

## **Abstract - Alabama A&M University**

This initiative seeks to increase awareness of DoD science and technology priorities such as: artificial intelligence/machine learning, biotechnology, cybersecurity, microelectronics and hypersonics/space to prepare for careers in national security and DoD science and technologies. The multi-university team consisting of: Alabama A&M University, a Historically Black College and University (HBCU); University of Houston–Victoria (UHV), a Hispanic Serving Institution (HSI); and Navajo Technical University (NTU), a Tribal College, will bolster the number and quality of eligible minority STEM students successfully participating in defense-related internships and career opportunities in the greater Huntsville, AL area and beyond. All project participants will be US citizens.

The primary public benefit of this effort is to broaden DoD exposure and employability of participants with secondary benefits to enhance the retention and knowledgebase of minority STEM students attending AAMU and its sister MSI institutions, UHV and NTU. These goals will be met by supplementing the traditional STEM classroom environment with multi-step year-round programs to: 1) introduce the students to the necessary soft skillsets necessary to succeed in the demanding DoD science and technology modernization priority areas; 2) give qualified students an in depth exposure to one or more topics within the DoD priority areas through faculty mentoring on a DoD-relevant project; and 3) match exceptional student candidates to co-op and internship opportunities within DoD and industry facilities that require real deliverables and workplace accountability.

To accomplish these goals, a three-phase pipelined approach is proposed to improve relevant technical skills, retention, level of participation in DoD fields and career success of minority students pursuing STEM disciplines. The innovative 3-step approach consists of: 1) A certificate program designed for 60-YR1, 80-YR2, and 80-YR3 eligible minority STEM students with financial incentives to complete a 14-week course, which consists of two workshop sessions per week alternating between technical DoD priority areas and career readiness; 2) A 10-week, on-AAMU campus summer program for 30-YR1, 40-YR2, and 40-YR3 certified students from Step 1, who applied and competed for slots in the program. The students participate in faculty subject matter expert (SME)-led projects. Faculty SMEs cover multiple designated DoD priority areas. Successful completion requires demonstration of technical competence and workplace acumen; 3) On-campus skill-based, matchmaking to align individual student's skills with DoD needs. Successful students from the Step 2 summer internship opportunity will qualify for marketing to regional DoD government and industry employers and ongoing AAMU contracting efforts. A dedicated Human Resource/Career Specialist will work with qualified students and government/industrial partners to accelerate job placement (co-op and internships), which match individual student's skills and interests with the needs of the partners.

The proposed program will help focus the interests and hone the technical skills of the participant students while facilitating a pipeline of highly qualified minority STEM graduates capable of strongly contributing to the future workforce of the DoD. These experiences will reinforce students' confidence and aptitude by building technical and basic employability skills, as well as impart a sense of responsibility and ownership in the defense mission. For sustainability, partnerships with local and national DoD agencies will be enhanced by the quality and availability of the supplied workforce. This will lead to increased contracting opportunities for AAMU within the Federal marketplace.

## **Abstract - Center for the Innovative Training of Youth STEM NOLA**

STEM NOLA is a community-based non-profit organization founded by New Orleans native, and former award-winning tenured Tulane University Engineering professor, Dr. Calvin Mackie. The mission of STEM NOLA is to grow future innovators, creators, and entrepreneurs through inspiration, engagement, and exposure to opportunities in the fields of Science, Technology, Engineering and Math (STEM). STEM NOLA recognizes that there is a lack of quality STEM educational opportunities (for both students and educators) geared toward underserved and military-dependant families. STEM NOLA also recognizes that the Department of Defense (DoD) is the largest employer of scientists and engineers in the United States, and as such, the DoD must maintain a robust pipeline of STEM talent by investing in educational STEM activities to ensure the DoD attracts the best and brightest talent this nation has to offer. In response to the issues highlighted above, through the support of the Department of Defense's Funding Opportunity HQ0034-20-S-FO01, STEM NOLA will fund a suite of programs in four communities across the Gulf South, all of which contain a strong military presence. The DoD-supported programming, and associated project outcomes, that will occur in each of these communities are as follows:

