



# Annual Performance Report

August 19, 2017 - May 31, 2018

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Cooperative Agreements  
(80NSSC17M0021, 80NSSC17M0022,  
80NSSC17M0023, and 80NSSC17M0024)

# A Note from the PI



For 50 years, the partnership between Oklahoma State University (OSU) and NASA has opened up new worlds of science, technology, engineering and mathematics (STEM) for thousands of students and educators across the United States. OSU first began

working with the NASA Johnson Space Center in Houston in 1969 with a plan to send former mathematics and science teachers in vehicles known as “Spacemobiles” to schools in eight states from Texas to North Dakota to tell and demonstrate the space agency’s amazing story to students and teachers in kindergarten through 12th grades. Since then, the OSU College of Education, Health and Aviation has worked with NASA across the country on projects including Teacher in Space, Teaching from Space, Explorer Schools, Digital Learning Network, the Interdisciplinary National Science Project Incorporating Research and Education Experience (INSPRE), Strategic Education Alliance, and now the current NASA STEM Pathway Activities - Consortium for Education (NSPACE) projects. We celebrate Dr. Ken Wiggins’ and Dr. Steve Marks’ outstanding leadership and stewardship within this rich partnership. Each of their retirements left a legacy of innovative opportunities and big shoes to fill.

As the latest principal investigator (PI) in this storied lineage, I am honored to work with the NSPACE project alongside the truly gifted team making the activities happen. Our partners in this endeavor include the 13-campus Texas A&M University system, 4-H, the Center for Sovereign Nations, Langston University, Northern Oklahoma College, and Technology for Learning Consortium. Through these partnerships, we are working diligently to reach underrepresented populations and help them take advantage of the incredible experiences offered through NSPACE. The highlights of each activity on the following pages will give you a glimpse of the impact of this important work.

During this first year of NSPACE, we have celebrated the rich history of the OSU-NASA Education partnership, embarked upon exciting new adventures through NSPACE activities, and continued to look toward emerging technologies and pedagogies to captivate and empower students and educators through NASA-unique STEM engagement, educator professional development, and institutional engagement.

— *Dr. Stansberry*

*School Head, Educational Foundations, Leadership, & Aviation Associate Professor, Educational Technology*

*Co-Investigator, NASA STEM Pathway Activities – Consortium for Education (NSPACE)*

*Founder, Emerging Technologies and Creativity Research Lab*










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*Quotes found in this report are from a third-party evaluation report. The external evaluator withholds names to protect participant privacy.*

Outcomes	CoSTEM Priorities
<p><b>STEM Engagement</b> Learners are interested, inspired, knowledgeable and challenged by NASA-unique resources and experiences</p> <p><b>Educator Professional Development</b> Educators have the knowledge, skills, and ability to deliver unique STEM content to learners</p> <p><b>Institutional Engagement</b> Increase STEM capabilities at formal and informal educational institutions and organizations by incorporating content based on NASA’s missions</p>	<ul style="list-style-type: none"> <li> Improve STEM Instruction</li> <li> Better Serve Groups Historically Under-represented in STEM Fields</li> <li> Enhance STEM Experience of Undergraduate Students</li> <li> Design Graduate Education for Tomorrow’s STEM Workforce</li> <li> Increase and Sustain Youth and Public Engagement in STEM</li> </ul>

# Executive Summary - Year One

## CHALLENGE

According to James Brown, the executive director of the STEM Education Coalition in Washington, DC, the future of the economy is in STEM - science, technology, engineering, and mathematics. Data from the US Bureau of Labor Statistics predict STEM occupations to grow to more than 9 million between 2012 and 2022; an increase of about 1 million STEM jobs over 2012 employment levels.

To help meet this challenge, NASA has taken on the goals of strengthening the nation's future workforce and attracting and retaining students in STEM disciplines.

## SOLUTION



As NASA STEM Pathway Activities - Consortium for Education, or NSPACE, celebrates its 1st anniversary, we look back on one transformative year and welcome in another.

The strength of NSPACE lies in its capability to highlight the Agency's mission and connect diverse audiences to NASA content, people, and facilities through a broad and varied portfolio of activities. NSPACE activities involve students and educators in hands-on experiences and research applications on Earth, in the air above Earth, and in the micro-gravity environment of space. Activities are "as only NASA can" and are designed to support NASA Education's goals of strengthening the Nation's future workforce, attracting and retaining students in STEM disciplines, and engaging Americans in NASA's mission.

This past year, the NSPACE team implemented **11** separate activities involving hundreds of separate events, online sessions, face-to-face experiences, and conferences.

