DEFENSE SCIENCE, TECHNOLOGY, ENGINEERING,
AND MATHEMATICS EDUCATION CONSORTIUM

ANNUAL PROGRAM REVIEW

OPTION YEAR ONE REPORT
SEPTEMBER 1, 2020—AUGUST 31, 2021

COOPERATIVE AGREEMENT
AWARD NUMBER
W911NF1920007
DEFENSE STEM EDUCATION CONSORTIUM

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<th>Description</th>
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<tbody>
<tr>
<td>AFB</td>
<td>Air Force Base</td>
</tr>
<tr>
<td>AIR</td>
<td>American Institutes for Research</td>
</tr>
<tr>
<td>BEST</td>
<td>Building Engineering and Science Talent</td>
</tr>
<tr>
<td>C4C</td>
<td>Counselors for Computing</td>
</tr>
<tr>
<td>C4I</td>
<td>Command, Control, Communications, Computers, and Intelligence</td>
</tr>
<tr>
<td>CEE</td>
<td>Center for Excellence in Education</td>
</tr>
<tr>
<td>CEMSE</td>
<td>Center for Excellence in Mathematics and Science Education</td>
</tr>
<tr>
<td>CMC</td>
<td>Consortium Management Committee</td>
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<tr>
<td>COVID-19</td>
<td>Coronavirus Disease</td>
</tr>
<tr>
<td>CGEST</td>
<td>Center for Gender Equity in Science and Technology</td>
</tr>
<tr>
<td>CREATE</td>
<td>Center for Research on Educational Equity, Assessment, and Teaching Excellence</td>
</tr>
<tr>
<td>CRP</td>
<td>College Readiness Program</td>
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<tr>
<td>DMV</td>
<td>The metropolitan region that includes Washington, DC; Maryland; and Northern Virginia</td>
</tr>
<tr>
<td>DRSC</td>
<td>Dayton Regional STEM Center</td>
</tr>
<tr>
<td>DoD</td>
<td>Department of Defense</td>
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<tr>
<td>DoDEA</td>
<td>Department of Defense Education Activity</td>
</tr>
<tr>
<td>DSEC</td>
<td>Defense STEM Education Consortium</td>
</tr>
<tr>
<td>FIRST</td>
<td>For Inspiration and Recognition of Science and Technology</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<td>---------</td>
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<tr>
<td>HBCU</td>
<td>Historically Black Colleges and Universities</td>
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<tr>
<td>IPA</td>
<td>Individual Program Administrator</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>K-12</td>
<td>Kindergarten Through 12th Grade</td>
</tr>
<tr>
<td>K-16</td>
<td>Kindergarten Through 12th Grade and Postsecondary Education Programs</td>
</tr>
<tr>
<td>LTF</td>
<td>Laying the Foundation</td>
</tr>
<tr>
<td>MI</td>
<td>Minority-serving Institution</td>
</tr>
<tr>
<td>MSRTC</td>
<td>Middle School Research Teachers Conference</td>
</tr>
<tr>
<td>MSU</td>
<td>Morgan State University</td>
</tr>
<tr>
<td>NCWIT</td>
<td>National Center for Women &amp; Information Technology</td>
</tr>
<tr>
<td>NMSI</td>
<td>National Math and Science Initiative</td>
</tr>
<tr>
<td>RSI</td>
<td>Research Science Institute</td>
</tr>
<tr>
<td>SNA</td>
<td>Social Network Analysis</td>
</tr>
<tr>
<td>STEM</td>
<td>Science, Technology, Engineering, and Mathematics</td>
</tr>
<tr>
<td>TIES</td>
<td>Teaching Institute for Excellence in STEM</td>
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</table>
This Annual Program Review provides a summary of activities and outcomes executed by the Defense Science, Technology, Engineering, and Mathematics Education Consortium (DSEC) over Option Year One, September 1, 2020–August 31, 2021.

OVERVIEW

Launched in 2019 by the Department of Defense (DoD), DSEC is a collaborative partnership that aims to broaden STEM literacy and develop a diverse and agile workforce with the technical excellence to defend our Nation. By addressing and prioritizing critical STEM challenges, DoD is investing in evidence-based approaches to inspire and develop the Nation’s science and technology workforce. The consortium is aligned to the Federal STEM Education Strategic Plan.

To achieve its goals, DSEC is organized into five management elements:

• **Element 1**, which provides leadership and coordination of DSEC, including planning and execution of consortium-wide deliverables;

• **Element 2**, which manages data collection, assessment/analysis, and reports for DSEC;

• **Element 3**, which promotes DoD STEM and DSEC as a coordinated and cohesive effort offering students and teachers a pipeline of STEM educational opportunities;

• **Element 4**, which implements STEM alumni studies that focus on targeted DSEC outcomes (i.e., building interest in and awareness of STEM careers in and outside of the DoD) among participants; and

• **Element 5**, which ensures that STEM outreach activities are supported, are of high quality, and are coordinated across all partner programs and initiatives.

During Option Year One, the management elements launched various initiatives to increase the effectiveness and efficiency of consortium operations, while maintaining the structures and processes that have led to DSEC’s successes in the base year. Of note, all elements collaborated to expand the Amaze online platform from a basic communications portal into a more robust event tracking and data management system.

During Option Year One, 111,758 students, educators, and other participants were served through DSEC.
Additionally, Element 1 launched the DoD STEM Ambassadors program to amplify the work of outstanding STEM teachers from across the Nation and extended the reach of DSEC through an Advisory to engage additional STEM partners in guiding the overall plans and activities of the consortium. Element 2 continued to support partners with how to use data to improve their outreach efforts. Element 3 launched a redesigned dodstem.us website and established and grew social media following for DoD STEM across Twitter, Facebook, Instagram, and LinkedIn. Element 4 finalized the design, development, and testing of the alumni surveys to document the purpose of the alumni studies and the processes to finalize the surveys. Element 5 supported the onboarding of seven new Innovation Bloc partners and led four HBCU/MI institutions in the design of successful proposals to join DSEC in Option Year Two.

With structures and processes refined by the management elements, DSEC programming reached students in all 50 states in the Nation, the District of Columbia, and the United States territories of Puerto Rico and Guam in Option Year One up from 39 states during the base year. DSEC’s impact in specific geographic regions of the country with large percentages of military-connected students was greater due to the consortium’s hub strategy. As shown in Exhibit 1 below, DSEC supports regional hubs in San Diego, California; Dayton, Ohio; and the Washington, DC, Maryland, and Virginia (DMV) area.

Several international programs also reach the DoD Education Activity regions of the Americas, Europe, and the Pacific.
My generation, perhaps more than any other, will have complex and pressing problems to face. We need problem solvers that can help make a difference, and because of the skills I’ve gained, I’m ready to be one of them.

– Student participant, MATHCOUNTS
The Defense STEM Education Consortium (DSEC) is purposefully designed to foster cohesion with the United States DoD and federal science, technology, engineering, and mathematics (STEM) strategic priorities. This section summarizes the strategic rationale and organizational approach of the consortium.
OVERVIEW
The DoD depends on nearly 300,000 STEM professionals across the Defense Laboratory Enterprise to meet national defense challenges and modernization priorities (outlined in the appendix). Aligned to the Federal STEM Strategic Plan, the DoD is investing in evidence-based approaches to inspire and develop the science and technology workforce pipeline across the United States.

VISION
Envisioned as a 5-year, up to $75 million investment, DSEC’s strategy is grounded in five consortium fundamentals to which all programming and activities align:

DSEC Fundamentals

| **Engage** students and educators in meaningful STEM experiences | DSEC will engage K–16 students and educators in meaningful formal and informal DoD STEM learning experiences. |
| **Serve** students who are military-connected and underrepresented in STEM | DSEC will focus on serving students who are underrepresented in STEM (as defined by DoD STEM).¹ |
| **Connect to the DoD STEM workforce** | DSEC will ensure STEM experiences are connected to the DoD STEM workforce and DoD careers. |

How will DSEC support these three priorities in a unique and innovative way?

| **Leverage** the network as a force multiplier | DSEC will leverage the consortium as a force multiplier to amplify the reach, visibility, and outcomes of DoD STEM. |
| **Evolve** the approach based on data | DSEC will use a data-driven approach to evolve and evaluate how DSEC operates over time to ensure positive outcomes for students and educators. |

Each of these consortium fundamentals is backed by research literature (see the base-period Annual Program Review for details) that supports the causal pathway among activities, outputs, outcomes, and ultimately DoD STEM’s desired impact.

¹Official DoD STEM definitions of underserved, underrepresented, and military-connected are included in the Appendix.
STRATEGIC ALIGNMENT

The DSEC strategy is purposefully aligned to both the Federal and DoD STEM Strategic Plans.

The Federal STEM Strategic Plan presents a vision for a future where all Americans will have lifelong access to high-quality STEM education, and the United States will be the global leader in STEM literacy, innovation, and employment. It is intended to serve as a “North Star” for the broader STEM community as it collectively charts a course for the Nation’s success. The plan sets forth three goals:

- **Build Strong Foundations for STEM Literacy** by ensuring that every American has the opportunity to master basic STEM concepts and to become digitally literate.
- **Increase Diversity, Equity, and Inclusion in STEM** and provide all Americans with lifelong access to high-quality STEM education, especially those historically underserved and underrepresented in STEM fields and employment.
- **Prepare the STEM Workforce for the Future**—both college-educated STEM practitioners and those working in skilled trades that do not require a 4-year degree—by creating authentic learning experiences that encourage and prepare learners to pursue STEM careers.

The 2021–2025 DoD STEM Strategic Plan is aligned with the federal plan through its mission to *inspire, cultivate, and develop exceptional STEM talent through a continuum of opportunities to enrich the current and future DoD workforce poised to tackle evolving defense technological challenges.* The four goals of the current DoD STEM Strategic Plan are as follows:

- Inspire community engagement in DoD STEM education programs and activities to provide meaningful STEM learning opportunities for students and educators.
- Attract the United States’ and DoD’s current and future STEM workforce through multiple pathways to educational and career opportunities.
- Increase representation of underserved and underrepresented groups in STEM education and workforce development programs, activities, and outreach.
- Advance the efficiency and effectiveness of STEM education and workforce development programs, activities, and outreach through evaluation and assessment.

The Federal STEM Strategic Plan articulates a series of action steps for how the U.S. Government intends to improve STEM education and workforce development for young Americans. These priorities for engagement and development—including STEM Ecosystems, meaningful STEM experiences, work-based learning, transdisciplinary learning, and computational literacy—align with the DSEC fundamentals.

Alignment to the Federal STEM Strategic Plan and DoD STEM Strategic Plan is summarized in *Exhibit 2.*
### Exhibit 2. DSEC Strategic Alignment

<table>
<thead>
<tr>
<th>FEDERAL STEM GOALS</th>
<th>Build</th>
<th>Increase</th>
<th>Prepare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong Foundations for STEM Literacy</td>
<td>Diversity, Equity, and Inclusion in STEM</td>
<td>the STEM Workforce for the Future</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FEDERAL STEM PATHWAYS</th>
<th>Develop</th>
<th>Engage</th>
<th>Build</th>
<th>Operate</th>
</tr>
</thead>
<tbody>
<tr>
<td>and Enrich Strategic Partnerships</td>
<td>Students Where Disciplines Converge</td>
<td>Computational Literacy</td>
<td>with Transparency and Accountability</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DoD STEM GOALS</th>
<th>Inspire</th>
<th>Attract</th>
<th>Increase</th>
<th>Advance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Engagement in STEM</td>
<td>STEM Workforce</td>
<td>Representation by Underserved</td>
<td>Efficiency and Effectiveness</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DSEC FUNDAMENTALS</th>
<th>Engage</th>
<th>Connect</th>
<th>Serve</th>
<th>Leverage</th>
<th>Evolve</th>
</tr>
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<tbody>
<tr>
<td>Students &amp; Educators in Meaningful STEM Experiences</td>
<td>to the DoD STEM Workforce</td>
<td>Students Who Are Military-Connected &amp; Underrepresented in STEM</td>
<td>the Network as a Force Multiplier</td>
<td>the Approach Based on Data</td>
<td></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>RTI International</th>
<th>Overall consortium management and strategy that promotes collaboration and sustainability</th>
<th>DSEC alignment to and coordination with DoD STEM</th>
<th>DSEC portfolio prioritization</th>
<th>DSEC communications and networking</th>
<th>Lead STEM alumni studies and engage in consortium evaluation / improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Institutes for Research (AIR)</td>
<td>Consortium, hub, and program evaluation</td>
<td>Coordination of evaluation agenda with DoD STEM</td>
<td>DSEC priority questions and data collection</td>
<td>Outreach partner program improvement</td>
<td>Lead data collection, analysis, and evaluation</td>
</tr>
<tr>
<td>Building Engineering and Science Talent (BEST)</td>
<td>Supporting collaboration through STEM outreach partner coordination</td>
<td>Liaise with DoD STEM and DoD laboratories</td>
<td>Outreach partner portfolio management</td>
<td>Outreach partner coordination</td>
<td>Engage in consortium evaluation / improvement</td>
</tr>
<tr>
<td>Dayton Regional STEM Center</td>
<td>Professional development for educators and collaboration to bring a variety of experiences and exposures to STEM pathways for students</td>
<td>Emphasis on military-connected communities</td>
<td>Emphasis on military-connected and underrepresented</td>
<td>Activity coordination within Dayton hub area</td>
<td>Engagement in hub evaluation and improvement</td>
</tr>
<tr>
<td><strong>DSEC FUNDAMENTALS</strong></td>
<td>ENGAGE Students &amp; Educators in Meaningful STEM Experiences</td>
<td>CONNECT to the DoD STEM Workforce</td>
<td>SERVE Students Who Are Military-Connected &amp; Underrepresented in STEM</td>
<td>LEVERAGE the Network as a Force Multiplier</td>
<td>EVOLVE the Approach Based on Data</td>
</tr>
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<td>---------------------------------------------------------------</td>
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</tr>
<tr>
<td><strong>Morgan State University CEMSE</strong></td>
<td>Professional development for educators and collaboration to bring a variety of experiences and exposures to STEM pathways for students</td>
<td>Emphasis on military-connected communities</td>
<td>Emphasis on military-connected and underrepresented</td>
<td>Activity coordination within DMV hub area</td>
<td>Engagement in hub evaluation and improvement</td>
</tr>
<tr>
<td><strong>University of California, San Diego – CREATE</strong></td>
<td>Specific Math Academy professional development and collaboration to bring a variety of experiences and exposures to STEM pathways for students</td>
<td>Emphasis on military-connected communities</td>
<td>Emphasis on military-connected and underrepresented</td>
<td>Activity coordination within San Diego hub area</td>
<td></td>
</tr>
<tr>
<td><strong>Arizona State University: Center for Gender Equity in Science and Technology (ASU CGEST)</strong></td>
<td>Culturally relevant cyber education and outreach activities for middle and high school girls</td>
<td>Programming aligned to DoD STEM careers</td>
<td>Emphasis on girls and students of color</td>
<td>Activity focus near DoD installations</td>
<td>Engagement in outreach program evaluation and improvement</td>
</tr>
<tr>
<td><strong>Center for Excellence in Education (CEE)</strong></td>
<td>Rigorous research and problem solving across multiple STEM disciplines with DoD STEM mentors and role models for high school and undergraduate students</td>
<td>Programming aligned to DoD STEM careers</td>
<td>Expansion of recruitment of underrepresented</td>
<td>Extension of student recruitment via DSEC</td>
<td></td>
</tr>
<tr>
<td><strong>Citizen Schools</strong></td>
<td>Experiential and inquiry-based approaches with STEM career mentors cultivating student creativity in science</td>
<td>Programming aligned to DoD STEM careers</td>
<td>Emphasis on underrepresented</td>
<td>Activity focus in DSEC hub areas: emphasis in Dayton</td>
<td></td>
</tr>
<tr>
<td><strong>CYBER.ORG</strong></td>
<td>Hands-on, technology-rich approach to cyber curriculum for students</td>
<td>Emphasis on military communities</td>
<td>Emphasis on military-connected</td>
<td>Activity focus in schools on DoD installations</td>
<td></td>
</tr>
<tr>
<td><strong>For Inspiration and Recognition of Science and Technology (FIRST)</strong></td>
<td>STEM mentors and role models engaging students in learning engineering principles and applications through hands-on experiences</td>
<td>Direct DoD lab engagement and mentorship</td>
<td>Emphasis on expansion of military-connected</td>
<td>Engagement in multi-partner outreach</td>
<td></td>
</tr>
<tr>
<td>DSEC FUNDAMENTALS</td>
<td>ENGAGE Students &amp; Educators in Meaningful STEM Experiences</td>
<td>CONNECT to the DoD STEM Workforce</td>
<td>SERVE Students Who Are Military-Connected &amp; Underrepresented in STEM</td>
<td>LEVERAGE the Network as a Force Multiplier</td>
<td>EVOLVE the Approach Based on Data</td>
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<tr>
<td>Learning Undefeated</td>
<td>Students participate in interactive, hands-on activities and experiences while building relationships with STEM professionals</td>
<td>Programming aligned to DoD STEM careers</td>
<td>Emphasis on underrepresented</td>
<td>Activity focus in DSEC hub area: emphasis in DMV</td>
<td>Engagement in outreach program evaluation and improvement</td>
</tr>
<tr>
<td>MATHCOUNTS</td>
<td>Increases interest and confidence in mathematics through education and outreach opportunities for middle school students</td>
<td>Emphasis on military communities</td>
<td>Emphasis on military-connected and low-income students</td>
<td>Extension of student communication via DSEC and hub programming</td>
<td></td>
</tr>
<tr>
<td>National Center for Women &amp; Information Technology (NCWIT)</td>
<td>Girls and young women interact with computing sciences in fun, creative, and hands-on environments</td>
<td>Programming aligned to DoD STEM careers</td>
<td>Emphasis on girls and women</td>
<td>Engagement in multi-partner outreach</td>
<td></td>
</tr>
<tr>
<td>National Math and Science Initiative (NMSI)</td>
<td>Creates inclusive and STEM-focused mindsets to promote equity in access and success in college-level STEM courses for high school students</td>
<td>Emphasis on military communities</td>
<td>Emphasis on military-connected</td>
<td>Activity focus near DoD installations</td>
<td></td>
</tr>
<tr>
<td>Robeson Community College</td>
<td>Authentic, real-world context and experiences in STEM with working STEM professionals in courses and internship opportunities</td>
<td>Programming aligned to DoD STEM careers</td>
<td>Emphasis on underrepresented</td>
<td>Engagement with DoD mentors and speakers</td>
<td></td>
</tr>
<tr>
<td>San Diego Miramar College</td>
<td>Engages students in high-quality, lab-based biotechnology curricula along with hands-on technical skills and training with STEM professionals</td>
<td>Programming aligned to DoD STEM careers</td>
<td>Emphasis on underrepresented</td>
<td>Activity focus near DoD Installations</td>
<td></td>
</tr>
</tbody>
</table>
### DSEC FUNDAMENTALS

<table>
<thead>
<tr>
<th>Program</th>
<th>Stakeholder</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Society for Science</strong></td>
<td>Students increase their awareness of current, real-world science topics and conduct meaningful research, and educators learn STEM pedagogy and methods to support students</td>
<td>Programming aligned to DoD STEM careers</td>
</tr>
<tr>
<td><strong>St. Petersburg College</strong></td>
<td>Students participate in hands-on, real-world experiences in STEM workforce and build confidence and interest in a STEM career</td>
<td>Programming aligned to DoD STEM careers</td>
</tr>
<tr>
<td><strong>Teaching Institute for Excellence in STEM (TIES)</strong></td>
<td>Collaboration across community stakeholders to ensure equitable access for K-12 students to engage in STEM experiences and learn about STEM career pathways</td>
<td>Direct DoD lab engagement</td>
</tr>
<tr>
<td><strong>TGR Foundation (TGR)</strong></td>
<td>Professional learning focuses on skill development and STEM career connections and accessible resources to increase deep student engagement in STEM</td>
<td>Programming aligned to DoD STEM careers</td>
</tr>
<tr>
<td><strong>USA Science and Engineering Festival (USASEF)</strong></td>
<td>Students and educators participate in STEM learning activities and engage with STEM professionals providing real-world context across a variety of STEM topics</td>
<td>DoD engagement in programming</td>
</tr>
</tbody>
</table>
THEORY OF CHANGE
The five consortium fundamentals work in concert to form a cohesive framework that enables near-term outcomes and long-term impact.

