SAND2020-11832R

Sandia National Laboratories

Tribal Colleges and Universities/Advanced Manufacturing Network Initiative

Phase II Sandia Technical Assistance

FY20 Q4 Progress Report

Stan Atcitty, Sandia National Laboratories
Energy Storage Technology and Systems Department

October 2020

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.
SAND2020-XXXX R

Issued by Sandia National Laboratories, operated for the United States Department of Energy by National Technology & Engineering Solutions of Sandia, LLC.

CONTENTS

1. Introduction 5
2. Tribal Colleges and Universities/ADVANCED MANUFACTURING NETWORK INITIATIVE 6
   - 2.1. Bay Mills Community College 6
   - 2.2. Cankdeska Cikana Community College 6
   - 2.3. Navajo Technical University 7
   - 2.4. Salish Kooteani College 7
   - 2.5. Turtle Mountain Community College 7
   - 2.6. United Tribes Technical College 8
3. 2020 TCU Advanced Manufacturing Technology Summer Institute 9
   - 3.1. Soft Skills 9
     - 3.1.1. One key insight I had was? 9
     - 3.1.2. One thing I learned that I did not realize before? 9
     - 3.1.3. What is one thing I will do differently as a result of what I heard today? 9
   - 3.2. Additive Manufacturing 10
   - 3.3. Mock Interviews 10
4. Additional Outreach 11
   - 4.1. AIHEC DoD Student Fellowship 11
5. Sandia National Laboratories Summer Internship 12
   - 5.1. 2020 Summer Internship 12
6. Conclusion 14

LIST OF TABLES

Table 1. Summary of FY2020 Summer Interns 12

ACRONYMS AND DEFINITIONS

Abbreviation	Definition
ABET	Accreditation Board for Engineering and Technology
AIHEC	American Indian Higher Education Consortium
AM	advanced manufacturing
AMNI	advanced manufacturing network initiative
BMCC	Bay Mills Community College
CAD	Computer Aided Design
CCCC	Cankdeska Cikana Community College
COVID-19	corona virus disease 2019
EAB	Engineering Advisory Board
ENR	Engineering
GPS	Global positioning system
MSIPP	Minority Serving Institution Partnership Plan
NNSA	National Nuclear Security Agency
NTU	Navajo Technical University
R&D	research and development
ROV	remotely operated vehicle
SKC	Salish Kooteani College
STEM	science, technology, engineering, and mathematics
TCUs	Tribal Colleges and Universities
TMCC	Turtle Mountain Community College
UTTC	United Tribes Technical College

1. INTRODUCTION

The National Nuclear Security Agency (NNSA) initiated the Minority Serving Institution Partnership Plan (MSIPP) to 1) align investments in a university capacity and workforce development with the NNSA mission to develop the needed skills and talent for NNSA's enduring technical workforce at the laboratories and production plants, and 2) to enhance research and education at under-represented colleges and universities. Out of this effort, MSIPP launched a new consortium in early FY17 focused on Tribal Colleges and Universities (TCUs) known as the Advanced Manufacturing Network Initiative (AMNI). This consortium has been extended for FY20 and FY21. The following report summarizes the status update during this quarter.

2. TRIBAL COLLEGES AND UNIVERSITIES/ADVANCED MANUFACTURING NETWORK INITIATIVE

The overall goal of the AMNI consortium is to establish a network of TCUs with essential advanced manufacturing (AM) facilities, associated training and education programs, and private sector and federal agency partnerships to both prepare an American Indian AM workforce and create economic and employment opportunities within Tribal communities through design, manufacturing, and marketing of high-quality products. Some examples of high-quality products involve next generation grid components such as mechanical energy storage, cabling for distribution of energy, and electrochemical energy storage enclosures. Sandia National Laboratories (Sandia) is tasked to provide technical advising, planning, and academic program development support for the TCU/American Indian Higher Education Consortium (AIHEC) Advanced Manufacturing Project. The TCUs include Bay Mills Community College (BMCC), Cankdeska Cikana Community College (CCCC), Navajo Technical University (NTU), , Salish Kooteani College (SKC), and Turtle Mountain Community College. Sandia is working closely with NTU and AIHEC to provide a meaningful AM Summer Institute for the summer 2020. The goal of the program is to bring advanced manufacturing science, technology, engineering, and mathematics (STEM) awareness and opportunities for the American Indian students. Sandia provides technical assistance to each of the TCUs regarding their current AM activities. The following provides a brief status update on Sandia's contributions to each of the TCUs this quarter.