**During This 1<sup>st</sup> Performance Year, NSPACE Activities Touched an Astounding**

.....

	<b>&amp;</b>	
<b>63,000 Educators</b>		<b>182,000 Students</b>

.....

**Across 45 states plus Washington DC, Puerto Rico, and the US Virgin Islands**

## IMPROVEMENTS

Year one of the NSPACE agreement is filled with fresh, innovative ways of doing business. We continually sought new ways to improve and enhance the value of project activities and incorporate current trends in the use of multimedia and new technologies.





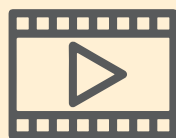
## Innovations Included



Launched  
**2** NEW  
Activities



Introduced the new  
**BrightSpace**  
Learning Platform



### PILOTED TUTORIAL VIDEOS

To Support Student  
Participants Through the  
Application Process



Automated  
Purchasing



Utilized our diverse  
**PARTNER NETWORK**  
to reach  
Underrepresented  
Populations



Worked with NASA  
Mission Directorates  
to design education  
experiences anchored in  
real-life NASA challenges



## SOCIAL MEDIA

NASA Education activities implemented by the NSPACE team reached a staggering amount of people through social media channels.



[facebook.com/jsceducation](https://facebook.com/jsceducation)



[twitter.com/NASAedu](https://twitter.com/NASAedu)



**934,874,432**  
People reached through  
Twitter, Facebook,  
Instagram, and other  
social media platforms



Explore the following pages for a more in-depth look at the portfolio of NSPACE activities and accomplishments.

“Thank you so much for the professional development you provided to our teachers! One never knows if teachers are going to feel the value of professional development... I’ve heard nothing but positive feedback.”

– Assistant Principal



# BEST

## Beginning Engineering, Science, and Technology

Outcome: Educator Professional Development

NASA’s Beginning Engineering, Science and Technology (BEST) Educators inspire and engage classroom teachers and informal educators nationwide in the engineering design process through real-world NASA challenges. BEST provides a series of educator professional development activities and instructional guides aligning to national standards and supporting educational functions at multiple NASA Centers. BEST Educators achieve broad geographic impact collaborating with school districts and informal education agency partners delivering professional development experiences through face-to-face and virtual trainings.

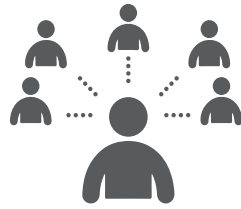
<https://www.nasa.gov/audience/foreducators/best/index.html>



## ACCOMPLISHMENTS



Trained **120** educators during March, April, and May



Implemented BEST at **6 NASA Centers**



“This specific project based learning utilizing a hands-on inquiry approach is exactly what the students at Felton need.”