-12 STEM Saturdays (four in each community per year): STEM Saturdays deliver high-quality, hands-on STEM education activities in a community-based setting. STEM NOLA's DoD-supported STEM Saturdays will provide STEM programming to participants in grades K-8, utilizing modules aligned to national educational standards. STEM NOLA anticipates that 2000+ students will participate in STEM Saturdays per community and that 2000+ families will register for information on further engagement. Through participating in STEM Saturdays, 85 percent of participating students and families will develop increased interest in STEM learning and STEM careers and 85 percent of participating families will be better equipped to support student learning.

-Four weeks of STEM-focused summer camps: STEM NOLA's DoD supported summer camps, which will be held in all four communities highlighted throughout this proposal, will provide high quality STEM-based instruction to students in grades 3th-8th for four weeks. 100 students will attend summer camp programming in each community annually and 85 percent of participating students will build increased knowledge of, and interest in, STEM learning, improve STEM career readiness and show improved academic achievement on parent surveys.

-Quarterly Professional Development for teachers in local schools: Throughout these professional development sessions, teachers will receive training to implement strategies that engage students in STEM activities, encourage opportunities to explore possible solutions, develop explanations for phenomena under investigation, elaborate on concepts and processes, and evaluate and assess their understanding based on evidence. STEM NOLA will serve 100 teachers and educational leaders through these professional development workshops. Ninety percent of these participants will report greater confidence and skill with STEM instruction on pre and post survey and that they are integrating high-quality STEM experiences into their curriculum and their students are expressing greater interest in STEM.

If successful, STEM NOLA's DoD supported programming will positively impact DoD capabilities by improving and expanding the talent pool for STEM-based careers within the DoD. STEM NOLA's programming will achieve this through high-quality educational programming that provides underrepresented and military-connected families with the skills and knowledge they need to succeed in DoD-based STEM careers while also improving teacher's ability to provide high-quality STEM instruction with the K-12 educational system.

## **Abstract - Cook Inlet Tribal Council Inc.**

*Operation Innovation: Enriching K-8 STEM education through digital fabrication* addresses the problem of the limited capacity of Alaska's public schools to develop an inclusive Science, Technology, Engineering, and Math (STEM) education ecosystem, resulting in poor STEM proficiency outcomes in many of Alaska's schools and school districts, particularly among Alaska Native students, who are persistently under-represented in STEM.

To improve the capacity of Alaska's education systems and communities to create impactful STEM educational experiences for students and teachers, the project will develop and test culturally- based instructional units aligned with National Science Standards, provide training and professional development for K-8 teachers, support an on-line community of practice, and install digital fabrication equipment in Alaska schools in 3 communities in 3 different school districts. To generate introductory awareness in STEM subjects and supplement understanding of foundational concepts in STEM, the project will demonstrate use of digital fabrication equipment in participating schools. To increase the number of K-8 students in Alaska who use 21<sup>st</sup> century technology, the program will deliver culturally based digital fabrication activities to K-8 students in participating schools. To build STEM skills and literacy in an evidence-based and innovative manner among Alaska students, the program will increase the frequency at which students served by the program engage in STEM practices and use STEM literacy skills.

The project's technical approach is based on a rationale that includes education strategies field-tested by the applicant and high quality independent educational research. It combines use of digital fabrication technology (the Fab Lab) with culturally-based instruction and project-based learning. The anticipated outcomes of the effort include the improved quality of resources and abilities associated with STEM education in Alaska, improved engagement of an underserved population in STEM, and increased exposure of an underserved population to STEM opportunities. Over 3 years the program will develop 12 new instructional modules, train 12 teachers, serve 6 schools, generate 260 cumulative student enrollments, and achieve a 10% increase in STEM engagement and STEM literacy among participating students.