Exhibit 3. DSEC Overall Logic Model

ACTIVITIES
- Outreach partners provide DoD STEM programming serving students and educators
- Regional hubs coordinate with partners and DoD facilities in select communities
- DSEC engages and follows up with DoD STEM alumni
- DSEC provides vision, alignment, coordination, and communication for DoD STEM
- DSEC connects outreach partners to share learning and strengthen programming
- DSEC evaluates its approach using formative and summative methods

OUTCOMES
- Increase student and educator interest and engagement in STEM
- Increase STEM knowledge and skills
- Increase connections among DoD STEM learning opportunities for students and educators
- Increase use of evidence and continuous improvement across DSEC-funded programs
- Increase access to STEM opportunities for military-connected and underrepresented students
- Increase student awareness of and interest in DoD STEM research and careers

LONG-TERM IMPACT
- Increase use of effective STEM learning and instructional strategies
- Increase pursuit of postsecondary STEM and DoD careers
- Increase diversity in STEM and DoD workforce
- Increase STEM preparation for military-connected students
LITERATURE SCAN

In the base year of the consortium (2019–2020), DSEC started to organize its activities according to five fundamentals—engage, serve, connect, leverage, and evolve—each of which were explored within the literature scan presented in the Base Year Annual Program Review. As the consortium evolved during the ongoing coronavirus disease (COVID-19) global pandemic, growing social unrest, and rising inequality, DSEC shifted focus and refined its efforts accordingly. The DSEC Consortium Management Committee (CMC) and DoD STEM staff identified four topics that address the current STEM challenges in Option Year One (2020–2021) and provided strategies on how DSEC can enable equitable STEM access based on an evidence-based approach. These timely, priority topic areas include: (1) COVID-19 and its initial impacts on the U.S. educational systems, (2) STEM education in rural communities, (3) STEM education in community colleges, and (4) social network analysis (SNA) as a tool to understand interorganizational interactions among consortium members.2

COVID-19 and Impacts on the U.S. Educational Systems

The COVID-19 global pandemic forced students, families, teachers, and other education stakeholders to shift to a virtual or hybrid learning environment, affecting the quality of education and exacerbating the inequalities experienced by underrepresented groups. Evidence suggests that the sudden shift to distance learning and school closures are associated with students learning less than they would have otherwise, especially in mathematics (Kuhfeld & Tarasawa, 2020). Kuhfeld and Tarasawa (2020) added that the lower levels of learning are more prevalent among families from economically impoverished circumstances and for students of color. Furthermore, Garet et al.’s (2020) initial report of the National Survey on Public Education’s Coronavirus Pandemic Response revealed that students in economically impoverished circumstances faced instructional challenges caused by a lack of access to technology. These challenges included limited access to high-speed internet in rural and high-poverty districts, which created disparities in distance learning approaches compared with urban and economically advantaged districts. Gaps such as the digital divide and the homework gap, which is defined as the “gap between school-aged children who have access to high-speed internet at home and those who don’t” (Vogels, 2021) exacerbate issues of learning loss that disproportionately impact students who are underrepresented in STEM (Nemer, 2015). DSEC’s commitment to underrepresented groups requires concentrated attention to disparities that students and educators may experience in online learning environments. As DSEC learns more about the lessons of COVID-19’s influence on K–16 education, the consortium will continue to evolve its approach in providing equitable access to STEM education.

STEM Education in Rural Communities

One of DSEC’s main goals is to broaden STEM literacy and develop a diverse workforce by expanding access and resources to students who are underrepresented and face barriers in STEM. Students from rural areas are among those who face several challenges that prevent them from accessing STEM opportunities and entering a STEM career. Inadequate access to a quality STEM curriculum (e.g., Advanced Placement courses, extracurricular activities), a lack of resources (i.e., district funding), and a lack of quality STEM teachers and counselors are some of the barriers within rural communities (Grimes, Arrastia-Chisholm, & Bright, 2019; Henley & Roberts, 2016; Morton et al., 2018; Rivera et al., 2019). These barriers negatively impact students’ preparation for postsecondary education, which is associated with under-enrollment in STEM degree programs (Rivera et al., 2019; Saw & Agger, 2021). Engaging rural students in STEM by offering quality access and resources is vital for providing equitable access to STEM education. Munn et al. (2018) reported that STEM engagement programs that include demonstrations, hands-on activities, outreach from STEM professionals, and college prep information are positively associated with increases in student engagement and interest in STEM. In addition, providing access to a networked system of mentors and opportunities to learn about college resources can help develop rural students’ interest in attending college (Rivera et al., 2019). Furthermore, place-based education can be used to increase rural students’ engagement in STEM education. Place-based education is a pedagogical approach that integrates the academic curriculum and students’ local community, allowing students to connect and apply their knowledge to current local issues (Zimmerman & Weible, 2017). In rural communities, place-based education allows students to incorporate STEM knowledge within their local community and learn how STEM education impacts their daily life (Harris & Hodges, 2018). Combined with experiential learning, place-based STEM education leads to increased student interest and engagement, which helps develop STEM literacy (Clark et al., 2015). Leveraging these pedagogical approaches and resources will enable DSEC to expand STEM access through formal and informal learning experiences while increasing engagement for students in rural communities who often face barriers in entering STEM.

2The “broad strokes” literature scan focused on identifying research relevant to DSEC’s goals. Our process was to scan peer-reviewed articles, white papers, and relevant reports that described the challenges, successes, and key lessons that can be learned to support the foundations of DSEC activities.
STEM Education in Community Colleges
As the consortium continuously aims to increase STEM literacy and develop a diverse workforce, DSEC has evolved its efforts to improve access for students to pursue STEM careers by expanding opportunities to include community college students. Community colleges serve nearly half of all U.S. undergraduate students: 41% of all U.S. undergraduate students and 39% of first-time, first-year students attend community colleges (American Association of Community Colleges, 2021). The accessibility and affordability of community colleges make these institutions an important resource for addressing STEM workforce needs (National Academy of Engineering & National Research Council, 2012). Students underrepresented in STEM are a DSEC priority and are largely served by community colleges who have high numbers of low-income, military-connected, and first-generation college students (American Association of Community Colleges, 2021). The workforce-oriented training and programming that community colleges offer support STEM pathways for students who are underrepresented and allow them to progress through postsecondary degrees and certifications (Noy & Zeidenberg, 2017). Transfer student success programs (i.e., transfer partnerships; Jackson et al., 2013) and undergraduate research experiences (Strawn & Livelybrooks, 2012) leverage community college resources and improve the experiences of students who are underrepresented in STEM pathways. Still, community college STEM students require additional support, such as mentoring and collaborative research environments, to enhance self-efficacy in STEM (Amelink et al., 2015) and obtain STEM degrees on time (within 2 years; Malcom & Feder, 2016). Leveraging community colleges to enrich students’ experiences in STEM aligns with DSEC’s continued efforts to improve access to STEM careers and to address the challenges of developing a diverse STEM workforce.

Using Social Network Analysis to Understand Interorganizational Interactions Among Consortium Members
DSEC operates as a network of STEM education partnerships among academia, not-for-profit organizations, and government. Understanding the interorganizational interactions and relationships among consortium members is essential to continuously enhancing the work of DSEC and increasing student and teacher opportunities in STEM. A growing body of literature suggests that the structure of relationships may have significant implications for what a network can accomplish (Greenberg et al., 2017; Nowell, 2009; Plastrik et al., 2014). Yet understanding the structure of relationships within a network can be challenging. SNA is an effective methodology for understanding interactions among organizations by visualizing relationships among network members (Ansell, Reckhow, & Kelly, 2009; Cross, Borgatti, & Parker, 2002; Daly & Finnigan, 2010; Evans et al., 2014) and allowing for statistical analyses that are otherwise hard to define (Borgatti et al., 2018). To understand relationships among members of a network, social network analyses are typically conducted by administering surveys to network participants that ask them to characterize their relationships to other network participants. SNA is an effective evaluation tool that can help stakeholders understand the strength of relationships among stakeholders (Nowell, 2009), promote effective network collaboration (Provan et al., 2005), and evaluate how relationships within a network evolve over time (Akiya, Sanchez, & Rayyes, 2016; Grunspan, Wiggins, & Goodreau, 2014). For example, the results of an SNA may indicate that certain key stakeholders in the network are not interacting with one another or that network members that share similar characteristics (e.g., they are located in the same geographic area) are more likely to interact with one another.

As the evaluation partner, AIR uses social network analysis to better understand interactions among organizations within the consortium by administering an online survey that asks partners to assess the types of interactions occurring among consortium partners. The results of the SNA, found on page 27 of this report, provide insight into the extent to which partners interact along a collaboration continuum, which consists of four distinct interaction types: networking, communicating, coordinating, and collaborating. A description of each level of interaction is included in the survey. The survey also captures the extent to which partners provide support reaching focal populations, such as military-connected students and students who are underserved in STEM. Results of the SNA are shared with the partners and consortium facilitators to generate insights about the types of interactions occurring among organizations, identify partners that may benefit from forming new connections, and understand the extent to which consortium activities support interactions among consortium members. For example, if the SNA shows that an organization interested in reaching military-connected students has not yet interacted with a partner that serves this population, this result could signify an opportunity to connect. Therefore, leveraging SNA as an evaluation tool to understand the relationships and interactions between partner organizations within a consortium can help DSEC expand equitable STEM access and opportunities.
PORTFOLIO AND OPERATIONAL STRUCTURE

DSEC PORTFOLIO

DSEC comprises organizations and institutions in partnership with DoD STEM. Each entity focuses on supporting or delivering unique STEM engagement opportunities for K–16 students or teachers, which align to the five DSEC fundamentals, as shown in Exhibit 4.

Exhibit 4. DSEC Option Year One Partner Organizations and Institutions

Innovation Bloc: The DSEC Innovation Bloc is a flexible allotment of DSEC funds to be periodically allocated to new STEM outreach partners. This vehicle is used to strategically address programming gaps, expand reach, and strengthen DSEC’s alignment to evolving DoD priorities.
REGIONAL HUB STRATEGY

A key component of the DSEC strategy is the emphasis on targeted, place-based programming. The hub approach emphasizes expanding the pool of traditionally underrepresented and military-connected students who are aware of, equipped for, and interested in STEM careers in the national security sector. DSEC has adopted the STEM Learning Ecosystem approach, which functions as a force multiplier in the STEM landscape. Each hub actively develops STEM Ecosystems in their respective region by growing deep partnerships and leveraging efficiencies of scale with multi-sector partners. This allows hubs to broaden participation and enrich accessible, inclusive outreach activities in regions with high concentrations of DoD installations. By cultivating deep local collaboration among diverse stakeholders engaged in STEM and leveraging existing networks, the hubs expand the reach and impact of all DSEC partners while fostering a community of practice mindset.

DoD STEM outreach success in every hub relies upon the collaborative engagement of DSEC partners, DoD installations, educators, and community-based programs. DSEC partners provide high-quality STEM programs, support networks of educators, and build brand awareness of DoD STEM as a trusted resource for advancing STEM for all learners. Hub leadership partners with DoD STEM Outreach Coordinators at installations to build and sustain relationships with local school districts and to provide authentic connections to DoD STEM professionals and awareness of DoD STEM careers (e.g., volunteers, speakers, role models, internship programs, on-site learning opportunities) in higher education settings.

The three DSEC regional hubs are located in San Diego, California (led by UC San Diego CREATE); Dayton, Ohio (led by the Dayton Regional STEM Center [DRSC]); and the Washington, DC, Maryland, and Virginia (DMV) area (led by the Morgan State University [MSU] Center for Excellence in Mathematics and Science Education [CEMSE]).

DSEC HUB STRATEGY GOALS

1. Expand the reach of DoD STEM programs with particular focus on historically underrepresented, underserved, and military-connected students.

2. Establish connections between local STEM programs and create pathways into DoD installations.

3. Identify opportunities to leverage DSEC partner collaboration within and across the hubs.
OPERATIONAL STRUCTURE

DSEC is managed through a five-part organizational structure: Element 1—Overall Consortium Management, led by RTI International (RTI); Element 2—Evaluation and Data Collection, led by the American Institutes for Research (AIR); Element 3—Outreach and Communications, led by RTI; Element 4—DSEC Alumni Studies and Engagement, led by RTI; and Element 5—Strategic STEM Outreach Initiatives, led by Building Engineering and Science Talent (BEST).

Exhibit 5. DSEC Structure
DSEC OUTCOMES

DSEC outcomes are summarized in this section. Information is organized around the five DSEC fundamentals.

A separate data chapter accompanying this report provides full evaluation details and is publicly available at dodstem.us/about/partners.
**Engage** students and educators in meaningful STEM experiences

DSEC will engage K-16 students and educators in meaningful formal and informal DoD STEM learning experiences.

<table>
<thead>
<tr>
<th>STUDENTS</th>
<th>TEACHERS</th>
<th>OTHER PARTICIPANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>107,586</td>
<td>2,417</td>
<td>1,755</td>
</tr>
</tbody>
</table>

**STUDENTS BY GRADE BAND**

- GRADES K-5: 10,421
- GRADES 6-8: 37,357
- GRADES 9-12: 50,383
- 2-YEAR: 1,751
- 4-YEAR: 576
- GRADUATE: 319

Not in School - 225  Not Reported - 6,704

DSEC partners engaged students and educators in **50 STATES + DISTRICT OF COLUMBIA, PUERTO RICO, & GUAM**

Several international programs also reach the DoD Education Activity regions of the Americas, Europe, and the Pacific.
Serve students who are military-connected and underrepresented in STEM

DSEC will focus on serving students who are underrepresented in STEM (as defined by DoD STEM).³

Option Year One Innovation Bloc enabled four new partners to join DSEC. Selection of these partners was informed by the priority to serve student populations who are traditionally underrepresented in STEM and had a focus on the role that community colleges can play in preparing students for careers in biotechnology.

³Official DoD STEM definitions of underserved, underrepresented, and military-connected are included in the Appendix.
**Connect to the DoD STEM workforce**

DSEC will ensure STEM experiences are connected to the DoD STEM workforce and DoD careers.

During Option Year One, DSEC engaged:

- **1,211 Volunteers**
  - 78% of volunteers were DoD affiliated
- **32 Teacher Volunteers**
- **67 Program Alumni**
- **129 Other Adult Volunteers**
- **41 Other Student Volunteers**
- **942 DoD Volunteers**

**Dayton Regional STEM Center (DRSC)** awarded Air Camp scholarships to six middle school students for a 5-day camp and 40 elementary school students for a 2-day camp. Air Camp provides K–8 students with an immersive STEM experience related to flight by focusing on STEM careers and applications at Wright-Patterson Air Force Base. The camps engage various speakers from the Air Force, as well as a trip to the U.S. Air Force Museum, and other hands-on experiences related to STEM and DoD careers.

DRSC offered 1,048 students in the Dayton area a chance to participate in a Virtual Career Fair.

**HUB SPOTLIGHT**

Morgan State University hosted a STEM Expo, which exposed more than 2,700 students to a variety of STEM and DoD STEM jobs and careers, including those affiliated with seven DoD laboratories.

These laboratories included the U.S. Army Combat Capabilities Development Command Chemical Biological Center, the U.S. Naval Research Laboratory, the Naval Surface Warfare Center Carderock/Naval Sea Systems Command, the Army Educational Outreach Program, the Walter Reed Army Institute of Research, DEVCOM Army Research Laboratory, and the U.S. Naval Academy STEM Center.
Leverage the network as a force multiplier

DSEC will leverage the consortium as a force multiplier to amplify the reach, visibility, and outcomes of DoD STEM.

Network connectivity:

- On average, each organization reported connecting to nine other organizations.
- The network has a density of 43%, meaning that slightly less than half of all possible connections occur in the network.

TIES and NCWIT are listed twice because they received Innovation Bloc funding to add additional programming.
Types of network connections:

- **Networking**: exchanging information
- **Communicating**: building a shared understanding
- **Coordinating**: creating complementary programming
- **Collaborating**: jointly designing or delivering programming

80% of connections were networking and communicating.

20% of connections were coordinating and collaborating.
Evolve the approach based on data

DSEC will use a data-driven approach to evolve and evaluate how DSEC operates over time to ensure positive outcomes for students and educators.

DSEC includes two distinct efforts to collect data and use it to inform the strategic approach of the consortium:

- Program Evaluation and Data Collection (Element 2)
- Alumni Studies (Element 4)

During Option Year One,

- All STEM education and outreach partners developed program-specific logic models for consistency in data collection and evaluation.
- Key recommendations from the hub case studies and CMC evaluation were incorporated into the annual program plan for Option Year Two.
- DSEC element IPAs developed new resources to support priority partner needs identified by base-year data, including a shared definition of meaningful STEM experiences, DoD STEM Style Guide, hub case studies, and member spotlights.
- Consortium leadership created a new mechanism for event tracking and data collection to increase efficiencies of ongoing information gathering and data sharing.
ASSESSING THE IMPACT OF DSEC STRATEGY

For DSEC, Option Year One alumni surveys provide preliminary evidence of the impact that DSEC-funded programs have on educators and students.

For educators, DSEC-funded programs had a positive impact on STEM awareness, perceptions, beliefs, and self-efficacy, with the strongest impact on STEM interest, all of which are related to positive student STEM outcomes. Additionally, while educators had positive beliefs about DoD STEM overall, they were less aware of DoD STEM career opportunities.

For students, DSEC-funded programs also had a positive impact on STEM awareness, interest, engagement, and identity; research suggests these factors are related to persistence in STEM, earning STEM degrees, and pursuing STEM careers. Students believed their participation in DSEC programs increased their interest in new STEM topics and working with mentors in STEM, prepared them for more challenging and advanced STEM coursework, and increased their interest in STEM careers.

One of DSEC’s priorities is to increase the number of individuals prepared for and interested in pursuing a STEM career in the DoD. When asked about a STEM career in the DoD, only 10% of students indicated they had such plans, with 52% unsure and 38% not interested. Students from racial/ethnic groups traditionally underrepresented and underserved in STEM were more likely than white and Asian students to consider a STEM career in the DoD (17.4% vs. 8%).

