

## Project Description

### Discover Revolutionary Opportunities with Newly Educated Technicians (DRONE Tech)

**RESULTS OF PRIOR SUPPORT.** Not applicable.

**MOTIVATING RATIONALE.** Unmanned aircraft systems (UAS) are an exciting technology with high demand opportunities for security, disaster response and surveillance. Drone is a term used interchangeably with UAS, as this is the media choice when referring to the technology. Although UAS have primarily been used for military purposes, new and emerging applications are developing in law enforcement, firefighting, agriculture, weather monitoring, border surveillance, suspect tracking, traffic monitoring, disaster relief, damage assessment, movie production, flood mapping, mining, communication broadcasts, search and rescue, and severe storm research. For example, unmanned aircraft have been used for environmental research in the Arctic, mapping of wildfire progression in the Alaskan wilderness, border surveillance in Arizona, and earthquake damage assessment in Haiti. These and other new applications will revolutionize the community's ability to monitor and understand the world and its environments.

The Federal Aviation Administration (FAA) Modernization and Reform Act of 2012 requires the FAA to develop a plan to integrate UAS into the National Airspace System (NAS) by September of 2015. Integration of UAS will dramatically change the aviation industry and the requirements for technician education on Next Generation (NextGen) technologies. NextGen technologies include the advances in aircraft electronics for performance based navigation and communication, composite structures and the computer systems that are a core part of UAS but also are becoming more common in the latest traditional aircraft being manufactured. Integration of UAS into the NAS will create more than 34,000 manufacturing jobs and more than 70,000 new jobs in the first three years (2015-2018).<sup>1</sup> Northland Community and Technical College (Northland) is well-positioned to be the leader in preparing current and future technicians with the education that will be required by the integration of UAS.

Several key opportunities have been identified that are to education, training and research in the emerging UAS field, including the: (1) STEM and UAS-related activities for secondary and post secondary students to be educated about current and future opportunities in UAS/aviation disciplines; (2) Research and development (R&D) for best practices in UAS education and professional development opportunities for high school teachers and two-year faculty about UAS disciplines; (3) Best practices for UAS training at the technical level; (4) Focus on development of new training programs across the country to fill the rising need for UAS technicians; (5) Certification standards; (6) A centralized body to compile and disseminate information about burgeoning UAS career and education opportunities; and (7) education and career pathways for these new and emerging careers.

To seize these opportunities, at the beginning of this rapid growth industry, partnerships with industry, education, and government, must be convened to develop and support initiatives aligning with NSF ATE for increasing technician education. Northland Community and Technical College has gained momentum by providing more than 54 years of high quality technician education to aviation maintenance technicians, and further developing the Nation's first UAS maintenance training program in 2011. Northland also partners closely with the University of North Dakota, which launched the Nation's first UAS pilot certificate program from the long-standing professional flight program in 2009. In 2013 Northland also developed the Nation's first two-year Imagery Analysis program due to the exponential increase in imagery applications and the inevitable integration of UAS into the national airspace, which will continue to increase the need for technicians in this discipline.

**Background on the UAS Industry.** The multitude of applications for UAS has led to a vast array of design types, sizes and capabilities for the various systems that exist and the future systems being manufactured. One thing remains the same across these diverse systems, the need for technicians with a broad range of skillsets and education and an ability function as lifelong learners throughout their careers. The industry is poised with a growth potential and transformation that is exciting to the future career possibilities for technicians who are educated on advancing aerospace technology.

## NSF-ATE Proposal Northland Community & Technical College – Proposal Narrative

Across the globe, the UAS market is growing rapidly:

- The economic impact of the integration of UAS into the NAS will total more than \$13.6 billion in the first three years of integration and will grow sustainably for the foreseeable future, cumulating to more than \$82.1 billion between 2015 and 2025;
- The manufacturing jobs created will be high paying (\$40,000) and require technical degrees;
- Tax revenue to the states will total more than \$482 million in the first 11 years following integration (2015-2025):

Every year that integration is delayed, the United States loses more than \$10 billion in potential economic impact. This translates to a loss of \$27.6 million per day.<sup>1</sup>

Technicians educated in all aspects of this NextGen technology will provide the solution to the rapidly emerging needs the industry will face. The 2014 Boeing Pilot and Technician Outlook, a respected industry forecast of personnel demand, projects that 533,000 commercial airline pilots and 584,000 new maintenance technicians will be needed to fly and maintain the world fleet over the next 20 years. <sup>ii</sup>With forecast like these the pipeline must be expanded beyond the current projections to meet future needs based on growth.