– Educator



## IMPROVEMENTS

- Implemented BEST curriculum at Network of States Institute



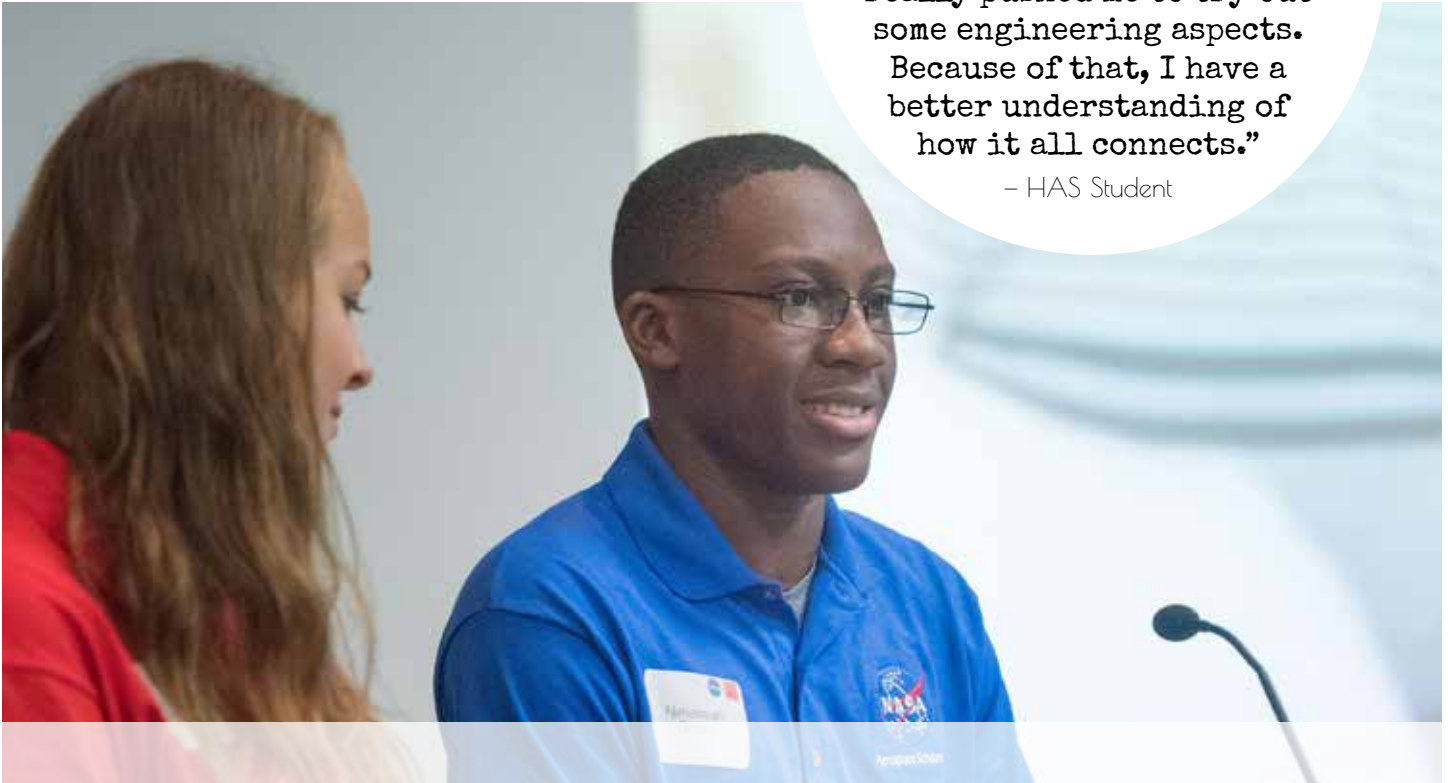
## ON THE HORIZON

Attending several educator conferences this summer sharing NASA BEST content



“I am generally more of a science person and HAS really pushed me to try out some engineering aspects. Because of that, I have a better understanding of how it all connects.”

– HAS Student



# HAS

Outcome: STEM Engagement

## High School Aerospace Scholars

Texas High School Aerospace Scholars, or HAS, is an interactive, online course culminating in an all-expenses-paid, onsite experience at the NASA Johnson Space Center (JSC). During the school year, Texas high school juniors gain knowledge learning the past, present, and future of space exploration. Eligible students travel to JSC to complete engineering design challenges and assist in planning a mission to Mars.

<http://has.aerospacescholars.org/>





## METRICS / ACCOMPLISHMENTS



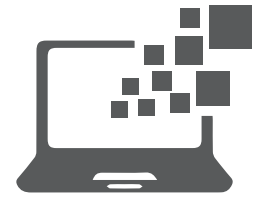
**683** students enrolled in the HAS online course



Representing **83** counties through the state of Texas



Female students made up almost **40%** of HAS online course participants



**4** interactive webinars with NASA subject matter experts



## IMPROVEMENTS

- Created on-demand multimedia tutorials for students
- Created online discussion boards where students interact with NASA subject matter experts
- Automated travel forms for efficiency
- Enhanced counselor training focusing on inquiry-based learning



## ON THE HORIZON

Over **260** Texas students invited to NASA's Johnson Space Center for a 6-day onsite experience including engineering design challenges, briefings by NASA subject matter experts, and tours of NASA-unique facilities.



Being a HUNCH student shaped my post high school career, and greatly influenced my academic and career pursuits; while also providing me with a network of industry experts that gave me priceless guidance and further insight.”

– HUNCH Participant



Outcome: STEM Engagement

# HUNCH

High School Students United with NASA to Create Hardware

High Schools United with NASA to Create Hardware, or HUNCH, started 15 years ago with a handful of schools producing hardware training items for the International Space Station (ISS). HUNCH has grown to over 150 schools across the country. In addition to producing hardware for flight and training, HUNCH reaches a diverse population of students through design projects, sewing flight and training articles, and even challenging culinary students to develop recipes for International Space Station crews. Over 20,000 students have participated with 94% moving on to pursue undergraduate degrees.