It is important to consider the type of DSEC-funded programs offered to educators and students in Option Year One when reviewing these results. Among students, internship programs reflected the strongest outcomes, on average, while STEM courses showed weaker outcomes than programs. For educators, fellowship programs reflected the strongest outcomes. The intensity and selectivity of these programs may have had an impact on the survey results.

This evidence is preliminary due to low survey response rates (about 45% for educators, about 4% for students) and likely unrepresentative samples for those who responded to the surveys, especially for students. Despite the low response rates, results aligned with patterns found in other research on STEM outcomes for educators and students, suggesting that these results can be useful as a starting point for discussions about and insights into the DSEC STEM program portfolio. The results also guide next steps for DSEC, including the need to share more information about DoD STEM careers with educators and students.
**SPECIAL PROGRAM: DOD STEM AMBASSADOR**

The DoD STEM Ambassador Program was a cohort of 14 educators who partnered with DSEC to advance STEM outreach throughout the 2020–2021 school year. The educators serving in the first cohort of Ambassadors were carefully chosen by DSEC partners to represent their respective organizations and DoD STEM based on their demonstrated history of outstanding commitment to the DSEC fundamentals, particularly for working with students who have been historically underrepresented in STEM and/or are military-connected. In addition to the numerous resources created, each DoD STEM Ambassador authored a blog post that will be featured on the DoD STEM website. They also presented at national, state, and/or local conferences to share DoD STEM resources, with some Ambassadors sharing at more than one conference. A few were featured on local and national news as well. Together, they formed a community of practice that met monthly to network and learn from each other.

**Objectives:**

- Provide resources to teachers who specifically serve targeted populations, especially during the COVID-19 pandemic.
- Recognize outstanding educators and promote deep STEM learning across the nation.
- Collaborate and strengthen relationships across the DSEC STEM Ecosystem.

"The opportunity to collaborate with other STEM teachers around the country with support from DoD STEM is unique and has already been incredibly helpful. I love being a ‘thought partner’ with other educators. For example, I’ve realized that showing students the interconnectedness of the different parts of STEM is just as important as focusing on any one area, such as chemistry or biology."

– Jonté Lee, DoD STEM Ambassador
2020–2021 DoD STEM Ambassadors & Partner Organizations

Vonceil Anderson
Western High School, Baltimore MD

Enrique Arce-Larreta
West High School, Salt Lake City, UT

Laura Drager
Harold Schnell Elementary, West Carrollton, OH

Genevieve Esmende
Wangenheim Middle School, San Diego, CA

Theresa Goltermann
Tabb Middle School, Yorktown, VA

Eriq Hearn
Academy of Richmond County HS, Augusta, GA

Toni Kaui
Nā Hunaahi, Pahoa, HI

Jonté Lee
Calvin Coolidge HS, Washington, DC

Taren Long
Chesapeake Public Charter School, Lexington Park, MD

Elizabeth Proctor
Jasper County HS, Monticello, GA

Chrissy Romero
Nina Otero Community School, Santa Fe, NM

Antia Thomas
Githens Middle School, Durham, NC

Elizabeth Vance
Cope Middle School, Bossier City, LA

Tameka Woodruff
Oxon Hill HS, Oxon Hill, MD
STEM ADVISORY

The DSEC STEM Advisory provides external perspectives on emerging trends in STEM, content expertise, outreach strategy vetting, and outreach support. The invited members of the Advisory serve as critical friends to test ideas, identify gaps, and prioritize areas of focus. The group consists of volunteer members who meet virtually at least twice per year. Members represent a mix of STEM content experts, military-connected professionals, and civilians in STEM roles or organizations. Advisory members have no consortium management responsibilities or voting privileges.

During Option Year One, the STEM Advisory met in November 2020 to review base-year data and provide input into the Innovation Bloc process and content priorities. The group met again in May 2021 to review preliminary data from the alumni studies and provide input into survey questions and additional data to understand the impact of DSEC strategy.

Option Year One 2020–2021 DSEC STEM Advisory Members

- Elizabeth Allan, PhD, University of Central Oklahoma
- Robert Berry, PhD, University of Virginia
- Chantel Dooley, PhD, Tragedy Assistance Program for Survivors
- Daniel Kelly, PhD, Texas Tech University
- Tim McClees, Aerospace Industries Association
- Linda Rosen, PhD, Retired, Change the Equation
- Ivory Toldson, PhD, Quality Education for Minorities Network
- Iris Wagstaff, PhD, American Association for the Advancement of Science
- Eric Wiebe, PhD, Friday Institute for Educational Innovation, NC State University
- Brenda Darden Wilkerson, AnitaB.org
BUDGET SUMMARY

DSEC operates on an annual program calendar of September 1 to August 31. The summary presented in Exhibit 6 represents the DSEC budget that guided operations for Option Year One.

The budget structure for Element 5 (STEM Education and Outreach Partners) is organized into four categories (see Exhibit 7). Each partner’s Option Year One activities are detailed in the next section of the report.

Exhibit 6. 2020–2021 Option Year One Budget

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>FUNDING</th>
<th>PERCENTAGE</th>
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<tbody>
<tr>
<td>ELEMENT 1</td>
<td>$557,988</td>
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<tr>
<td>ELEMENT 2</td>
<td>$1,081,928</td>
<td>7.2%</td>
</tr>
<tr>
<td>ELEMENT 3</td>
<td>$812,828</td>
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<tr>
<td>ELEMENT 4</td>
<td>$414,978</td>
<td>2.8%</td>
</tr>
<tr>
<td>ELEMENT 5</td>
<td>$12,097,711</td>
<td>80.8%</td>
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</table>

TOTAL $14,965,433

Exhibit 7. OY1 DSEC Outreach Partner Funding Structure

<table>
<thead>
<tr>
<th>STEM OUTREACH CATEGORY</th>
<th>DSEC CMC MEMBER</th>
<th>DSEC OUTREACH HUB COORDINATOR</th>
<th>STEM EDUCATION AND OUTREACH PARTNER</th>
<th>DSEC INNOVATION BLOC PARTNER</th>
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<tr>
<td>FUNDING LEVEL</td>
<td>&gt;=$1,500,000</td>
<td>$175,000</td>
<td>$250,000 – $550,000</td>
<td>$175,000 – $450,000</td>
</tr>
<tr>
<td>FIRST</td>
<td>NMSI</td>
<td>Dayton STEM</td>
<td>CEE</td>
<td>ASU CGEST</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSU CEMSE</td>
<td>MATHCOUNTS</td>
<td>Citizen Schools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UC San Diego CREATE</td>
<td>NCWIT</td>
<td>CYBER.ORG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Society for Science</td>
<td>NCWIT – IB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TGR</td>
<td>TIES – IB</td>
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<td>Robeson Community College</td>
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<td></td>
<td></td>
<td></td>
<td>San Diego Miramar College</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>St. Petersburg College</td>
</tr>
</tbody>
</table>
“FIRST has helped me see opportunities to learn and problem solve in all aspects of my life and to encourage others to do the same. … accepting that I will make mistakes, but that means the opportunity to learn from these is so much greater.”

– Student participant, FIRST
STEM Education and Outreach Partners

During Option Year One, DSEC included 19 STEM education and outreach partners, three of which were regional hubs. This section includes a brief overview of each outreach partner’s DSEC-funded activities and a summary of their outreach approach. Program profiles are included in alphabetical order.

A separate data chapter accompanying this report provides full evaluation detail and is publicly available at dodstem.us/about/partners.
Arizona State University Center for Gender Equity in Science and Technology (ASU CGEST)

CGEST actively drives the discourse and experiences of underrepresented girls in STEM by owning, generating, and critiquing the collective body of scholarship on and offering culturally responsive programs for girls of color (e.g., African American, Native American, Latinx, Asian American) and STEM education.

SCOPE SUMMARY

CGEST launched a pilot initiative in Hawaii aimed at increasing the awareness, access, and interest of Native Hawaiian girls in meeting the critical need for information technology (IT) and cybersecurity professionals. A cohort of 116 girls in grades 9 to 12 were recruited primarily from local communities near military installations. Five mentors were also trained to work with this cohort to support culturally relevant IT and cybersecurity curricula geared to resonate with students in a meaningful and long-lasting way. The program was facilitated in a weeklong summer camp and enriched by follow-up internship opportunities.

OPTION YEAR ONE FUNDING CATEGORY

Innovation Bloc: $175,000–$450,000
DSEC FOOTPRINT

RATIONALE FOR APPROACH

CGEST prepares young girls of color to develop not just a stronger identity as an emerging computer scientist but also one that is intersectional and does not separate community, academic, professional, and science identity into separate categories. Through the CompuGirls program, girls are encouraged to apply computer science learning to solve modern community challenges that matter to them, which improves retention.

Culturally relevant STEM experiences support girls of color in the development of positive STEM identity, as their backgrounds and identities are an integral part of the learning process (Hughes et al., 2020). Girls who participate in out-of-school-time STEM programs feel more confident trying new activities and struggling through difficult concepts in ways they are not able to in the traditional classroom setting (Hughes et al., 2019).

ALIGNMENT TO DSEC STRATEGY

**Engage students and educators in meaningful STEM experiences**

Girls and young women learn about IT and cybersecurity in an engaging and culturally relevant way.

**Serve students who are military-connected and underrepresented in STEM**

The programming focuses on Native Hawaiian girls, an underrepresented group in computer sciences.

**Connect to the DoD STEM workforce**

Mentors from local military installation areas are recruited to partner with girls in the program.
## LOGIC MODEL

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
</table>
| Virtual engagement sessions | Engage | - Learn how to build a coalition  
- Learn about cybersecurity as a field  
- Become more critical about engagement in online settings (digital footprint)  
- Understand what data is and how this relates to their daily actions | - Develop skill in presenting findings/work  
- Understand challenges and recognize sources of support for women of color in the industry (military or private)  
- Understand the cyber needs of their communities (assets)  
- Make coursework choices leading to a career in cybersecurity  
- Consider cybersecurity as a career option |
|             | Serve |  |  |
|             | Connect |  |  |
| Spring Camp | Engage | - Learn how to communicate with different community members  
- Parents learn about cybersecurity and how it applies to the real world (community, careers)  
- Become aware that cybersecurity is a component/division of military installations | - Develop skill in presenting findings/work to the community  
- Develop a community of support (peers, parents, community and cultural advisors) |
|             | Serve |  |  |
|             | Connect |  |  |
| Video Mentor Leadership Series | Engage | - Become aware of tech leadership roles | - See themselves in the position of tech leadership |
|             | Serve |  |  |
| Cyber Leader Series | Engage | - Learn how to build a coalition  
- Learn about cybersecurity as a field | - Develop skill in presenting findings/work  
- Understand challenges and recognize sources of support for women of color in the industry (military or private) |
<p>|             | Serve |  |  |</p>
<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
</table>
| Cybersecurity course (online) | Engage | • Understand the ethics of cybersecurity and its impact on my community  
• Identify data forms  
• Understand how a networked society functions  
• Understand critical media literacy and how it relates to cybersecurity  
• Understand computer-mediated communication effects  
• Understand the difference between security and privacy  
• Develop self-regulatory learning skills  
• Develop techno-social change agency | • Understand the potential effects of data creation, data collection/storage, and data dissemination  
• Increase self-regulatory learning for cybersecurity  
• Increase techno-social change agency |
Center for Excellence in Education (CEE)

CEE was founded by Admiral H.G. Rickover in 1983 to nurture the development of gifted and talented students in the STEM disciplines. CEE sponsors the Research Science Institute (RSI) each summer for academically talented high school and college students to nurture careers of excellence and leadership in STEM. Some students will also have the opportunity to participate in an internship program with DoD laboratories.

SCOPE SUMMARY
RSI is traditionally a 6-week residential program that brings high-caliber U.S. high school rising seniors and their international counterparts to the Massachusetts Institute of Technology to conduct mentored research. RSI is held at the Massachusetts Institute of Technology annually for about 80 high school students, of which 15 are considered DoD Scholars. During this program year, the event was held virtually because of COVID-19. Additionally, the DoD Summer Lab Research Intern Program paired college students with DoD lab internships, using a blend of virtual and in-person modalities to nurture careers of excellence and leadership in STEM for academically talented students.

OPTION YEAR ONE FUNDING CATEGORY
STEM Education and Outreach: $250,000–$550,000

15
DoD-sponsored students participated in the RSI program (more than 1,300 student applicants)

12
students received internships in DoD laboratories
DSEC FOOTPRINT

Programming Includes a National Reach

RATIONALE FOR APPROACH

Participants in CEE programming increase their knowledge of STEM careers by working side by side with professionals in the field, including in select DoD laboratories. All participants have the opportunity to increase their STEM skill set, including process skills such as report writing and communication. These experiences encourage students to apply to college and pursue a STEM degree.

Participation in STEM internships supports gifted students in developing a clear vision of their “future academic selves” that includes an enriched understanding of their talents and skills and how to achieve their future goals (Gotlieb et al., 2016). Wu et al. (2019) also found that partnerships with institutions of higher learning provide high school gifted students opportunities to explore broader experiences that further develop academic excellence in STEM disciplines, thus preparing them for successful transitions to higher education.

ALIGNMENT TO DSEC STRATEGY

Engage students and educators in meaningful STEM experiences

Hands-on practical experience with DoD laboratories leads to a better understanding of working in the scientific disciplines, such as working conditions and other professional considerations.

Connect to the DoD STEM workforce

DoD STEM professionals serve as guest lecturers at the RSI. Students participate in internship program work with DoD laboratories.
### LOGIC MODEL

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research Science Institute (RSI)</strong></td>
<td>Engage</td>
<td>• Better understanding of scientific disciplines (working conditions, professional considerations) &lt;br&gt; • Increased knowledge in STEM area of interest &lt;br&gt; • Increased knowledge of the college application process and available scholarships &lt;br&gt; • Increased confidence in writing, oral presentations, and lab protocols/techniques &lt;br&gt; • Greater clarity on career goals/available careers and what it means to be a researcher &lt;br&gt; • Better insight into specific STEM careers &lt;br&gt; • Recurring participation as staff/mentors &lt;br&gt; • Awareness of and access to the larger STEM network that CEE represents</td>
<td>• Increased knowledge of opportunities to work in research (all STEM disciplines) &lt;br&gt; • More students applying to college and pursuing a STEM degree &lt;br&gt; • Increased skills in STEM for scholars, including process skills such as report writing and communication &lt;br&gt; • Increase in RSI scholars pursuing a career in a STEM field &lt;br&gt; • Increase in the number of individuals participating in CEE</td>
</tr>
<tr>
<td>RSI/CEE Internship Program</td>
<td>Connect</td>
<td>• Better understanding of scientific disciplines (working conditions, professional considerations) &lt;br&gt; • Increased knowledge in STEM area of interest &lt;br&gt; • Honed lab skills, protocols, and techniques &lt;br&gt; • Improved communication skills</td>
<td>• Increased knowledge of working within DoD STEM labs/DoD STEM research &lt;br&gt; • Increased skills and experience in STEM</td>
</tr>
</tbody>
</table>
Citizen Schools is a national nonprofit that works in schools and at the systems level to provide hands-on learning experiences and STEM career mentors who ignite curiosity, build confidence, and help develop students into the next generation of leaders.

SCOPE SUMMARY
Citizen Schools extended its Makers + Mentors Network and Catalyst programming to the Greater Dayton, San Diego, and DMV regions and extended Maker Fellow selection and representation at Historically Black Universities and Colleges (HBCUs), Minority-Serving Institutions (MIs), and community colleges across the country. Citizen Schools supported the growth of maker-centered learning programming within Dayton, including through the placement of an AmeriCorps Maker Fellow with the Dayton Regional STEM Center and an AmeriCorps VISTA (Volunteers in Service to America) member with the Greater Cincinnati STEM Collaborative. Citizen Schools supported the Dayton STEM Ecosystem through resources within the Makers + Mentors Network community of practice and through added capacity from Maker Fellows designed to support more regional collaboration between the Dayton and Cincinnati STEM Ecosystems. As part of the DSEC-supported program and in partnership with Dayton-based middle school science teachers, Citizen Schools’ Catalyst program simultaneously brought high-quality, standards-aligned STEM projects and career mentors into the classroom.

OPTION YEAR ONE FUNDING CATEGORY
Innovation Bloc: $175,000–$450,000

- 287 students participated in the Catalyst program
- 5,039 students benefited from maker-centered learning programming
RATIONALE FOR APPROACH

By supporting a robust local hub of STEM professionals, teachers, community programs, and schools in Dayton, Ohio—which is linked to and supported by a national STEM network—Citizen Schools and other local agencies can bring more STEM education opportunities to the region.

STEM integration in secondary schools has been shown to decrease achievement gaps involving underrepresented student populations (Bicer & Capraro, 2018; Wiswall et al., 2014). Students experience increased academic achievement, engagement in school, and increased interest in pursuing STEM careers when instructional content is taught through the lens of real-world problems (Dorph et al., 2018; Guzey et al., 2016; Newman, Dantzler, & Coleman, 2015).

ALIGNMENT TO DSEC STRATEGY

**Engage** students and educators in meaningful STEM experiences

Mentors in the Makers + Mentors Network program engage students in experiential learning. The Catalyst program engages students in high-quality, research-based STEM curricula in their science classes.

**Serve** students who are military-connected and underrepresented in STEM

Recruitment activities are targeted to reach underserved students. By partnering with DSEC hubs in Dayton and DMV, the program will also reach military-connected students.
## LOGIC MODEL

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
</table>
| **STEM Catalyst Program**  
(work with Dayton-area teachers including professional development, coaching, and volunteer matching) |  
**Engage**  
- Teachers implement the curriculum units in their classrooms  
- Teachers deepen practice in implementing experiential learning in their classrooms  
- Teachers become aware of how to use trained volunteers to support science instruction and student engagement  
- Teachers learn social-emotional learning (SEL) instructional strategies  
- Teachers and students become aware of STEM career pathways |  
**Connect** |  
- Students demonstrate mastery of the curricular standards taught in the units  
- Students learn how to apply science knowledge to a real-life context  
- Teachers work effectively with trained volunteers in their classrooms  
- Teachers develop confidence in delivering experiential learning in their classrooms  
- Teachers develop self-efficacy and a growth mindset in their teaching practice  
- Students gain engineering practice skills through experiential learning  
- Students gain SEL competencies through experiential learning  
- Teachers and students increase their understanding of career pathways in science  
- Volunteers are satisfied with their experience and have a positive engagement with teachers and the program |
| **Maker Fellows**  
(work with local schools) |  
**Engage**  
- Maker Fellows design, support, and lead maker-centered programming at host sites  
- Maker Fellows bridge connections between K–12 schools and higher education, focusing on redesigning career and technical education curriculum, internships/apprenticeships, and industry mentoring/career connections  
- Students have increased exposure to innovation and industry mentors |  
**Connect** |  
- Maker Fellows develop efficacy in maker-centered learning development and implementation  
- Maker Fellows develop interest in future STEM/STEM education career pathways  
- Host sites build capacity and buy-in for creating maker-centered learning experiences for K–12 students  
- Students develop increased interest in pursuing STEM careers and understanding career pathways |
| **STEM Coalition building**  
(ecosystems) |  
**Engage**  
- Students learn to create and present projects with team members  
- Teachers, students, and parents become aware of STEM career pathways  
- Members of the STEM Ecosystem engage with the entire Makers + Mentors community of practice |  
**Connect** |  
- Students gain confidence in creating and presenting projects  
- Students gain confidence in working with a team  
- Teachers, students, and parents increase their understanding of career pathways in science  
- Students make connections with community-level stakeholders |

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**ANNUAL PROGRAM REVIEW • 47**
CYBER.ORG’s mission is to ensure that every K–12 student gains foundational and technical cybersecurity knowledge and skills. To achieve that mission, CYBER.ORG empowers teachers with resources and training needed to deliver cyber content to students. CYBER.ORG was formerly known as the National Integrated Cyber Education Research Center.

