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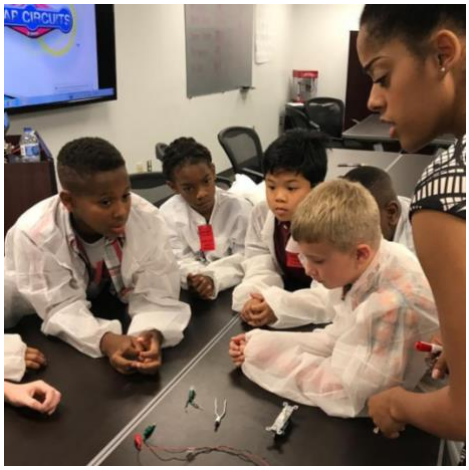

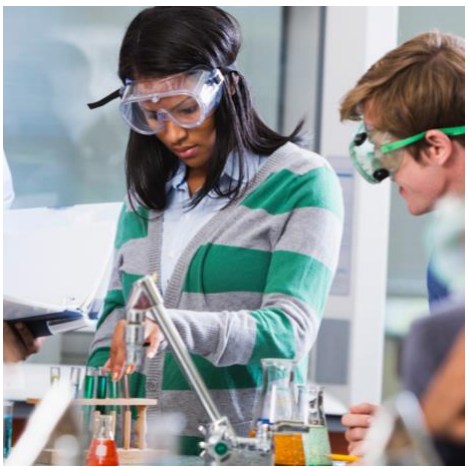

ARMY EDUCATIONAL OUTREACH PROGRAM

JSS

2019 Annual Program Evaluation Report
Executive Summary

April 2020

ARMY EDUCATIONAL OUTREACH PROGRAM

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1 | AEOP Consortium Contacts

U.S. Army Contacts

Matthew Willis, Ph.D.
Director for Laboratory Management
Office of the Deputy Assistant Secretary
of the Army for Research and Technology
matthew.p.willis.civ@mail.mil

Jack Meyer
Army Educational Outreach Program (AEOP) Director
Office of the Deputy Assistant Secretary of the Army
for Research and Technology
jack.m.meyer2.ctr@mail.mil

AEOP Cooperative Agreement Manager

Christina Weber
AEOP Cooperative Agreement Manager
U.S. Army Combat Capabilities Development
Command (CCDC)
christina.l.weber.civ@mail.mil

Battelle Memorial Institute – Lead Organization

David Burns
Project Director, AEOP CA
Director of STEM Innovation Networks
burnsd@battelle.org

JSS Program Administrators

Sue King
JSS Program Director
Technology Student Association
sking@tsaweb.org

Roseanne White, Ph.D.
Principal Investigator
Technology Student Association
rwhite@tsaweb.org

Evaluation Team Contacts – NC State University

Carla C. Johnson, Ed.D.
Evaluation Director, AEOP CA
carlacjohnson@ncsu.edu

Toni A. Sondergeld, Ph.D.
Assistant Director, AEOP CA
tonisondergeld@metriks.com

Janet B. Walton, Ph.D.
Assistant Director, AEOP CA
jwalton2@ncsu.edu

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2 | Executive Summary

Junior Solar Sprint (JSS), managed by the Technology Student Association (TSA), is an Army Educational Outreach Program (AEOP) science, technology, engineering, and mathematics (STEM) education program where 5th-8th grade students apply scientific understanding, creativity, experimentation, and teamwork to design, build, and race solar electric vehicles. JSS activities occur nationwide, in classrooms and schools, through extracurricular clubs and student associations, and as community-based events that are independently hosted and sponsored. The AEOP's JSS programming is designed to support the instruction of STEM in categories such as alternative fuels, engineering design, and aerodynamics. Through JSS, students develop teamwork and problem-solving abilities, investigate environmental issues, gain hands-on engineering skills, and use principles of science and math to create the fastest, most interesting, and best crafted vehicle possible. Students have the opportunity to participate in JSS through TSA chapters and Army-hosted locations across the country.

This report documents the evaluation of the FY19 JSS program. The evaluation addressed questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and program objectives. The assessment strategy for JSS included questionnaires for students and mentors and focus groups with students at the national event.

In 2019, students participated in JSS through TSA-affiliated state competitions, JSS Jumpstart Competitions, and the national competition in National Harbor, Maryland.