The project will impact DOD capabilities by adding a culturally-informed digital fabrication program serving elementary and middle school students to the existing suite of DOD STEM offerings, increasing the number of available early intervention programs, and diversifying the range of educational strategies represented by DOD STEM programs. With its emphasis on reaching under-served and under-represented populations, the project will contribute significantly to realization of DOD STEM Goal 4 (Promote).

## **Abstract - Goshen Education Consulting**

STEMKAMP is a summer, co-curricular camp that provides hands-on experiences in Science, Technology, Engineering and Mathematics for Kids (i.e., dependents) of Active Military Personnel (STEMKAMP). This program is a multi-state rollout of a successful STEM camp framework to 10 military connected school districts through 2023 that will reach up to 3,750 3<sup>rd</sup> – 8<sup>th</sup> grade students.

STEMKAMP supports the mission of the DoDSTEM strategic plan goal to INSPIRE youth and engage the community in STEM education and outreach in the K-12 domain. This is completed by supporting and enhancing student and educator participation in DoD-sponsored STEM events. The summer camps will be open to all children in the military connected school districts but will target and give preference to kids of active military personnel (KAMPers).

**Problem:** Military connected communities do not have ready access to STEM Summer camps. These types of programs have shown positively results for linking students to STEM careers and keeping future STEM professionals in the educational pipeline. An analysis completed with six military connected, collaborating districts demonstrated that only 3 of the districts had an available camp within a 20-mile radius and the median cost for a one-week program was in excess of \$500, which is beyond the reach for most military families. Only one of these programs served 3<sup>rd</sup> – 5<sup>th</sup> graders. These problems are exacerbated when one considers dependents of active military personnel have high mobility rates and emotional stressors related to their parent(s) unpredictable and possibly life-threatening occupations. All the military connected school districts agreed that a local STEM camp would be well attended and would be well supported by the local teachers.

**Program Objectives:** Goal 1: Connect a network of STEM related informal education organizations with military connected school districts. Goal 2: Expand the successful STEMgirls camp to a nationwide STEMKAMP.

**Technical Approach:** Goshen Education Consulting and iBIO Institute will partner with 10 military connected school districts across the United States with an existing successful hands-on summer science camp for 3<sup>rd</sup> – 8<sup>th</sup> grade students. The five-day summer camp will help students connect critical thinking and problem-solving skills to a wide variety of STEM careers through hands-on experience with STEM concepts and access to STEM professionals. As a result, students will gain a better understanding for current STEM careers, develop basic engineering skills, practice higher-order thinking skills, and gain the self-confidence and motivation to continue a path toward a STEM career. The cognizant state organizations associated with the Coalition of State Bioscience Institutes will be engaged to provide regional support to the military connected school districts to work toward local sustainability by the end of the program period.

**Anticipated Outcomes:** The three SMART summative outcomes are: (1) 7 of the programs will be 80% sustainable after program completion in Summer 2023, (2) 40% or more of KAMPers will want to have a STEM Career as an adult each year of the camp, and (3) 60% or more of KAMPers will identify a scientist at the “Inquiry” level each year of the camp using the Draw a Scientist Survey.

## **Abstract - Hillsborough County Public Schools**

Hillsborough County, which approximates the size of the state of Rhode Island, includes Tampa, a large urban city, and several outlying municipalities and communities. Hillsborough County is economically, ethnically, and linguistically diverse, with 27% of families speaking a language other than English. Serving the families in this region is Hillsborough County Public Schools (HCPS), the 7th largest school district in the nation. HCPS has 296 school sites and enrolls over 223,000 students. Currently, 59% of HCPS students are considered economically disadvantaged, as compared to the state average of 53.9%. There are 160 HCPS schools designated as Title I due to the large percentage of students from low socio-economic backgrounds. Eighty-eight percent of HCPS schools have at least one student who is classified as military-connected.