**SCOPE SUMMARY**

CYBER.ORG piloted its cyber curriculum across the full K–12 spectrum at schools serving two major installations of the Air Force Strike Command: Minot Air Force Base (AFB) in Minot, North Dakota, and Ellsworth AFB in Rapid City, South Dakota. The intervention included a series of 2-day workshops to introduce teachers to the CYBER.ORG curriculum and modules, lesson plan development, site visits by subject matter experts, delivery of curricula technology equipment, and implementation during the 2020 fall semester, all via hands-on immersion. The intervention was tailored to state standards and specific school needs at each location. Ongoing support took place with Minot AFB and Barksdale AFB throughout Option Year One. Relationships and plans were developed with Malmstrom AFB in Great Falls, Montana, for on-site professional development and student programming early in Option Year Two. In addition, a virtual cybersecurity program is being developed that will serve students of base personnel and active military, which will be facilitated for students by on-base personnel and staff at on-base community centers. CYBER.ORG provided cyber professionals to speak to participants at CGEST CompuGirls and NCWIT Counselors for Computing programs in Option Year One.

**OPTION YEAR ONE FUNDING CATEGORY**

Innovation Bloc: $175,000–$450,000

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632 military-connected students participated in cyber curriculum workshops

3 teachers participated in cyber professional development workshops
DSEC FOOTPRINT

RATIONALE FOR APPROACH

By providing a K–12 STEM/cyber education program focused on a limited set of school systems that support military children within the Air Force Global Strike Command, CYBER.ORG will increase cyber skills and address the challenges in providing military children with a consistent STEM education as they migrate between school systems and during any related social-emotional changes.

Cybersecurity supports the development of students’ computer science skills and 21st-century skills, and gives students real-world experience in the application of computational thinking (Weibe, Kite, & Park, 2020). The CYBER.ORG program research has reported a significant increase in students’ interest in cybersecurity careers, as well as an increase in students’ general awareness for how to protect their own privacy and security (CYBER.ORG, 2020).

ALIGNMENT TO DSEC STRATEGY

**Engage students and educators in meaningful STEM experiences**

CYBER.ORG’s cyber curriculum is hands-on and technology rich.

**Serve students who are military-connected and underrepresented in STEM**

The program specifically targets two major military installations.
## Logic Model

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build relationships with base personnel</td>
<td>Serve</td>
<td>• Program expands from classrooms to out-of-school environments</td>
<td>• Increased base personnel capacity to integrate programming into their community</td>
</tr>
<tr>
<td></td>
<td>Connect</td>
<td>• Base personnel use cybersecurity curriculum in their existing programming</td>
<td>• Increased base personnel capacity to use cybersecurity curriculum in their existing programming</td>
</tr>
<tr>
<td>Provide teacher professional development on cybersecurity curriculum</td>
<td>Serve</td>
<td>• Teachers understand how cybersecurity applies to the subject matter that they teach</td>
<td>• Increased teacher ability to integrate cybersecurity content with the subjects they teach using best practices</td>
</tr>
<tr>
<td></td>
<td>Engage</td>
<td>• Teachers learn how to integrate cybersecurity with other content</td>
<td>• Increased teacher ability to integrate cybersecurity into existing curriculum</td>
</tr>
<tr>
<td></td>
<td>Connect</td>
<td>• Teachers feel confident in introducing cyber education in their diverse learning environment</td>
<td>• Increased teacher confidence in implementing cyber education in learning environments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers have an increased awareness of cybersecurity careers</td>
<td>• Increased teacher awareness of cybersecurity careers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers feel confident in introducing cyber education in their diverse learning environment</td>
<td>• Increased teacher ability to provide cybersecurity curriculum through remote learning</td>
</tr>
</tbody>
</table>

### INNOVATION BLOC

- **DEFENSE STEM EDUCATION CONSORTIUM (DSEC)**
- **PARTNERS > CYBER.ORG**
**For Inspiration and Recognition of Science and Technology (FIRST)**

FIRST is a robotics community that prepares young people ages 4–18 (PreK–12) for the future through a suite of inclusive, team-based robotics programs that can be facilitated in school or in structured after-school programs. Boosted by a global support system of volunteers, educators, and sponsors, teams operate under a signature set of FIRST Core Values to conduct research, fundraise, design, build, and showcase their achievements during annual challenges.

**SCOPE SUMMARY**

FIRST leveraged DoD funding to support over 1,300 teams across 40 states and territories and 13 countries in mentor-based research and robotics programs. Four FIRST programs were included: FIRST LEGO League Explore, FIRST LEGO League Challenge, FIRST Tech Challenge, and FIRST Robotics Competition. Each of the DoD-sponsored teams received grants covering FIRST program registration fees, products, and materials. FIRST LEGO League Discover Class Pack grants were also made available through targeted communication at DoD sites. Thirty-three Class Pack grants were awarded and provided educators with STEM learning experiences for PreK–1 students (ages 4–6) for in-classroom or after-school programming to encourage connections to core curricular content in school and increase participation of underserved communities during traditional school hours.

**OPTION YEAR ONE FUNDING CATEGORY**

DSEC CMC Member: >$1,500,000

12,199 students served through DoD STEM investments

724 DoD scientists and engineers served as mentors for robotics teams, volunteering an estimated 175,000 hours
**DSEC FOOTPRINT**

Programming Includes a National Reach and DoDEA International Locations

**RATIONALE FOR APPROACH**

*FIRST* participants increase their knowledge of engineering principles and coding and programming concepts in an applied setting as they work to solve a problem. As team members, participants learn the *FIRST* Core Values, building their collaboration, communication, and innovation skills. Working alongside STEM career professionals increases participants’ awareness of STEM careers and contributes to the development of positive attitudes toward STEM.

Students who participate in STEM competitions are more likely to pursue STEM-related careers (Miller et al., 2018). Studies show *FIRST* Robotics programs have a statistically significant impact on students’ interest in STEM careers and their knowledge of the real-world applications of STEM (Melchior et al., 2018). Robotics also promotes the development of computational thinking, as students must engage in algorithmic thinking to automate both sensing and motorized components (Weibe, 2020).

**ALIGNMENT TO DSEC STRATEGY**

**Engage** students and educators in meaningful STEM experiences

Students learn engineering principles and applications and teamwork skills through hands-on experience in an applied setting.

**Serve** students who are military-connected and underrepresented in STEM

In the 2020–2021 season, approximately 20% of *FIRST* participants sponsored by DoD STEM were eligible for free or reduced-price lunch through the National School Lunch Program.

DoD-sponsored *FIRST* teams are connected with military installations and Department of Defense Education Activity (DoDEA) schools across the United States and overseas.

**Connect to the DoD STEM workforce**

Each *FIRST* team that receives DoD STEM funding is required to have a DoD or DoDEA mentor or coach, thereby providing exposure to DoD STEM careers and opportunities to all participating students. In the 2020–2021 season, 724 DoD employees volunteered to mentor *FIRST* teams.
# LOGIC MODEL

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All FIRST programs</strong></td>
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<tr>
<td><strong>FIRST LEGO League</strong> (grades PreK-8)</td>
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<tr>
<td><strong>FIRST Tech Challenge</strong> (grades 7-12)</td>
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<tr>
<td><strong>FIRST Robotics Competition</strong> (grades 9-12)</td>
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</tr>
<tr>
<td><strong>Engage</strong></td>
<td></td>
<td>• Students gain an awareness of what coding is used for and what is needed to code</td>
<td>• Increased knowledge of coding/programming concepts in an applied setting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students know more about engineering, technology, and computer science as a profession</td>
<td>• Increased awareness of STEM careers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students learn about and use an engineering research design approach to problem-solving by understanding the scope of the problem, identifying an approach, and then working within parameters and constraints to find a viable solution</td>
<td>• Improved critical thinking and problem-solving skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students develop and apply programmatic thinking in order to solve a problem</td>
<td>• Increased coding and programming skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students improve their communication skills through teamwork</td>
<td>• Improved project design and management skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students increase their ability to use tools and build with their hands</td>
<td>• Increased teamwork (collaboration, communication, and innovation – FIRST Core Values)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students enjoy engineering and feel capable as engineers</td>
<td>• Increased engineering skills and abilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students persevere in problem-solving to complete their projects</td>
<td>• Development of and increase in positive attitudes about STEM</td>
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<tr>
<td></td>
<td></td>
<td>• Students have an emerging interest in STEM and see themselves pursuing a STEM career</td>
<td>• Increased self-efficacy and persistence in STEM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students see the value in supporting others in STEM work</td>
<td>• Purposeful support of other students in STEM work</td>
</tr>
<tr>
<td><strong>Engage</strong></td>
<td></td>
<td>• Students learn to program their model/robot to perform a desired function</td>
<td>• Increased knowledge of engineering principles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students gain an understanding of engineering principles and how they are applied, particularly in mechanical and electrical engineering</td>
<td>• Understanding of STEM career pathways (e.g., which schools are recommended, which classes might be necessary)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students have an increased ability to complete basic engineering tasks</td>
<td>• Connections to a STEM learning network that includes fellow students and STEM professionals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students network with other FIRST participants, mentors, and/or coaches during the season’s design process and following the events</td>
<td>• Increased number of FIRST volunteers to support outreach</td>
</tr>
</tbody>
</table>

| Connect | Connect |
Learning Undefeated provides STEM experiences for high-needs communities by providing equitable access to education and inspiring students to imagine their own success. Through innovative and experiential education programs for grades K–12, Learning Undefeated sparks interest in DoD STEM careers, building the workforce that will drive the innovation economy and bridging school, community, health, and business.

SCOPE SUMMARY
Learning Undefeated convened the Emerging Leaders in Biotechnology program to build lasting mentor relationships between high school and college students—specifically Black, Hispanic, and American Indian or Alaskan Native girls—to cultivate and reinforce their STEM identity, develop their interest in joining the STEM workforce, and support groups that are typically underrepresented in STEM careers. The 5-month program provided participants with meaningful, semi-monthly educational experiences, at-home science resources to facilitate authentic laboratory investigation, engagement with DoD STEM professionals, and a group competition.

OPTION YEAR ONE FUNDING CATEGORY
Innovation Bloc: $175,000–$450,000

56 students served by virtual Emerging Leaders in Biotechnology program

98% of participants were female, 2% of participants were non-binary
DSEC FOOTPRINT

RATIONALE FOR APPROACH

Participating in interactive, hands-on activities and experiences while building relationships with STEM professionals in DoD biotechnology-related careers will break down barriers that keep female students from completing STEM degrees. Introducing them to near-peer role models in an open and nonthreatening environment facilitates honest conversations about gender, family, careers, and the role these factors play in career success, providing mentees with unparalleled insight and the empathy that only someone who has recently been in their situation can provide.

Positive outcomes of similar mentoring programs included a strong positive correlation to students’ self-efficacy (Denson, 2017). Students also reported an increase in confidence, an increased sense of camaraderie, and a deeper understanding of how STEM is relevant to our everyday lives as a result of their mentoring experience (Denson et al., 2015). Kendricks, Nedunuri, and Arment (2013) examined minority student mentoring programs and found that student participants perceived that their involvement in a mentoring program was the biggest contributing factor to their academic success.

ALIGNMENT TO DSEC STRATEGY

Engage students and educators in meaningful STEM experiences

Participants learn biotechnology fundamentals through fun, creative, and hands-on environments, provided through home laboratory kits and collaborative opportunities in the Learning Undefeated “Mobile eXploration Lab.”

Serve students who are military-connected and underrepresented in STEM

Recruitment activities are targeted to reach underserved female students, including a partnership with Montgomery College where 50% of enrolled students are from groups typically underrepresented in STEM.

Connect to the DoD STEM workforce

DoD STEM workforce professionals are included in the Emerging Leaders in Biotechnology sessions to provide awareness of and real-world insight into STEM careers.
## LOGIC MODEL

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamentals</th>
<th>Immediate Changes and Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerging Leaders in Biotechnology Program</td>
<td>Engage</td>
<td>Students increase their interest in biotechnology and STEM</td>
</tr>
<tr>
<td>Summer lab time</td>
<td>Serve</td>
<td>• At least 50% of students will report an increase in interest in biotechnology and STEM for corresponding items in the survey</td>
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<tr>
<td></td>
<td></td>
<td>• At least 50% of students will express an interest in biotechnology or STEM during focus groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased student efficacy, confidence, and knowledge with STEM concepts and biotechnology techniques</td>
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<tr>
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<td></td>
<td>• At least 70% of students will report an increase in knowledge about STEM for corresponding items in the survey</td>
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<td>• At least 70% of students will express an increase in confidence in a STEM topic</td>
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<tr>
<td></td>
<td></td>
<td>Students increase their awareness of and interest in learning about high-demand STEM and DoD biotechnology-related careers</td>
</tr>
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<td></td>
<td>• At least 70% of students will report understanding that there are many different careers in STEM and within the DoD</td>
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<td></td>
<td>• At least 70% of students will express an interest in learning more about STEM topics and/or careers in STEM</td>
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<td>• At least 70% of students will be aware of alternative pathways to a STEM career that are not part of the traditional 4-year degree path</td>
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<td>• At least 70% of students will express that they are comfortable with skills related to a STEM career</td>
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<tr>
<td></td>
<td></td>
<td>Mentors increase their confidence in leading STEM work</td>
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<tr>
<td></td>
<td></td>
<td>Mentors increase their understanding of the value of mentorship</td>
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<tr>
<td></td>
<td></td>
<td>Mentors develop an increased interest in giving back to the community</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A learning community is created, where students participating in this work eventually move into a mentorship role</td>
</tr>
</tbody>
</table>
MATHCOUNTS

MATHCOUNTS provides middle school students with the opportunity to engage and grow in mathematics through the National Math Club, the Math Video Challenge, and the MATHCOUNTS Competition Series.

SCOPE SUMMARY

MATHCOUNTS provided math programming for students in grades 6 through 8 and provided extra support for new coaches and teachers working in low-income schools. This work included sponsoring a variety of outreach activities, math competitions and clubs in DoDEA areas, and the Math Video Challenge national program. A non-school competitor option was also offered for students whose schools were not able to conduct extracurricular activities.

OPTION YEAR ONE FUNDING CATEGORY

STEM Education and Outreach: $250,000–$550,000

13,882 students served through National Math Club

9,628 students participated in National Math Competition and Math Video Challenge
RATIONALE FOR APPROACH

Students participating in MATHCOUNTS programming increase their interest and confidence in mathematics. Through individual and team activities, students strengthen their math skills and learn collaboration and communication skills. Teachers who work with MATHCOUNTS gain valuable resources for their classrooms, particularly those who teach in low socioeconomic areas.

MATHCOUNTS student participants reported that participation in the program supported their mastery of math/STEM concepts, and 80% of student participants planned to take more math than is required in high school (Reid et al., 2017). When asked about their career interests, student participants were most likely to report that they were interested in becoming an engineer, and 80% of all students reported an interest in pursuing a STEM-related career (Reid et al., 2017). MATHCOUNTS also has a positive impact on teacher coaches as 90% reported that the program improved their ability to teach mathematics (Reid et al., 2017).

ALIGNMENT TO DSEC STRATEGY

Engage students and educators in meaningful STEM experiences

Students gain confidence, skills in problem solving and critical thinking, and improved attitudes about math through working with MATHCOUNTS materials and engaging in the programming activities.

Serve students who are military-connected and underrepresented in STEM

The majority of Math Video Challenge participants are underrepresented students, and about one in four competition schools each year are Title I schools. MATHCOUNTS provides additional support and resources to new coaches and Title I schools to help them have a successful experience. To reach diverse students, MATHCOUNTS conducts outreach and provides recruitment incentives to educators in targeted areas.

Connect to the DoD STEM workforce

Members of the DoD STEM workforce have the opportunity to volunteer as speakers at MATHCOUNTS events to promote STEM career pathways. MATHCOUNTS features DoD STEM fellowships, internships, and scholarships in its promoted communication about alumni opportunities.
# Logic Model

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Math Competition</td>
<td>Engage</td>
<td>• Teachers receive high-quality materials to use in their classrooms</td>
<td>Students:</td>
</tr>
<tr>
<td>National Math Club</td>
<td></td>
<td>• Students learn how to approach nonroutine problems with confidence</td>
<td>• Improve teamwork and collaboration skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students show increased interest in “doing math,” demonstrated by consistent</td>
<td>• Improve problem-solving and critical thinking skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>attendance at MATHCOUNTS practices and events</td>
<td>• Increase their interest in math</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students see themselves as “math people” and enjoy doing math</td>
<td>• Have increased confidence in math</td>
</tr>
<tr>
<td>Math Video Challenge</td>
<td>Engage</td>
<td>• Students show increased interest in “doing math,” demonstrated by consistent</td>
<td>• Have increased positive attitudes toward STEM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>effort to complete video project and participation in video team meetings</td>
<td>• Express interest in taking math classes beyond the minimum high school</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students see themselves as “math people” and enjoy doing math</td>
<td>requirements</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Increase participation overall and particularly from underrepresented groups</td>
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<tr>
<td></td>
<td></td>
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<td>• Teachers use materials with their students</td>
</tr>
</tbody>
</table>

### Students:
- Improve communication skills
- Improve teamwork and collaboration skills
- Increase their interest in math
- Have increased confidence in math
- Have increased positive attitudes toward STEM
- Increase participation overall and particularly from underrepresented groups
- Have increased interest in taking math classes beyond the minimum high school requirements
National Center for Women & Information Technology (NCWIT)

NCWIT focuses on providing computing and IT experiences for girls through its AspireIT programming, which pairs a female career professional with a partner organization to provide STEM computing experiences to girls. For AspireIT, NCWIT manages a network of 1,500 organizations that work together to increase women’s participation in computing.

SCOPE SUMMARY
NCWIT supported peer-led coding programs in the three targeted DSEC regional hub areas: San Diego, DMV, and Dayton. Using a near-peer model, NCWIT’s AspireIT program leaders taught young girls fundamentals in programming and computational thinking in fun, creative environments that were supported by program partners from the NCWIT community. NCWIT coordinated with DSEC partners and hub leads to promote the AspireIT programs and increase awareness of DoD STEM career opportunities.

INNOVATION BLOC SCOPE SUMMARY
NCWIT hosted Counselors for Computing (C4C) introductory workshops in each of the three hubs, disseminated resource and supply kits for counselors unable to attend C4C, and selected 10 Counselor Champions to participate in a C4C Leadership Institute.