JSS 2019 Fast Facts	
Description of program	Junior Solar Sprint (JSS), managed by the Technology Student Association (TSA), is an army Educational Outreach Program (AEOP) which focuses on science, technology, engineering and mathematics (STEM) concepts. The program is available for 5th to 8th grade students and provides the opportunity for students to apply scientific understanding, creativity, experimentation, and teamwork to design, build, and race solar electric vehicles. Junior Solar Sprint activities occur nationwide, in classrooms and schools, through extracurricular clubs, student associations and as community-based events that are independently hosted and sponsored.
Participant Population (who is eligible for program)	5th-8th grade students
Number of Applicants/Participants	2,224
Number/Percentage of U2 Participants*	1,197(67.3%)
Placement Rate	N.A.
Number of Adults (Mentors and Volunteers – incl. Teachers and Army S&Es)	326

JSS 2019 Fast Facts	
Number of K–12 Teachers (including preservice)	268
Number of Army S&Es	0
Number of Army/DoD Research Laboratories	6
Number of K-12 Schools	353
Number of K-12 Schools – Title I	149 reported (majority of schools left blank)
Number of Other Collaborating Organizations	1
Total Cost	$253,663
CCDC Cost	$3,067
IPA Cost**	$250,596
Total Travel	$47,745
CCDC Travel	$3,067
IPA Travel	$1,259
Participant Travel	$43,419
Total Awards	$1,648
Student Awards/Stipends	$1,648
Adult/Teacher/Mentor Awards	$0
Cost Per Student	$114

∗ U2 calculations are based upon Cvent participation data that reflects enrollment of n=2,970

*The total IPA cost does not include $69,875 for the purchase of bulk solar kits purchased in FY19.

Summary of Findings

The FY19 evaluation of JSS collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided below.

2019 JSS Evaluation Findings	
Priority #1: *Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base*	
JSS served increasing numbers of students in FY19 and continues to reach students from populations historically underrepresented and underserved in STEM.	JSS program administrators reported a total of 2,224 participants including 345 participants from Okinawa and American Samoa who were not registered. This represents an increase of 51% over the 1,081 participants reported by program administrators in FY18. Cvent registration data are available for 1,778 students (446 less than reported by the program). The 1,778 students registered in Cvent represents a 39% increase as compared to FY18
	Less than half (44%) of FY19 participants were female, an increase as compared to FY18 (37%). Over half (60%) of students identified themselves as White (53% in FY18). The proportion of students identifying themselves as Black or African American decreased somewhat in FY19 (9%) as compared to FY18 (11%), although the proportion of Hispanic or Latino/a students increased in FY19 (13%) as compared to FY18 (8%).
	Over two-thirds (67%) of FY19 students met the AEOP definition of underserved (U2), a substantial increase from the 34% of JSS students who met the U2 criteria in FY18.
Students reported engaging in STEM practices during JSS.	More than two-thirds of students (70% -97%) indicated engaging with each STEM practice at least once during JSS, except for working with a person who works in a STEM field on a real world project (62%).
	No significant differences in STEM practice engagement were found by U2 status or any demographic area examined.
	No statistical differences were identified between students' STEM engagement in school and in JSS. This may be attributable to the fact that JSS activities are often completed as a class requirement and may therefore be perceived as in school activities by students.
Students experienced gains in STEM knowledge during JSS.	More than half of survey participants reported high levels of learning (learned more than a little or learned a lot). Two aspects of STEM knowledge for which than two-thirds of participants reported these levels of learning were new knowledge of a STEM topic (75%) and research on a STEM topic or field (68%).

	No significant differences in STEM knowledge gains were found by U2 status or any demographic area examined.
Students experienced gains in their STEM competencies or skills.	Approximately half or more of students indicated learning more than a little or a lot (high levels of learning) on all items associated with their STEM competencies. Three-quarters or more of students reported that they learned either "more than a little" or "a lot" in using knowledge and creativity to suggest a solution to a problem (75%) and making a model to show how something works (75%).
	No significant differences in STEM competency learning were found by U2 status or any demographic area examined.
Students reported high levels of learning in 21st Century skills; suburban students reported higher levels of learning than their peers.	More than half of students (51%-81%) reported high levels of learning (learned more than a little or learned a lot) across all 21st Century skills items. Skills for which nearly 80% or more of respondents reported high levels of learning were managing projects to complete them on time (79%), using creative ideas to make a product (79%), working creatively with others (81%), and collaborating with others effectively (80%).
	While no significant differences in 21st Century Skill gains were found by overall U2 status, students attending suburban schools reported greater impact compared to urban/rural students (large effect size).
Students reported substantial gains in their learning related to their STEM identities – their interest in and feelings of capability in STEM.	Approximately two-thirds or more of students (65%-76%) agreed with all statements related to STEM identity. Topics with which three-quarters or more of participants reported agreement were feeling more prepared for more challenging STEM activities (75%), thinking creatively about a STEM project/activity (76%), and feeling like they accomplished something in STEM (76%).
	No significant differences in STEM identity gains were found by U2 status or any demographic area examined.
Priority #2: *Support and empower educators with unique Army research and technology resources.*	
Mentors reported using a range of mentoring strategies with students, although very few mentors responded to the questionnaire.	A majority of mentors reported using all strategies associated with each area of effective mentoring.
	Very few mentors (n=10) responded to questionnaire items.
Most students expressed high levels of satisfaction with their JSS experiences; students also had a variety of suggestions for program improvement.	Approximately half or more responding students (48%-79%) reported being at least somewhat satisfied with all aspects of the JSS program. Three-quarters or more of students indicated they were at least somewhat satisfied with JSS's location (75%) and the help they received from their teachers or mentors (79%). Nearly a third (29%) of students did not experience guest speakers in their JSS experience.
	Students were overwhelmingly positive in their comments about their satisfaction in open-ended questions and in focus groups. STEM learning, career information, having fun, and the opportunity to build skills such as