2.1. Bay Mills Community College

BMCC is a two-year tribal college chartered by the federally recognized Bay Mills Indian Community of Michigan. The school is located in Brimley, Michigan. Bay Mills' R&D focus area is on composite materials, thermoplastic fiber and resin, design and optimization through finite element analysis, and material characterization.

The COVID19 restrictions have played a major role in delaying plans to visit Bay Mills for outreach and R&D assessment activities. However, conversations with Bay Mills are on-going regarding advanced materials and characterization.

No technical assistance collaboration took place during this quarter. The majority of the discussions were focused on the summer institute.

2.2. Cankdeska Cikana Community College

CCCC is a tribal college in Fort Totten, North Dakota on the Spirit Lake Reservation. CCCC is focused on AM remote operated vehicles (ROV) for environmental sensing and data analysis. They are utilizing Solid Works, Solid Professor software tool, and 3D prototype printing.

Sandia was in the process of visiting CCCC for outreach activities and to get R&D updates, but the planning was curtailed because of COVID19 restrictions.

No collaborative technical assistance during this quarter. The majority of the discussions were focused on the summer institute.

2.3. Navajo Technical University

NTU is a tribally controlled postsecondary career and technical institution in Crownpoint, New Mexico. Two smaller campuses are located in Chinle, Arizona and Teec Nos Pos, Arizona. The NTU campuses are located on the Navajo Reservation. NTU's activity is focused on AM of metal part machining and processing, certification of 3D metal printed parts, and inspection methodologies and techniques including equipment operation and optical metrology including testing and characterization of materials.

Sandia manager, Karen McDaniel and Deidre Pine, a Computer Aided Design (CAD) and Drafting Specialist, out of the Tester Development & Use Control Design Department, provided an information session on the NTU campus on February 21, 2020. The presentations focused on a high-level overview of Sandia, background on Tester Development & Use Control Design department, Creo 3D modeling, 3D printing, and mechanical and electrical design concepts. Ten NTU students and three faculty members attended the meeting. Student contacts were made and future collaboration is on-going.

Stan Atcitty continues to lead the Engineering Advisory Board (EAB) for NTU. Stan has been serving as Chair of EAB since 2014. Since the receiving of the Accreditation Board of Engineering and Technology (ABET), the NTU EAB function has been focused on sustaining the ABET accreditation and strategically expanding programs to include other disciplines like Chemical and Mechanical Engineering programs. NTU is the first TCU to obtain such a significant milestone. The spring 2020 meeting was held via teleconference on June 11, 2020. The fall meeting is currently scheduled for October 15, 2020 and most likely it will be another teleconference meeting.

2.4. Salish Kooteani College

SKC is a tribal college based in Pablo, Montana which serves the Bitterroot Salish, Kootenai, and Pend d'Oreilles tribes. The SKC campus is on the Flathead Reservation.

SKC is focused on computer control and monitoring and digital fabrication. SKC is utilizing their expertise in computer control and monitoring build a submersible ROV. SKC is also focusing on getting students on the technician, engineer, scientist pathway by training students to use advanced manufacturing equipment in its digital fabrication laboratory.

Sandia was planning to travel to SKC to get project update and provide outreach activities at nearby high school but it was curtailed due to the COVID19 situation. Communication with SKC is on-going. No technical assistance collaboration during this quarter. The majority of the discussions were focused on the summer institute.

2.5. Turtle Mountain Community College

TMCC is a tribal college located in Belcourt, North Dakota. TMCC was founded by the Turtle Mountain Band of Ojibwa in 1972. There are over 25,000 enrolled members, 34 percent of whom live on or near the Tribe's 86,989 acres. TMCC is focused on AM ROVs for environmental sensing and characterization. Furthermore, they have increased their focus area in material science and 3D printable materials.

TMCC had a teleconference with Steve Burger and Anup Parikh, both mechanical engineers from the Robotics & Counter Robotics department, on January 09, 2020. The conversation focused on design considerations for a module that can be mounted externally to a variety of unmanned vehicles and conduct environmental sampling. Sandia provided guidance on global positioning system (GPS) design approaches and data logging techniques. Discussions are on-going.

No technical assistance collaboration took place during this quarter. The majority of the discussions were focused on the summer institute.

2.6. United Tribes Technical College

UTTC Pre-Engineering program was notified on September 24, 2020, that they were the recipient of a grant from AIHEC and the NNSA's AM Initiative. Ms. Alexa Azure, a faculty member at UTTC, is the principal investigator for the grant. Since the notification, she has started working with the five TCUs in under the MSIP program on designing a laboratory and associated curriculum for AM activities. UTTC is located in Bismarck, North Dakota (ND), It was established in 1969 by an association of ND's Native tribes and it offers certificate programs and two-year degrees in over 20 programs of study.

