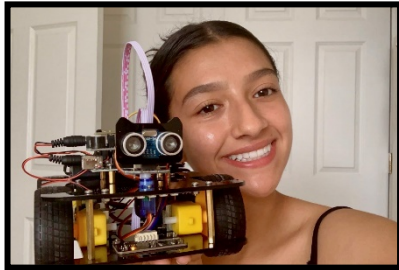


NASA MINORITY UNIVERSITY RESEARCH AND EDUCATION PROJECT (MUREP) AEROSPACE ACADEMY (MAA)

FY 2020 ANNUAL PERFORMANCE REPORT



FUNDING SOURCE:
OFFICE OF STEM ENGAGEMENT
MINORITY UNIVERSITY RESEARCH AND
EDUCATION PROJECT
(MUREP)

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ACTIVITY DESCRIPTION

The NASA MUREP Aerospace Academy, or MAA, was designed as a national, innovative activity with an aim to increase participation and retention of historically underserved and underrepresented K-12 youth in STEM. MAA targets students in grades K-12 along with parents/adult caregivers and family members as direct participants in STEM engagement activities. MAA advances student learning through an integrated, comprehensive support system. The MAA program is composed of three core components: Authentic STEM Experiences, Technology-Rich Environments (TRE), and Family Involvement.

In fiscal year (FY) 2018, cooperative agreements were awarded to seven MSIs nationwide, while announcing an additional six in FY 2019 as part of the original solicitation. Thus, implementation of MAA activities for FY 2020 was conducted at 13 sites located across nine (9) states. Locations included community colleges, four-year colleges/universities, Historically Black Colleges or Universities (HBCUs), Hispanic-serving Institutions (HSIs), Predominantly Black Institutions (PBIs), and Asian American and Native American Pacific Islander-serving Institutions (AANAPISIs). MAA funding affords MSIs the opportunity to develop engaging new avenues for inspiring students in STEM fields.

Table 1. MAA Awardees

FY 2018 Awards	Albany State University	Albany, GA	FY 2019 Awards	Florida Atlantic University	Boca Raton, FL
	California State University	Fresno, CA		Hartnell College	Salinas, CA
	Elizabeth City State College	Elizabeth City, NC		Morgan State University	Baltimore, MD
	Navajo Technical University	Crownpoint, NM		San Jacinto Community College	Pasadena, TX
	Tennessee State University	Nashville, TN		University of California, Riverside	Riverside, CA
	Texas State University	San Marcos, TX		York College	Jamaica, NY
	University of Texas at El Paso	El Paso, TX			

ACTIVITY GOALS

The primary goal of the MAA activity is to utilize NASA's unique resources to:

- Build the interest, skills and knowledge necessary for K-12 students to pursue STEM careers by engaging them in authentic STEM experiences built around NASA mission content.

The four (4) objectives that support how the MAA will accomplish its goal are:

- Increase the number of historically underserved and underrepresented students interested in NASA-specific STEM careers;
- Provide skills to parents and caregivers to work with and encourage their children in STEM activities and programs;
- Involve community groups, business, industry, museums, and educational and professional organizations through mentoring, field trips, guest speakers and other MAA activities; and
- Engage students in first-hand experiences in STEM such as hands-on learning, research, use of advanced technology, peer support groups, and mentoring relationships with professionals working in the STEM fields.

ACTIVITY BENEFIT TO PERFORMANCE GOALS

Due to restrictions of face-to-face interaction caused by the COVID-19 pandemic, virtual instruction became the sole means of student and family participant engagement efforts across all MAA sites. MAA site activities including learning opportunities for direct student learners, outreach events for the general public, and educator professional development (EPD) were thus unavoidably presented to participants in a virtual format. As a result of COVID-19 and the associated transition to virtual, the number of direct student learners engaged in MAA activities was severely impacted during year two operations. Despite these limitations, the MAA was still able to provide a benefit to performance goals.

Performance Goal 3.3.3: Provide opportunities for students, especially those underrepresented in STEM fields to engage with NASA’s aeronautics, space, and science people, content, and facilities in support of a diverse future NASA and aerospace industry workforce.

By design, the MAA Activity provides opportunities for students to engage with NASA in support of a diverse future NASA and aerospace industry workforce. Specifically, the MAA program engages students in grades K-12 in authentic hands-on STEM learning opportunities using content built around NASA missions and research that resembles the work of NASA scientists and engineers. Through these channels, MAA sites build student interest, skills, and knowledge that prepare them to pursue STEM careers. MAA was not designed for participants to contribute directly to NASA’s missions and work; however, awardee activities generally demonstrated positive impacts (see Figure 1) by offering meaningful and purposeful learning opportunities for intended audiences.

In FY2020, MAA engaged a total of 61,638 total direct and outreach participants. Direct participants are direct beneficiaries of MAA activities as proposed by individual sites. Direct participants receive numerous opportunities for STEM instruction throughout each quarter, as opposed to one-time activities provided through outreach. For direct reach, 22,856 participants were involved in first-hand learning experiences for students, families, and educators. Of these, 15,139 were student participants (47% female), and 4,494 were reported as parents/ adult caregivers or families. Educators made up a total of 3,223 participants. Educators participated through engagement in NASA and MAA-related educator professional development (EPD) activities. Outreach participants, defined as short-duration one-time engagement in NASA MAA-related activities, made up 38,782 participants. The information provided here is extracted from site quarterly and annual reports.

FY2018 Awarded MAA Sites

Albany State University (ASU)

Total Direct Students = 601; Total Family Participants = 1; Total Educators = 41; Total Public Outreach = 95

Using a Saturday model, ASU MAA implemented STEM activities for predominantly middle school students throughout rural southwest Georgia. These activities increased student exposure to STEM through experiential learning opportunities. Prior to COVID-19, ASU reported participants were using TRE engagement tools such as Lego EV3 to complete design and coding exercises that allowed students to explore STEM challenges and solve practical problems. Additionally, NASA STEM-based content was provided by ASU’s partner organizations to engage students in NASA project-based learning activities. Through an allegiance of ASU MAA community partners, educators engaged in face-to-face and virtual training sessions. For example, a First Lego League Robotics training session

for local educators was hosted through a partnership with the Georgia Institute of Technology *Center for Education Integrating Science, Mathematics, and Computing* (CISMIC) and the Southwest Georgia Regional Educational Service Agency

As a result of the COVID-19 pandemic, mandates and restrictions were put in place which prohibited in-person activities on campus and at partner locations. As a result, ASU MAA programs were transitioned to online environments for the spring session. In the summer, virtual programs engaged participants with activities surrounding various STEM themes, including artificial intelligence, coding, data science, and drones. These STEM-enriching activities helped spark student interest amongst middle and high school students. ASU MAA also provided outreach activities to educate parents / caregivers on the importance of STEM activities and to spark student interest in STEM-specific careers.

California State University, Fresno (CSU, Fresno)

Total Direct Students = 1,024; Total Family Participants = 117; Total Educators = 322; Total Public Outreach = 322

Students from CSU Fresno's MAA were engaged in face-to-face after-school and Saturday programs during events such as the Kremen School Open House, and STEM events at Saroyan Elementary and the Fresno Temple. These family-oriented events engaged direct learners and members of the community in STEM-focused MAA activities. One of the events had families working together to construct rovers through an engineering design challenge. During these events, MAA staff distributed information on NASA missions, opportunities in STEM for students, and provided giveaways. Throughout the Youth Technology Institute (YTI) Saturday program, "take-home-challenges" related to class activities were sent home with students to encourage continuous STEM engagement at home with family members. Early in the fiscal year, educator professional development was provided for MAA instructors in a face-to-face format; however, adjustments were made to programs and facilitation methods in order to continue engagement efforts with participants as a result of the pandemic.

After the onset of COVID-19, CSU Fresno MAA incorporated Google Classroom applications and other efforts to allow students to participate in MAA instruction using Chromebooks. These efforts were undertaken to ensure the Fresno State MAA could continue to engage participants in authentic STEM experiences using virtual methods. Virtual activities continued to align with NASA missions, STEM Engagement priorities, and Communication Themes. These activities exposed students to authentic learning through hands-on inquiry-based lessons in STEM via take-home design challenges. Direct learners also had an online summer camp opportunity. Fresno State MAA provided parents/caregivers of direct learners with STEM kits to take home so students could complete STEM activities at home via Zoom.

Elizabeth City State University (ECSU)

Total Direct Students = 1,435; Total Family Participants = 145; Total Educators = 20; Total Public Outreach = 6,516

In year two, ECSU MAA continued to serve students in the North Carolina (NC) region using a variety of engagement efforts for direct learners and outreach participants. After-school, Saturday Academy, and Summer Programs enabled ECSU MAA to implement STEM activities for students from elementary through high school. Engineering Design Challenges (EDC) were used to engage participants in age-appropriate lessons in STEM. Students also examined real-world STEM

applications by presenting persuasive arguments for an Alternative Energy Wind Turbine project, advocating for the establishment of wind farms in the six counties in northeastern North Carolina.