	collaboration, problem-solving, and leadership were all cited as sources of satisfaction.
	Students made a wide variety of suggestions for program improvement. Over half (55%) of respondents mentioned improvements to the JSS rules or guidelines or providing more information about these. A third (33%) of students suggested improvements to the scheduling or organization of the event. Other suggestions focused on changing elements of the competition (e.g., the number of trials and track quality), providing more mentoring for students, and expanding the age range for JSS.
Mentors reported satisfaction with JSS features and online supports and noted a number of strengths of JSS. Mentors also made suggestions for program improvement.	Mentors who responded to the questionnaire reported being satisfied with JSS features they had experienced. Half or more of mentors (50%-100%) reported being at least somewhat satisfied with all JSS features they had experienced. Over half had not experienced JSS invited speakers and field trips. A large majority of mentors (70%-90%) reported being at least somewhat satisfied with all JSS online supports. Nearly all mentors reported that they were somewhat or very much satisfied with terminology (90%) and Build A Car resources (90%). There were no online resources for which mentors reported dissatisfaction.
	Mentors responding to open-ended survey questions noted a number of strengths of JSS including teamwork and the opportunity for students to engage in problem solving.
	Mentors suggested a range of program improvements, including the following: • Providing better or clearer instructions • Providing more staff at the national competition • Providing online tutorials or video links for difficult topics (e.g., gear ratio and torque) and the design process • Updating lesson materials • Providing free solar panels • Providing both indoor and outdoor races or an alternative indoor track • Generally improving the track • Providing teams with practice runs • Having 3 time trials rather than 2 • Allowing time for teams to make adjustments or repairs to their cars • Scoring all portfolios at the national event rather than just the semi-finalists' • Providing more information or communication about other AEOPs • Sending JSS staff to visit schools
Priority #3: *Develop and implement a cohesive, coordinated and sustainable STEM education outreach infrastructure across the Army*	

Students learned about JSS primarily through their schools and reported various motivations for participating. Mentors learned about AEOP primarily through the TSA.	A third or more of participants learned about AEOP from someone who works at their school (42%) and school communications (newsletter, email, website) (35%).
	Students were motivated to participate in JSS by an interest in STEM, a desire to learn something new or interesting, the opportunity to have fun, the opportunity to learn, the hands-on nature of JSS, and the opportunity to be with friends.
	Mentors primarily learned about JSS through the TSA website and past JSS participation.
Few students had participated in any AEOP other than JSS and most were not interested in participating in AEOPs other than JSS in the future.	Most students had never participated in AEOPs in the past, including GEMS (97%) or eCM (95%); 16% had participated in Camp Invention at least once
	A large proportion of students (89%) reported being interested in participating in JSS again. A quarter of participants indicated being interested in GEMS (25%). Fewer than a quarter (14%-24%) indicated interest in participating in any other AEOP.
	Students were most likely to report that participation in JSS (78%), their teachers (76%), and their JSS mentors (65%) were impactful resources for raising their. Awareness of JSS.
Students reported learning about STEM careers generally during their JSS experiences and, to a lesser extent, about STEM careers within the Army or DoD, and identified past participation in JSS and their teachers or mentors as the most helpful resource for learning about DoD STEM careers.	Approximately three-quarters (76%) of students reported learning about at least one STEM job/career in general, with 19% learning about five or more. Students were less likely to have learned specifically about DoD STEM jobs/careers. Sixty-two percent of students reported learning about at least one DoD STEM job/career, and only 8% said they had learned about five or more.
	Students were most likely to report that past participation in JSS (63%), their teachers (63%), and their JSS mentors (52%) were impactful in making them aware of DoD STEM careers.
Most students had positive opinions about DoD research and researchers, although many students did not have an opinion about these topics.	Two-thirds of students had favorable opinions about three of the four DoD research/researchers items. Less than half of students agreed or strongly agreed that DoD research is important to most people.
	Over a quarter (25%-35%) did not express an opinion about DoD research and researchers, suggesting that students may have had limited exposure to DoD research and researchers in JSS.
Students reported being somewhat more likely to engage in STEM activities in the future after participating in JSS, although some reported no	Approximately half or more of students (49%-75%) reported being more likely or much more likely to engage in all STEM activities. Activities most impacted most by JSS were participation in a STEM camp, club, or competition (65%); using a computer to design or program something (65%); working on a STEM project or experiment in a university or