According to the 2013 study conducted by the Association for Unmanned Vehicle Systems International (AUVSI) by 2025 total job creation is estimated at 103,776. As demand for these jobs increases, so will median wages: UAS industry wages range from \$16.21 for general maintenance and repair workers to \$34.42 for UAS lead mechanics, inspectors, shop supervisors, and managers.<sup>i</sup>



Why Northland? Northland Community and Technical College is located in a region that has gained national recognition for its thriving UAS economy. The nearby Grand Forks Air Force Base has recently been made an Air Combat Command that deploy UAS, and now serves as home to a squadron of General Atomics Predator UAS as part of the Department of Homeland Security's U.S. Customs and Border Protection mission. Northrop Grumman's Global Hawk UAS also makes its home at the base. Federal funding for the base's UAS efforts include \$457,985 in 2006 from the Department of Defense U.S. Army Research Office and \$50 million in 2008 from an Air Force contract to train pilots for the Predator UAS.

In addition to significant research and development efforts at the Air Force Base, the University of North Dakota's (UND) Center for UAS Research, Education and Training collaborates with private sector partners on UAS development, and with the FAA on integrating UAS into the National Air Space. UND has an aerospace science specialty, and began offering a four-year degree in UAS piloting in 2009. Northland students can transfer general courses to UND through an articulation agreement. Northland currently has articulation agreements with

UND between Northland's Aviation Maintenance Technology program and UND's programs in piloting, aerospace management, and related disciplines.

Northland's notable track record in federal grant administration, particularly for its new UAS maintenance program, makes the college an ideal candidate to lead the development on UAS educational pathways and professional development opportunities.<sup>1</sup> The DOL grants Northland received allowed the college to invest in high-tech equipment to update the programs to the latest industry technology. Priority was also placed on

---

<sup>1</sup> In 2010, Northland was awarded a \$4,996,884 grant from the U.S. Department of Labor (DOL) Employment and Training Administration American Recovery and Reinvestment Act to develop the nation's first civilian UAS maintenance training program. This program commenced in fall 2011. The program, which has the Aviation Maintenance Technology certification as a prerequisite, includes 30 credits in system maintenance, avionics, and computer networking. In September 2011, Northland was awarded a \$4,794,337 grant from the DOL Trade Adjustment Assistance Community College and Career Training program to develop an Associate of Applied Science degree in Imagery Analysis.

## NSF-ATE Proposal Northland Community & Technical College – Proposal Narrative

the developments of Cisco Tele-presence video conferencing systems that would extend the classroom while maintaining instructor contact and the overall rigor of aerospace education. These improvements were made intentionally to lead to projects that would have broader impact to technician education and can now be leveraged by this NSF project to allow increased access to high quality UAS education.

Northland's current relationships with industry further lend to the college's ability to lead the development of a national model for developing career pathways into UAS careers. For example, Northrop Grumman, a leading global security company providing aerospace and electronics services and more, has made equipment and scholarship fund donations to Northland Community and Technical College. Northrop Grumman has also hired Northland graduates across the world into technician positions on one of the most advanced UAS in production, the RQ-4 Global Hawk. Placement locations for students have included Anderson Air Force Base in Guam, the Naval Air Station in Sigonella, Italy, and Misawa Air Base in Japan, as well as multiple positions stateside. General Atomics, which oversees Predator UAS used by the U.S. Customs and Border Patrol at the Grand Forks Air Force Base, provides input into Northland's aerospace curriculum, and also benefits from hiring Northland graduates. Northland is working with these industry partners and others to develop specialized aviation coursework intended to attract high school students into STEM curriculum.

Northland initiated the development of standards for UAS maintenance through a coalition of industry, manufacturers, military branches, the Federal Aviation Administration and the National Center for Aerospace and Transportation Technologies (NCATT). NCATT is now a part of the ASTM International, formerly known as the American Society for Testing and Materials. NCATT, a former funded NSF ATE, sets aerospace industry maintenance standards and is the primary body for civil certification for maintenance training programs. Compliance with its standards are sought and acknowledged by the Federal Aviation Administration using FAR Part 91 as baseline acceptable minimums. Through NCATT, Northland is leading the development of a "first of its kind" UAS knowledge standards guide and certification process. This proactive partnership is visionary and groundbreaking in the UAS field. By writing the UAS maintenance standards, Northland is shaping UAS maintenance practices nationwide.

There are sixty-six fundamental subject knowledge, task performance and task knowledge, activities, and functions within the NCATT Standard for Unmanned Aircraft System (UAS) Maintenance. The UAS standards were identified and defined by aerospace industry Subject-Matter-Experts (SMEs) through an NCATT facilitated, industry recognized, occupational analysis workshop. NCATT workshops focus on the "job" an individual performs in relation to an identified topic or career field.

New-generation aircraft will require technicians to continually develop new skills: holding an Airframe and Powerplant certificate alone may get you in the door, but continuing education and knowledge will be key factors to the career-minded aviation maintenance technician.<sup>iii</sup> A skilled UAS maintenance technician requires a broad range of knowledge and skillsets across: math and physics, flight mechanics, aircraft electronics, radio theory, stability and control, propulsion systems, aerospace materials science, and computer science. They are responsible for all aspects of preventative maintenance, damage and malfunction assessment, and repair techniques for aircraft, communications and navigation systems and ground control stations. Their day to day tasks range from install, operating, support, upgrade or maintain the software, hardware, automated equipment and systems that support ground and flight operations.