Though HCPS offers a number of STEM educational opportunities, the district lacks an intentional connection between existing offerings and DoD STEM career pathways. Thus, the goal of HCPS' *K-8 Pipeline to DoD Careers* project is to increase the number of students who are prepared for the 21<sup>st</sup> century DoD STEM workforce. This goal will be accomplished by focusing on three objectives: 1) enhancing the district's capacity to offer innovative STEM programming related to DoD focus areas; 2) improving the educational opportunities for students in DoD STEM fields; and 3) encouraging students to more deeply engage in DoD STEM fields. The project is designed with the knowledge that to be most impactful, students should have opportunities for STEM learning in both formal and informal settings. Thus, the district's project consists of two main components: development of a rigorous, engaging, in-school curriculum; and out-of-school time opportunities offered throughout the school year and each summer to augment the formal STEM offerings. Each component will encompass activities designed around core themes connected to the DoD science and technology priorities of cybersecurity, robotics, computer science and coding, and aerospace and rocketry.

As a result of the project activities, HCPS expects a variety of short and long-term outcomes that will ultimately impact DoD capabilities and help achieve DoD's STEM Mission to, "attract, inspire, and develop exceptional STEM talent across the education continuum to enrich the current and future DoD workforce to meet defense technological challenges." To this end, HCPS anticipates the following short-term outcomes: increased district capacity to offer coordinated STEM education; increased student competency in STEM; increased student awareness of DoD STEM careers; and increased number of students interested in continuing STEM education in order to pursue DoD STEM careers. Additionally, the following long-term outcomes are expected: increased student readiness for advanced STEM coursework in middle/high school; increased student readiness for STEM higher education that will lead to DoD career; and the production of shareable guidance for other districts.

## **Abstract – RTI International**

Science, technology, engineering, and mathematics (STEM) have long represented catalyst disciplines for U.S. modernization, discovery, and technological innovation. America's continued global competitiveness in the 21<sup>st</sup> century demands a well-prepared and diverse STEM workforce. This vision can only be achieved by strengthening the foundational driver of future STEM talent: equitable access to high-quality STEM education opportunities for youth.

STARward STEM will facilitate transformative STEM enrichment through transdisciplinary project-based learning (PBL). PBL is a teaching method in which students learn by actively engaging in real-world, hands-on projects that require the application of knowledge across disciplines. An evidence-based approach, the Federal STEM Strategic Plan specifically cites PBL as a high-impact technique to foster STEM enrichment for students and communities.

The scope of annual program impact includes more than 4,622 K–12 school students and 303 educators in the Cumberland County School district of North Carolina. STARward STEM will directly support a feeder pattern of 10 schools (one high school, two middle schools, seven elementary schools) whose student population is 72% economically disadvantaged and 81.5% racially underrepresented in STEM. Program objectives include:

1. Improve teacher efficacy through the structured implementation of STEM PBL.
2. Increase student engagement in meaningful STEM learning experiences.
3. Expand STEM participation for student populations typically underrepresented in STEM.
4. Increase youth interest in STEM career pathways and DoD STEM opportunities.
5. Build capacity of Cumberland County Schools to sustain STEM PBL implementation through regional partnerships to support STEM learning for students and teachers.

STARward STEM will focus on Space, a capability and resiliency modernization priority of DoD Research and Engineering. The program culminates by sending students' actual projects to the International Space Station for experimentation aboard a commercial rocket launch. The experiment is then returned to the students for additional data analyses. The program will be phased in over 3 years, where the first year will include planning, co-design, curriculum alignment, and PBL implementation with teachers. One of the features that differentiates RTI's PBL support is the use of integrated instructional coaching. This method of development provides one of the strongest known effect links between educator practice and student achievement. The second and third years will focus on deep PBL implementation with a job-embedded approach to minimize loss of instructional time. Student experiment launches will be conducted in years 2 and 3.