In response to state mandates restricting face-to-face interactions due to the COVID-19 pandemic, ECSU MAA transitioned STEM offerings for its learners to online environments for the Summer Academy and Family Involvement sessions. Some activities included engineering designs with wind turbines, computer programming, and robotics assembly. Incorporating training in robotics, student teams participated in a unique project using Vernier LabQuest and sensors for water quality testing and physical education activities. Other activities were virtual field trips to the NASA Langley Research Center, Virginia Air & Space Museum, North Carolina Transportation Museum, and the ECSU Planetarium. These activities and virtual trips reinforced student learning despite restrictions for in-person engagement.

Navajo Technical University (NTU)

Total Direct Students = 450; Total Family Participants = 0; Total Educators = 21; Total Public Outreach = 500

The Navajo Technical University (NTU) MAA site continued to provide STEM instruction for K-12 learners through a summer academy focused on principles of robotics. The NTU MAA hosted several indirect, outreach, and informational events at schools during after school hours, exposing Native American students, teachers, and tribal faculty to MAA and NASA content. Multiple online and face-to-face professional development offerings helped to enhance relationships with local schools and increase educator awareness of MAA engineering and manufacturing offerings. Visits by the MAA principal investigator to local schools, along with events at area schools and local sites across the Navajo Nation's remote region also helped interested MAA participants learn more about NASA programs, missions, and work.

NTU students and educators were significantly impacted at the onsite of the COVID-19 pandemic. Due to lack of transportation and Wi-Fi capability across the Navajo Nation and reservation, parents were not able to drive to NTU to pick up supplies and materials for their student's STEM learning. The principal investigator took it upon himself to drive across the reservation to drop off hot spots which were provided by NTU and other partners for student and family use. STEM materials, supplies and kits, were mailed to the students' homes in preparation for NTU's Summer Robotic Academy.

Texas State University, San Marcos

Total Direct Students = 306; Total Family Participants = 201; Total Educators = 20; Total Public Outreach = 149

Texas State University, San Marcos MAA expanded its reach into the central Texas community by offering a series of six Saturday sessions for participants that support STEM learning inside participants' homes. STEM Saturdays mainly consisted of TRE activities such as interaction with 3-Dimensional printers and pens, EV3 Lego Robotics, Sphero robots, Snap Circuits, and virtual reality sets. Direct participants also used technology with NASA Eyes, Google Translate, LEGO Mindstorms, and Sphero. Prior to the onset of pandemic restrictions, Texas State MAA also utilized TRE options during family STEAM nights. Following the onset of the pandemic, modifications to improve the NASA Backpack Initiative (a packet of STEM materials students receive from MAA sites to take home, complete, and return to the site) allowed the site to continue to engage MAA participants. Another activity, 'STEM Camp in a Box', an assortment of cost-efficient resources such as paper, curriculum lessons, and materials to complete assignments, helped to engage middle school students in STEM. This innovative method provided meaningful learning experiences to students and families

during summer 2020. Additional efforts to reach underrepresented populations included translating text from English to Spanish to eliminate language barriers and increase parental involvement. Professional development focused on program enhancement and extension, grant close-out meetings with stakeholders to discuss sustainability efforts, inventory of material, and project evaluation. Participating educators completed and attended webinars, developed curriculum, and created bilingual resources. Participating educators received specially designed digital badges in recognition for their participation in the program.

Efforts for sustainability highlighted connections to the Lyndon Baines Johnson (LBJ) Institute and a local school district with plans to adopt the modified NASA Backpack Initiative, the summer camp structure, and the NASA Girls in Engineering, Mathematics and Science (GEMS) after the conclusion of the MAA award.

Tennessee State University (TSU)

Total Direct Students = 1,045; Total Family Participants = 375; Total Educators = 40; Total Public Outreach = 71

At the start of the fiscal year, the TSU MAA site leveraged collaborations with several partner schools in economically disadvantaged neighborhoods to offer additional MAA STEM programming in their MAA in-school and Saturday programs. The first STEM in the Gym event, at one of TSU's MAA partner schools, engaged students and parents in MAA hands-on and simulation-based activities. Some of the reported activities included the Iota Portable, inflatable planetarium, drones, Little Bits Space Kits, 3-Dimensional printers, electronics and circuits, flight simulator, and VEX Robotics. Family Empowerment Sessions provided family members with practical strategies for supporting student's STEM pursuits, using and applying emerging technologies, and accessing STEM and NASA resources. During Black History month, TSU hosted an event entitled "Black Innovators in STEM Education," which highlighted minority innovators in STEM fields and allowed students to engage in hands-on activities. TSU MAA activities this year also included the development of a new online STEM resource center. The online STEM resource center provides students, parents, and teachers with information on STEM careers, STEM challenges, educational resources, content, homework tutorials, and other helpful materials.

Due to the COVID-19 pandemic, restrictions and mandates forced site leadership at TSU to pivot all MAA offerings to virtual formats in order to engage learners in the second half of their year two activities. TSU's MAA team was able to launch a virtual Summer Math and Science Academy. MAA sessions with student participants took place through Google Classroom and Zoom. These offerings allowed students to engage in computer science fundamentals, including basic coding in creating interactive animations, simulations, and applications. Educators were also able to continue engagement through professional development training, which offered innovative instructional strategies and emerging technologies specific to robotics, coding, and aeronautics.

University of Texas at El Paso (UTEP)

Total Direct Students = 987; Total Family Participants = 286; Total Educators = 77; Total Public Outreach = 530

At the beginning of year two, MAA Southwest continued serving K-12 students, before school, after-school, and during their Saturday modes of operations. Youth from underserved and economically disadvantaged areas in the surrounding southwest Texas region and beyond were offered 36+ hours of

STEM content. Activities were conducted during after-school programming, Saturday sessions, and during a two-week Summer Camp. In support of NASA STEM themes, such as high-altitude weather balloons and scientific payload development systems, several events for families and the community took place inside TREs before March of 2020. Activities included drones, flight mechanics through simulation, scientific payload experiments, and small satellites (CubeSat). Other activities focused on computer design stations, wind tunnels, two flight simulator stations, a microgravity drop tower, and 3-Dimensional printer stations. UTEP MAA also created online STEM courses by modifying their established curriculum and STEM lessons for virtual summer camp opportunities. Multiple family involvement sessions were offered on the university campus to connect family members with student learning paths, in order to support students preparing for post-high school STEM learning.

MAA Southwest continued organizing and participating in STEM-themed indirect outreach events and activities geared for family participation. Examples of outreach with members of the general community, involved hands-on STEM robotic color pathway Ozobot detectors and interacting and engaging the public at a local Space Festival. Prior to the COVID-19 pandemic, family involvement sessions were held on-campus, inside UTEP's Tech Café. On several occasions, MAA Family Café participants enjoyed the opportunity to utilize hands-on Ozobot robots using colored markers and watching a UTEP MAA presentation with exciting STEM activities. Four workshops were hosted for educators which emphasized the background and implementation of UTEP MAA, goals for MAA SW Camp participants, facilitation methods, brief history of drones, and a day-by-day breakdown of materials. An educator from one of UTEP's MAA partner school (Harmony School of Innovation), was honorably chosen by NASA Headquarters as an Airborne Astronomy Ambassador.

UTEP's MAA integrated with community partners and infused NASA STEM content into existing out-of-school time platforms which in hand, allowed students access to quality STEM content. Partnerships with schools and local organizations supported sustainability efforts for UTEP MAA. UTEP established partnerships with: Lockheed Martin Space Systems, United Way, and Insights El Paso Science Center. These partnerships will assist the UTEP MAA in developing sustainable funding, which could lead to continued STEM learning programs for regional school districts.

FY2019 Awarded MAA Sites

Florida Atlantic University (FAU)

Total Direct Students = 1,425; Total Family Participants = 64; Total Educators = 25; Total Public Outreach = 0

The FAU MAA engaged students in grades 6-12 from the surrounding South Florida community through both in-school, after school, and virtual implementation methods. Content for lower grades middle school students focused on concepts such as: perimeter and area, Cartesian coordinates, solving simple equations, structure of the sun, size of the universe, tracking change over time, and properties of terrestrial planets. For high school learners, content focused on algebra-2 rational expressions, equations with radicals, exponential and logarithmic functions, arithmetic sequences and series, geometric sequences, applications in ground truth studies, and applications in nature mapping.

FAU educators were engaged in several STEM offerings. These offerings were held via WebEx with STEM educators at partner schools. MAA site leadership disseminated certificates of participation to attendees at the conclusion of a virtual Teachers' Professional Development training session. STEM

educators from Miami-Dade, Broward, and Palm Beach Counties were invited to participate in the summer workshops along with STEM educators from other partnering schools.

The MAA at FAU continued utilizing partnerships and relationships within their STEM ecosystem to acquire guest speakers, support, and opportunities/information for students and their families. Family events were also held via WebEx with the Lauderdale Lakes Middle and Lake Worth Community High School STEM teachers and administrators.