The NCATT UAS Maintenance Standard can be used by aerospace industry education and training entities to develop lesson plans as part of a complete education and training program focused on UAS maintenance. It can also be used to develop specialized and/or targeted UAS maintenance education and training needs.

Northland has built the infrastructure and equipment needs but must now focus on working with regional partners including high schools and industry to develop the models that will lead to filling these needs. A key focus of building the infrastructure and acquiring equipment was meeting the 21st century education models by incorporating technology that would allow instructors to extend the classroom through interactive distance delivery. A cornerstone of this type of equipment are Cisco Tele-presence rooms, which have allowed for the general education courses students take to be taught cross campus and received at any of Northlands three campus locations using video conferencing to combine classrooms. The summer of 2014 launched the first hybrid offering of the first semester of the UAS maintenance program in a new format, which extended the

NSF-ATE Proposal  
Northland Community & Technical College – Proposal Narrative

classroom beyond the bricks and mortar of Northlands traditional campuses allowing students to use WebEx to plug into the Tele-presence classroom. The instruction maintained the synchronous time between students and instructors and allowed for an interactive classroom where students could demonstrate the assembly and function of computer components as part of the microprocessor maintenance course. Students could share presentations to the class on current events and trends taking place in the UAS industry from any location. Students also used computer-based training for avionics and synchronous class time with the instructor to discuss questions and review content for quizzes and exams.

This type of instruction and interaction will smoothly transfer into strengthening the relationships between Northland faculty and the high school classroom. Northland faculty will be able to provide special guest presentations on specific areas that high school educators would like to bring into the classroom with little logistical hurdles. It will also be a tool that allows for improved collaboration on developing Northlands current curriculum to meet the needs when offering the curriculum to high school students.

The equipment and supplies purchased for the lab activities also focused on equipment that was mobile and easily reconfigured based on flexibility in training location. This project will allow Northland to take full advantage of this mobility by building opportunities to bring the lab activities outside the college to continue increasing interest in STEM technology.

**MISSION AND GOALS.** The goal of this project is to develop education and career pathway opportunities in emerging UAS disciplines. It will aid recruitment and produce a highly-educated workforce to meet current and future industry-recognized and accepted workplace competencies in NextGen technologies. Northland will assist industry partners in modernizing current workforce skillsets and advance STEM interest in secondary and post-secondary environments to sustain the expected job growth into the future. Northland will meet this goal through the following objectives:

- Goal 1: Provide professional development to faculty in emerging technologies and instructional theories focused on UAS education.
- Goal 2: Create curriculum to address gaps in current and future UAS education programs.
- Goal 3: Promote and provide educational opportunities to underrepresented populations and rural areas.
- Goal 4: Dissemination of instructional materials, research information, papers.

**PROJECT STRATEGIES - OBJECTIVES, ACTIVITIES, TIMELINES, AND DELIVERABLES**

**Objectives and Supporting Activities:**

***1 Professional Development Opportunities for Northland Aerospace Program Faculty***

- 1.1 To maintain and increase education in the latest aerospace technological advancements Northland will send at least 4 aerospace faculty to professional development opportunities with a focus on small UAS programming and engineering.
- 1.2 Knowledge gained at professional development opportunities will assist to refine current UAS curriculum, increasing the readiness to meet growing industry need.
- 1.3 Professional development opportunities will aid in the development of outreach and recruitment tools.
- 1.4 Faculty attending professional development opportunities will cross train other department faculty to ensure a well-rounded academic core that enhances technician education.

***2 Establish Regional Partnerships***

- 2.1 Cultivate relationships with high school educators and administration that will lead to the development and implementation of UAS technician education. Northland recently established a working relationship with the North Valley Career and Technology Center (NVCTC) in Grafton, ND

## NSF-ATE Proposal

### Northland Community & Technical College – Proposal Narrative

in support of the goals outlined in this project. NVCTC provides a shared resource for local high schools to enhance technician education in many disciplines. This project will allow for the expansion into UAS education at the Center.

- 2.2 Leverage the University of North Dakota's existing UAS Center of Excellence for Research, Education and Training in developing UAS curriculum and pathways.
- 2.3 The FAA designated test sites will also be leveraged for broader impact of dissemination to the other test site locations, which will also have similar growing needs for technician education in UAS.
- 2.4 Develop a communications plan and survey with industry partners for active engagement on career pathway developments.
- 2.5 U.S. Northern Command Customs and Border Protection have one of the longest standing histories of UAS operations in the national airspace with the Predator MQ-9 UAS. CBP leadership and their supporting contractor, General Atomics Aeronautical Systems Inc., will provide subject matter expertise for this project and host tours of their operations. The United States Air Force operates one of the largest UAS in production at the Grand Forks Air Force Base. Air Force leadership and their supporting contractor Northrop Grumman Corporation will provide subject matter expertise for this project and host tours of their operations for parents and prospective students to become further educated on UAS.
- 2.6 Build a deeper relationship with military veterans at the Air Force Base to identify ways to better meet the needs of work schedules through flexible training opportunities leveraging the online and hybrid delivery of the UAS program.
- 2.7 Reaching parents and family will be a key strategy to foster interests of the future technician workforce for the UAS industry.