One of the courses offered at UTTC is ENR 116 Introduction to Engineering. This course serves as an introduction to engineering and the engineering disciplines. Specifically, this course covers ethics, systems, indigenous engineering, and introductions to useful software such as Matlab and CAD. Additionally, professional engineers are invited to the classroom, via the web due to COVID19, to discuss their work and journey to where they are now. Stan Atcitty was invited to join the class on September 17, 2020 to discuss his journey to where he is now at Sandia. There were four students in the class, three males and one female. The students represented Tribes from Three Affiliated Tribes (Mandan, Hidatsa, Arikara Nation), Standing Rock Sioux, Fort Peck, and Winnebago of Nebraska. The students asked multiple questions and were genuinely interested in learning more from Dr. Atcitty.

3. 2020 TCU ADVANCED MANUFACTURING TECHNOLOGY SUMMER INSTITUTE

The original plan for 2020 TCU AM summer institute was to be held on the NTU campus, but due to COVID19, the institute was conducted remotely. Sandia, with close coordination with NTU, provided the following lectures. The institute hosted sixteen American Indian students representing six TCUs. The following provides a brief overview of the topic areas.

3.1. Soft Skills

The soft skills lecture was provided by Marie Capitan, a Diversity Workforce Specialist whose is a member of the Navajo Tribe. Marie provided a lecture on June 30, 2020 entitled, "What I Need to Know About Inclusion and Diversity". The lecture covered key inclusion and diversity topics which encouraged student engagement and participation. These topics included how to be our authentic selves, how to cultivate inclusion in a workplace, understanding the four dimensions of diversity, how and why it's important to listen effectively, how to be an ally for other when situation arises, and the importance of having a conversation at work or in work groups. The virtual presentation did impact the ability to conduct an end of the course evaluation to assess the student's learning of the content. In lieu, however, students were asked to answer one of three questions: 1) what was one key insight I had?, 2) what was on thing I learned that I did not realize before?, and 3) what is one thing I will do differently as a result of what I heard today? The following is a summary of the students' comments to the question of their choice. Their responses suggest they found the learning beneficial, relevant, and actionable.

3.1.1. One key insight I had was?

- *To be understanding and listen.*
- *To be more kind and more approachable and to be an active listener rather than be opinionated.*
- *Everyone tends to have assumptions or bias towards other before learning anything about them.*

3.1.2. One thing I learned that I did not realize before?

- *The more we can have a conversation; it gets easier to talk about the topic. Which is a relief to not hold all that in.*
- *That is hard to talk about!*

3.1.3. What is one thing I will do differently as a result of what I heard today?

- *I will try to keep more of an open mind to differing views; and be less headstrong and set in one way or another.*
- *Don't judge others.*
- *To better my listening skills.*
- *I will try to listen better and not change the subject to talk about me.*
- *To hear another's side of the story and beliefs; to practice being an active listener and to take it in so I can expand my perspective on the world.*
- *To be more approachable.*

3.2. Additive Manufacturing

Shawn Whetten, a technical staff in the Coating & Additive Manufacturing Department, provided two lectures. The first lecture was on May 22, 2020 entitled, "Overview of and Design for Additive Manufacturing". This lecture provided and overview of common additive manufacturing technologies and design principals that need to be considered when utilizing AM. This lecture also walked through the design of a 3D printed part to reinforce the design principals that were taught. The second lecture was on May 25, 2020 entitled, "Applications of Additive Manufacturing". This lecture taught how AM is used in various research disciplines at Sandia and showed exotic uses of AM in industry. The purpose of this lecture was to teach students that AM is much more than 3D printing with a MakerBot and encourage participants to think outside the box3D Modeling

Justin Mulligan and Deidre Pine, both out of the, Tester Development & Use Control Design department, provided information Creo 3D modeling, 3 printing techniques, and mechanical and engineering design concepts. Justin and Deidre are scheduled to provide a lecture on July 2, 2020. Deidre Pine is a member of the Navajo Tribe.

Justin is a Product Design Engineer at Sandia. He is passionate about additive manufacturing and regularly utilize its benefits to support the tester group. He gave a virtual presentation on the design of an additively manufactured tester enclosure. He showed how he uses AM in a design of a tester currently used in the field, noting AM design considerations. The students were very interested in the presentation and asked several questions over voice and text chat. Deidre focused her presentation on how to create 3D models and assemblies using the 3D modeling software, Creo. The benefits of Creo were presented along with examples of how to use the tool. The students asked questions during the presentation and were very active in the chat room.