An implementation and outcome research study will be conducted each program year. Research questions are aligned to the following outcomes: Increased district capacity to support implementation of STEM PBL, increased teacher STEM content knowledge, increased teacher self-efficacy in STEM PBL, increased quality of teachers' STEM lessons, improved student attitudes toward STEM, increased student awareness of STEM postsecondary and career opportunities, and improved student interest in STEM career pathways. Intended impacts include, (1) Sustained support in the district for high-quality STEM PBL; (2) Increased number of teachers consistently implementing STEM PBL throughout district; (3) Increase in students pursuing advanced STEM courses in high school; (4) Increased number of students choosing STEM pathways in postsecondary life; (5) Increased number of students entering STEM careers; and (6) Increased interest in DoD STEM careers.

## **Abstract - Trident Technical College**

The **Building Outreach Opportunities to Motivate and Inspire the Next Generation in STEM** (BOOMING in STEM) initiative will help address acute STEM workforce needs in the Charleston, South Carolina, region by leveraging existing college and community resources to create new engagement experiences. Clear pathways for students to explore STEM options and train for STEM careers will strengthen and expand the regional talent pipeline and help address the need for well-trained, diverse employees in fields such as advanced manufacturing and cybersecurity, critical DoD priorities.

Project goals:

- 1) Build a clear STEM workforce pathway that begins with engagement for youth and connects them to relevant coursework in K-12, Trident Technical College (TTC) programs, internships with Joint Base Charleston (JB CHS) and Naval Information Warfare Center Atlantic, and apprenticeships with TTC and local industry, and then guides interested students into baccalaureate and graduate programs
- 2) Serve military-connected students by providing engaging outreach activities and by strengthening the STEM resource infrastructure and activities at Joint Base Charleston's Child and Youth Center
- 3) Broaden the participation of underserved and rural communities through partnerships and outreach opportunities
- 4) Create sustainability through project activities and relationships with educational, community, and industry partners

TTC proposes a multifaceted and community-based approach to increase the number of individuals entering STEM careers, building a clear pathway from initial interest to engagement opportunities to coursework that leads to employment. Project staff will work with partners to create this educational pathway, which will use engaging STEM activities to immerse K-12 students in learning experiences beyond the four walls of school.

Project staff will offer STEM outreach activities to military-connected, rural, and disadvantaged youth, will work with the JB CHS Child and Youth Program to support STEM programming, will offer both a Manufacturing Institute and non-credit coursework to teens, will share information with youth and teens about internship and apprenticeship opportunities, as well as STEM and DoD career opportunities, and will educate youth and teens about the educational requirements for STEM careers and help connect them to educational opportunities.

The proposed BOOMING in STEM project will address the National Defense Education Program's aim to "maintain a robust pipeline of STEM talent by investing in pre-kindergarten through undergraduate STEM activities." Focusing particularly on youth from 7-18, the proposed project will improve the capacity of TTC and the Charleston area to motivate students through impactful STEM educational experiences. Through these experiences and through meaningful collaboration with educational, community, and industry partners, students will be inspired to pursue careers in critical STEM fields. The BOOMING in STEM project will help prepare the future DoD workforce to meet defense challenges in alignment with DoD and Federal STEM Strategic Plans.

## **Abstract – University of Illinois, Chicago**

### **Educational and Research Training Collaborative: Workforce Development for National Defense**

The project will create a unique program of long-term mentored research experiences for undergraduate students at the University of Illinois at Chicago (UIC) in order to prepare and engage students for technical careers in the interest of national defense. We will recruit academically talented students, prioritizing student veterans, interested in majoring in science, technology, engineering or mathematics (STEM) areas. Students will form academic cohorts and engage in multi-part experiential research training with a focus on DoD priorities as part of the proposed program. We propose to match students with academic mentors engaged in research of relevance to DoD modernization priorities for three years of individualized mentorship. In addition, students will participate in summer workshops and activities with the goal of building a student community and increasing their sense of ownership of their research. Within the cohort forming activities, the students will participate in the co-Laboratory, a summer bridge program that will provide an introduction to the research process, and the Problem Solvers Summer Institute for Defense, where our students will work within teams to become familiar with some of the most pressing scientific and technical problems facing the DoD. The capstone of the program will be placement of selected students in DoD laboratory internships for 10 weeks between their junior and senior years. We will examine the impact of our program on the students' GPA, time-to-graduation, and most importantly, choice of STEM careers or post-graduate school with the help of an experienced evaluator that will perform both formative and summative evaluations. Finally, we propose a UIC DoD Day to bring together UIC students and faculty with scientists at DoD Laboratories to foster collaboration and stronger interactions between the institutions. In the setting of a large, diverse public Research I institution, we lay out a blueprint to bring together UIC students and faculty in scientific and technical disciplines with DoD Lab scientists to create a sustainable network for the future.