### **3 Articulation Agreements**

- 3.1 Establish articulation agreements with high schools interested in preparing students for technical career that requires post-secondary education. Articulation agreements will provide academic and occupational pathways that will lead to careers in aerospace disciplines. These will include the core UAS maintenance disciplines such as advanced avionics, advanced composites, computers, and UAS specific operational concepts.
- 3.2 Working through partnerships with secondary school educators, we plan to evaluate and demonstrate the need of specific secondary education areas such as math and sciences that have a direct tie to post secondary aerospace programs.
- 3.3 Leverage Northland's existing Cisco Tele-presence video conferencing rooms as a tool to reach into high school classrooms presenting special guest speakers sessions and a way to deliver UAS related education courses.
- 3.4 Research high school faculty credentials needed to teach aerospace related courses.
- 3.5 Identify transfer of veteran Military Occupational Skills (MOS) into Northland's aerospace programs by working with the Global Hawk UAS maintenance training team at the Grand Forks Air Force Base and appropriate leadership.

### **4 Conduct Workshops and Summer Camps**

- 4.1 Host faculty workshops for secondary and post secondary educators about UAS and curriculum that can be integrated into the classroom. Northland will work to establish articulation agreements for courses that can be offered for dual credit providing a pathway into Northland's related UAS program. Educators will be provided with curriculum and materials needed to integrate this UAS related curriculum into existing STEM related career technology programs.
- 4.2 Host summer camps targeted for secondary students interested in exploring career opportunities surrounding UAS and highlighting the importance of STEM related classes in their current education. Secondary instructors will be invited to help facilitate these camps and provide a direct link to the education and career pathways.

### **5 Dissemination of UAS educational curriculum and best practices**

## NSF-ATE Proposal

### Northland Community & Technical College – Proposal Narrative

- 5.1 Northland faculty will publish educational articles in aviation related magazines and send copies to participating secondary educators for use in the classroom establishing a link between post secondary education programs and secondary students.
- 5.2 Develop a variety of resources posted on the Northland website including announcements about the professional development workshops and summer camps.
- 5.3 Evaluation surveys completed by employers will be used to modify existing curriculum and update best practices.
- 5.4 Provide Minnesota Department of Employment and Economic Development (DEED) Veterans Office with information and materials for dissemination at WorkForce Centers and staff meetings for outreach to veterans.

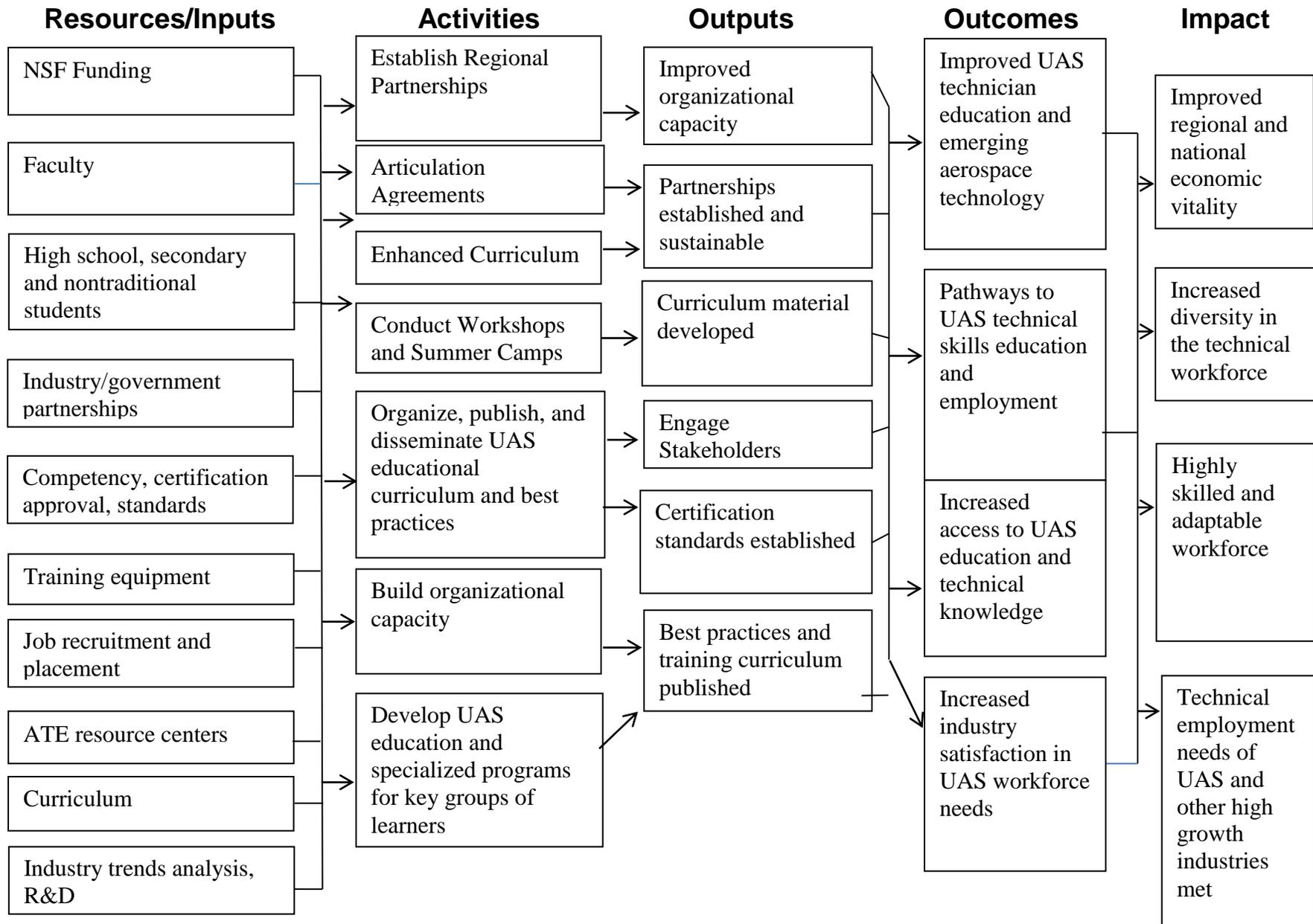
#### **6 *Build organizational capacity***