change in their likelihood of future engagement; students at suburban schools experienced larger impacts than their peers.	professional setting (67%); and playing/working with a mechanical/electrical device (75%).
	While few students reported that they were less likely to engage in STEM activities after participating in JSS (2%-13%), up to a third of students (19%-33%) reported that there was no change in the likelihood that they would engage in future STEM activities after participating in JSS.
	No significant differences in likelihood to engage in STEM activities in the future were found by overall U2 status, although students attending suburban schools reported greater gains in their intentions to engage in STEM in the future compared to urban/rural students (medium effect size).
JSS had positive impacts on students in areas of their STEM learning, interest, appreciation for STEM research, and interest in STEM careers; the areas of least learning were associated with the AEOP and the DoD. Students named a range of benefits of participating in JSS.	More than a third of students (38%-62%) reported JSS helped them to grow in their interest about each item asked. Students indicated JSS helped them grow the most in the following areas: their STEM knowledge, skills, and abilities confidence (62%); interest in participating in STEM activities outside of school requirements (54%); and interest in earning a STEM degree (51%).
	Areas in which students reported no growth, or growth that was not related to JSS were all statements related to the AEOP or DoD and included the following: more awareness of other AEOPs (52% no JSS related growth), more awareness of DoD STEM research/careers (54% no JSS related growth), more interest in participating in other AEOPs (59% no JSS related growth), and more interest in pursuing a STEM career with the DoD (62% no JSS related growth).
	No significant differences in overall impact of JSS participation were found by overall U2 status or any demographic area examined.
	In an open-ended survey item, the most often cited benefit of JSS participation, was teamwork or collaboration followed by the opportunity to develop STEM skills. STEM learning, problem-solving skills, and career information were also cited as benefits.

Recommendations for FY20 Program Improvement/Growth

FY19 was another successful year for JSS, including a substantial increase of participation of underserved students compared to FY18 (67% compared to 34% respectively). Students reported growth in knowledge of STEM (75%) during JSS and 79% learned how to manage and complete a project on time. JSS participants also experienced growth in the STEM identity, with 76% reporting that they felt like they had successfully accomplished something in STEM. The FY19 evaluation did uncover some areas for potential improvement that are the basis of recommendations for FY20 program improvement and/or growth which are outlined below.

AEOP Priority: Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base

JSS nearly doubled the participation of underserved students in FY19 to an impressive 67%. We commend TSA for this effort and encourage them to continue focus on maintaining and growing the participation of underserved youth in JSS.

AEOP Priority: Support and empower educators with unique Army research and technology resources

As in the previous three years, both teachers and students continued to report challenges with the directions, logistics, and judging for the JSS competition. In addition to previously suggested areas for improvement (i.e., clearer instructions, updated lesson materials) participants in FY19 provided additional detailed guidance for TSA on how to make the program more successful. These included having more staff at the national competition, providing online videos or tutorials for difficult topics (e.g. gear ratio and torque), improving the track, allowing teams to adjust their cars, and scoring all portfolios at the national event rather than just the semi-finalists. Some teachers who are leading JSS teams may be doing this as their first experiences with STEM, so providing more scaffolded materials for teachers is one recommendation for FY20. Additionally, we would ask that TSA consider the opportunity for modeling the engineering design process and allowing students to make refinements to their cars if possible, at competition. Finally, both adults and students asked to have practice runs before the actual race and we ask that TSA consider this request.

AEOP Priority: Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army

1. As in FY16, FY17, and FY18 student respondents (national competition participants) continued to report having little knowledge of other programs in the AEOP, as over 50% shared they did not learn about other AEOPs during JSS. In FY19, 20% of JSS participants indicated they were not interested in any other AEOPs. It is recommended that TSA find a way to share AEOP information across the board with all participating JSS teams (including those that are not supported by AEOP funds).

2. As in FY18, JSS struggled to obtain necessary response rates for mentors/teachers in FY19 (ten respondents in FY19 compared to four in FY18). It is again recommended that JSS develop a strategy for engaging adults in completing the survey. This strategy should include a mandate for participating teachers in the program to complete the survey, particularly for those who have students competing at the national competition.

To view the rest of the report:

JSS Evaluation Report Narrative Part 2
JSS Evaluation Report Appendices Part 3