Hartnell Community College (HCC)

Total Direct Students = 3,867; Total Family Participants =1,007; Total Educators = 277 Total Public Outreach = 2,449

The HCC MAA site continued expanding their reach in the surrounding urban and rural areas of Salinas Valley, California through, a Saturday academy, after-school programs, and summer offerings. MAA at HCC centered around three (3) central themes: NASA Academy, Coding Academy, and Astronomy Academy. During the last two quarters of the fiscal year, activities transitioned from face-to-face to virtual offerings. Educator training enabled educators to obtain the necessary comfort levels for instructing MAA sessions virtually. Take-home activities, in both English and Spanish, were created to support parental engagement for STEM learning. The Coding Academy summer camp provided engagement opportunities for outreach participants, in STEM content, for students in grades 2-12. Technology-rich opportunities allowed students to engage with low-cost microcomputer (Arduino) units through interactive online lessons. Family science-themed programs were hosted online to showcase students' work and to inform family members of strategies, which they could use, to support student learning at home.

Several ongoing partnerships, within the local ecosystem of Hartnell College, expanded their efforts to serve students from several different school districts. Through agreements with elementary schools, efforts were aligned with site plans and goals for sustainability and the NASA Coding Academy activities.

Morgan State University (MSU)

Total Direct Students = 894; Total Family Participants = 261; Total Educators = 52; Total Public Outreach = 1,012

The Baltimore MUREP Aerospace Academy (BMAA), at Morgan State University, experienced significant impacts that caused a halt in their MAA program at the beginning of the second year of performance. In spite of these impacts, the site was able to transition from face-to-face to virtual offerings for their participants. The site pursued alternative methods and was successful with offering STEM related activities to students through their Saturday Academy. Professional development opportunities included technology and communications training, with an emphasis on virtual learning platforms, in order to effectively integrate hands-on STEM activities. Educators at MSU also prepared take-home STEM kits to engage youth in other ways. The STEM home activity kits were distributed each week of the summer camp to participants registered for the MAA program.

Throughout year two, opportunities were limited for using TRE resources on the campus of MSU; however, the site was able to engage students with the use of laptop computers, tablets, electronic kits, and other computerized science lab equipment.

San Jacinto College

Total Direct Students = 568; Total Family Participants = 0; Total Educators = 40; Total Public Outreach = 7,661

San Jacinto College Pathway to the Stars (PTTS) MAA program experienced significant impacts, at the beginning of their Year 2 operations, due to stay-at-home orders issued by the Governor of Texas. The curriculum was revamped for 5th-8th grade participants by infusing technology to facilitate STEM lessons and curriculum with aerospace components. The curriculum was aligned to NASA mission directorate themes and the Texas Essential Knowledge and Skills (TEKS) requirements. Content included lessons on traveling to Mars, rocketry (including Bernoulli's principle), forces of flight, and Newton's Laws. For space exploration, modules that supported transportation on Mars (Perseverance rover), human survival in space (including energy sources, space suits, hydroponics, water filtration, air filtration, and habitats), and medical and health considerations for astronauts were utilized to engage students. Other activities included an airplane landing challenge, buoyancy activities metallurgy, and Moon Mapping. Camp supplies were ordered and sent directly to the teacher and student's home addresses.

Due to COVID-19 restrictions, many of the scheduled STEM outreach events and family/parent events were postponed.

University of California, Riverside

Total Direct Students = 36; Total Family Participants = 250; Total Educators = 0; Total Public Outreach = 3,967

The UCR MAA site engaged high-school students in the UCR Summer Academy, a 5-week summer course at the University. Students came from eight (8) different high schools in four (4) different surrounding school districts. Matching funds provided by a partnering school (Riverside Unified School District - RUSD), supported an additional 15 MAA students. Throughout the fiscal year, virtual public astronomy lectures live-streamed on YouTube, engaged participants in the potential habitability of extra-solar planets. In collaboration with the Riverside Astronomical Society, a different virtual stargazing event was hosted in the summer. Family involvement activities took place throughout the year; family involvement activities consisted of two hours of hands-on activities. Other engagement efforts consisted of virtual demonstrations/experiments, mini-science lectures, and a career panel.

An upcoming planned collaboration with the UCR extension (a program that offers innovative and flexible support for programs from experts in the field) will support educators to receive 4.0 credits and a certificate from UCR. An additional ten (10) high-school teachers will be supported through a merit-based fellowship. New partnerships were established to execute a virtual solar viewing event in collaboration with the UCLA Department of Earth, Planetary, and Space Sciences.

City University of New York (CUNY) - York College

Total Direct Students = 2,501; Total Family Participants = 1,787; Total Educators = 2,288; Total Public Outreach = 15,510

The York College MAA developed experiential learning opportunities to engage MAA participants in TRE activities, centered on allied-health and financial literacy-related lessons, through computer software. The director and site coordinators devised a common strategy to impart grade-specific online lessons to student participants. York MAA transitioned from a synchronous face-to-face in-class setting to virtual learning. Six (6) new STEM learning activities were introduced to the middle and high school participants. The STEM learning activities were taught by pre-service educators and past MAA students, enrolled in colleges or universities. Engagement efforts through virtual platforms

included flight simulators and drones. Lessons to support those activities helped reinforce concepts surrounding the simulation of flight, functions or robotics, Global Positioning Systems (GPS), and weather-related air-traffic-control-related phenomena. Peer mentoring allowed former York MAA students to mentor younger-aged students engaged in experiential learning practices, centered on research investigation and problem-solving. Several top-performing MAA students lead this initiative and they continue to work with schools to foster advances in research and STEM-based activities for younger audiences. York MAA participated in NASA's Artemis program-supported webinars; students' complete essays and activities which reinforced NASA's work through STEM engagement efforts.

Family involvement participants attended a webinar entitled "*Charting a Course for Success: America's Strategy for STEM Education.*" Professional development was designed to provide strategies for teaching innovative STEM technology and up-to-date knowledge to instructors, using platforms such as the NEON (NASA Educators Online Network). Several pre-service teachers and aides earned professional development credit from attending these sessions.

York MAA established a STEM alliance with local schools and youth-serving organizations to remain a highly sought STEM collaborator within their local STEM ecosystem. External recognition from the Civil Air Patrol, City Council, several professional societies, and widespread media coverage helped spread the York MAA opportunity. One noteworthy accomplishment was York's establishment with New York City Port Authority and Greater Jamaica Redevelopment Project, a financial agreement that supports York's MAA activities, particularly TRE initiatives. In addition, the York Early College Academy (YECA), through a grant provided by the Melinda and Bill Gates Foundation, provided volunteers for the MAA program and is becoming a sustainable partner.

Performance Goal 3.3.4: Enhance the effectiveness of education investments using performance assessment and evaluation-driven processes.

MAA sites are required to conduct their own independent evaluations using independent evaluators, who assisted in the preparation of the Comprehensive Evaluation Plan. There are several benefits of using third-party external evaluators to assist with the completion of the annual or final evaluation reports that assess the extent to which each site achieved its intended outcomes. The MAA Evaluation point of contact conducts a meta-evaluation to assess the methodological rigor of the grantees' annual evaluation reports.

At this time, evaluation specialists have conducted the meta-evaluation of only the FY2018 grantees' evaluation reports. The meta-evaluation of year 2 evaluation reports for the FY2018 grantees revealed that the sites have been successful in completing their intended outcomes. The MAA has had impacts on participants in the outcomes of: Student STEM Interest, Student STEM Career Interest, Student STEM Knowledge, Parent STEM Engagement, and Facilitator STEM Comfort. The following table shows the number of FY18 cohort sites with reported positive effects in each of the outcome listed above. The number of sites and the type of student impacts are highlighted below for each of the FY 2018 grantees.

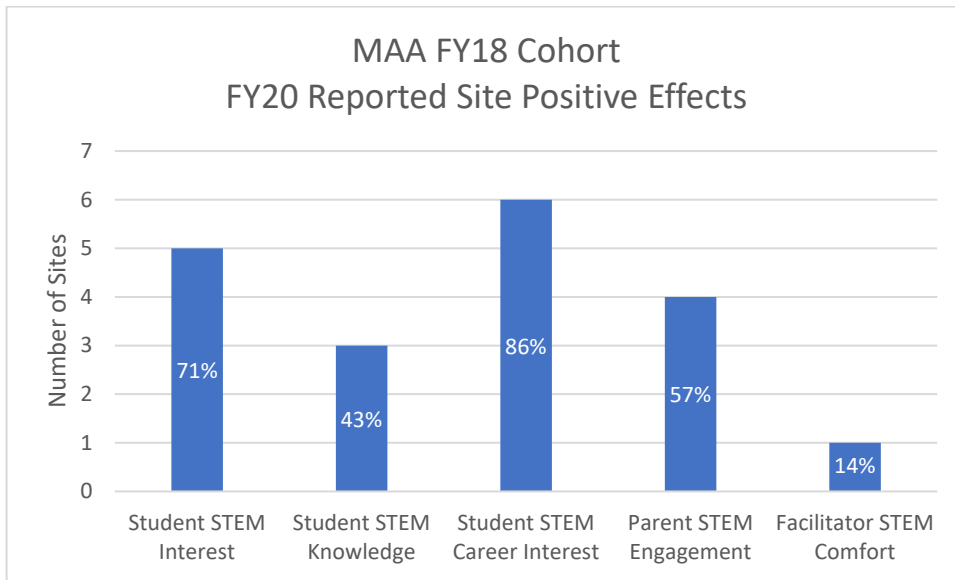


Figure 1. MAA Student Impacts for Year Two programs.