- 6.1 Identify a communications strategy designed to leverage already established partnerships within the Minnesota State Colleges and Universities (MnSCU) system.
- 6.2 Identify a communications strategy designed to engage and collaborate with community partners in education, government and industry.

#### **7 *Develop UAS education and specialized programs for key groups of learners***

- 7.1 Develop classroom curriculum for UAS related courses focused on key groups of learners.

NSF-ATE Proposal  
 Northland Community & Technical College – Proposal Narrative



NSF-ATE Proposal  
Northland Community & Technical College – Proposal Narrative

**UNIQUE POPULATIONS TO BE SERVED.** In addition to the traditional two-year college student, three unique populations will be served: (1) Secondary and Post-Secondary Students; (2) Non-Traditional Students; and (3) Veterans.

**Secondary and Post-Secondary Students:** The future of the U.S. economy relies on the skills of its workforce, particularly those skills needed to succeed in high-growth, high-demand industries in science and technology. The Bureau of Labor Statistics reports that the most significant job gains for 2006-2016 will be in scientific/technological jobs (5.9%).<sup>iv</sup> However, numerous studies point to the realization that the nation's students lack essential STEM (Science, Technology, Engineering and Mathematics) skills. One international assessment revealed that U.S. 15-year-olds rank 28<sup>th</sup> in the world in math literacy and 24<sup>th</sup> in science literacy.<sup>v</sup>

In addition to growing concerns around STEM proficiency, legislators and educational institutions are exploring methods to increase general interest in STEM and STEM-related occupations. Data from ACT indicates only one-third of 8<sup>th</sup> and 12<sup>th</sup> graders express interest in STEM majors and careers. The challenge rests in increasing students' proficiency in STEM and interest in pursuing STEM occupations. Being a new and emerging technology allows Unmanned Aircraft Systems to capture the imagination and inspire youth into STEM related education and career fields. The proposed secondary and post-secondary outreach and curriculum emphasizes early engagement and enrichment in STEM concepts, spurring increased proficiency and greater likelihood to pursue STEM careers.

Northland will partner with the Pine to Prairie Cooperative Center to link to eight schools in Minnesota that participate in Project Lead the Way (PLTW). PLTW is an established national program that provides STEM curriculum in K-12 schools. According to a survey of PLTW students at the end of their senior year, 70% indicated that they intend to study engineering, technology, computer science, or another applied science, and 93% intend to pursue at least a two-year or four-year degree after high school. Additionally PLTW participation was significantly related to persistence into the second year of college, especially for those students who had taken three or more PLTW courses.<sup>vi</sup> Concepts from UAS, Imagery Analysis and related fields will be integrated into existing PLTW curriculum. Following the one-year pilot in eight selected PLTW schools, Northland will work to expand UAS curricular offerings into all PLTW schools in Minnesota. Northland's confirmed partnership with the Pine to Prairie Cooperative will also link Northland to the Minnesota state association for PLTW, which will aid in disseminating information about the inclusion of UAS-related concepts in PLTW and build interest around integrating these concepts in other schools statewide. The UAS curriculum developed could eventually be adapted for existing PLTW curriculums nationwide.