OPTION YEAR ONE FUNDING CATEGORY
STEM Education and Outreach: $250,000–$550,000
Innovation Bloc: $175,000–$450,000

325 students served through AspireIT program
923 counselors and educators served through Counselors for Computing (C4C) program
RATIONALE FOR APPROACH

As girls interact with computing sciences, they gain skill and confidence in coding and computational thinking. By partnering with female mentors from the computing field, participants learn about career pathways and opportunities and can see a role model who looks like them in a tech field. Counselors are influencers—they advise and encourage students in their education and career aspirations; therefore, NCWIT provides counselors professional development to help them expand their view on who should pursue careers in technology.

Female professionals provide important identity supports for female students as they are more likely to engage in computer science when they see others like themselves “doing computer science” (Google & Gallup, 2016; Stout et al., 2011). Informal learning opportunities in coding and computer science increase students’ interest in STEM and reduce the achievement gap between students of low-income and high-income households (NRC, 2015). Research on girls’ participation in the NCWIT Aspire in Computing Program showed that previous experience in coding was the most important factor in girls’ decisions to pursue degrees in computer science or computer engineering and that other computer science experiences did not have the same effect (DuBow et al., 2020; Weston et al., 2019).

ALIGNMENT TO DSEC STRATEGY

**Engage students and educators in meaningful STEM experiences**

Girls and young women learn programming fundamentals and computational thinking in fun, creative, and hands-on environments.

**Serve students who are military-connected and underrepresented in STEM**

The programming focuses on girls, an underrepresented group in the computing sciences. NCWIT provides coding programs in the three DSEC hub areas, located in areas with a high concentration of military-connected students.

**Connect to the DoD STEM workforce**

Near-peer mentors share DoD STEM career opportunities and pathways with program participants. DoD STEM workforce members share opportunities through C4C workshops.
# LOGIC MODEL — ASPIREIT

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
</table>
| Planned coding and computational thinking (CT) learning sessions; toolkit for educators and community members | Engage | • Students use programming to solve a problem  
• Students become aware of how computing applications are used to address social issues  
• Students understand the role of teamwork in CT work and increase their confidence in collaboration and communication skills  
• Students are more comfortable and confident in CT work  
• Students express interest in a career in computing | • Increased participant competence related to fundamental programming concepts  
• Increased participant exposure to computing applied to address social issues  
• Increased participant teamwork, collaboration, and communication skills  
• Increased participant confidence in pursuing computational coursework  
• Increased participant positive attitude toward STEM careers |
| Field trips | Engage | • Students increase their confidence in teamwork, collaboration, and communication skills  
• Students are more comfortable and confident with CT work  
• Students express interest in a career in STEM | • Increased participant teamwork, collaboration, and communication skills  
• Increased participant confidence in pursuing computational coursework  
• Increased participant positive attitude toward STEM careers |
| Working with others to create and present a CT program | Engage | • Leaders increase their confidence in teamwork, collaboration, communication, and leadership skills  
• Members increase their expertise and confidence in their ability to plan and lead a session on CT  
• Members are more confident in their CT skills  
• Members express interest in STEM | • Increased leader teamwork, collaboration, communication, and leadership skills  
• Increased member expertise and confidence in planning and presenting their knowledge of CT  
• Increased member confidence in CT skills  
• Increased member persistence in STEM |
| Creating an activity plan, presenting it for consideration, and then carrying it out with students | Engage | • Leaders increase their confidence in teamwork, collaboration, communication, and leadership skills  
• Members increase their expertise and confidence in their ability to plan and lead a session on CT  
• Members are more confident in their CT skills  
• Members express interest in STEM | • Increased leader teamwork, collaboration, communication, and leadership skills  
• Increased member expertise and confidence in planning and presenting their knowledge of CT  
• Increased member confidence in CT skills  
• Increased member persistence in STEM |
<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction</td>
<td>Connect</td>
<td>- Students are aware of career pathways in computing</td>
<td>- Increased participant knowledge of career pathways (including DoD career pathways) and opportunities in computing</td>
</tr>
<tr>
<td>with industry</td>
<td></td>
<td>- Students express interest in a career in computing</td>
<td>- Increased participant positive attitude toward STEM careers</td>
</tr>
<tr>
<td>professionals</td>
<td></td>
<td>- Students better understand the possible pathways for women into computing careers</td>
<td>- Increased student understanding of opportunities for women in computing careers</td>
</tr>
<tr>
<td>Programming</td>
<td>DSEC Fundamental</td>
<td>Immediate Changes</td>
<td>Primary Impacts</td>
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<tr>
<td>Initial sessions</td>
<td>Engage Connect</td>
<td>• Counselors increase their understanding of computer science (CS), including opportunities, resources, gender issues, and where change needs to begin</td>
<td>• Increased counselor knowledge of the types of resources available</td>
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<tr>
<td></td>
<td></td>
<td>• Counselors learn how to use tools for counseling</td>
<td>• Increased counselor use of tools for counseling</td>
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<td></td>
<td>• Counselors learn how to use Zoom and Google Classroom</td>
<td>• Improved counselor remote meeting skills</td>
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<td></td>
<td>• Counselors gain introductory coding skills and can talk about coding at an introductory level</td>
<td>• Increased counselor ability to talk knowledgeably about coding</td>
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<td></td>
<td>• Counselors know how to integrate CS career paths with routine counseling</td>
<td>• Increased counselor advocacy of CS for students</td>
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<td></td>
<td>• Counselors develop an intention to change advising practices</td>
<td>• Changed counselor attitudes and adoption of inclusive language when counseling students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Counselors recognize equity and access issues</td>
<td>• Increased counselor follow-up at school to find CS allies among other school personnel</td>
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<td>• Counselors understand the opportunities for action on systemic barriers and that action needs to be taken</td>
<td>• Increased counselor endorsement of underrepresented students who identify as women at schools for Aspirations in Computing Awards offered by NCWIT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Counselors have better understanding of DoD STEM opportunities</td>
<td>• Increased counselor promotion of DoD STEM opportunities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students are informed of DoD STEM opportunities such as the SMART Scholarship Program</td>
<td>• Increased student awareness of DoD STEM opportunities</td>
</tr>
</tbody>
</table>

| Online modules | Engage Connect | • Counselors increase their understanding of CS (opportunities, resources, gender issues) and where change needs to begin | • Increased counselor knowledge of the types of resources available |
| | | • Counselors know how to integrate CS career paths with routine counseling | • Increased counselor advocacy of CS for students |
| | | • Counselors develop an intention to change advising practices | • Changed counselor attitudes and adoption of inclusive language when counseling students |
| | | • Counselors recognize equity and access issues | • Increased counselor follow-up at school to find CS allies among other school personnel |
| | | • Counselors understand the opportunities for action on systemic barriers and that action needs to be taken | • Increased counselor endorsement of underrepresented students who identify as women at schools for Aspirations in Computing Awards offered by NCWIT |
National Math and Science Initiative (NMSI)

NMSI focuses on providing military-connected students with access to rigorous and challenging AP STEM education opportunities across the United States. Through NMSI’s two core programs, the College Readiness Program (CRP) and Laying the Foundation (LTF) Summer Academy, military-connected schools are provided a host of teacher professional development opportunities, student supports, and school supports. These programs result in proven outcomes that empower students with college readiness and preparation for skills certification in a wide variety of STEM career pathways, whether military or civilian.

SCOPE SUMMARY

In Option Year One, NMSI provided its multi-year CRP and LTF program to schools that met the DoD threshold requirements for serving military-connected students, which included having sponsors serving on active duty and in the National Guard and Reserves. Professional development and resources were also extended to select middle schools, which focused on STEM-related coursework to ensure students are better prepared for Advanced Placement STEM coursework in high school. NMSI expanded Advanced Placement STEM availability in a virtual environment to better serve military-connected students in remote locations where in-school offerings were not provided and for those in a home-school environment.

OPTION YEAR ONE FUNDING CATEGORY

DSEC CMC Member: >$1,500,000
Creating inclusive and STEM-focused mindsets among school administrators and teachers increases the number and diversity of students who participate and excel in college-level STEM courses while in high school. Those experiences create greater consideration for STEM careers and prepare more students for postsecondary coursework in STEM or early success in the military and civilian workforce.

The federal government identified three goals for providing high-quality STEM education for all learners in the report *Charting a Course for Success: America’s Strategy for STEM Education* (NSTC, 2018): (1) build strong foundations for STEM literacy; (2) increase diversity, equity, and inclusion in STEM; and (3) prepare the STEM workforce for the future. The NMSI Laying the Foundation program has increased student performance as students of teachers that participated in the training outperformed students with comparable academic achievement and scored on average 3.2 points higher on the ACT (Phelan & Brown, 2017). The NMSI College Readiness Program has also been shown to have long-term positive impacts on high school students as the students of teachers trained in the program passed more Advanced Placement exams while in high school and were more likely to stay in college beyond the second year (Jackson, 2014).

**ALIGNMENT TO DSEC STRATEGY**

**Engage students and educators in meaningful STEM experiences**

Students work with a nationwide network of well-trained and experienced teachers who engage them in positive STEM teaching practices and coaching. Students participate in online study sessions, coaching, and Advanced Placement practice exams to increase achievement on official Advanced Placement exams.

**Serve students who are military-connected and underrepresented in STEM**

NMSI focuses on working in schools with military-connected students whose sponsors are serving on active duty and the National Guard and Reserves. NMSI programs provide teacher professional development and administrative program support to assist schools in their efforts to ensure that students have the opportunity to advance toward STEM careers.

**Connect to the DoD STEM workforce**

Students are invited to explore DoD STEM career opportunities and engage with DoD STEM mentors who can help them see the career opportunities available to them and provide insight into education and career pathways.
## Logic Model

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>College Readiness Program</strong></td>
<td></td>
<td><strong>Engage</strong></td>
<td><strong>Primary Impacts</strong></td>
</tr>
<tr>
<td>Student supports</td>
<td></td>
<td>- More students sit for AP exams</td>
<td>- The number of students taking AP STEM exams increases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Students increase their computational thinking skills</td>
<td>- Students have increased knowledge of STEM content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Students learn about STEM careers and the academic pathways needed to pursue them</td>
<td>- Students have increased knowledge of STEM careers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Students are more engaged in STEM-related coursework</td>
<td>- Students apply to postsecondary educational institutions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Students are more likely to apply to postsecondary educational institutions</td>
<td>- Students increase positive perceptions of STEM</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Serve</strong></td>
<td>- Students are more likely to pursue a STEM degree</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Teachers feel more confident in their ability to engage students and incorporate hands-on learning into their classrooms</td>
<td>- Students are more engaged in their STEM courses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Teachers implement hands-on practices taught in the trainings into their teaching</td>
<td>- Students realize STEM careers are open to them—they can picture themselves in a STEM career</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Connect</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Schools understand the gaps in their STEM AP course offerings</td>
<td>- Teachers have increased confidence in engaging students in STEM content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Schools create action plans to offer more AP courses</td>
<td>- Teachers incorporate more hands-on learning into their classrooms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Teachers are trained to deliver AP course offerings</td>
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</tr>
<tr>
<td><strong>Laying the Foundation—Summer Teacher Academy (grades 6–12)</strong></td>
<td></td>
<td><strong>Engage</strong></td>
<td><strong>Primary Impacts</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Teachers feel more confident in their ability to engage students in grades 6–12 and incorporate hands-on learning into their classrooms</td>
<td>- Teachers have increased confidence in engaging students in STEM content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Teachers implement hands-on practices taught in the trainings into their teaching</td>
<td>- Teachers incorporate more hands-on learning into their classrooms</td>
</tr>
</tbody>
</table>
Robeson Community College

Robeson Community College, a designated U.S. Department of Education minority-serving institution (MI) located in southeastern North Carolina, is committed to improving STEM education and training for its rural, minority population. Through STEM program offerings, enhanced student support services, and internships, Robeson Community College will increase the number of graduates who are work-ready or ready for degree advancement.

SCOPE SUMMARY

Robeson Community College provided internships in partnership with Public Schools of Robeson County and Emerging Technology Institute, a DoD contractor. Emerging Technology Institute developed internship curricula and a cyber laboratory that engaged students in real-world cyber laboratory work experience. Emerging Technology Institute hosted a series of STEM webinars and one STEM event with military and industry STEM professionals to showcase new technologies and workforce development.

OPTION YEAR ONE FUNDING CATEGORY

Innovation Bloc: $175,000–$450,000

13 students participated in IT/Cybersecurity pathways program

7 participating students received summer internships
DSEC FOOTPRINT

RATIONALE FOR APPROACH

If high school and undergraduate students are engaged in hands-on STEM activities and internship opportunities, they will have an increased STEM skill set, improved confidence, and will be more likely to choose and persist in a STEM pathway in and through college and beyond. Working with STEM and DoD mentors helps students understand exciting STEM careers and education pathways that are available to them.

The development of students’ STEM identity requires they have an interest in STEM professions, are able to develop confidence in STEM skills, and are able to envision how they can contribute to STEM enterprises (Krishnamurthi et al., 2014). Mentoring programs between high schools and institutions of higher learning nurture students’ academic success in STEM and prepare students for transitions to STEM-related careers (Wu et al., 2019). Knouse and Fontenot (2008) identify internships as one of the most beneficial industry partnerships, which support students in developing STEM skills and thereby enhancing future employment opportunities.

ALIGNMENT TO DSEC STRATEGY

**Engage** students and educators in meaningful STEM experiences

Students interact with working STEM professionals, providing real-world context to the STEM topics/classes they encounter at school.

**Serve** students who are military-connected and underrepresented in STEM

Recruitment activities are targeted to reach underserved students. Robeson Community College comprises over 45% underrepresented/underserved students.

**Connect** to the DoD STEM workforce

Through hosted STEM webinars, students hear from DoD STEM professionals and learn more about DoD career pathways and opportunities.
## LOGIC MODEL

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes and Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internships</td>
<td>Engage</td>
<td>• Students gain real-world (work-based) experience in a STEM career</td>
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<tr>
<td></td>
<td>Serve</td>
<td>• Students earn at least two industry credentials</td>
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<td></td>
<td></td>
<td>• Students learn about job environments through workforce participation and events</td>
</tr>
<tr>
<td>Career and Technical Education (CTE) pathways</td>
<td>Engage</td>
<td>• Students earn cybersecurity certification</td>
</tr>
<tr>
<td></td>
<td>Serve</td>
<td>• Faculty obtains additional training and credentials to teach additional cybersecurity courses</td>
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<tr>
<td></td>
<td></td>
<td>• The number of students declaring a major in IT/cybersecurity increases</td>
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<tr>
<td></td>
<td></td>
<td>• Program retention rates improve ≥80%</td>
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<tr>
<td></td>
<td></td>
<td>• Collaboration of industry engagement with IT faculty increases</td>
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</tbody>
</table>
San Diego Miramar College’s mission is to prepare students to succeed by providing quality instruction and services in an environment that supports and promotes success, diversity, inclusion, and equity with innovative programs and partnerships to help students complete degrees/certificates, transfer, enroll in workforce training, or advance their careers.

SCOPE SUMMARY
San Diego Miramar College provided summer session for-credit classes, separate from the college’s normal offerings and at no cost to 50 prioritized students, that led to a Certificate of Achievement in Biotechnology and industry-recognized credentials. Eleven subsidized internships were facilitated in partnership with the life sciences industry association, Biocom Institute. Enhanced career development services were offered to all 50 students in the pipeline and included resume workshops, one-on-one resume and interview preparation sessions, and counseling to support students in the development of an updated education plan that fit their individual career goals.

OPTION YEAR ONE FUNDING CATEGORY
Innovation Bloc: $175,000–$450,000

50 students served by DSEC
11 students received biotechnology internships
DSEC FOOTPRINT

RATIONALE FOR APPROACH

By participating in hands-on technical skills training and obtaining foundational skills based on industry needs in the biotechnology field, students can obtain stackable certificates, understand career pathways, and become work-ready and competitive candidates for well-paying STEM careers.

Underrepresented students experience increased success through affirming environments that promote racial and ethnic minority students’ success in STEM education as students benefit from cohort-style educational structured experiences (Charleston & Leon, 2016; Espinosa, 2011; Palmer, Maramba, & Dancy, 2011). Students, especially minority students, report an increase in motivation to persist in STEM career training when they have support in the development of STEM identities (Hurtado et al., 2010; McGee et al., 2016).

ALIGNMENT TO DSEC STRATEGY

Engage students and educators in meaningful STEM experiences

The program at San Diego Miramar College engages students in high-quality, laboratory-based biotechnology curricula. Students interact with working STEM professionals, providing real-world context to the STEM topics/classes they encounter at school.

Serve students who are military-connected and underrepresented in STEM

Recruitment activities are targeted to reach underserved students. Among San Diego Miramar College students, 67% identify as persons of color, 57% receive financial aid, and 25% are first-generation college students.
## Logic Model

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes and Primary Impacts</th>
</tr>
</thead>
</table>
| **Summer courses** | Engage | • Students earn credits toward certification  
• Students are prepared to take the certification exam  
• Students increase their job readiness  
• Students gain resume-building experience |
| Serve | | |
| **Internships** | Engage | • Students gain real-world (work-based learning) experience in a STEM career  
• Students learn about work culture  
• Students gain resume-building experience |
| Serve | | |
Society for Science

Based in Washington, DC, the Society for Science has been a champion for science since 1921, dedicated to expanding scientific literacy, effective STEM education, and scientific research. The Society is known for award-winning journalism, world class science research competitions, and outreach and equity programming.

SCOPE SUMMARY

The Society enhanced Broadcom MASTERS (the premier middle school STEM research competition in the United States) with a suite of awards, including an annual DoD STEM Top Talent Award, a semifinalist award for all Top 300 Broadcom MASTERS, and 26 affiliated fair student awards for local fairs that are close to military bases or are of a strategic priority to DSEC. The Society also brought together 244 middle school research teachers for professional development in a virtual Middle School Research Teachers Conference (MSRTC). The Society executed a marketing plan to reach at least 55,000 educators at military-connected middle schools with information about Science News for Students, a free online magazine providing age-appropriate science news at the middle school level with 11.5 million unique visitors during Option Year One. In addition, 400 military-connected high schools are receiving the Science News in High Schools program, which highlights the cross-curricular nature of STEM, provides connections to current STEM applications and careers, and links directly to primary research.

OPTION YEAR ONE FUNDING CATEGORY

STEM Education and Outreach: $250,000–$550,000
DSEC FOOTPRINT

Programming Includes a National Reach

RATIONALE FOR APPROACH

Teachers participating in the MSRTC learn STEM pedagogy from each other and about methods to help their students complete scientific research, thereby creating more positive STEM experiences for students in their classrooms. Strong preparation in secondary science was found to be significant to retention, persistence, and success among college students of color pursuing degrees in STEM fields (Palmer, Maramba, & Dancy, 2011). Awards for students competing at middle school science fairs and through the Broadcom MASTERS competition incentivizes students to continue their scientific research efforts.

ALIGNMENT TO DSEC STRATEGY

Engage students and educators in meaningful STEM experiences

Students conduct meaningful STEM research and compete in science fairs and at Broadcom MASTERS. Students increase their awareness of current, real-world science topics through use of the Science News for Students and the Science News in High Schools program. Teachers learn STEM pedagogy and methods to help their students complete scientific research at the MSRTC.