Independent Evaluators assessed the extent to which each site achieved its intended outcomes. Please note: All sites were not tracking each of the five outcomes. To summarize MAA sites' progress in achieving MAA goals and objectives, a review of sites' MAA evaluation and annual reports was conducted. The following table provides the objectives achieved by each site.

	Objective 1		Objective 2		Objective 3		Objective 4	
	Y1	Y2	Y1	Y2	Y1	Y2	Y1	Y2
Albany State University	•	•	•		•	•	•	•
California State University Fresno	•	•	•	•	•	•	•	•
Elizabeth City State University	•	•	•	•	•	•	•	•
Navajo Technical University	•	•	•		•	•	•	•
Tennessee State University	•	•	•	•	•	•	•	•
Texas State University	•	•	•	•	•	•	•	•
University of Texas El Paso	•	•	•		•	•	•	•

Figure 2. FY18 Awards Year Two Alignment to MUREP objectives.

One-hundred percent of the FY 2018 sites (7 out of 7) presented evidence of meeting MAA Objective #1 (Increase the number of historically underserved and underrepresented students interested in NASA specific STEM careers) and MAA Objective #4 (Engage students in participatory activities such as hands-on learning, research, use of advanced technology, peer support groups, and mentoring relationships with professionals working in the STEM fields).

Four of the seven sites (57%) from the FY2018 cohort demonstrated evidence of having provided skills, information, and STEM engagement opportunities to parents/caregivers to work with and encourage their children in STEM (MAA Objective #2). However, three sites were unable to conduct parent/caregiver events in Year 2, due to COVID-19 restrictions and limitations.

Site progress toward meeting MAA goals and objectives is measured on a quarterly basis, as well as in the annual/evaluation reports. One hundred percent of the MAA FY 2018 (7 out of 7) grantees provided evidence of meeting MAA Objective #3 (to involve community groups, business, industry,

museums, and educational and professional organizations through mentoring, field trips, guest speakers and other MAA activities).

FY 18 Cohort Evaluation Report – Methods and Results Summary

The following table summarizes the data collection instruments and performance measures by FY18 cohort site. Further details and results from each site are also provided.

		Albany State	Elizabeth City State	Fresno State	Navajo Tech	Tennessee State	Texas State	UTEP	
	Instrument Type								Performance Measure(s)
Student	Attendance/Enrollment	•	•	•	•	•	•	•	Reach Demographics
	Pre- and Post-Test	•	•	•	•				Student STEM Interest Student STEM Knowledge Student Career Interest
	Post- Only Surveys		•	•	•	•			Student STEM Interest Student Career Interest Program Quality Family Engagement
	Interviews		•				•		Student STEM Interest Student STEM Knowledge Student Career Interest Program Quality
Parent	Interviews							•	Student STEM Interest
	Surveys	•	•	•	•	•	•	•	Family Engagement Program Feedback Student STEM Knowledge
	Attendance/Enrollment	•	•	•				•	Reach
Facilitator	Demographics		•	•	•			•	Reach
	Interviews		•		•	•			Student STEM Interest Program Quality
	Pre- and Post-Test		•						Facilitator STEM Knowledge Pedagogical Skills
	Surveys		•	•	•	•	•	•	Family Engagement Program Quality Pedagogical Skills Facilitator STEM Knowledge Use of Technology
Other	DoS		•	•					Program Quality Use of Technology
	Partner/Stakeholder Feedback			•	•	•			Program Quality
	Outreach records			•	•	•			N Partnerships
	Partner MOU/Service Contracts	•	•	•				•	N Partnerships

Table 1. FY 2018 Grantees - Data Collection Instruments and Performance Measures

Albany State University collected demographic information including grade, gender, and race. Surveys using Likert-type response scales were administered to all students following their participation (i.e., posttest design). Questionnaires were divided into two parts: a) summer camp-related questions (overall quality of program, its effectiveness and impact, motivation, etc.) and b) students’ interest, family support and confidence in STEM education and successful career. Frequencies for each response were reported at the individual item level.

In examining participants’ self-assessed STEM knowledge, approximately 90% of participants agreed to the following statements: “This summer camp enhanced my problem-solving ability”; “This summer camp enhanced my critical thinking ability”; “This summer camp increased my knowledge in space science”; and, “This summer camp helped me to connect science to real world applications.” Evaluators assessed increased interest and motivation to STEM careers and found 87% of participants agreed to the statement “I will have a career in STEM.” In addition, 87% of participants agreed to the statement “I will enjoy a career in STEM.” Evaluators at Albany State University also assessed personal interest and confidence in STEM education and career and found, 78% of participants agreed to the statement “I will graduate with a college degree in STEM area.” Finally, 83% of participants agreed to the statement “I will have a successful STEM career.” The Paragon TEC evaluation team determined these findings demonstrate conclusive, positive results.

California State University – Fresno measured objectives quantitatively using a variety of instruments. Student attendance sheets informed dosage hours for student participants. STEM knowledge was measured using surveys administered as part of a pretest-posttest design. Scores were generated for each student on the surveys to demonstrate a change in knowledge. The Common Instrument (STEM Interest), provided by the PEAR Institute (Program in Education, Afterschool, & Resiliency), was also administered on a pretest-posttest basis. Parent attendance was collected and recorded to track the number of Family Café events parents attended. One-time parent surveys, administered at the end of the program, were used to measure the level of STEM discussion between parents and their children. Attendance sheets were used to measure the count of MAA instructors in the program. Instructor comfort with STEM was also measured using both a pretest and posttest, as well as an end-of-year survey. Frequencies for each response were reported at the individual item level. In addition, the overall quality of STEM activities offered in MAA was assessed using the Dimensions of Success (DoS) observer tool, which incorporates qualitative and quantitative data analysis.

By the end of year one, 51% of participants had gained or maintained an interest in STEM from the pretest to posttest; however, at the end of year two, this figure had increased substantially, to 71%. In addition, first-time participants indicated a greater STEM interest than other participants. Although there was a slight decline in overall STEM interest in both years due to most participants demonstrating strong STEM interest at pretest, there was a substantial increase from year one to year two in the portion of participants gaining or maintaining an interest in STEM. The program now has a conclusive, positive impact on student participants' STEM interest as a result of participating in the program. Also, during FY20, 89% of students reported gaining more knowledge in STEM; this represents an increase over year one. Similarly, the portion of respondents claiming to “know more about science” increased to 79%. Moreover, the portion of clients indicating they “learned new scientific vocabulary words” increased dramatically, from 62% in year one to 72% in year two.

Through Family Café Parent surveys, 96% of parents reported having more conversations with their children about STEM, a slight improvement over the 92% in year one. However, there were slight decreases in parents reporting they talk with their children more about the following topics as a result of participating in the program: future STEM careers; the children's progress in school; going to college; and pursuing a career in STEM. Nonetheless, the proportion of positive responses remains in the upper quartile and therefore indicates positive program impact in parental involvement. Over both years, almost all parents reported having more conversations with their children about their progress in school, post-secondary education, and future STEM career goals as a result of participating in Family Café. More than 80% of parents indicated a better understanding of STEM and new, STEM-related information through program involvement with their children, participating in Family Café events, and completing the take-home STEM challenges. Parents also were more comfortable with the technology used in distance learning, including Zoom use and ability to upload materials and assignments. Year two offered a unique opportunity to assess distance learning program impact with parents, as parents went online with their children.

Elizabeth City State University utilized data collection instruments or sources for conducting evaluation including a Student Application and Parental Survey, an MAA Student Feedback Survey, a Pre/Post Topic Self-Efficacy Assessment Survey, the Dimensions of Success (DoS) Observation tool, a K-12 Professional Development Feedback Survey, and interviews with students.

For analysis of the student application and parental survey, descriptive statistics were used to examine the characteristics of the participants, including disaggregation of the data by historically underserved

or underrepresented populations. For analysis of the feedback survey, descriptive statistics were used to summarize and to disaggregate group differences. Inferential statistics were used to test the statistical significance of changes in outcome variables and to examine possible group differences.

