

Tribal Colleges and Universities/ American Indian Research and Education Initiatives Advanced Manufacturing Technical Assistance Project

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1 Introduction

The National Nuclear Security Agency (NNSA) created a 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 program in early FY17 focused on Tribal Colleges and Universities (TCUs). The following report summarizes the project focus and status update during this reporting period.

2 TCU/AIHEC Advanced Manufacturing Project

The overall goal of this project 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), Southwestern Indian Polytechnic Institute (SIPI), and Salish Kooteani College. AIHEC and Sandia, with collaboration from SIPI, will be establishing an 8-week summer institute on the SIPI campus during the summer of 2017. Up to 20 students from TCUs are anticipated to take part in the summer program. The goal of the program is to bring AM science, technology, engineering, and mathematics (STEM) awareness and opportunities for the American Indian students. Prior to the summer institute, Sandia will be providing reviews on curriculum plans at the each of the TCUs to ensure the content is consistent with current AM design and engineering practice. In addition, Sandia will provide technical assistance to each of the TCUs in regards to their current AM activities.

Sandia, AIHEC, and the TCUs under this project had a kickoff meeting on the SIPI campus October 21, 2016. The purpose of the meeting was to discuss the goals of the AM project, AM R&D project ideas, and the summer institute. Each of the TCUs proposed various AM R&D ideas, and Sandia provided feedback and recommendations for each idea. The project ideas and Sandia's contributions are provided in the next sections.

2.1 Bay Mills Community College

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. Based on the October 2016 kick-off meeting, BMCC will be focusing the three AM related R&D projects: 1) advanced material for flywheel energy storage systems, 2) ballistic panels for energy systems, and 3) reinforced/lightweight materials for energy systems.

2.1.1 Advanced Material for Flywheel Energy Storage Systems

The first meeting took place on January 10, 2017 between Chris Griffen (BMCC), Jeff Parker (BMCC), Mickey Parish (BMCC), Fred Deans (Allied Comptech), Stan Atcity (Sandia), and Don Bender (Sandia), a flywheel expert. BMCC had questions on methods of flywheel rotor manufacturing, flywheel testing, and advanced material for next generation flywheels. Don Bender provide comprehensive feedback to BMCC. A follow-on teleconference is anticipated after this reporting period.

2.1.2 Ballistic Panels for Energy Systems

The technical meeting between BMCC and the Sandia subject matter expert has not taken place during the writing of this report. It is anticipated the meeting will take place early this calendar year.

2.1.3 Reinforced/lightweight Materials for Energy Systems

Similar to the Ballistic Panels focus area, the technical meeting between BMCC and the Sandia subject matter expert has not taken place during the writing of this report. It is anticipated the meeting will take place early this calendar year.

2.2 Cankdeska Cikana Community College

Cankdeska Cikana Community College (CCCC) is a tribal college in Fort Totten, North Dakota on the Spirit Lake Reservation. CCCC will work collaboratively with Sioux Manufacturing and BMCC on AM of various energy system manufacturing. CCCC is in the early stages of defining AM related R&D. Sandia plans to work closely with BMCC and CCCC to determine the R&D focus area related to AM. A preliminary meeting and discussion took place during the October 2016 kick-off meeting. Technical discussions are on-going.

2.3 Navajo Technical University

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 activity is focused on the exploration of additive manufacturing techniques. The first teleconference took place on Jan 16, 2017 between Scott Halliday (NTU), Stan Atcitty (Sandia), and Bradley Jared (Sandia), an additive manufacturing subject matter expert. Sandia provided technical feedback on additive manufacturing of metal part machining and processing, certification of 3D metal printed parts, and inspection methodologies and techniques including equipment operation and optical metrology. Scott Halliday expressed interest in touring Sandia's AM facility in the near future. Technical discussions are on-going.

2.4 Southwest Indian Polytechnic Institute

Southwest Indian Polytechnic Institute (SIPI) is a federally operated Bureau of Indian Affairs community college located in Albuquerque, New Mexico. SIPI is funded by the Bureau of Indian Education, an agency within the U.S. Department of Interior. SIPI will be hosting the 8-week summer institute during the summer of 2017. The overall goal of the institute is to educate and bring AM R&D and STEM awareness to up to 20 TCU students across the nation. The detail planning for the institute is on-going. Sandia plans to invite various subject matter experts from Sandia to make presentations and to mentor student teams during the 8-week program.

2.5 Salish Kootenai College

Salish Kootenai 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 will focus on three AM related R&D projects: 1) BisonSat II miniature satellite deployment, 2) characterization of advanced manufactured materials, and 3) rapid prototyping laboratory development.

2.5.1 BisonSat II Miniature Satellite Deployment

BisonSat is a satellite with an earth science mission to demonstrate the acquisition of 100-meter or better resolution visible light imagery of the earth using passive magnetic stabilization. Some of the images will be of the Flathead Indian Reservation to be used primarily for engaging tribal college students and tribal communities in NASA's mission. BisonSat is the first CubeSat designed, built, tested, and operated by tribal college students. The satellite was launched on October 8, 2015. Unfortunately, the BisonSat is not responding transmission with less than one year in orbit. A teleconference meeting took place on December 12, 2016 between Thomas Trickel (SKC), Stan Atcitty (Sandia), and Charles Carter (Sandia), a subject matter expert in complex reliability analysis. Sandia provided technical information on Failure Modes, Effects, & Criticality Analysis (FMECA) process. This is a formal process that looks at each component of the system and addresses how it could fail and what the effects would be.

2.5.2 Characterization of Advanced Manufactured Materials

The type of characterization techniques used for AM materials is to be determined. Sandia will be providing technical feedback on data analysis and design review for the 2017 summer institute at SIPI. The total number of mentors and lectures is to be determined.

2.5.3 Rapid Prototyping Laboratory Development

SKC will be a rapid prototyping facility in the area of electrical circuit board R&D. Sandia will be providing the state-of-the-art tools and techniques and technical guidance on rapid prototyping. A teleconference is anticipated to cover additional details in the near future.

3 Conclusion

It is anticipated that Sandia's contributions will ramp up during the next few months and especially during the summer institute establishment. The technical discussion with each of the respective TCUs will continue on a needs basis. Sandia is currently on track.