Serve students who are military-connected and underrepresented in STEM

Awards are provided for middle school–affiliated fairs at military-connected locations. Preference is given to military-connected schools and schools supporting students who are underrepresented in STEM for special opportunities connected with the MSRTC. Outreach to military-connected educators takes place to encourage the use of Science News for Students as a resource to share with students. Science News in High Schools is distributed to military-connected high schools, including DoDEA schools and those that are part of NMSI’s military-connected schools.

Connect to the DoD STEM workforce

MSRTC provides an opportunity for DoD STEM to share information about the DoD STEM workforce with middle school educators.
<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadcom MASTERS Competition</td>
<td>Engage</td>
<td>• Engagement with a broader science community increases</td>
<td>• Increased interest, confidence, and persistence in STEM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students gain confidence in STEM ability and are likely to continue in competitions</td>
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</tr>
</tbody>
</table>
| Middle School Research Teachers Conference | Engage  Serve Connect | • Teachers learn STEM pedagogy and ways to help their students complete scientific research  
• Teachers gain knowledge about science competitions  
• Teachers learn about STEM military careers that their students could pursue  
• Teachers learn about professional development opportunities with DoD labs  
• Engagement with a broader science community increases  
• Students have increased confidence in presenting their work | • Increased knowledge of teaching STEM topics in the classroom  
• Teachers see themselves as leaders in science education |
| Science News for Students           | Engage  Serve     | • Awareness of current, real-world science topics increases  
• Awareness increases of current science news resources to bring into the classroom | • Increased knowledge of and interest in current, real-world science topics |
St. Petersburg College

St. Petersburg College alumni rank first in Florida for possessing the most valuable job skills among 2-year colleges. Founded in 1927, St. Petersburg was Florida’s first 2-year college and the first to offer bachelor’s degrees. St. Petersburg offers more than 110 degree and certificate programs, including many high-demand, high-skill, and industry-recognized workforce certifications.

SCOPE SUMMARY

The St. Petersburg College STEM Internship Expansion Initiative provided underrepresented minorities and military-connected students with professional development and career training in STEM-related industries. Through this program, 42 underrepresented minority and veteran students received the opportunity to gain valuable experience in STEM industry sectors through paid internships. These opportunities were in STEM-related fields, including IT, biotechnology, engineering/advanced manufacturing, healthcare, biology, and environmental science.

OPTION YEAR ONE FUNDING CATEGORY

Innovation Bloc: $175,000–$450,000

42 students were accepted into the STEM Internship Expansion Initiative

35% of intern survey respondents were offered employment by their internship site hosts
DSEC FOOTPRINT

RATIONALE FOR APPROACH

By participating in meaningful hands-on, real-world experiences in the STEM workforce, students build their confidence and interest in a STEM career. Career readiness is a key component to student success, and receiving professional development prepares student interns to effectively network with industry experts and perform at the highest level in the workforce.

The development of students’ STEM identity requires they have an interest in STEM professions, are able to develop confidence in STEM skills, and are able to envision how they can contribute to STEM enterprises (Krishnamurthi et al., 2014). Knouse and Fontenot (2008) identify internships as one of the most beneficial industry partnerships, which support students in developing STEM skills and thereby enhancing future employment opportunities.

ALIGNMENT TO DSEC STRATEGY

Engage students and educators in meaningful STEM experiences

Students interact with working STEM professionals, providing real-world context to the STEM topics and classes they encounter at school.

Serve students who are military-connected and underrepresented in STEM

Recruitment activities are targeted toward underserved students. Over 60% of students enrolled at St. Petersburg College are women, and 40% are minorities. Of students over the age of 26, 69% are at low–moderate income levels.
## LOGIC MODEL

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes and Primary Impacts</th>
</tr>
</thead>
</table>
| Career readiness workshops | Engage | • Students gain knowledge of career skills such as workplace communication, resume development, job search skills, interviewing skills, and personal branding  
• Students feel more confident to begin an internship |
| Serve |  |
| STEM internship expansion | Engage | • Students participate in work-based learning experiences  
• Students gain real-world experience in a STEM career  
• St. Petersburg College strengthens partnerships with STEM industry partners |
| Serve |  |
TGR Foundation, A Tiger Woods Charity

TGR Foundation, a Tiger Woods Charity, has targeted STEM skills and career awareness for underrepresented students. Building on its previous work with in-person teacher development, TGR is producing an online training academy for STEM educators to receive professional development for implementing high-quality, integrated STEM teaching and learning in the classroom in addition to hosting virtual professional development training sessions for educators across the country.

**SCOPE SUMMARY**

TGR Foundation provided STEM teacher professional development with a focus on underserved students and supplemented their online training academy with reusable assets for STEM educators across the country to provide professional development that will aid in implementing high-quality, integrated STEM teaching and learning in the classroom. Programming included how to successfully implement online inquiry-based learning and more. Targeted marketing efforts took place in the three DSEC hub regions to ensure that educators from those areas were aware of and could access these resources. Dedicated STEM studio sessions were held for teachers in the Dayton and DMV hub regions and for the DoD STEM Ambassador cohort. TGR Foundation also identified additional opportunities to engage with DSEC partners on new initiatives to deliver STEM professional development to teachers and STEM learning opportunities to students with targeted emphasis on the same DSEC hubs and military-connected students.

**OPTION YEAR ONE FUNDING CATEGORY**

STEM Education and Outreach: $250,000–$550,000

185 teachers participated in STEM professional development

119 teachers served through STEM studios
RATIONAL FOR APPROACH

Teachers who participate in professional learning that focuses on skill development and connection to STEM careers, using TGR’s self-paced online training modules as supplemental learning opportunities, benefit from improved STEM teaching practices. This helps establish a virtual community of like-minded STEM educators and provides easily accessible resources that can be used to strengthen and deepen future in-person TGR trainings and seminars.

STEM integration in secondary schools has been shown to decrease achievement gaps involving underrepresented student populations (Bicer et al., 2018; Wiswall et al., 2014). Blended learning in STEM produced higher achievement scores than traditional teaching approaches (Seage & Türegün, 2020).

ALIGNMENT TO DSEC STRATEGY

**Engage** students and educators in meaningful STEM experiences

Teachers learn how to integrate STEM programming with other subjects through project-based learning to highlight real-world problems and roles. This results in more student-centered learning environments, increasing deep student engagement in STEM.

**Serve** students who are military-connected and underrepresented in STEM

TGR is focusing its efforts on the DSEC hub areas, all of which serve military-connected and underrepresented students.

**Connect to the DoD STEM workforce**

DoD STEM workforce professionals are included in the teacher training modules to provide real-world insight into STEM careers.
# LOGIC MODEL

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online training academy</td>
<td>Engage</td>
<td>• Teachers understand how to integrate STEM programming with other subjects&lt;br&gt;• Teachers can identify high-quality materials&lt;br&gt;• Teachers use project-based, inquiry-based, and transdisciplinary learning with students to highlight real-world problems and roles&lt;br&gt;• Teachers are more likely to implement STEM strategies following the training&lt;br&gt;• Teachers provide STEM career insights to students by linking classroom activities to STEM careers&lt;br&gt;• Teachers have more confidence in ability to engage with students in STEM&lt;br&gt;• Teachers have confidence in talking to students about careers in STEM&lt;br&gt;• Teachers understand collaborative teaching strategies&lt;br&gt;• Teachers develop new techniques to deliver STEM education&lt;br&gt;• Teachers are more confident in their ability to engage with students in STEM&lt;br&gt;• Teachers are confident in discussing careers in STEM with their students&lt;br&gt;• Teachers develop an understanding of collaborative, student-centered teaching strategies&lt;br&gt;• Teachers develop new techniques to deliver STEM education</td>
<td>• Teachers recognize and implement high-quality, integrated STEM programming in the classroom&lt;br&gt;• Teachers become more aware of linking classroom activities to STEM careers&lt;br&gt;• Teachers have increased confidence in implementing STEM strategies within the classroom&lt;br&gt;• Student exposure to STEM careers increases&lt;br&gt;• Teachers collaborate and engage within a community of STEM educators</td>
</tr>
</tbody>
</table>
Teaching Institute for Excellence in STEM (TIES)

TIES is an international STEM education consultancy and learning service provider. TIES believes that catalyzing broad, diverse stakeholder engagement in support of robust STEM education creates a force multiplier effect that strengthens our schools and communities and helps ensure that all students complete secondary education “STEM ready.” TIES facilitates design studios within the DSEC hubs that bring community stakeholders together to create STEM Ecosystems.

SCOPE SUMMARY

TIES expanded existing partnerships between STEM Ecosystems and DoD installations and facilitated Design Studios in each of the hubs to co-create a set of design principles for STEM programming, outreach, and sustainability. This resulted in the development of custom hub activities and sustainability plans for each hub. TIES also coordinated with BEST to increase hub connections to STEM Ecosystems (including the use of virtual design studios).

INNOVATION BLOC SCOPE SUMMARY

Through its operation of the STEM-on-the-Go mobile fabrication and machining van, TIES brought an industry-recognized credentialing program in Additive Manufacturing to three high schools in Onslow and Harnett County, NC, and supported Career Technical Education Programs, including Woodworking and Project Lead the Way.

OPTION YEAR ONE FUNDING CATEGORY

STEM Education and Outreach: $250,000–$550,000
Innovation Bloc: $175,000–$450,000

163 participants in STEM Ecosystems across three DSEC hub regions
133 students and 3 teachers served by the DoD STEM-on-the-Go van
RATIONAL FOR APPROACH

Creating a STEM Ecosystem brings together the collective assets of community stakeholders to ensure that all K–12 students have the opportunity to engage in STEM experiences and acquire knowledge of STEM career pathways. As part of these ecosystems, DoD STEM professionals gain an opportunity to communicate with lay audiences about their work and opportunities available to students.

Partnering across formal and informal institutions allows programs to leverage the expertise and resources of multiple institutions and have a collective impact that is larger than any one of the institutions would have individually (Harlow et al., 2020; Kania & Kramer, 2011).

ALIGNMENT TO DSEC STRATEGY

Engage students and educators in meaningful STEM experiences

The STEM Ecosystem develops a well-defined plan for programming that adheres to the community’s goals and maximizes opportunities for positive STEM learning experiences in and out of school. The STEM-on-the-Go van brings authentic engineering tools and software to students and educators, enhancing STEM teaching and learning.

Serve students who are military-connected and underrepresented in STEM

Development of STEM Ecosystems includes a focus on equity and access to STEM opportunities for military-connected and underrepresented students in each of the DSEC hub regions.

Connect to the DoD STEM workforce

Design Studio work with the DSEC hubs includes a focus on career pathways at DoD laboratories and military installations located throughout each hub region.
# Logic Model – TIES Ecosystems

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
</table>
| Develop customized hub activities: Dayton hub | Engage | • Become accepted into the STEM Learning Ecosystem community of practice  
• Build a governance structure and codify this work with a group of stakeholders | • Leverage existing governance structure and planning team to work on an actionable plan for sustainability  
• Convene/communicate with a funder’s collaborative of local philanthropies and corporate funders |
| | Serve | | |
| | Connect | | |
| | Leverage | | |
| Develop customized hub activities: San Diego hub | Engage | • Convene a virtual design studio (fall 2020)  
• Leverage existing San Diego Ecosystem to better understand and build out a full portfolio of STEM offerings | • Support creation of a working group to ensure connectivity to and networking within the broader San Diego Ecosystem to focus on a sustainable DSEC mission of serving military-connected and underrepresented students |
| | Serve | | |
| | Connect | | |
| | Leverage | | |
| Develop customized hub activities: DMV hub | Engage | • Develop relationship between Baltimore-based Bmore STEM and DSEC hub toward sustainability  
• Work toward building a pipeline for students to enter internships at DoD facilities and other industry partner locations, including a mentoring program  
• Work on expansion into DC/Northern VA (priority growth areas)  
• Create a community of practice among the DoD lab STEM coordinators (in coordination with DoD STEM office) | • Increase partner representation from DC and northern VA, including DoD labs  
• Deepen the relationship with the existing Baltimore STEM Learning Ecosystem  
• Work to develop a plan/platform for virtual programming (that is shared with other hubs) |
| | Serve | | |
| | Connect | | |
| | Leverage | | |
| Lead quarterly status calls: All hubs | Leverage | • Connect with each hub partner to formatively assess progress toward goals and outcomes | • Continue to connect hub leads to DSEC’s mission (fundamentals) |
## LOGIC MODEL – TIES DIGITAL FABRICATION LAB

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhancing career and technical education and engineering programs (Use of the mobile van)</td>
<td>Engage</td>
<td>- Students develop or build upon machining and digital fabrication skills on a range of equipment, both digital and analog&lt;br&gt;- Awareness of DOD STEM civilian careers increases</td>
<td>- Transfer of skills to postsecondary education, apprenticeship, or career context&lt;br&gt;- Increased likelihood of following a STEM teaching career trajectory&lt;br&gt;- Increased likelihood of pursuing a STEM career&lt;br&gt;- More positive attitude and greater awareness of STEM careers in the community&lt;br&gt;- Greater student consideration of careers in DoD STEM (military or civilian)</td>
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<tr>
<td></td>
<td>Serve</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Connect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stackable-credentialing programs at high schools</td>
<td>Engage</td>
<td>- Students earn National Occupational Competency Testing Institute (NOCTI) stackable industry-recognized credentials in additive manufacturing and computer-aided design&lt;br&gt;- Schools will become NOCTI credentialing sites&lt;br&gt;- Teachers receive professional development to enhance their background knowledge of additive manufacturing content for the NOCTI credentialing exam</td>
<td>- Transfer of skills to postsecondary education, apprenticeship, or career context&lt;br&gt;- Increased likelihood of following a STEM career trajectory (military or civilian)&lt;br&gt;- Opportunity for AP teachers to earn industry-recognized credentials</td>
</tr>
<tr>
<td></td>
<td>Serve</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Connect</td>
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</tbody>
</table>
USA Science and Engineering Festival (USASEF)

The USA Science and Engineering Festival is the flagship event of Science Spark, a nonprofit whose mission is to inspire the next generation toward careers in STEM fields with a particular emphasis on modeling diversity and inclusion. Out of this flagship event, SciFEST All Access, X-STEM All Access, and Inspire Educator programs were created to further fuel inspiration.

SCOPE SUMMARY

The USA Science and Engineering Festival supported DoD’s commitment to increase participation of underserved and military-connected students and teachers in STEM programs by sponsoring outreach efforts for their virtual SciFEST All Access, where both DoD STEM and DSEC had a presence.

OPTION YEAR ONE FUNDING CATEGORY

STEM Education and Outreach: $250,000–$550,000

25,117 students served by virtual SciFEST and X-STEM All Access programs

640 teachers participated in Inspire Educators workshops
RATIONALE FOR APPROACH

Students and educators who attend SciFEST All Access will participate in STEM learning activities and interact with STEM career professionals, often learning about professions and career opportunities that they did not know existed before this experience. These positive experiences inspire students to pursue STEM coursework and careers. Educators who attend Inspire Educators workshops will be exposed to professionals in educational content development, educator peers, and those with inspiring and exciting concepts for presenting content to students. These positive experiences inspire educators and equip them with skills that lead to confidence to try new and innovative STEM learning tools in their classrooms.

ALIGNMENT TO DSEC STRATEGY

**Engage** students and educators in meaningful STEM experiences

Students interact with working STEM professionals, providing real-world context to the STEM topics and classes they encounter at school.

**Serve** students who are military-connected and underrepresented in STEM

DoD’s commitment to diversity and inclusion is a focus of SciFEST All Access. The USA Science and Engineering Festival works with other nonprofit organizations to identify and invite underserved communities.

**Connect** to the DoD STEM workforce

Students learn more about DoD STEM professional career pathways and opportunities.
## Logic Model

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>SciFEST All Access (virtual)</td>
<td>Engage</td>
<td>• Students increase knowledge about STEM topics</td>
<td>• Increased student knowledge and understanding of STEM topics</td>
</tr>
<tr>
<td></td>
<td>Connect</td>
<td>• Students become more aware of and interested in STEM careers, including DoD</td>
<td>• Increased student awareness of and interest in STEM career pathways and military pathways</td>
</tr>
<tr>
<td>Inspire Educator Workshops (virtual)</td>
<td></td>
<td>• Students increase awareness of accessing STEM career pathways (such as internships)</td>
<td>• Increased student awareness of accessing STEM career pathways</td>
</tr>
<tr>
<td>X-STEM All Access (virtual)</td>
<td></td>
<td>• Parents gain better understanding of a student’s STEM career planning</td>
<td>• Increased parent interest and involvement in student STEM career pathways</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers understand new ways to engage students in STEM learning</td>
<td>• Increased teacher ability to engage students in STEM learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers gain better understanding of STEM careers and pathways to those careers</td>
<td>• Increased teacher confidence in teaching STEM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers build confidence in STEM teaching</td>
<td>• Increased teacher ability to use STEM educational tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers are equipped with STEM educational tools</td>
<td>Teachers share with their students information learned at the SciFEST All Access related to STEM topics and careers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers are exposed to STEM career opportunities</td>
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</tr>
</tbody>
</table>
I have always loved aerospace and being able to come to Air Camp was a great experience where I learned so much about the basics of aerospace engineering. Learning from this now will help me a lot in my future career.

– Matthew, student participant, Dayton Regional STEM Center
Three of the DSEC-funded STEM education and outreach partners serve as regional hubs supporting targeted, place-based programming. Hubs facilitate connections between DSEC outreach programs, DoD Installations, and local schools through their deep understanding of the community context in which they are embedded. Hubs are accepted as trusted partners in their communities that speed up the implementation rate and sustainability of programs. Each of the three hubs prioritize building relationships with and creating opportunities for schools and districts within or near their surrounding counties. Hubs also function as STEM Ecosystems in their regions.

All three hubs set their goals and workplans to align to the DSEC fundamentals, and also focused on meeting their unique community needs in Option Year One. This section includes a brief overview of each hub’s DSEC-funded activities and a summary of their outreach approach.
Dayton, OH, Hub: Dayton Regional STEM Center (DRSC)

DRSC is a professional development institute located in southwest Ohio. DRSC serves as a regional clearinghouse for information regarding STEM activities, awards programs, and research opportunities for students and teachers.

SCOPE SUMMARY

DRSC provided STEM teacher professional development, improved access to DoD STEM experiences for students, and engaged in STEM workforce advocacy, including STEM career awareness, apprenticeships for students, and mentor meetings. DRSC strengthened the STEM workforce pipeline in the Dayton region by engaging students in DoD, DSEC partner, and regional STEM outreach opportunities and programs—including Science Saturdays, Dayton STEM Ecosystem, Future Fair, and the distribution of at-home and summer/after-school STEM kits. DRSC also partnered with the Air Force Research Laboratory and other DSEC partners to offer opportunities for the region.

HUB GOALS

1. Leverage DSEC hub role and newly acquired designation as an official STEM Ecosystem to expand partnerships.
2. Deepen outreach and connection to area DoD assets and stakeholders.
3. Increase student participation in DSEC partner programs.
4. Increase teacher understanding of STEM through professional development.
5. Increase student participation in STEM outreach to promote STEM careers, with a focus on military-connected and underserved students.