Northland will also provide concurrent enrollment opportunities related to UAS, and similar fields. Research shows that students who participate in dual enrollment are more likely than their peers to finish high school, enter college and complete a degree. This means dual enrollment can greatly benefit students in rural areas, which report lower college-going and postsecondary attainment rates than other locales. However, rural areas face unique challenges in providing high-quality dual enrollment programs<sup>vii</sup> Concurrent enrollment courses will be taught by high school faculty members who are certified to administer college-level courses, either in-person or online. These courses prepare students for the rigors of higher education, and provide a seamless pathway from high school to college, as credits can be transferred to appropriate programs at technical institutions. Providing UAS education through PLTW and concurrent enrollment will also further Northland's connection with a variety of parties, including the Minnesota State Colleges and Universities system, which oversees articulation from these programs to higher education institutions, and a wide variety of faculty and personnel from MnSCU colleges, who oversee course development for the programs. PLTW and concurrent enrollment, coupled with the information about career opportunities provided by Northland, strengthen a pathway of education and career resources for those pursuing UAS related disciplines.

**Nontraditional Students—Incumbent, Underemployed, Unemployed, and Displaced Workers and Adult Learners:** Developing on-line and hybrid materials using Northland's high-tech aerospace training equipment, labs and Cisco Tele-presence system will foster an environment leading to increased access by non-traditional students. With the UAS program focusing on multiple areas of advances in the aerospace industry, there are many opportunities incumbent workers can use to enhance skills and increase career opportunities in specialized disciplines.

## NSF-ATE Proposal

### Northland Community & Technical College – Proposal Narrative

Companies have begun using the certifications obtained through Northland's aerospace education program as preferred hiring qualifications for careers as UAS maintenance technicians. With a positive hiring climate for aviation maintenance technicians many students are pulled between continuing to advanced certifications and entering the workforce with minimum qualifications. Opening more flexible opportunities and developing pathway models to careers in UAS will illustrate the benefit of continued education and help to fill a growing need.

The grants Northland received from the DOL American Recovery and Reinvestment Act in 2010 and 2011 fostered the development of a strong relationship with local Adult Basic Education and WorkForce Centers to identify and prepare adult learners through the KeyTrain and WorkKeys program, which are interactive online learning tools used to identify career aptitude and assess skill level. Northland will employ these relationships, tools and strategies to assist adult learners in locating learning opportunities.

**Veterans and Military Spouses:** Credentials in UAS Maintenance and related disciplines are excellent options for veterans and soldiers returning from Operation Iraqi Freedom and Operation Enduring Freedom. Training in UAS Maintenance, Imagery Analysis, and related fields provides excellent opportunities for this audience. Many times, the Federal Aviation Administration will take into consideration skills acquired during military service through the individual review of the Military Occupational Specialty certificate. The Thief River Falls WorkForce Center employs a Veterans Services staff member in its Northland campus office to aid in veteran recruitment. This office has direct access to counterparts at the regional Veteran's Administration Outreach Office, including support efforts with the Wounded Warriors "Warrior to Work" program and the Transition Training Academy.

Northland will use internal resources and the partnerships with Minnesota Department of Employment and Economic Development DEED Veterans Office to communicate education and career opportunities to a veteran audience. UAS marketing and communications materials will be distributed at regular WorkForce Center staff meetings on campus and within DEED's office to share information about UAS related discipline programs, discuss the program's requirements and applicability to skills held by veterans. DEED's Senior Veterans' Employment Representative will share information specific to UAS related disciplines during workshops veterans participate in prior to separating from the military, as veterans often seek information about potential educational opportunities during these workshops.

#### **ROLES OF EXTERNAL PROJECT PARTNERS.**

1. *Secondary Education:* The Pine to Prairie Cooperative will connect Northland with Project Lead the Way schools in Minnesota. The Cooperative will facilitate the relationship between Northland and eight pilot schools to test the UAS-related STEM curriculum. The Cooperative will assist in curriculum development and review, articulation agreements, and information dissemination. In addition, concurrent enrollment opportunities through Northland will allow high school students to take 100-level courses in UAS, and related fields as juniors and seniors in high school. Students can take these courses for college credit to transfer to Northland's technical programs. Northland will also work with schools in Minnesota currently offering elective courses in aviation studies, which will be enhanced as a result of the developed UAS curriculum.
2. *Higher Education/Research and Development:* The University of North Dakota UAS COE will extend its longstanding relationship with Northland to the proposed project by providing access to R&D opportunities, providing feedback on curriculum, and continuing development and improvement to articulation agreements. The Minnesota State Colleges and Universities (MnSCU) will provide Northland with academic leadership and connections to two- and four-year institutions across Minnesota as well as leverage the MnSCU Transportation Center of Excellence for synergistic activities.
3. *Advanced Technological Education Centers:* 360° Manufacturing and Applied Engineering ATE Regional Center of Excellence will provide support with respect to best practices for summer camps, collaboration on curriculum, recruitment for programs and dissemination of project outcomes and deliverables. The National Resource Center for Materials Technology Education (MatEd) will collaborate in the project areas of high performance composite materials. MatEd will provide curriculum resources for composites instruction based on research and industry validated core competencies for composite technicians. The National Resource Center for Aerospace Technical Education (SpaceTEC) will support the project with composites and avionics curricular materials and access to SpaceTEC and CertTEC activities and resources. ASTM and NCATT will

## NSF-ATE Proposal

### Northland Community & Technical College – Proposal Narrative

provide certification standards for UAS maintenance technicians and will provide updates as changes are made.