Participants overwhelmingly agreed that the program increased their interest and understanding of STEM-related fields and better prepared them for success in STEM-related courses in school. Most student participants indicated they were at least somewhat interested in STEM. Student participants overwhelmingly agreed the program increased their interest and understanding of STEM-related fields and better prepared them for success in STEM-related courses in school. Participation in the program increased students' interest in STEM-related learning, STEM courses, and in pursuing STEM-related careers regardless of students' interest in STEM prior to the program. Furthermore, program participants overwhelmingly agreed that the program increased their interest in and understanding of STEM-related fields and better prepared them for success in STEM-related courses in school. Almost all respondents expressed some degree of interest in participating in similar programs in the future. Students were also surveyed on the job areas in which they were most interested in, and the most selected areas were "Science" (37%) and "Technology/Computers" (36%). The STEM-related area of healthcare was also a popular selection among students (30%). Overall, interest in STEM careers accounted for most responses, followed by an interest in arts, business, sports, education, and other fields. Student participants were further surveyed about their interest in specific areas of science in which they were most interested. The most popular area was engineering (49%), followed by chemistry, computer science, physics, biology, and environmental science.

Navajo Technical University did not explicitly discuss evaluation methods in their first submission of year-two performance as a result of COVID-19 and several additional challenges. NTU proposed using a mixed-methods evaluation approach. In quarterly reports, NTU discusses using surveys, interviews, observations and collected documents to collect data from both students and teacher participants. Google forms were listed as a possible source of distribution. Further, it is noted descriptive statistics would be used for analysis to consider the relationships between programming and STEM career interest over time. NTU requested and was granted permission for a change in independent evaluators; as a result, the site was granted an extension to submit an addendum to their year 2 evaluation report. Upon receipt and review of the addendum evaluation report, a summary will be provided and the FY2020 MAA Annual Performance Report will be modified and updated accordingly.

Tennessee State University collected demographic information, including grade, gender, and ethnicity. The number of contact hours for each program was also highlighted. Close to 60% of all participants expressed specific interest in identified STEM post-secondary careers and subjects. Most respondents agreed to the following statements: "I believe I can be successful in a career in engineering" (74%); "When I am older, I might choose a career that uses math" (64%); and "I would consider a career in science" (73%). Most (62%) of the elementary students consistently expressed interest in post-secondary STEM subjects and STEM-related careers, exceeding the 50% program target. Similarly, 57% of the middle school students in the sample expressed interest in post-secondary STEM subjects and STEM-related careers, exceeding the 50% program target. To supplement this quantitative data, evaluators also collected qualitative data in the form of interviews with teachers and staff members. The evaluators made the evaluation more robust from year one to year two by incorporating this qualitative data, which revealed the impression among teachers and staff members that students were inspired by the program to pursue STEM careers.

Parents and guardians provided ongoing data and information regarding their involvement and engagement in their children's STEM activities and assignments at home. Based on the information collected and reported by parents and guardians during the reporting period, it was noted that 93% of respondents indicated they made sure that their children's math and science homework was done on time. Additionally, approximately 79% of the parents and guardians reported they believed that, "I make a significant difference in my child's school performance in math/science."

Texas State University, San Marcos used a mixed-methods design to evaluate all aspects of the program, including student STEM learning, collaboration and activities with community organizations and school districts, educator professional development, and impact on student STEM engagement of parents/caregivers in workshops. The data analysis consisted of both descriptive and inferential statistics. A revised version of the Professional Learning Educator Assessment Survey (PLEAS) validated by the Methodology, Measurement, and Statistical Analysis (MMSA) department at Texas State University was utilized to assess educator perceptions and effectiveness of professional development. Survey instruments that had been validated and found to have strong psychometric properties were utilized to meet the data requirements for each of the objectives. Other data sources included program registrations, attendance, sign-in sheets, and other project implementation records. Qualitative data were acquired through individual interviews, focus group discussions, direct observations of program activities and events, and curriculum reviews. Qualitative research was analyzed utilizing Dedoose and MaxQDA for more effective coding. Fidelity of implementation was determined through an ongoing examination of actual implementation activities compared to those specified in the proposal.

Ninety-nine percent (99%) of parents agreed to the statement "My child is now more interested in Science and Technology after attending STEM Saturday's at Lockhart ISD/Seguin ISD." The evaluator also conducted semi-structured interviews with parents, teachers, and various stakeholders such as science coordinators, college student camp assistants, administrators, and school board members.

Parents, facilitators, and teachers were asked about their perceptions of students' STEM career interest. The interviews revealed that Latina mothers often displayed a proactive approach when supporting the participation of their children in the STEM camps and thus became instrumental in encouraging their Latina daughters to pursue STEM careers. Parents, especially Latina mothers, felt the NASA FAMA program provided an avenue for their Latina daughters to be interested more in STEM and felt the need to bring their daughters to every single STEM Saturday. One parent said she hopes the district has the "means to keep supporting these types of programs and make them available for people who otherwise wouldn't be able to afford a summer camp or wouldn't have the resources to buy these materials for their children." Overall, parents were excited to bring their children to the workshop, expressed how motivated their children were to attend the Saturday workshops, and the importance of exposing their children to various technology such as robots, 3D printers, and Virtual Reality headsets. Teachers noticed a significant impact of the NASA STEM Saturday program on students and felt the need to extend the program to all grade levels in a district-wide capacity.

University of Texas – El Paso collected data from teacher and parent surveys, as well as student pre- and post- surveys. Data collection was automated, allowing for a large volume of high-quality data. Items in the surveys often had Likert-type response options measuring agreement, and frequencies for each response were reported at the individual item level.

Students were surveyed about career interest in various STEM fields. At posttest, approximately half of respondents indicated they had “a lot of interest” in careers in each of the following: science (46%); technology/computers (50%); engineering (47%); and mathematics (46%). There were substantial increases in interest from pretest to posttest in each field. Similarly, all the fields yielded substantial decreases in the portion of respondents indicating “no interest.” Another career field included in the instrument, identified as “NASA careers,” also yielded substantial increases in respondents claiming, “a lot of interest” and substantial decreases in respondents claiming, “no interest.”

Based on presentation feedback, 71% of parents believe the MAA Southwest Presentation encouraged their child to participate in NASA-based STEM activities. Eighty five percent of the parents indicated they believe the activities created an awareness to choose a STEM career in their children. In addition, 57% of parents stated they plan to encourage their child to consider a STEM career. Moreover, 86% of parents indicated the activity has made them more aware their child can study STEM. The data indicate the caregivers find the activities interesting and worthwhile. Results show student perceptions of family support increased as a result of the program. Caregivers became more aware of the possible STEM careers for their children and plan to encourage them to study these subjects. Family members feel confident in the ability to support and encourage their children. The family support for student STEM pursuits also shows substantial increases.

Facilitators’ confidence with and knowledge of STEM content was assessed. For all items assessing that construct, most respondents strongly agreed with the statement. Most respondents found the workshops to be useful and high-quality, and almost all participants stated they feel confident they can teach the NASA MAA curriculum. In addition to collected quantitative data via surveys, the evaluators also conducted interviews with teachers to assess their perceptions of the impact of the program. Teacher participants believed the experience and workshops provided by the site has helped them to get out of their comfort zone and try new lessons, challenges, and activities with their students. Some teachers also firmly believed the quality of their instruction improved tremendously by integrating the lessons into their own classroom teaching.

FY 19 Cohort Evaluation Report – Methods Summary

Due to the period of performance for the FY 2019 grantees, the FY 2020 Annual/Evaluation Reports for some sites are currently under review; however, for consistency, the evaluation methods and evaluation results (some preliminary) for all sites are listed below.

Florida Atlantic University used surveys featuring a six-point Likert-type response scale to assess feedback from middle school students attending a planetarium show. The site also reported using similarly structured electronic feedback surveys for teachers to evaluate professional development trainings and the summer workshop. Response frequencies and descriptive statistics were reported for each individual item, and the internal consistency reliability of the scales was also calculated using coefficient alpha. This site also utilized an open-ended feedback survey for assessing the professional development trainings. The responses were coded, and the frequency of each coded theme was analyzed.

The following highlights the evidence of positive impact from the various stakeholders of the project including in-service STEM teachers, students and families. Many of the middle school students (>92%) agreed the events were a good use of their time, that it increased their interest or knowledge in

STEM, and that they would like to have more events like it in the future. Based on the STEM teachers' evaluation of the Professional Development training program, most teachers (96%) agreed at least slightly that the topics discussed in the workshop are a good fit for their classes and engaging for students. All responding teachers also agreed that the topics "are useful in increasing students' STEM interest, skills, and knowledge", with a majority selecting "strongly agree." Almost all teachers (96%) also indicated that they could effectively teach the concepts in their classes. All 24 teachers agreed that the program improved their confidence teaching STEM content related to NASA. Several teachers also liked the variety and breadth of topics and the relevance of some topics to students and the curriculum. Based on the participation and observation of the Family Café event, the families praised the quality of information presented by the guest speakers during the online Family Café event. Several respondents also praised the quality of the images used in presentations, and the quality of information related to pursue STEM education and STEM careers.

Hartnell College used the following data collection instruments for its evaluation: participant surveys for a sample of K-4, 5-8, and 9-12 activities, STEM Academy student surveys, STEM Academy parent surveys STEM Academy teacher surveys, and interviews with partners and collaborators in the project's STEM ecosystem.