OPTION YEAR ONE FUNDING CATEGORY

Outreach Hub Coordinator: $175,000

46 students served through Air Camp

15 teachers received professional development through the STEM Fellows program

Coordinated program delivery in Ohio area in partnership with 8 DSEC Education and Outreach partners and 2 DSEC hubs
DSEC FOOTPRINT

RATIONALE FOR APPROACH

Aligning resources and opportunities in the hubs creates a pipeline of STEM activity for K–12 students and brings together the collective assets of community stakeholders to ensure that all K–12 students have the opportunity to engage in STEM experiences and knowledge of STEM career pathways. In addition, DoD STEM professionals gain an opportunity to communicate with lay audiences about their work and opportunities available to students.

ALIGNMENT TO DSEC STRATEGY

**Engage** students and educators in meaningful STEM experiences

The professional development that DRSC provides assists teachers in planning and facilitating meaningful STEM experiences for students. Additional collaboration with DSEC Education and Outreach partners brings a variety of STEM experiences and exposure to STEM pathways and careers to students and educators in the Dayton, Ohio, region.

**Serve** students who are military-connected and underrepresented in STEM

DRSC promotes connection pathways and engagement opportunities for other outreach partners within the Greater Dayton region. Developing the STEM Ecosystem includes a focus on equity and access to STEM opportunities for military-connected and underrepresented students.

**Connect** to the DoD STEM workforce

DRSC brokers connections between the local DoD STEM workforce and other outreach partners.

**Leverage** the network as a force multiplier

DRSC has developed trusting relationships within the Greater Dayton region and brokers relationships among schools, community partners, DoD installations, and DSEC Education and Outreach partners.
## Logic Model – Regional Growth

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarterly communication with Air Force stakeholders</td>
<td>Connect</td>
<td>• Clear communication of Dayton Regional STEM Center (DRSC) events/activities</td>
<td>• Improved communication between DRSC and DoD programs leads to more STEM opportunities for students and teachers</td>
</tr>
<tr>
<td></td>
<td>Leverage</td>
<td>• Opportunities for PreK–12 students to engage with DoD programming</td>
<td></td>
</tr>
<tr>
<td>Asset mapping</td>
<td>Leverage</td>
<td>• Clear and accurate picture of DSEC programming in the Dayton region</td>
<td>• Improved awareness of DSEC activities based on geographic location</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Analysis of data informs future programming decisions</td>
</tr>
<tr>
<td>Further the development of the Dayton, Ohio, STEM Ecosystem (DO STEM)</td>
<td>Engage</td>
<td>• Improved communication network for STEM stakeholders in the Dayton region</td>
<td>• Increased opportunities for diverse students to engage in STEM offerings</td>
</tr>
<tr>
<td></td>
<td>Serve</td>
<td></td>
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</tr>
<tr>
<td>Programming</td>
<td>DSEC Fundamental</td>
<td>Immediate Changes</td>
<td>Primary Impacts</td>
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</tr>
<tr>
<td>Air Camp</td>
<td>Engage</td>
<td>- Military-connected students and/or students underrepresented in STEM have increased STEM experiences via scholarships</td>
<td>- High-quality STEM experience for students&lt;br&gt;- Increased awareness of DoD STEM careers</td>
</tr>
<tr>
<td></td>
<td>Serve</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Connect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Career Awareness Week</td>
<td>Engage</td>
<td>- Students learn about local STEM career opportunities</td>
<td>- Increased awareness of STEM careers&lt;br&gt;- Increased awareness of DoD STEM careers</td>
</tr>
<tr>
<td>(virtual – in May)</td>
<td>Serve</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Connect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Saturdays</td>
<td>Engage</td>
<td>- Students gain knowledge of various science topics and careers</td>
<td>- Increased awareness of STEM careers&lt;br&gt;- Increased awareness of science topics</td>
</tr>
<tr>
<td></td>
<td>Serve</td>
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</tbody>
</table>
DMV Hub: Morgan State University (MSU) Center for Excellence in Mathematics and Science Education (CEMSE)

MSU CEMSE enhances STEM education in Maryland with special focus on the underrepresented minority student population. Located in the DMV region, CEMSE has abundant access to DoD installations and serves as a professional development provider and hub coordinator to facilitate connections between DSEC Education and Outreach partners, local community members, and DoD laboratories.

**SCOPE SUMMARY**

MSU CEMSE provided professional development to STEM teachers, supported a STEM mentor program, hosted a virtual STEM Expo, and focused on minority engagement in STEM in the DMV region. As a regional DoD outreach hub, CEMSE collaborated with DSEC partners CYBER.ORG, MATHCOUNTS, NCWIT, TGR Foundation, and TIES to provide student outreach, programming, exposure to STEM careers, and professional development for pre-service and in-service educators. In partnership with Citizen Schools, two Maker Fellows supported the development of programming at MSU for middle and high school students located within the community, including military-connected schools in the DMV. MSU served as the lead—with support from BEST, RTI, and AIR—to support two initial community college and HBCU partners in designing pathways to reach traditionally underserved populations in STEM. The initial network focus areas were the DMV and Dayton regions, with Bowie State University, Prince George's Community College, Central State University, and Sinclair Community College invited to participate. The planning phase included a landscape analysis and needs assessment to determine the pathway options to consider for implementation. The design phase included supporting the institution partners in the design of their pathways programs and completing applications for DSEC funds to implement the pathway beginning in fall 2021.

**HUB GOALS**

1. Expand participation in DSEC partner programs.
2. Deepen connection to stakeholders across the DMV region, with a focus on leveraging the existing Baltimore STEM Ecosystem to function as a force multiplier for the work of DSEC.
3. Increase student participation in the STEM Expo at MSU.
4. Increase the number of STEM career and DoD STEM career exhibits at the STEM Expo.

**2,753**

students participated in the 2020 Virtual STEM Expo

**106**
educators participated in professional development programming

**OPTION YEAR ONE FUNDING CATEGORY**

Outreach Hub Coordinator: $175,000
DSEC FOOTPRINT

DMV

RATIONALE FOR APPROACH
Aligning resources and opportunities in the hubs creates a pipeline of STEM activity for K–12 students and brings together the collective assets of community stakeholders to ensure that all K–12 students have the opportunity to engage in STEM experiences and knowledge of STEM career pathways. In addition, DoD STEM professionals gain an opportunity to communicate with lay audiences about their work and opportunities available to students.

ALIGNMENT TO DSEC STRATEGY

Engage students and educators in meaningful STEM experiences

The professional development provided by CEMSE assists teachers in planning and facilitating meaningful STEM experiences for students while earning graduate credit. Additional collaboration with DSEC Education and Outreach partners brings a variety of STEM experiences and exposure to STEM pathways and careers to students and educators in the DMV region.

Serve students who are military-connected and underrepresented in STEM

CEMSE promotes connection pathways and engagement opportunities for other outreach partners within the DMV region. Developing the STEM Ecosystem includes a focus on equity and access to STEM opportunities for military-connected and underrepresented students.

Connect to the DoD STEM workforce

CEMSE brokers connections between the local DoD STEM workforce and other outreach partners.

Leverage the network as a force multiplier

CEMSE has developed trusting relationships within the DMV region and brokers relationships among schools, community partners, DoD installations, and DSEC Education and Outreach partners.
<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase work with military-connected schools in the area</td>
<td>Engage</td>
<td>• Middle school and high school students have more opportunities to participate in DSEC and DoD STEM programming</td>
<td>• More military-connected students participate in DSEC and DoD STEM programming</td>
</tr>
<tr>
<td></td>
<td>Serve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase connection with DoD laboratories in the DMV area</td>
<td>Leverage</td>
<td>• K–12 students and teachers engage in DoD STEM activities with DoD laboratories and facilities</td>
<td>• DoD laboratories increase their involvement in supporting DSEC</td>
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<tr>
<td>Continue development of the DMV STEM Ecosystem</td>
<td>Leverage</td>
<td>• Stakeholder engagement expands toward a shared understanding of increasing access to STEM learning opportunities for all students</td>
<td>• DMV STEM Ecosystem becomes a source for connection and collaboration among STEM partners in the region</td>
</tr>
<tr>
<td></td>
<td>Evolve</td>
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</tbody>
</table>
## LOGIC MODEL – STEM OUTREACH PROGRAMMING

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
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</thead>
<tbody>
<tr>
<td>2020 Virtual STEM Expo</td>
<td></td>
<td></td>
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<tr>
<td>Engage</td>
<td>Students participate in STEM activities linked to STEM jobs and careers</td>
<td></td>
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<tr>
<td>Serve</td>
<td></td>
<td>Students increase their knowledge of DoD STEM careers</td>
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<tr>
<td>Connect</td>
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<tr>
<td>Rocketry Club for middle and high school students</td>
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</tr>
<tr>
<td>Engage</td>
<td>Students gain knowledge of rocket science</td>
<td>Students have an increased awareness of STEM careers</td>
<td></td>
</tr>
<tr>
<td>Serve</td>
<td>Students learn about aerospace jobs and careers</td>
<td></td>
<td></td>
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<tr>
<td>Connect</td>
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<td></td>
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<tr>
<td>Professional development seminar for DMV teachers (virtual)</td>
<td></td>
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<tr>
<td>Engage</td>
<td>Teachers expand digital platforms for teaching and learning</td>
<td>Teachers increase skills for teaching STEM virtually</td>
<td></td>
</tr>
<tr>
<td>Serve</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undergraduate Near-Peer Mentoring Program (virtual)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engage</td>
<td>K–12 students gain knowledge of STEM topics</td>
<td>High school students increase their STEM skills</td>
<td></td>
</tr>
<tr>
<td>Serve</td>
<td>MSU students gain experience in mentoring</td>
<td>High school students have an increased knowledge of DoD STEM careers</td>
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<tr>
<td>Connect</td>
<td></td>
<td>MSU students develop mentoring skills</td>
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<tr>
<td>Virtual field trips for military-connected schools</td>
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<tr>
<td>Engage</td>
<td>Students and teachers learn about military STEM careers and opportunities</td>
<td>Students and teachers increase their knowledge of STEM opportunities</td>
<td></td>
</tr>
<tr>
<td>Serve</td>
<td></td>
<td>Students increase their knowledge of DoD STEM careers</td>
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<tr>
<td>Connect</td>
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San Diego, CA, Hub: University of California San Diego (UC San Diego) Center for Research on Educational Equity, Assessment, and Teaching Excellence (CREATE)

UC San Diego CREATE was established in 1997 to support local K–12 outreach and college preparation for students who are too often underrepresented in higher education. CREATE serves as a professional development provider and hub coordinator to facilitate connections among DSEC Education and Outreach partners, local community members, and DoD laboratories.

**SCOPE SUMMARY**

UC San Diego CREATE organized, coordinated, and communicated across the San Diego region’s DoD-supported STEM outreach programming to share ideas and build on shared networks and program strengths. UC San Diego CREATE assisted DoD STEM outreach programs in expanding or deepening their reach for high-potential, traditionally underserved, and underrepresented students in San Diego as program funds allowed. Programs included MATHCOUNTS, NCWIT’s AspireIT program, TIES, NMSI, DoD internships, Space and Naval Warfare Systems Center speakers, panelists, and naval mentorships. UC San Diego CREATE also recruited for a new DSEC partner, San Diego Miramar College, and supported the design of the UC San Diego Math Project Academy near Camp Pendleton. In addition, robust conversations took place to recruit new DSEC programs such as the TGR Foundation and Citizen Schools into the San Diego area.

**HUB GOALS**

1. Streamline connectivity and outreach to the DoD installations to improve access to and efficiency of DoD resource allocation.
2. Gather and map existing STEM programming data to better understand the STEM landscape, including identifying STEM deserts.
3. Deploy resources more equitably for more impact.
4. Continue to increase connectivity with the existing San Diego STEM Ecosystem to act as a force multiplier for the work of DSEC.

**OPTION YEAR ONE FUNDING CATEGORY**

Outreach Hub  
Coordinator: $175,000  
Innovation Bloc: $175,000–$450,000

258 students participated in STEM panel series

12 students and 25 teachers served by the UC San Diego Math Project Academy

Coordinated program delivery in San Diego area in partnership with 5 DSEC Education and Outreach partners
Rationale for Approach

Aligning resources and opportunities in the hubs creates a pipeline of STEM activity for K–12 students and brings together the collective assets of community stakeholders to ensure that all K–12 students have the opportunity to engage in STEM experiences and knowledge of STEM career pathways. In addition, DoD STEM professionals gain an opportunity to communicate with lay audiences about their work and opportunities available to students.

Alignment to DSEC Strategy

**Engage students and educators in meaningful STEM experiences**

UC San Diego Math Academy professional development provided by UC San Diego CREATE’s Math Project assists teachers in planning and facilitating coding through mathematical problem solving for students. Additional collaboration with DSEC Education and Outreach partners brings a variety of STEM experiences and exposure to STEM pathways and careers to students and educators in the San Diego region.

**Serve students who are military-connected and underrepresented in STEM**

UC San Diego CREATE promotes connection to pathways and engagement opportunities for other outreach partners within the Greater San Diego region. Development of the STEM Ecosystem includes a focus on equity and access to STEM opportunities for military-connected and underrepresented students.

**Connect to the DoD STEM workforce**

UC San Diego CREATE brokers connections between the local DoD STEM workforce and other outreach partners and acts as a trusted catalyst among K–16 partners and nonprofits to accelerate acceptance of and interest in DoD STEM programming.

**Leverage the network as a force multiplier**

UC San Diego CREATE has developed trusting relationships among the Greater San Diego region’s educators and nonprofits and among government officials and brokers relationships among schools, community partners, DoD installations, and DSEC Education and Outreach partners.
# Logic Model — Regional Growth

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revise and revisit the geographic information system (GIS) map to inform programming</td>
<td>Leverage</td>
<td>• Determine where new programming occurred in 2019–2020 in the San Diego area&lt;br&gt;• Determine gaps in DSEC programming in the San Diego area</td>
<td>• K–12 districts, teachers, and students in the San Diego area have access to a yearly calendar of events&lt;br&gt;• Partner coordination and collaborative efficiencies increase</td>
</tr>
<tr>
<td>Host a Design Studio event with TIES</td>
<td>Leverage</td>
<td>• Increase connection with regional and DSEC partners</td>
<td>• Partner coordination and collaborative efficiencies increase&lt;br&gt;• Local STEM educators gain an understanding of available programming</td>
</tr>
<tr>
<td>Build relationships between DSEC partners and local educators and schools that serve priority student groups</td>
<td>Serve Leverage</td>
<td>• Make local educators and schools from identified districts more aware of DSEC partner programming&lt;br&gt;• Increase collaboration with leading STEM advocates in identified districts</td>
<td>• Participation of students and teachers in DSEC programming increases in identified districts</td>
</tr>
<tr>
<td>Continue to support marketing of DSEC program events</td>
<td>Leverage</td>
<td>• Introduce and broaden awareness of DSEC partner programs&lt;br&gt;• Increase collaboration and support from leading STEM advocates in identified districts</td>
<td>• Participation of students and teachers in DSEC programming increases throughout the San Diego area</td>
</tr>
</tbody>
</table>
## LOGIC MODEL – STEM OUTREACH PROGRAMMING

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEM panel series</strong></td>
<td></td>
<td><strong>Engage</strong></td>
<td><strong>Connect</strong></td>
</tr>
<tr>
<td>highlighting military careers</td>
<td></td>
<td>• High school and community college students participate</td>
<td>• High school and community college students gain knowledge of military-connected careers in STEM</td>
</tr>
</tbody>
</table>

## LOGIC MODEL – UC SAN DIEGO MATH

<table>
<thead>
<tr>
<th>Programming</th>
<th>DSEC Fundamental</th>
<th>Immediate Changes</th>
<th>Primary Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summer Institute for Teachers</strong></td>
<td></td>
<td><strong>Engage</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants learn discrete math concepts</td>
<td>• Teachers increase their mathematical content knowledge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants gain knowledge of how discrete math links to computer science foundations</td>
<td>• Teachers develop mathematical pedagogical content knowledge for discrete math</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants develop fluidity in expressing recursive functions and connecting them to explicit forms (iteration)</td>
<td>• Teachers learn new tools to use strategically in the classroom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants develop a rudimentary knowledge of cryptography and counting (combinations and permutations)</td>
<td>• Teachers gain pedagogical content knowledge attending to SMP5 (using tools strategically) and connecting mathematics with computer science</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants gain programming skills in Python on Jupyter notebooks</td>
<td>• Participants can program in Python using the Jupyter notebooks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers learn about multiple resources and where to find them</td>
<td>• Teachers draw upon multiple resources to use in the classroom</td>
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<tr>
<td></td>
<td></td>
<td>• Teachers gain the confidence to develop/ implement this learning in their classrooms</td>
<td>• Teachers gain the confidence and independence to develop lessons and implement the project in their classrooms</td>
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<tr>
<td></td>
<td></td>
<td>• Teachers learn to work together to develop lessons</td>
<td>• Teachers form a robust professional network on the topic of discrete math</td>
</tr>
<tr>
<td>Programming</td>
<td>DSEC Fundamental</td>
<td>Immediate Changes</td>
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</tr>
<tr>
<td>Summer Academy for Students</td>
<td>Engage Connect</td>
<td>• Participants learn discrete math concepts</td>
<td>• Students increase their mathematical knowledge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants gain knowledge of how discrete math links to computer science foundations</td>
<td>• Students gain knowledge of DSEC partner opportunities</td>
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<td>• Participants develop fluidity in expressing recursive functions and connecting them to explicit forms (iteration)</td>
<td>• Participants can program in Python using the Jupyter notebooks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants develop a rudimentary knowledge of cryptography and counting (combinations and permutations)</td>
<td>• Students pursue other STEM opportunities (e.g., internships, club memberships, research experiences)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants gain programming skills in Python on Jupyter Notebooks</td>
<td>• Students pursue coursework toward a STEM career</td>
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<td></td>
<td></td>
<td>• Students gain awareness of STEM opportunities with DoD facilities and other DSEC partners</td>
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<tr>
<td></td>
<td></td>
<td>• Students gain awareness of STEM careers</td>
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<tr>
<td>Follow-up sessions with teachers</td>
<td>Engage Connect</td>
<td>• Teachers continue to gain proficiency with Python</td>
<td>• Teachers increase their mathematical content knowledge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers understand how to refine Python coding projects for students</td>
<td>• Teachers develop mathematical pedagogical content knowledge for discrete math</td>
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<td>• Teachers learn about multiple resources and where to find them</td>
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<td>• Teachers gain the confidence and independence to develop lessons and implement the project in their classrooms</td>
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</table>
I enjoyed the opportunity to meet teachers across the nation at the Middle School Research Teacher Conference... who all have a goal of engaging students in authentic scientific research.