## **Abstract – University of Illinois, Urbana-Champaign**

The overall goal of this project is to increase the number of students and enhance the education of students pursuing careers in space. The objective is to create an integrated set of educational resources, implement them strategically in undergraduate classrooms, K-12 classrooms, outreach events, and workshops, and assess their efficacy in achieving our goal. The public benefit of the project is expanded opportunities, materials, and resources for enhancing K-12, undergraduate, teacher/professor, and general public knowledge and understanding of DoD science and engineering, specifically as it relates to space, and broader publicity, dissemination, and awareness of DoD internships, fellowships, and STEM careers. These benefits are assured to be distributed and implemented broadly because we leverage our existing network of relationships with institutions in our State, Region, and across the Country.

We create three main types of educational resources: (1) a web-based self-study platform of massive open online courses (MOOCs) by space experts; (2) hands-on activities and kits incorporating environmental testing, AI, and rocket propulsion; and (3) an undergraduate student design challenge focused on vertically landing a model rocket. We then implement these materials, activities, and tools strategically across the country by leveraging our state-wide, regional, and national partners (academic, non-profit, government) who are already engaged in undergraduate and K-12 STEM education, teacher training, and K-12 and general public outreach. Perhaps most importantly, we incorporate assessment throughout the project. We work closely with the University of Illinois I-STEM Center for Innovation in Teaching and Learning (I-STEM/CITL) to incorporate education best practices and integrate assessment tools and metrics. We thereby assess and quantify the efficacy of our program and achievement of our goal.

The technical rationale for this approach is rooted in research related to enhancing student learning and attracting students to STEM careers. The types of educational resources we plan to develop have been shown to greatly enhance student foundational knowledge, hands-on capabilities, and overall engineering design aptitude. Our project idea is to create an *integrated* set of educational resources focused on space, specifically: (1) MOOCs containing videos and handbooks created by space experts; (2) hands-on kits with space-relevant sensors, avionics, and robotics; and (3) an undergraduate student design challenge to vertically land a model rocket. We then implement these space education resources strategically in undergraduate classrooms, K-12 classrooms, outreach events, teacher training events, and workshops.

The organization and integration of educational resources we develop is organic and inherent to our project. Resource type 1 is a set of four MOOCs focused on foundational information domains relevant to space. These are linked with resource type 2 that includes four packages of hands-on kits focused on core technologies relevant to space. Resource type 3 is a student design challenge focused on designing, building, demonstrating, and competing against rival teams to vertically land a model rocket. The student design challenge has three tier levels of competition (basic, intermediate, advanced) and leverages the foundational information students acquire using resource type 1, as well as the hands-on skills and capabilities students develop using resource type 2.

## **Abstract – University of Southern California**

**Problem:** A major challenge to building a STEM workforce is promoting entry, retention, and persistence of undergraduate students, as less than half of college entrants intending to major in a STEM field complete a STEM degree within five years, and less than six percent of non-STEM majors eventually change to a STEM major. Projections indicate that between 400,000 and 2 million STEM positions may be unfilled by 2025. Although mentoring can grow STEM career pipelines by improving retention and diversity of students, it is difficult to scale up mentoring.