Despite the significant constraints presented by the COVID-19 pandemic and program adaptations, 4,035 students participated in programming. Pre-service elementary school teachers and STEM majors also participated. Staff provided 7 parent engagement activities to 595 parents and provided hands-on activities designed to engage parents in working with their children using problem solving, communication, and engineering principals. Hartnell's MAA collaborated with 85 partners. Additionally, 49% of Hartnell MAA partners were part of the community resource fairs at their Family Cafés before the pandemic began. Partners are interested in continuing supporting the resource fairs once it is safe to do so.

Morgan State University used quantitative methods, relying on multiple data collection instruments and reporting primarily descriptive statistics. The data sources include parent surveys, virtual classroom observations, student surveys, and teacher feedback. Most surveys relied on a Likert-type response scale; however, for younger students, an alternate survey using emoji was utilized to express participants' satisfaction or dissatisfaction with the program. For classroom observations, The Dimensions of Success (DoS) Field Observation Protocol was used. Teacher feedback was collected using open-ended questions for written responses.

Results indicate that over 60% of student participants expressed an interest in STEM and NASA after participation in the program. Ninety-five percent (95%) of parents expressed satisfaction with the virtual summer camp. Additionally, 95% expressed satisfaction or extreme satisfaction with pickup procedures for students' supplies. The distribution of mean scores for overall satisfaction was 4.5 out of a 5-point scale. Furthermore, when questioned about program activities and demonstrations, 92% of parents agreed or strongly agreed that the virtual camp's activities and demonstrations enhanced the students' interest. Teachers were observed and evaluated using the DOS tool. Overall, teachers delivered activities that reflect appropriate planning, preparation and utilization of advanced virtual classroom technologies.

San Jacinto Community College used a mixed-methods approach to evaluate the program. Quantitative data were collected from student and parent participants though the distribution of pretests and posttests for each activity. In addition, surveys featuring Likert-type response scales were

administered at the start and end of each four- or six-week session and each summer session. The qualitative data collection methods consisted of interviews and focus groups with instructors, parents, students, peer mentors, and partners. These protocols allowed participants to provide candid feedback for addressing program strengths and deficiencies.

A formative and summative evaluation was undertaken to track the progress and effectiveness of the program in meeting its objectives. As a construct of the formative evaluation, a process evaluation was performed. The process evaluation appraised student enrollment, student involvement in experiential and other activities offered, parent participation, and partner inclusion. A summative evaluation will determine the final effectiveness of the project.

Pre and post afterschool program content tests demonstrate that students had modest gains in STEM related knowledge. On average, for students who had both pre and post content scores, scores rose by an average of 1 percentage-point over the course of the program. Summer camp participants were given a STEM content test before and after they attended camp, to determine the extent to which their subject matter knowledge changed over time. The analysis found that students experienced significant gains in STEM knowledge over the course of the camp. For some questions (i.e. “How many GPS satellites are currently orbiting Earth) pre and post correct response rates increased quite dramatically from 21% to 80%, marking significant strides.

Like student feedback, parental , on the summer camp was also positive. Parents (94%) reported students sharing at least one “cool” lesson they learned at camp. Training participants provided feedback on the professional development via a short survey. Feedback was extremely positive, with 90% of respondents agreeing or strongly agreeing that the professional development training video was effective in preparing them to teach the project. Minimal disruptions to programming took place, though programming was forced to be primarily remote.

University of California – Riverside All program participants at this site were provided surveys designed to reflect their STEM experience. Two types of evaluation methods were conducted for the MAA project: formative (process) evaluation and summative (outcome) evaluation using mixed methods with quantitative and qualitative data. Project leaders and evaluators collaborated to develop evaluation forms and surveys to assess the usefulness of program components and the extent to which the MAA program was achieving its goals. Evaluation surveys included formative and summative questions with Likert scale and free response items to assess participants’ satisfaction with project activities, as well as participants’ achievement of activity objectives. Quantitative data from all surveys were analyzed using frequencies, descriptive statistics, and inferential statistics to identify differences in responses before (assessed retrospectively) and after the implementation of a program activity.

The percentage of high school respondents who had high interest in taking more science classes and workshops increased from 89% to 100% over the course of the Summer Academy. Additionally, the percentage who had a high interest in pursuing a college degree in a STEM related field rose from 78% to 94%, and the percentage who had a high interest in pursuing a NASA-related career also rose from 78% to 83%. Each of these findings were statistically significant. Survey respondents from this group reported that the program gave them the benefits of better preparing them for college and increasing their knowledge of the origins of the universe. While the Cosmic Thursday questionnaire did not have questions to assess interest in training as scientists, computer scientists, engineers, and entrepreneurs, analysis of open-ended responses indicated that the talks increased interest in science-related subjects and projects such as astronomy, physics and space exploration for some attendees. Some attendees also

noted that a benefit of the talks was motivating their K-12 children to pursue education in NASA-related fields.

The majority (89%) of the 770 public outreach event survey respondents reported a better understanding of astronomy as a result of attending the events. All three participants (100%) in the Teacher Academy reported feeling more prepared to teach advanced topics in data science, statistics and data visualizations, Python programming and data structures, and machine learning in algorithms after completing the training program.

York College used a variety of data collection activities including the use of quarterly student surveys which help attribute increases in student interest based on participation in MAA. Feedback from parents was also highlighted and parent focus groups were utilized to collect parent/ adult caregiver feedback.

York MAA continues to employ innovative, tailored, and widespread recruitment strategies, informing the larger public about this program and the value it contributes to students, families, and communities. For example, the program virtually disseminated NASA content and program-related information via social media posts and e-mail communications, which increased awareness among the general public about the nature of activities implemented by York MAA. Moreover, deep cultural understanding of the local Queens community informed the program's decision to be inclusive in their language, with brochures being available in both English and Spanish. These digital and culturally responsive efforts were found to have contributed to Fall 2020 program enrollment.

Performance Goal 3.3.5: Provide opportunities for students to contribute to NASA's aeronautics, space, and science missions and work in exploration and discovery.

Although the majority of MUREP activities focus on higher education opportunities for undergraduate and graduate students, the MAA's focus and targeted audience is students in grades K-12. Even though the focus of the MAA is on students in grades K-12, a few of the MAA grantees proposed that they would utilize pre-service teachers and graduate students to assist them with their day to day MAA operations; however, this was not a MAA solicitation requirement and it is up to and at the discretion of each of the grantees to propose how they will implement their MAA.

Although MAA students do not explicitly make direct contributions to NASA's missions and work, the specific goal of MAA is to build the interest, skills and knowledge necessary for K-12 students to pursue STEM careers by engaging them in authentic STEM experiences built around NASA mission content. Through structured components such as *Authentic STEM Experiences*, learners engage directly in science and engineering practices to enhance STEM skills using content related to NASA missions and research.

The specific alignments to NASA missions varied across sites. MAA students were engaged and participated in the following:

- Developing solutions to design challenges,
- Conducting science investigations,
- Participating in authentic experiential learning opportunities at the K-12 level,

MAA sites worked to create or modify grade-appropriate STEM activities for students that aligned to NASA missions, provided professional development for MAA educators, and structured virtual activities, as a result of COVID-19, to engage direct learners as well as those of the general public. Below are some of the NASA resources which were utilized by MAA grantees:

- NASA STEM content including Artemis Mission; Next Gen STEM; and other STEM-related activities from NASA official websites;
- Dissemination of home-based STEM kits for students and families to complete at home paralleled with virtual instruction from MAA educators; and
- Presentations on key strategies for families during virtual instruction of children at home.

ACTIVITY ACCOMPLISHMENTS

Despite restrictions caused by COVID-19, MAA sites successfully transitioned their face-to-face MAA programs to virtual offerings. Leveraging quarterly and monthly discussions with sites, the MAA activity management was able to use proactive methods to offer guidance for the completion of year two operations. Sites worked to conduct programs outside of the scope originally proposed and operated within COVID-19-related confinements. Several sites reported using Artemis Mission-related content and other STEM activities such as Next Gen STEM activities. Students and family involvement participants made up the largest group of direct participants reported in year two; however, family involvement and technology-rich experiences remained a challenge due to the pandemic.

In spite of impacts, due to the pandemic, MAA sites continued to find innovative ways to showcase their MAA programs and its learning opportunities. The UTEP MAA site renovated a school bus with Wi-Fi for local students to log onto websites and complete MAA activities and their school homework and classroom assignments. The NTU MAA site provided students on the reservation with hot spots and chrome notebooks and computers which were donated by the university and other partners; because of the distance to the university the hot spots and computers were driven to the students' homes. To continue student engagement efforts, many MAA sites facilitated a safe drive-thru style pickup of STEM kits, for MAA student and family members to complete at home. For families who had not transportation, the materials and supplies were mailed to the students' homes. Due to significant impacts due to COVID-19, several sites had to acquire new partners or find new ways for collaboration with their established partners. These examples, along with several others, emphasize the innovative and creative ways in which the MAA sites continued to engage their participants, despite the impacts and limitations they were faced with as a result of COVID-19.