<http://www.nasahunch.com/>



## METRICS / ACCOMPLISHMENTS

### Five Challenges Offered

#### 1 DESIGN and PROTOTYPING



Finalists included 216 students from 29 schools in 15 states; several projects are under consideration for flight production

#### 2 CULINARY CHALLENGE



Student-created recipe selected by NASA for inclusion in astronaut meals aboard the International Space Station

#### 3 SPACE FLIGHT HARDWARE



Nearly 900 flight hardware parts produced by students at 17 schools across the nation

#### 4 SPACE FLIGHT SOFTGOODS



98 sleeping bag liners, 73 cargo transfer bags (CTB), 8 stowage bags, and 7 payload caddies produced for astronauts to use in space as well as pre-flight training

#### 5 NASA VIDEO/MEDIA



5 schools competed in this new challenge producing media showcasing ISS experiments and HUNCH's role supporting NASA missions



## IMPROVEMENTS

- Recruited a celebrity chef to serve as an expert reviewer for the Culinary Challenge
- Incorporated social media to extend reach to new and diverse audiences



## ON THE HORIZON


Year two of the NSPACE agreement will kick-off a new partnership with the Human Exploration Research Analog, or HERA - a unique habitat designed to serve as an analog for isolation, confinement, and remote conditions in exploration scenarios. (Students will build soft goods to support the HERA mission.)



Softgoods CTB



Hardware Locker



“I believe the work I completed helped develop me as an engineer and that the Micro-g NExT project facilitated my interest and involvement for a future career in the aerospace industry.”

– Micro-g NExT Student

Outcome: Institutional Engagement

# MgNExT

Micro-g Neutral Buoyancy  
Experimental Design Teams

Micro-g Neutral Buoyancy Experiment Design Teams (MgNExT) challenges undergraduate students to design, build, and test a tool or device addressing an authentic, current space exploration challenge. The overall experience includes hands-on engineering design, test operations, and public outreach. Student teams travel to the NASA Johnson Space Center (JSC) to test their tools in the simulated microgravity environment of the Neutral Buoyancy Laboratory (NBL) - a 6.2 million gallon pool used for astronaut training.

<https://microgravityuniversity.jsc.nasa.gov/>



## METRICS / ACCOMPLISHMENTS



**239** students and faculty participated in the MgNExT online community



**127** students traveled to JSC to test their tool in the NBL



Participants represented **22** colleges & universities in **16** states, **4** minority serving institutions, & **1** community college



Students participated in **9** online sessions with NASA subject matter experts



## IMPROVEMENTS

- Audited processes and changed milestone due dates to support a more rigorous technical review by NASA subject matter experts
- Collaborated with the Jet Propulsion Laboratory (JPL) to develop a challenge addressing sampling missions on planetary bodies using the Buoyant Rover for Under Ice Exploration (BRUIE) as a platform
- Developed four new challenges - Module Leak Repair System, Sharp Edge Detection and Removal/Covering, Extravehicular Activity (EVA) Zip Tie Cutters, Under Ice Sampling Device



## ON THE HORIZON

MgNExT Team will continue collaborations with NASA scientists and engineers developing future challenges based on current, real-world problems.



“We try to do real engineering...that’s why this has been amazing, because this is unbelievably real.”

– MgUE Participant



Outcome: Educator Professional Development

# MgUE

Microgravity University for Educators

Microgravity University for Educators, or MgUE, challenges student and educator teams to solve technical problems by designing, building, and testing prototypes in a simulated microgravity environment - the Precision Air Bearing Floor. Challenges involve student-derived solutions to technical problems identified by NASA scientists and engineers. (Paired with a team, a NASA mentor helps integrate student-derived solutions with the Precision Air Bearing Floor.) Participating educators receive professional development during the online and onsite portions by attending virtual meetings, webinars, NASA tours, briefings with NASA subject matter experts, and NASA-unique experiences.

<https://microgravityuniversity.jsc.nasa.gov/>



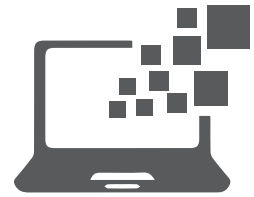
## METRICS / ACCOMPLISHMENTS



**54** students and educators tested their prototype on the Precision Air Bearing Floor



**9** teams from **6** states and Puerto Rico attended the two test weeks at JSC



Hosted **5** webinars helping teams prepare for test week at JSC



## IMPROVEMENTS

- Invited students to JSC to test their prototypes with their educators
- Incorporated a microgravity digital badge into the professional educator development



## SOCIAL MEDIA

#NASAMGUE reached more than **8 million** people on social media.