**Solution:** Our project will fill this gap by developing and disseminating CareerFair.ai, a web-based portal where: a) students can interact for free with virtual STEM professionals in DoD priority areas; and b) STEM professionals can build their own intelligent mentors. In a prior ONR STEM grant, we developed MentorPal: a machine-learning natural language understanding (NLU) system that can be automatically trained to identify the most appropriate response to an input question by processing video-recorded answers. Our project will scale this up, by developing a self-serve platform for recording and publishing virtual mentors. The result will be a sustainable, expanding virtual career fair where students can talk to a diverse array of professionals to learn about different pathways to STEM careers. Core objectives are:

- 1) Enabling STEM professionals to build virtual mentors to amplify their mentoring impact;
- 2) Scaling up virtual mentorship to thousands of college students, especially underserved ones;
- 3) Conducting a large-scale efficacy study on the impact of virtual mentorship on knowledge and understanding, and level of interest, related to career development in STEM.

**Impact:** CareerFair.ai is the first outreach project to empower outreach stakeholders to create their own AI agents. This represents not just the first such project for STEM outreach, but the first framework for non-specialized authors to build their own AI-driven virtual human. A key impact of this approach is that it can scale up: High-impact mentors will be made available to all students, anywhere, even at home (e.g., web browser, smartphone). Thus, this project will have an immediate impact and build a lasting outreach infrastructure.

**Direct Impact:** Our project will strengthen STEM pipelines through undergraduate institutions that disproportionately educate underserved students (low-income, under-represented minority, or first-generation to attend college), who persist in STEM at lower rates. CareerFair.ai will increase awareness, interest, and career planning strategies for DoD-critical STEM careers (e.g., cybersecurity, AI, biotechnology, quantum computing). Our first site is the largest California State University (CSU) campus, in Fullerton (CSUF), which has 34,812 undergraduate students, of which 70% are underserved. CareerFair.ai outreach there will support a larger, more diverse STEM workforce. CareerFair.ai will be embedded and promoted in multiple centers, starting with the CSUF career center (8,000 unique visitors/year). Moreover, the system will bridge students and STEM professionals by enabling contact with mentors and connecting students to on-site resources (e.g., alumni, career fairs, workshops).

**Outreach Infrastructure:** Higher education STEM pipelines are leaky nationally: students are often unaware of STEM opportunities, and at least 1 million graduates could be added to the STEM workforce if students intending to major in STEM persisted to complete a degree. Successful results at CSUF in Y2 will be leveraged to expand outreach to the broader CSU system (481,210 students; largest US four-year public university system) and members of the California Community Colleges System. Finally, the software will be provided with full government-purpose rights and will be available for sharing STEM and other types of expertise to support DoD training needs.