The NASA Shared Services Center (NSSC) MAA Grants Officer was invited and eagerly participated in a MAA teleconference call with the MAA Principal Investigators and their staff, to discuss the final period of performance for the grantees and addressed questions regarding :submitting a request for No Cost Extensions (NCE), request for budget reallocation of funds, challenges of operating due to COVID-19 conditions, concerns regarding not being able to operate as proposed and impacts centered-around their evaluation related activities. The MAA grantees found the Q&A session with the MAA Grants Officer to be very beneficial.

Also, during FY 2020, a MAA Tiger Team was formed. The purpose of the MAA Tiger Team was to discuss the current MAA 2.0 Model and to provide feedback and make recommendations for a MAA 3.0 Model. Recommendations were based upon feedback from the evaluation external expert review

panel member of the OSTEM MAA Tiger Team. References/citations were used from the MAA 3.0 literature review. These references were used to inform the recruitment and/or retention of participants from groups historically underrepresented or underserved in STEM fields.

ACTIVITY CONTRIBUTION TO ANNUAL SUCCESS CRITERIA

Success Criteria 3.3.3 STEM-20-1: Meet or exceed the national average in two of the four categories of student diversity for NASA STEM enrollees in internships, fellowships, or other student engagement opportunities. Diversity Categories: (1) students across all institutional categories and levels (as defined by the U.S. Department of Education), (2) racially or ethnically underrepresented students (Hispanics and Latinos, African Americans, American Indians, Alaska Native, Native Hawaiians and Pacific Islanders), (3) women, and (4) persons with disabilities at percentages that meet or exceed national averages for science and engineering enrollees, as determined by the most recent, publicly available data from the U.S. Department of Education’s National Center for Education Statistics.

MAA sites report quarterly on participant data such as student demographics; however, it is optional and voluntary.

Success Criteria 3.3.4 STEM-20-2: Achieve milestone(s) in the implementation of performance assessment and evaluation of STEM engagement investments.

- **Milestone:** Award one competitive agreement to conduct a multi-year, third-party, project-level evaluation of the National Space Grant College and Fellowship Project.

The MAA Activity serves K-12 student participants. MAA sites indirectly address success criteria 3.3.4 by hiring a third-party independent evaluator to assess impacts of their MAA programs. The Paragon TEC MAA Evaluation point of contact conducts a synthesis and meta evaluation of each of the individual MAA site reports, to summarize findings and conclusions. MUREP, as a project within NASA, has created a team to evaluate separate constructs to examine common trends across the MUREP Agency Portfolio, which is comprised of mostly programs aimed to engage college-level students. The MAA Activity was included and evaluated under the MUREP Agency Portfolio along with the other higher education programs.

Success Criteria 3.3.5 STEM-20-3: Number of paper presentations and peer-reviewed research publications (and beginning in FY2021 to include student proposed solutions and products) resulting from STEM engagement investments.

- **Target:** 1300 paper presentations and peer-reviewed research publications resulting from STEM engagement investments

The MAA Activity serves K-12 student participants. Sites are not required to produce paper presentations, peer-reviewed research publications, or student proposed solutions and products; however, the MAA does indirectly address success criteria 3.3.5. In FY 2020, York College MAA provided a total of seven (7) published results of research or activities that directly contributed to their MAA activity. The titles of those papers and/or publications are provided below.

1. The NASA MUREP Aerospace Academy (MAA): Playing a pivotal role in bridging the knowledge-gap during the COVID-19 pandemic.
2. How will the NASA 2020 Mars Mission further our knowledge of Mars and the possibility of habitation, and how has it evolved from past missions?
3. The progress of space exploration from the first American human spaceflight program to Mars Rover.
4. How can bacteria housed in a dome be used to improve life on Mars?
5. Human health and wellness in space: A review of common effects, current research, and methods of prevention.
6. Microgravity and its bearing with space flight-related research.
7. NASA MUREP Aerospace Academy engaging high school students in robotics with geoscience applications: York College, Queens, New York City.

ACTIVITY IMPROVEMENTS MADE IN THE PAST YEAR

The following serves as activity improvements during the applicable reporting period:

- The Activity Manager continued to monitor project funds on a quarterly basis into year two.
- Hosted opportunities for MAA sites to learn best practices from one another during monthly teleconferences. Discussions focused on the following topics: working in COVID conditions to engage students in STEM; retention rates of assessment forms through virtual platforms; and student cognitive fatigue when engaged in virtual instruction for primary school and extracurricular activities.
- The MAA Activity Manager continued to work with each MAA site to seek efficiencies for expenditure of remaining funding for their MAA grant. Meetings were held with Principal Investigators to discuss their budget status and plans for operating under their Year Three No Cost Extension. Technical assistance for sites continue to be a critical aspect for ensuring site leadership had current information from a centralized perspective, while sites were operating under COVID-19 conditions.
- The MAA management office continued reviewing and discussing each MAA site's plans for sustainability.

ACTIVITY PARTNERS AND ROLE OF PARTNERS IN ACTIVITY EXECUTION

MAA sites are required to develop partnerships with the goal to sustain activities beyond initial NASA funding. Internal as well as external partners help to sustain activities through financial and/or fringe benefits as contributions towards sustainability efforts. *Direct investments* are those that come in the form of a monetary value (e.g., grants, scholarship funds, or actual financial investments) while *in-kind investments* are estimates that result in a service or venue that does not require financial assistance to cover a cost (e.g., classroom space provided, lights, computers provided by the institution, etc.).

MAA sites proposed their plans to establish partnerships and/or collaborations within their local communities and regional STEM Ecosystems. Organizational types included: local schools, school districts, businesses, museums, educational/ professional societies, other higher education institutions or departments, faith-based organizations, government agencies, state and local vicinities, youth serving organizations, and others.

MAA 2018 Cohort Partners and Contributors

MAA Institution	Partnering Organization	Resources Provided through Partnership	Partnership Type (In-kind or Financial Contribution)
Albany State University (ASU)	Albany State University	President's Office at ASU supported MAA activities and sponsored meals for the MAA STEM Olympics outreach event	In-Kind (Internal)
	Museum of Aviation	MAA program supplies	In-kind (External)
	Flint River Quarium	Field trips, USDA summer food service program for sessions	In-Kind (External)
	Georgia Tech CEISMC - Atlanta GA	Robotics and STEM curriculum professional development support for educators	In-Kind (External)
	United States Department of Agriculture (USDA)	Lunch meals for participants of the Summer MAA program at ASU - Food Service Program (SFSP)	In-Kind (External)
	Southwest Georgia Regional Educational Service Agency - Camilla, GA	Provided curriculum and implementation support	In-Kind (External)
	Boys & Girls Club of Albany, GA	Technology, space for MAA activities, transportation and participants, transportation	In-Kind (External)
	YMCA Albany, GA	Space, participants, transportation	In-Kind (External)
	Positive Direction Youth Center, Dawson, GA	Assistance with recruitment of MAA participants	In-Kind (External)
	Mt. Olive Community Outreach Center, Albany, GA	Space for MAA activities, unique participants, and transportation support.	In-Kind (External)
California State University – Fresno	Dougherty, Mitchell, Calhoun, Terrell, Lee, Baker, and Worth County Schools		
	NASA Kennedy Space Center (KSC), Florida		
	California State University - Fresno, CA	Space on campus to house the MAA activities, free storage unit to store supplies, materials and office space. Classrooms and computer labs for weekday activities, Saturday programs and professional development workshops	In-Kind
	Partnering CSU, Fresno School Districts	Provided space on school campus for MAA instructors to implement MAA programming and a venue to run family activities for parents and students	In-Kind (Internal)
	Partnering CSU, Fresno School Districts	Space for MAA activities and compensation for MAA instructors to implement MAA summer programming	In-Kind (Internal)
	Education Pathway Grant	Salaries, materials/ equipment for workshops on weekends and consumable supplies	Financial Contribution

MAA Institution	Partnering Organization	Resources Provided through Partnership	Partnership Type (In-kind or Financial Contribution)
	California Department of Education Region 7 STEM Hub Grant Clovis Unified - Clovis, CA; Kepler Neighborhood Schools - Fresno, CA; Central Unified - Fresno, CA; Mendota Unified - Mendota, CA; Woodville Union, Woodville, CA; Sutter Middle School, Fowler, CA. Inspired Charter School, Fresno	Salaries and training of MAA instructors and workshop presenters	Financial Contribution
Elizabeth City State University (ECSU)	Elizabeth City State University	Space, lighting, materials, activity supplies, and printing for classrooms and TRE for MAA activities	In-Kind (Internal)
	Burroughs Wellcome Fund North Carolina Math and Science Education Network (NC-MSEN) United States Coast Guard Base, Elizabeth City: NC Museum of the Albemarle Dare County, Northern Carolina Division of Aviation Northeast Academy for Aerospace and Advanced Technologies Warren County School District Port Discover TCOM, L.P. First Flight Society University of North Carolina (UNC) Chapel Hill – Morehead Planetarium	Program support and supplies Teachers, staff, and transportation for Saturday Academy	Financial Contribution In-Kind (External)
Navajo Technical University (NTU)	Navajo Technical University Southwestern Indian Polytechnic Institute Crownpoint Middle School and High School Miyamura High School Gallup-McKinley School Districts Navajo Transitional Energy Company (NTEC)	Space, lighting, materials, activity supplies, and printing for classrooms and TRE for MAA activities	In-Kind (Internal)
Tennessee State University (TSU)	Tennessee State University TSU	Building and classroom space, lighting, materials, activity supplies, and printing for classrooms and TRE for MAA activities Work-Aid Students Work- Study Students	In-Kind (Internal)
	Civil Air Patrol Neely's Bend Elementary School, McKissack Middle School, John Early Middle School, and Ida B. Wells Elementary School/Metropolitan Nashville Public Schools (MNPS) Tennessee Technological University (TTU)	Technology-rich environment tools and supplies for MAA participants	In-Kind (External)