4. *Industry:* Northrop Grumman and General Atomics will provide subject matter expertise for curriculum development and review, ensure curriculum aligns with industry standards, and support summer camps for faculty, secondary and post secondary students.
5. *Statewide Economic Development:* Minnesota Governor Dayton has indicated that UAS and its related business and employment opportunities align with his priorities for statewide economic development, and visited Northland College on October 10, 2011 for a Regional Economic Development Summit. DEED's Veterans Office will aid in disseminating information to a veteran audience.

**MANAGEMENT PLAN,** Northland Community and Technical College will act as the fiscal agent for this project. The PI and Co-PI will meet monthly to review project activities and progress towards planned outcomes and will be accountable to the Dean, the Vice President of Academic Affairs, and to the President.

#### **KEY STAFF POSITIONS AND ROLES.**

Principal Investigator (PI): Jonathan Beck is a military veteran with 15 years of aerospace experience. Jon is uniquely suited to fulfill the position as a PI for this project with 10 years of direct experience working in the advancing field of Unmanned Aircraft Systems. Mr. Beck helped to establish the Minnesota Army National Guard's first UAS organization serving as a Standardization Operator overseeing the development of the education and evaluation programs for Pilots, Sensor Operators and Maintenance personnel. He has served two tours performing UAS operations in Iraq. Following his second deployment he worked as an instructor at Fort Huachuca, Army headquarters for UAS education and training. In 2009, he was selected for a team to establish a new Army program, the Gray Eagle (Predator Variant UAS). Mr. Beck served as a team lead overseeing the initial curriculum development of the program until 2011, at which time he came to Northland to help develop and implement the nation's first UAS Maintenance Training Program.

The PI will hold the ultimate responsibility for all grant activities, including grant implementation, communication at all levels, evaluation, sustainability and reporting. The PI will also assist in the planning and execution of professional development opportunities and summer camps, provide regular reports on project financial information, outcomes and activities to Northland administration and the NSF project officer. The PI will compile annual reports as well as a final project report and a project outcomes report for the general public. Reports will be submitted through NSF's electronic reporting system. The PI will also respond to annual surveys through Western Michigan University to provide data about students and educators impacted by the project and will provide any other data required by NSF.

Co-Principal Investigator (Co-PI): Co-PI, Thomas Biller is a 25 year retired Air Force military veteran. Mr. Biller holds a BA in education and was a lead trainer at Cannon Air Force Base for aviation maintenance education and training. His primary experience in the military was focused on advanced aircraft electronic systems (avionics). Avionics are a critical element to UAS. The Co-PI will assist in the planning and execution of his duties under the PI's direction.

**NSF INVOLEMENT.** The PI will maintain close communication with the appropriate program officer throughout the project. He will also maintain close communication with the Mentor provided through the NSF ATE Mentor-Connect Program who helped guide the proposal. He will adhere to all NSF requirements, including the data management and mandated reporting, and any other requirements of NSF.

**SUSTANABILITY PLAN.** This project will become sustainable through several crucial strategies. A key aspect of sustainability rests in staying abreast of new and emerging technologies, and ensuring professional development opportunities maintain focus on the cutting-edge of technology, which will continue impacting future industry technician training. The PI will be responsible for engaging in quarterly industry meetings to learn about current and future technologies and update or revise activities based on industry landscape.

To ensure financial sustainability, the PI will work with partners in industry, academia, workforce development and other sectors to coalesce the current sustainability efforts of each entity, and will work

NSF-ATE Proposal  
 Northland Community & Technical College – Proposal Narrative

with project and college leadership to strategize the most effective mechanisms to continue the project’s work. A number of strategies will be investigated and pursued, including: increased student enrollment resulting from inspiring secondary students into this STEM technician program; assigning a fee to summer camps and professional development sessions beyond the grant; pursuing public and private funding opportunities to continue growing operational capacity; and seeking industry investment into their future technicians.

**EVALUATION PLAN.** Dr. Sandra Mikolaski and Dr. Manjari Wijenaike will serve as external evaluators for this project. Mikolaski and Wijenaike each have over 19 years of experience with National Science Foundation grants and programs serving the community college arena. They were the founding staff at the National Workforce Center for Emerging Technologies (NWCET, Bellevue WA) and led the Center from 1995 to 2010. NWCET was of the first NSF ATE Centers of Excellence in Information Technology education. They have served as Principal, Co-Principal Investigators and Senior Personnel on numerous ATE projects; and work as technical monitors, consultants, and advisors to several ATE projects. They evaluate grant progress; work with NSF grantee teams on project management, planning, and dissemination; and conduct research and analysis for recommendations on program improvement. They currently serve as Senior Team Members on *Mentor-Connect: Leadership Development and Outreach Initiative for ATE* working to coach new PIs and community colleges through the NSF grant process.