3.3. Mock Interviews

The summer institute provided a number of mock interviews to provide students a unique opportunity to practice interviewing skills. These are typically done in an environment similar to an actual face-to-face interview, however, due to COVID19 these interviews were conducted virtually. Dylan Moriarty, a geoscience engineer at Sandia and a member of the Navajo Tribe, conducted the interviews on July 10, 2020. He interviewed two students: Nick Bittner of CCCC and Terril Lee of NTU. Dylan provided valuable feedback throughout the interviews and encouraged them to ask questions along the way. This was time well spent and both students made it clear they appreciated the format.

4. ADDITIONAL OUTREACH

4.1. AIHEC DoD Student Fellowship

AIHEC conducts a program known as the DoD-Fellowship which is a 10-week summer research program sponsored by the Office of the Under Secretary of Defense for Research and Engineering. The faculty-student research team consists of one faculty member and one student from TCUs. The research teams work closely with subject matter experts from DoD research laboratories such as Army and Navy Research Labs. This program provides a unique experience for students and provides them possible career opportunities. This program also provides remote mentoring opportunities where they invite various profession speakers. Stan was invited to make a presentation on June 23, 2020 on his journey from the Navajo Reservation to his professional career at Sandia. Twelve STEM students and six faculty member representing five TCUs attended his presentation. They ask multiple questions; many of which focused on personal career development.

5. SANDIA NATIONAL LABORATORIES SUMMER INTERNSHIP

5.1. 2020 Summer Internship

Sandia was in the position to hire six American Indian summer interns as of January 2020. However, due to the COVID19 issue, only three students had projects that qualified for remote internship. Sandia was in the position to hire three summer interns, but one did not fulfill all requirements. The following provides a quick summary of the two students that were hired, their schools, and departments.

Sarah LaVallie is a member of the Turtle Mountain Band of Chippewa from Dunseith, North Dakota. She is currently pursuing a B.S. in Mechanical Engineering at North Dakota State University (NDSU) and is expected to graduate May 2021. She attended the Turtle Mountain Community College prior to attending NDSU. Sarah's summer project was focused on performing exploratory data analysis of solar photovoltaic production. She determined the relationship between extreme weather events and photovoltaic energy production by comparing various types of weather data (temperature, wind speeds, etc.) for various photovoltaic locations within a given time period. The following was Sarah's impression of her experience.

"My remote internship at Sandia this summer was very much a learning experience for me. Not only did I develop new skills and gain insight into an area that I'm interested in, I also gained experience working in a remote environment. Participating in a remote internship posed some new challenges, such as giving presentations virtually and maintaining communication with my mentors despite never seeing them face-to-face. As a result, I feel more confident in my ability to remain flexible and adapt to unprecedented situations. Overall, this was a really memorable and positive experience and I'm grateful to have this opportunity!"

Victoria Charley is a member of the Navajo Tribe and from Thoreau, NM. She is pursuing a B.S. in Electrical Engineering at Navajo Tech University. Victoria was a tester development and use control designer. She developed 3-D models, assemblies, and drawings from 2-D sketches. The 3-D models were developed using commercial-of-the-self parts which was used to expand the Computer Aided Design library ensuring faster and easier production of parts. The following was Victoria's impression of her experience.

"My time at Sandia National Laboratories was very challenging, educational and fun. From the first day and throughout my internship, I was welcomed, educated and challenged. I was impressed to see that there was a high number of indigenous professionals that worked at Sandia as well. My overall experience at Sandia National Laboratories was met with many professionals that were willing to aide and educate the future engineers, such as myself. SNL offered an intense program that made you think outside the box, become independent and become part of a team that strived for excellence."

Table 1. Summary of FY2020 Summer Interns

#	Student	Colleges & Universities	Sandia Department
1	Sarah LaVallie	North Dakota State University/Turtle Mountain Community College	Electric Power Systems Research

#	Student	Colleges & Universities	Sandia Department
2	Victoria Charley	Navajo Tech University	Tester Development/Use Control Design

6. CONCLUSION

The Sandia team provided four lectures and mock interviews for the AM summer institute coordinated by NTU. Discussions with each of the respective TCUs regarding various technical assistance is on-going.

Sandia hired its first MSIPP American Indian summer intern during the summer of 2018. Sandia hired three summer interns for the summer 2019. Sandia hired two summer interns for the summer of 2020 and these interns worked remotely due to the COVID19 issue.

Sandia, namely Stan Atcitty, continues to chair the NTU Engineering Advisory Board activities. Spring meeting was held on June 2020 via teleconference and the fall meeting is tentatively scheduled for October 2020.