MAA Institution	Partnering Organization	Resources Provided through Partnership	Partnership Type (In-kind or Financial Contribution)
	Meharry Medical College Vanderbilt University Goodwill Corporation City of Nashville Mayor's Office (2019)		
Texas State University, San Marcos	The Seguin Independent School District (SISD) Hays Consolidated Independent School District (CISD), San Marcos CISD, and Lockhart ISD, and Lockhart Junior High Robotics Club Seguin Fire Fighters Department Civil Air Patrol KVUE Meteorologist Jason Mikell Centro Cultural Hispano de San Marcos	Administrator time, facility usage during the STEM Saturday programs two custodial staff facility rental cost	In-Kind (Internal)
University of Texas at El Paso (UTEP)	University of Texas at El Paso Lockheed Martin Cooperation UTEP Society of Women Engineers "SWE" El Paso TECH2O Water Center El Paso ISD; El Paso, TX; Canutillo ISD; Canutillo, TX; Socorro ISD; Socorro, TX; Fabens ISD, Fabens, TX; Ysleta ISD Lil' Petit Home Schoolers El Paso County United Way NASA Goddard Space Flight Center - Exploration & Space Communication Division	Building and classroom space, lighting, materials, activity supplies, and printing for classrooms and TRE for MAA activities Funding for MAA STEM activities outreach platforms to participants Provided STEM outreach volunteers for UTEP MAA SW STEM venues. Year-round venue for STEM K-12 Outreach, space at no cost UTEP MAA K-12 outreach participants through summer camps	In-Kind (Internal) Financial Contribution In-Kind (Internal)

MAA 2019 Cohort Partners and Contributors

MAA Institution	Partnering Organization	Resources Provided through Partnership	Partnership Type (In-kind or Financial Contribution)
Florida Atlantic University	Avirom & Associates, Inc. NovTech, Inc.	MAA program supplies for Family Involvement events MAA program supplies for Family Involvement events	In-Kind (External) In-Kind (External)

MAA Institution	Partnering Organization	Resources Provided through Partnership	Partnership Type (In-kind or Financial Contribution)
	Aerojet Rocketdyne Lauderdale Lakes and Lake Worth High Schools Broward and Palm Beach School District Broward College North Palm Beach State College South South Florida Science Center and Aquarium	MAA program supplies for Family Involvement events	In-Kind (External)
Hartnell Community College (HCC) District	Hartnell Community College (HCC) District	Space on campus to house the MAA activities, free storage unit to store supplies, materials and office space. Classrooms and computer labs for weekday activities, Saturday programs and professional development workshops	In-Kind
	The American Association of Airport Executives Annual Conference in Salinas, CA	The Executive at the Salinas Airport decided to financially contribute to Hartnell K-12 STEM activity to help support science and aeronautical studies in Salinas Valley	Financial Contribution
	Alisal Union School District	Contracts to run NASA Academy and Coding Academy at 12 schools.	Financial Contribution
	Salinas City Elementary School District	Contracts to run NASA Academy and Coding Academy at 14 schools.	Financial Contribution
	Castroville, Gonzales, Soledad, and Greenfield Districts	Facility space and lighting for MAA activities	In-Kind (External)
Morgan State University (MSU)	Morgan State University	Classroom and computer lab space, lighting, materials, activity supplies, and printing for classrooms and TRE MAA activities	In-Kind (Internal)
	Abbottston Elementary School	Provided teachers' salary, classrooms and students who work with MAA for implementation of the in-school model.	In-Kind (Internal)
	Garrett Heights Elementary and Middle Schools	Provided site for in-school MAA implementation during regular school day. Inclusive of teacher's salary, materials, classroom space and participants.	In-Kind (Internal)
	Morgan State University Foundation, non-profit partner	Family involvement coordinator and MAA staff salary, cost for instructional materials (5 Oculus Goggles).	In-Kind (Internal)
San Jacinto Community College (SJCC)	San Jacinto Community College (SJCC)	Space, Principle Investigator salary, lighting, materials, activity supplies, and printing for classrooms and TRE for MAA activities	In-Kind (Internal)
	City of Houston Airport Systems Houston Texas	Reduced cost to rent Houston Space Port facilities	In-Kind (External)
	HEB Grocers, Corporate	Cost for meals during summer activities and supplies for MAA participants	Financial Contribution
	Boeing, Lunar Planetary Institute, Intuitive Machines Alpha Space Houston TX & SAIC Houston TX participated in Ecosystem Meeting Barrios Houston TX participated in Ecosystem meeting		

MAA Institution	Partnering Organization	Resources Provided through Partnership	Partnership Type (In-kind or Financial Contribution)
	MEI Technologies Houston TX participated in Ecosystem meeting LaPorte, Sheldon, Pasadena, Deer Park and Galena Park ISDs		
University of California at Riverside (UCR)	The Thirty Meter Telescope International Observatory	Supplies for activities during the classroom visits	In-Kind (Internal)
	Riverside Unified School District (RUSD)	Contributed to support students from RUSD to participate in the UCR Summer Academy	Financial Contribution
	University of California, Riverside, Department of Physics and Astronomy	Parking passes and refreshments for the Cosmic Thursdays public lecture attendees	In-Kind (External)
	Camp Highlander	Venue and facilities for <i>Mercury Transit</i> event and materials for the hands-on activities at the Science Camp	In-Kind (External)
	Riverside Unified School District, Val Verde Unified School District, Redlands Unified School District, Chaffey Joint Union High School District, Jurupa Unified School District, San Bernardino City Unified School District, and Loma Vista Middle School		
York College (City University of New York)	York College	Provides classrooms supports additional staff, public safety, custodial service, printing, postage, telephone, etc.	In-Kind (Internal)
	Department of Education (DOE), New York	Several students funded by DOE to work with Dr. Khandaker to gain research experience through an internship to increase knowledge in environmental issues	In-Kind (External)
	ConEdison	Additional STEM classes particularly K9-12.	Financial Contribution
	AT&T Corporation	Cost of high school students research-related expenses including attending annual STEM conferences, participating in out-of-state science competitions including INTEL challenges	Financial Contribution
	National Grid	Vex Robotic Kits and components including Drones to enrich the MAA Program and introduce modern technology to 9-12 students	Financial Contribution
	York College Educational Technology Department	Use of their 3D printing facilities	In-Kind (Internal)
	Greater Jamaica Development Corporations (GJDC) Downtown Committee	Promotes NASA MAA Program by circulating news/updates through monthly meeting. Dr. Khandaker is involved with education aspect particularly dealing with increased groundwater table in the neighborhood and keeps citizens aware of the consequences related to health and environmental issues	In-Kind (External)

MAA Institution	Partnering Organization	Resources Provided through Partnership	Partnership Type (In-kind or Financial Contribution)
	<p>American Museum of Natural History (AMNH)</p> <p>United States Environmental Protection Agency Geological Survey (Coram Office, Long Island) HillCrest High School; IS 238 Q (Hollis); JHS 217 (Jamaica); JHS 8 Q (Jamaica); JHS 202 Q (Ozone Park); JHS 210 Q (Ozone Park); IS 295 Q (Queens Village); iJHS 226 Q (south Ozone Park); IS 192 (St. Albans); Q IS 231 Q (St. Albans); Al Ihsan Academy; District 13 (Brooklyn); District 14 (Brooklyn); District 15 (Brooklyn); District 16 (Brooklyn); District 24 (Queens); District 25 (Queens); District 26 (Queens); District 27 (Queens); District 28 (Queens); District 29 (Queens); District 30 (Long Island City, Queens); Elmont (Long Island); Valley Stream (Long Island); Hunter College, New York University, Stony Brook University, Buffalo State University College Now Program CUNY Explorer's Program Aviation Institute , Geological Society of America (GSA): Premier geoscience society 4H Club: Bronx, NY Queens Central Library, CEC President, Queens District 28, Infinity Love Foundation (Supporting, Inspiring and Empowering Young Girls), Greater Jamaica Business District Association, District 25</p>	<p>Provides free tickets and allows parents to visit various exhibits on a regular basis</p>	<p>In-Kind (External)</p>