At the start of the project, the evaluators will meet with the PIs and project team at Northland Community and Technical College to develop a set of mutually agreed upon formative and summative evaluation goals, activities, and deliverables. The **formative evaluation component**, which is crucial to the success of this project and therefore requires a continuous feedback loop, will provide the framework for improvements especially in the areas of *regional partnerships, enhanced curriculum, articulation agreements, and successful implementation of workshops and summer camps*. Findings will be delivered to the PI and grant team at least twice each year based upon analysis of processes and quarterly milestones and the efficacy of how project tasks are carried out. Data collection methodologies for the external evaluation will include both quantitative and qualitative data (from interviews, observations, and focus groups with project stakeholders).

The **summative evaluation component** seeks to measure and document the project’s progress toward its goals and the impact of the project as a whole in terms of broader impact and intellectual merit. Baseline project data (both descriptive and comparative data) will be gathered through focus groups (rapid ethnography) when feasible, and phone/online surveys with students, faculty, college administrators and industry stakeholders. This data will track: a) qualitative enhancements in UAS professional development for faculty; b) quality and relevance of new UAS curriculum produced; c) opportunities created for education/employment of underrepresented populations and students from rural areas; and d) the dissemination and implementation of UAS curriculum and supporting educational resources.

<b>Project Activities/Deliverables</b>	<b>Evaluation Activity</b>	<b>Evaluation Deliverable</b>
Establish regional partnerships	Monitor/describe number, diversity of partnerships through interviews with stakeholders	Report on level of engagement of stakeholders, sustainability of partnerships, and improved organizational capacity
Set up articulation agreements	Monitor/describe participation and process of articulation agreements and impacts for students	Report on improved pathways to UAS technical skills, education, and employment
Develop enhanced curriculum	Monitor/describe process for designing courses and implementing curricula	Report on (1) faculty/student response to enhanced curriculum (2) successful completion of learning outcomes and (3) industry satisfaction of student preparation
Conduct workshops and	Onsite	Report on how camps and

NSF-ATE Proposal  
Northland Community & Technical College – Proposal Narrative

summer camps	observations/descriptions of workshops and camps with special focus on engagement of secondary students and pathways for non-traditional students, veterans, military spouses	workshops improve access to and knowledge of UAS technical skills and emerging aerospace technology
Organize, publish, and disseminate UAS educational curriculum and best practices	Assess the quality and quantity of certification standards established and best practices/training curricula published and interview employers	Report on levels of increased industry satisfaction with recruiting qualified employees and adaptability of workforce; accessibility of resources on website; and usability of new curriculum
Build organizational capacity	Interview college administrators for their perceptions of improved collaborations among education, government, and industry	Report on communications strategies for increasing awareness of UAS education and careers
Develop UAS education and specialized programs for key groups of learners	Interview/survey students and faculty to evaluate the number and diversity of increased opportunities, better partnerships with secondary schools, and enhanced classroom practices	Report on industry and student perceptions of increased economic vitality, diversity of workforce, and availability of jobs/employees. Report on data gathered from secondary schools about effectiveness of hybrid delivery of curriculum

**DISSEMINATION PLAN.** Northland’s website will be leveraged as a platform for dissemination of project results, outcomes, and progress. The website will include a variety of resources including announcements about the professional development workshops and summer camps hosted by the project. This website will house a variety of media applications to offer visitors interactive resources regardless of their geographic location; resources will include videos of teaching demos, sample lesson plans, and communications and marketing tools for higher education institutions interested in secondary education STEM outreach in their regional schools.

The educational articles Northland faculty will write and have published in aviation related magazines which will be sent to high schools, will also provide a platform for education on UAS and the advancing technology in the aerospace industry. The magazines will also be used to highlight the workshop and summer camp opportunities, and capture and market future events.

In addition, Northland will develop UAS education and career pathways materials including information about UAS applications to distribute to a wide variety of audiences, including industry partners, secondary schools, and prospective students. These presentations will outline industry projections and the many applications of UAS. The presentations will serve both as communications and marketing tools and sources of education about UAS and related disciplines.

**BROADER IMPACTS OF PROPOSED ACTIVITIES.** Integration of UAS into the National Airspace System is underway at six test sites across the county and will create a revolutionary force changing aviation and the demands for future technician education. The FAA’s plan for full integration of UAS is scheduled to be complete by September of 2015. The time to prepare is now. The pathways model and curriculum generated by this project will meet the growing demands placed on the Red River Valley Region. Relationships between secondary, post secondary, resource centers, and industry will be better-aligned and lead to higher quality education. It will also allow for implementation in other regions immediately affected by the integration of UAS and the growing careers in related disciplines. Providing opportunities for faculty to continue advancing their life-long learning in aerospace related technologies will be a driver to cultivate the next generation of technicians who understand the difference in training and education and value of being a life-long learner.