## Abstract – University of Toledo

*Nurturing STEM in Early Childhood for Military Connected Families* (NURTURES) is a STEM program that provides a holistic approach to Early Childhood (EC) science education. It targets 135 teachers, ~2,700 students, and ~10,800 family members in preschool through grade 3. NURTURES combines teacher professional development (PD) (composed of a two-week Summer Institute (SI) and academic year support including monthly online learning community meetings and one-on-one coaching) with family engagement in scientific inquiry via family science activity take-home packs (FSP) and Community Events hosted at schools or in the community. Teaching EC science has been linked to student gains in reading, writing, and mathematics. However, science, and in particular inquiry-based science, is rarely taught to young children. NURTURES addresses this problem by adapting a proven-effective innovative program from a typical face-to-face format to an asynchronous modality and distant delivery to expand its reach to EC teachers serving military-connected children and families. NURTURES is well suited for the mobility of military families because our research has demonstrated value-added impacts on students' learning that carry over into middle school. Objectives include: 1) improving teaching and learning outcomes through science integrated with technology, engineering, and mathematics, 2) providing an innovative approach that combines teacher PD with family and community engagement, 3) inspiring and developing early STEM talent, 4) helping foster the future STEM workforce early in a child's education, 5) adding to DoD STEM programs by offering programming that includes preschool and early grade students, 6) improving the capacity of educational systems by including families and communities, 7) teaching families how to engage children in STEM learning to promote lifelong STEM learning, 8) focusing on broad geographic areas of the US, giving priority to underrepresented and underserved communities to cultivate diverse student interest and ability in STEM, 9) enhancing the educational experiences of students, parents, and teachers, and 10) providing a strategy for program sustainability. The University of Toledo (UT), Georgia State University (GSU), and Washington School Research Associates (WSRA) will team with military-connected partners that include military bases, military-connected schools, and Purple Star schools with all branches of the military represented. UT, GSU, and WSRA will serve as program facilitators. In year 1 of this 3-year project, we will provide face-to-face SIs (hosted by each higher education partner) at Purple Star Schools in Ohio and schools linked to Fort Benning and Joint Base Lewis-McChord. Synchronous communication will connect the 3 sites. Video of sessions will provide material to be used online later. Year 2 will offer blended PD where participants meet in person and facilitators use packaged video (developed from the prior summer), Guidebooks, and inquiry materials to run their respective SIs. Year 3 will offer a fully asynchronous experience to teachers throughout the USA. The technical infrastructure will utilize established, cross-platform online systems that are widely accessible, thereby offering a pathway to sustainability of the program. SIs will introduce teachers to the process of distributing the FSP and best practices for hosting Community Events. The Community Events are flexible so that teachers can link them to their local area. At the conclusion of the project, we will have identified the affordances and constraints of changing the NURTURES program to online and distant delivery focusing on *fidelity* (quality), *outcomes*, and *sustainability* for military-connected participants. A mixed-methods approach is used in both the research and evaluation plans providing a comprehensive look at the effectiveness and impact of the program on teachers, students, and families.

## **Abstract - Virginia Polytechnic Institute and State University**

This program will establish a proactive early-university classroom introduction for students to the core mission and career opportunities involved in national defense. By providing a controlled atmosphere where clearable U.S. citizen students can learn about both research methodology (common to many schools) and ITAR-level DoD-/IC-relevant missions and use cases (unique), we can begin to instill students with a passion for national service, while also preparing them for on-campus experiential learning activities that will facilitate their entry into future internships.

Developed by faculty members at the VT Hume Center, we have successfully established an ITAR-controlled classroom experience via an *Intro to Restricted Research* course that informs and recruits students into DoD / IC careers. Using this class to bolster our ITAR-controlled experiential learning pipelines will help embed students in an environment that currently achieves a 75% conversion rate of students into careers supporting national defense.

The proposed program elements for introducing undergraduates to restricted research fall in four primary areas: (1) formalizing approval for *Intro to Restricted Research* as a regular course offering, (2) expanding curriculum development to include a broader range of case studies, (3) curate support from a consortium of DoD contractors and internal VT stakeholders for endowed support, and (4) initiate expansion of the course offering to other schools in Hume's experiential learning network via recorded sessions, guidelines on establishing their own similar programs, and inclusion in Hume's National Security Education Program.

- **Formalized Course Offering Approval:** all stakeholders involved within VT have approved the special studies offering, with conversion to a regular class planned after two completed semesters. This conversion to a 'regular' course will provide access to student tuition dollars that help subsidize future teaching of the class.
- **Curriculum Development:** given our intent to engage a broad spectrum of majors in the class, we plan to create course materials for additional deep dive sessions for DoD systems.
- **Consortium-based Endowment:** given the broad interest in clearable workforce development, we plan to establish a consortium-based endowment to ensure the sustainability of the course. A significant portion of the long-term support will be via Virginia Tech's tuition model.
- **Curricular Outreach:** by leveraging existing partnerships with HBCUs, the other senior military institutes, and the Commonwealth Cyber Initiative partners, we will broaden the audience for introducing undergraduates to restricted research as well as future career opportunities in the DoD.

Our goal is to transform the prototyped course offering and make it a bedrock of the internal recruitment pipeline for these students, building interest early in their academic careers. The funding will also allow us to diversify the offering to broader audiences, fitting perfectly within the Hume Center's chartered mission of DoD/IC workforce development.