– Kathy, teacher participant, Society for Science
DSEC is arranged into five operational elements:
(1) Consortium Management, (2) Program Evaluation,
(3) Outreach and Communications, (4) STEM Alumni
Management, and (5) Strategic Outreach Initiatives.
This section describes key activities and highlights for
each DSEC operational element.
ELEMENT 1: CONSORTIUM MANAGEMENT

INDIVIDUAL PROGRAM ADMINISTRATOR (IPA)
Rebecca Stanley, PhD (RTI)

SCOPE SUMMARY IN OPTION YEAR ONE (2020–2021)
The primary scope for Element 1: Consortium Management in Option Year One was to provide leadership and coordination of DSEC. Element 1 ensured that all operational elements focused on planning and executing programs in alignment with DoD STEM priorities and goals. In addition, RTI planned and executed consortium-wide deliverables, facilitated consortium meetings, and completed overall consortium management efforts. RTI executed all tasks associated with Element 1, which included project management, logistics, status reporting, subcontracting, communications within DSEC, CMC management, annual planning, STEM Advisory management, and liaising with DoD STEM.

KEY ACTIVITIES
• Planned, managed, and executed DSEC quarterly meetings, engaging all management and outreach partners to promote communication and alignment.
• Executed and managed all subawards and subcontracts with DSEC partners.
• Established cadence; planned, managed, and executed biweekly CMC and Cooperative Agreement Manager coordination meetings.
• Prepared DSEC-wide deliverables, including monthly status updates, quarterly reports, summary documents, and ad hoc requests.
• Organized and managed the overall DSEC project plan.
• Managed intra-DSEC general communications.
• Managed and executed DSEC business operations such as contracts, financial reporting, forecasting, and invoicing.
• Coordinated and managed STEM Advisory activities and contributions.
• Established the application and review process for Innovation Bloc.
• Organized and prepared the DSEC Annual Program Review.
• Organized and prepared the DSEC Annual Program Plan, including input structure for all partners (midyear/interim and final versions).
• Established processes and protocols to ensure smooth integration of Innovation Bloc partners and activities and facilitated onboarding sessions with each new partner.
• Planned, managed, and executed virtual networking meetings with DSEC partners around important and timely themes.
• Collaborated with Elements 2, 3, 4, and 5 to redesign Amaze to centralize event tracking, data reporting, and information management into a single platform.
OUTCOME HIGHLIGHTS

- Fostered relationships and promoted collaboration across DSEC organizations to strengthen the consortium.
- Facilitated shared visioning and strategic alignment.
- Facilitated networking sessions around topics of interest such as transitioning to remote learning, using data purposively, and supporting military-connected students.
- Collaborated with CMC members to move work forward, select and approve new Innovation Bloc partners, and encourage further collaboration among partners.
- Extended the reach of DSEC through an Advisory to engage additional STEM partners in guiding the overall plans and activities of DSEC.
- Responded to feedback from partners to allow for more time for partner engagement and collaboration at DSEC functions.
- Developed and launched the DoD STEM Ambassador program.
ELEMENT 2:
PROGRAM EVALUATION

INDIVIDUAL PROGRAM ADMINISTRATOR (IPA)
Joseph Wilson, PhD (AIR)

SCOPE SUMMARY IN OPTION YEAR ONE (2020–2021)
The primary scope for Element 2: Program Evaluation was to manage data collection, assessment/analysis, and reports for DSEC structured around four overall goals:

1. Develop priority questions and evaluation agendas in collaboration with DoD and consortium members.
2. Improve data availability, consistency, and quality for DoD STEM programs.
3. Generate new evidence about the reach and impact of DoD STEM programs.
4. Support learning and continuous improvement through the consortium.

KEY ACTIVITIES BY EVALUATION TASK

Evaluation Coordination
- Created methodology brief for outreach partners in coordination with Element 4 to distinguish the difference between each element’s collected data and addressed outcomes.
- Coordinated data collection with Element 4 to reduce the overall DSEC partner data burden.
- Held onboarding meetings with all Innovation Bloc partners.
- Delivered the base year evaluation chapter in interactive PDF and Section 508–compliant PDF versions.
- Created two at-a-glance one-pagers highlighting the executive summary and outreach partner data from the evaluation chapter.
- Discussed base year evaluation findings with the DSEC STEM Advisory.
- Produced a literature scan covering key topics that included the impacts of COVID-19 on the U.S. educational system, STEM education in rural communities and community colleges, and SNA as a tool to understand interorganizational interactions within a consortium.

Hub Evaluation
- Launched monthly survey to collect partner and hub networking activity.
- Met monthly with BEST and TIES to review SNA data and refine understanding of networking connections.
- Updated hub logic models to align with the DSEC fundamentals.
- Developed framework and protocols for first hub case study.
- Conducted interviews with hub leads and select external hub partners.
- Delivered hub case study report.

Partner Evaluation
- Created sample registration questions for partners to use in support of DSEC data collection efforts.
- Updated outreach partner logic models to align with the DSEC fundamentals.
- Provided partners and hubs an Element 2 timeline and summary of data requests for Option Year One during one-on-one meetings.
• Launched monthly partner and hub networking activity survey.
• Met monthly with BEST and TIES to review SNA data and refine understanding of networking connections.
• Provided coordinated support with BEST to HBCU/MI Pathways Network institutions.
• Launched annual survey to collect participant data and logic model outcomes from all partners and hubs.

Consortium Management Evaluation
• Conducted interviews and compiled artifacts to create the Option Year One Consortium Management Evaluation Report.

Data Visualization
• Solicited partner and hub approval for public disclosure of map data on ArcGIS.
• Supported DSEC understanding and use of map visualizations by holding walk-through sessions, sharing video tutorials, and creating documentation on available map layers.
• Improved performance of all DSEC-related map renderings on ArcGIS.

OUTCOME HIGHLIGHTS
• Provided continued support for outreach partner and hub understanding of evaluation through discussions to align their logic models with the DSEC fundamentals.
• Consolidated the annual survey to one platform and provided guidance documents to improve education and outreach partners’ user experience.
• Coordinated with other element partners to make evaluation tools more useful and streamlined.
• Shared findings and products with DSEC members through group presentations and discussions to increase transparency and member understanding of the tools available to them.
• Produced the first hub case study and delivered a second consortium management evaluation.
• Delivered the base year data chapter in an interactive PDF format and received positive feedback on the layout and structure.
ELEMENT 3: OUTREACH AND COMMUNICATIONS

INDIVIDUAL PROGRAM ADMINISTRATOR (IPA)
Janell Kochevar (RTI)

SCOPE SUMMARY IN OPTION YEAR ONE (2020–2021)
For Option Year One, there were two primary objectives for Element 3: Outreach and Communications. The first was to continue to promote DoD STEM and DSEC as a coordinated and cohesive effort offering students and teachers a pipeline of STEM educational opportunities. The second was to plan, manage, and execute an elevated communication strategy supporting DoD STEM priorities and goals.

KEY ACTIVITIES
• Redesigned and launched the first phase of the dodstem.us website. Modernized the technology stack and system infrastructure. Improved the organization of the website content and updated the look and feel to appeal to a broad audience.
• Developed “We are DoD STEM” awareness raising campaign highlighting DoD STEM professionals, innovations, and opportunities.
• Added a “SMART Scholarship-for-Service” page to the Participate section of the dodstem.us website to highlight SMART scholar benefits and awardees. Worked with the SMART program office to cross-promote application cycles on the dodstem.us website and social media channels.
• Highlighted DoD Innovator Spotlight awardees in the Meet DoD STEM section of the dodstem.us website and promoted the DoD Innovator webinar series.
• Added “Our Impact” page to the About section of the dodstem.us website to highlight program activities and outcomes, evaluation reports, and the DoD Strategic Plan.
• Created a workflow to allow for easy submission of calendar events to be added to the dodstem.us website.
• Continued to create and feature engaging blog posts that showcase a range of activities across DSEC and DoD STEM.
• Directed and incorporated a DoD STEM overview video into the dodstem.us website.
• Incorporated a Partner Resource section into the online resources section of the dodstem.us website in response to COVID-19.
• Utilized the FIRST grant portal for the third year running and incorporated improvements from lessons learned from prior years to improve user experience.
• Supported the DoD STEM Evaluation and Assessment Capability (EAC) 2019 and 2020 data collection efforts.
• Created the DoD STEM Careers section of the website, launched in Option Year 2.
• Refined the Event Tracker and associated surveys for use in Option Year Two.
• Developed and incorporated interactive informational modules housed within the Amaze platform to aid in sharing information and expectations with all partners.
• Coordinated with Elements 2 and 4 to standardize the DSEC data collection platform.
• Completed over 30 after-action event summaries.
• Coordinated outreach efforts with communication leads of DSEC partners.
• Produced a communications toolkit.
• Designed the Annual Program Review.
• Continued support of slide development needs (e.g., quarterly meetings and DSEC presentations).
• Created and managed DoD STEM social media presence on Twitter, Facebook, Instagram, and LinkedIn.
• Developed social media guidelines and content development protocols with the DoD STEM program office.

OUTCOME HIGHLIGHTS
• Maintained a cohesive brand identity for DoD STEM to embody and advance DoD STEM’s vision and mission through design and creative direction.
• Received our highest traffic of the period during the week of the launch of the redesigned dodstem.us, with over 9,000 user visits and over 18,000 page views, which is a spike of over 475% of the typical website traffic.
• Promoted over 100 DoD STEM partner events on the dodstem.us calendar.
• Established and grew social media following for DoD STEM across Twitter, Facebook, Instagram, and LinkedIn.
• Produced 10 “We are DoD STEM” spotlight videos featuring DoD STEM professionals, scientists and engineers, and DoD STEM alumni.
• Collaborated across all elements to improve the efficiency of event tracking and data collection.
• The EAC 2020 data call received twice the number of responses received in the prior year.
ELEMENT 4: STEM ALUMNI MANAGEMENT

INDIVIDUAL PROGRAM ADMINISTRATOR (IPA)
Katherine McKnight, PhD (RTI)

SCOPE SUMMARY IN OPTION YEAR ONE (2020-2021)
The primary scope for Element 4: STEM Alumni Management included implementing the STEM alumni studies. The alumni studies component focused on surveying students (ages 13+) and educators (e.g., teachers, counselors) who participated in DSEC-funded programs and were the primary beneficiaries of those programs. The surveys focus on targeted DSEC outcomes (i.e., building interest in and awareness of STEM careers in and outside of the DoD).

KEY ACTIVITIES
- Coordinated data collection efforts from program partners with Element 2.
- Finalized the student and educator alumni surveys via field tests from October to December 2020.
- Coordinated alumni survey protocols with each participating DSEC partner program to ensure that all programs (1) shared survey links with the targeted program participants, (2) followed up with participants to help ensure higher survey response rates, and (3) provided program participant demographics for developing survey weights to control for survey nonresponse.
- Launched the alumni surveys using the RTI-designed platform for online data collection.
- Interviewed and analyzed the data from 33 DSEC program alumni, primarily from MATHCOUNTS, to verify survey responses and to dig deeper on program outcomes than could be done via surveys.
- Analyzed survey response data for students and educators, as well as by program type to develop the annual report to the DoD on key DSEC outcomes.
- Worked with Element 3 to develop a system in Amaze to streamline data collection efforts with partner programs, including gathering program participant information in a standardized manner from each partner for Option Year Two.
- Developed an onboarding process for DSEC partners for Option Year Two to help ensure a clear understanding of the alumni studies and what their participation will entail.
- Designed system architecture for online portfolio system and developed digital components for badging protocol.
- Prepared design mock-ups of student portfolio system.
- Interviewed DSEC program alumni from FIRST, NCWIT, Society for Science, and the Junior Science and Humanities Symposium for inclusion in the “We Are DoD STEM” campaign.
OUTCOME HIGHLIGHTS

• Completed a report summarizing the design, development, and testing of the alumni surveys to document the purpose of the alumni studies and the processes to finalize the surveys.

• Developed English and Spanish versions of the student alumni survey and an English version of the educator survey.

• Shared a sample of results at the March Quarterly Meeting with DSEC partners to demonstrate initial learnings, and to show how data would be analyzed to help ensure understanding of the process and improve partner efforts to participate and support high response rates from their participants.

• Developed an annual report summarizing the alumni survey results, limitations, and recommendations for improvements.

• Developed foundational elements of student portfolio system to pilot with select DSEC partners.
ELEMENT 5: STRATEGIC OUTREACH INITIATIVES

INDIVIDUAL PROGRAM ADMINISTRATOR (IPA)
John Yochelson (Building Engineering and Science Talent [BEST])

SCOPE SUMMARY IN OPTION YEAR ONE (2020–2021)
The primary scope for Element 5: Strategic Outreach Initiatives is to ensure that STEM outreach activities are supported, are of high quality, and are coordinated across all partner programs and initiatives. Element 5 is accountable for managing the complex network of STEM education and outreach partners, including driving alignment to DSEC fundamentals and to the Federal STEM Strategic Plan. Element 5 also provides monthly status check-ins with each partner and regular reports to the CMC.

KEY ACTIVITIES

- Coordinated with outreach partners as they conducted STEM outreach events, both virtually and face to face.
- Represented and promoted DSEC at local and national STEM events.
- Provided orientation and support when DSEC partners changed leadership.
- Coordinated a DSEC master event tracker across education and outreach programs and hubs.
- Informed DoD STEM of noteworthy DSEC partner and hub activities.
- Enhanced coordination with Element 1 to respond to DSEC issues in real time and refined intra-DSEC communication strategy with partners.
- Implemented Professional Learning Communities with hubs.
- Monitored hub mapping strategies.
- Supported the onboarding of new Innovation Bloc partners.
- Facilitated collaboration among DSEC partners and new Innovation Bloc partners.
- Implemented the planning process with MSU CEMSE for an HBCU/MI Network Pathways Initiative with Bowie State University, Prince George’s Community College, Sinclair Community College, and Central State University.
- Supported ongoing Elements 2 and 4 data collection efforts.
- Contributed to Element 2 SNA.
- Supported Element 3 connectivity to DSEC partners.
- Engaged with TIES on STEM Ecosystem development.
- Engaged with DSEC partners in virtual meetings and webinars.
OUTCOME HIGHLIGHTS

- Supported the expansion of STEM education and outreach partners’ programs in all three hub regions: San Diego, Dayton, and DMV.
- Contributed to hub quarterly meetings.
- Maintained regular dialogue and fostered strategic alignment among the hubs.
- Deepened collaboration for STEM education initiatives among outreach partners through joint activities and invitations to participate in DSEC-sponsored events.
UNDERREPRESENTED/UNDERSERVED

Diversity is representative of diverse intellectual, social, ethnic, and economic backgrounds with a goal of having DoD’s programs reflect the nation’s demographics. Underrepresented/underserved populations include the following:

- Military-connected students
- Low-income students (free and reduced-price meals)
- Students belonging to racial and ethnic minorities that are historically underrepresented in STEM (i.e., Alaska Natives, Native Americans, Blacks or African Americans, Latinx/Hispanics, Native Hawaiians, and other Pacific Islanders)
- Students with disabilities
- Students with English as a second language
- First-generation college students
- Students in rural, frontier, or other federal targeted outreach schools
- Females in certain STEM fields where they remain underrepresented (e.g., physical science, computer science, mathematics, or engineering)

MILITARY-CONNECTED STUDENTS

- Military child: dependents of members of the Active Duty Armed Forces
- Military-connected: military child plus the dependents of members of the National Guard and Reserves
- Military-affiliated: military-connected plus the dependents of veterans
- Military-connected school: schools where a minimum of 10% of the student population is military-connected

These definitions have been updated in the Department of Defense STEM Strategic Plan FY2021-FY2025. The updated definitions will be used to guide the work of DSEC for Option Year Two and beyond.
DOD RESEARCH AND ENGINEERING MODERNIZATION PRIORITIES

AS OF AUGUST 31, 2021

https://www.cto.mil/modernization-priorities

ARTIFICIAL INTELLIGENCE (AI)
DoD will leverage AI to enable U.S. forces to operate more effectively and efficiently. The Department is evaluating which processes and procedures can be enabled via adoption of AI technology to meet warfighter needs and Defense priorities.

BIOTECHNOLOGY
Biotechnology is an engineering discipline that utilizes or exploits living systems to produce a wide range of technologies and products. Future advances in biotechnology will provide new operational capabilities to DoD across multiple domains, spanning material and systems, military medicine, warfighter performance, and chem-bio defense.

AUTONOMY
Autonomy extends and complements human capabilities. Advantages include persistence, size, speed, maneuverability, and reduced risk to human life. DoD targets seamless integration of diverse unmanned/mixed team capabilities that provide flexible options for the Joint Force.

CYBER
Cyber is a unique operational domain with significant security challenges and potential leap-ahead capabilities for military operations requiring enhanced command, control and situational awareness, and autonomous operations. Ability to gain and maintain the U.S. technological edge in cyberspace in the face of rapid evolution is essential to maintaining mission readiness.

DIRECTED ENERGY
When directed energy matures to a deployable capability, our armed forces will have the potential to defend against several types of threats with great precision and minimal collateral damage, at minimal cost per engagement. High Energy Laser technology development and advancements in hardware are making laser weapon systems increasingly viable.

FULLY NETWORKED COMMAND, CONTROL, AND COMMUNICATIONS
Fully Networked Command, Control, and Communications technology encompasses the capability to acquire, process, and disseminate information across force elements. DoD requires a clear path to robust Command, Control, Communications, Computers and Intelligence (C4I) with multiply redundant fully networked “Comms.” Existing capabilities require sufficient protection against an increasing threat, in pervasiveness and effectiveness.

HYPERSONICS
Hypersonic weapons travel five or more times the speed of sound. There is a focus on the tactical capability that these sorts of weapons bring to theater conflicts or regional conflicts: very quick response, high-speed, highly maneuverable, difficult to find and track and kill. DoD is modernizing the offensive and defensive force structure to both utilize and deter this capability.
MICROELECTRONICS

Microelectronics have been rapidly evolving as the demand for inexpensive and lightweight equipment has increased and have been incorporated into countless DoD systems. DoD’s modernization ability is jeopardized by foreign microelectronics production, actions, and investments. DoD must develop and deliver next generation microelectronic technologies to enhance lethality, ensure critical infrastructure, and achieve economic competitiveness.

QUANTUM SCIENCE

Quantum computers pose an impending threat to secure communications. Continued U.S. dominance in quantum information science will keep the United States ahead of these risks, and National Security Agency crypto-modernization will protect the most sensitive communications against a quantum computer attack. Quantum sensing will deliver new and assured precision position, navigation, and timing capabilities, keeping military forces safe in Global Positioning System-denied theaters. Quantum networks will deliver drastically enhanced sensors for finding and fixing elusive targets and will deliver resource multiplying effects for commercially developed quantum computers to solve DoD’s hardest analytical problems.

SPACE

The U.S. way of war, across all domains, depends on timely and assured space effects. Adversary capabilities and advancements require the United States to move quickly to a more defendable and resilient space posture. Added protection and resiliency to the current spacecraft fleet is essential.

5G

5G will bring about wireless, ubiquitous connectivity across humans, machines, and the Internet of Things. DoD will adapt 5G and next generation technologies to “operate through” congested and contested spectrum and in spite of compromised networks to ensure maximum readiness, lethality, and partnering among allies. 5G prototyping and experimentation will be conducted in collaboration with the defense industry and commercial suppliers to accelerate U.S. prominence in the 5G global ecosystem.
REFERENCES


