsoft
Ron	Hariprashad	RS&H
Ripley	Raubenolt	SCS Engineering
Sarah	Solomon	County of Los Angeles Department of Public Works
Joseph	Coverston	Pennsylvania State University Applied Research Laboratory
Ryan	Cruz	Lockheed
Katherine	Delarosa	Advanced Environmental Laboratories
Ximena	Lugo	Kimley-Horn and Associates, Inc.
Alex	Rivero	General Electric
Jason	Soto	SIA Solutions LLC
Patrick	Uriarte	iRobot
Michael	Thompson	Raytheon
Rocio	Trimino Gort	A&P Consulting Transportation Engineers, Corp.
Adrian	Muino	Lockheed Martin