# MUREP MOO

## Minority University Research and Education Program (MUREP) Other Opportunities (MOO)



### ACCOMPLISHMENTS



Provided **1,157** students with significant, direct student awards in higher education



Impacted **4,900** students and **595** educators through MOO awardee outreach events



### IMPROVEMENTS

- Amplified MOO impact by publishing NASA student success stories.
- Increased internship opportunities by 50%
- Established 13 new partnerships supporting sustainability of programs



### ON THE HORIZON

This summer, 21 students from five institutions will serve as interns at various NASA Centers working alongside NASA STEM professionals.

MUREP Other Opportunities (MOO) awards six Minority Serving Institutions (MSIs) with NASA funding and support to innovatively create and implement STEM opportunities designed to attract, retain, and support the success of underrepresented students in STEM degree programs. Through this targeted approach, MUREP MOO supports NASA's goal of a diverse workforce.



<https://www.nasa.gov/offices/education/programs/national/murep/home/index.html>





Outcome: Institutional Engagement

# MUREP MIRO

Minority University  
Research and  
Education Program  
(MUREP) Institutional  
Research  
Opportunity  
(MIRO)

The MUREP Institutional Research Opportunity, or MIRO, aims to strengthen and develop the research capacity of Minority Serving Institutions, or MSIs, in areas of value to NASA’s mission. NASA invites MSIs across the nation to submit research proposals based on current NASA needs. Selected institutions receive funding, support from NASA subject matter experts, and an allocation of paid NASA internships for students working on research projects.

## ACCOMPLISHMENTS



**10** MSI proposals representing **7** states and the US Virgin Islands selected for support



Placed **71** MIRO interns at NASA Centers



## IMPROVEMENTS

- Strengthened communication between grantee institution research teams and principal investigators by increasing the number of opportunities for virtual connection
- Working to better highlight grantee accomplishments in MUREP reporting increasing visibility to MIRO



# NCAS

Outcome: STEM Engagement

NASA Community College Aerospace Scholars, or NCAS, is an educational experience for community college students interested in exploring careers in science, technology, engineering and mathematics. Students participate in a five-week online community, consisting of discussions, webinars with NASA subject matter experts and mission design challenges. Based on performance, select students attend a four-day engineering design challenge at a NASA Center.

NASA  
Community  
College  
Aerospace  
Scholars

<http://ncas.aerospacescholars.org/>



## METRICS / ACCOMPLISHMENTS



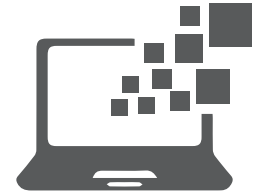
Over **800** students participated in NCAS online community



**Increased** staffing and expansion from 9 NASA Centers to 10



Conducted 11 onsite experiences at 8 NASA Centers reaching **453** students



Offered students dozens of **webinars** with NASA subject matter experts



## IMPROVEMENTS

- Implemented communication enhancing technology, Signal Vine, to increase application completion rate and lower attrition rate in the NCAS online community
- Created peer-mentor element with outstanding NCAS alumni during NCAS onsite experience
- Enhanced NCAS staffing model with three Regional Education Coordinators nationwide
- Expanded NCAS onsite experience to all NASA Centers



## ON THE HORIZON

**18** additional onsite experiences scheduled for the 2018 calendar year.



**“I am committed to advocating [NCAS]. Sam and Kristen have broadened their sense of possibilities and their sense of confidence as a result. This strengthening of their confidence is priceless.”**

– Community College Professor



“Next generation of explorers working on the next generation of spacesuits: inspiring to see student design ideas for new spacewalking hardware.”

– Astronaut Kate Rubins

# SUITS

Outcome: Institutional Engagement

NASA Spacesuit User Interface Technologies for Students (SUITS) is a mission-driven design challenge where college student teams design and create spacesuit informatics using the augmented reality (AR) platform - Microsoft HoloLens. Spacesuit avionic informatics help astronauts become more efficient and effective during a spacewalk, often in the form of visual displays. The student-designed visual display and audio environments present information to aid astronauts with performing simulated extravehicular activity (EVA) tasks. After developing their environment, selected student teams traveled to the NASA Johnson Space Center (JSC) to test their prototypes.

# NASA Spacesuit User Interface Technologies for Students

<https://microgravityuniversity.jsc.nasa.gov/>




## METRICS / ACCOMPLISHMENTS



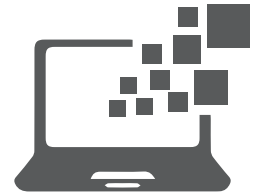
Launched first mission-driven **coding challenge** for JSC Office of Education: developing a new partnership with EVA Office  



**48** students and faculty tested prototypes at JSC 



The **10** participating institutions included a community college and minority serving institution  



Offered three online interactive sessions engaging **238** students



## ON THE HORIZON

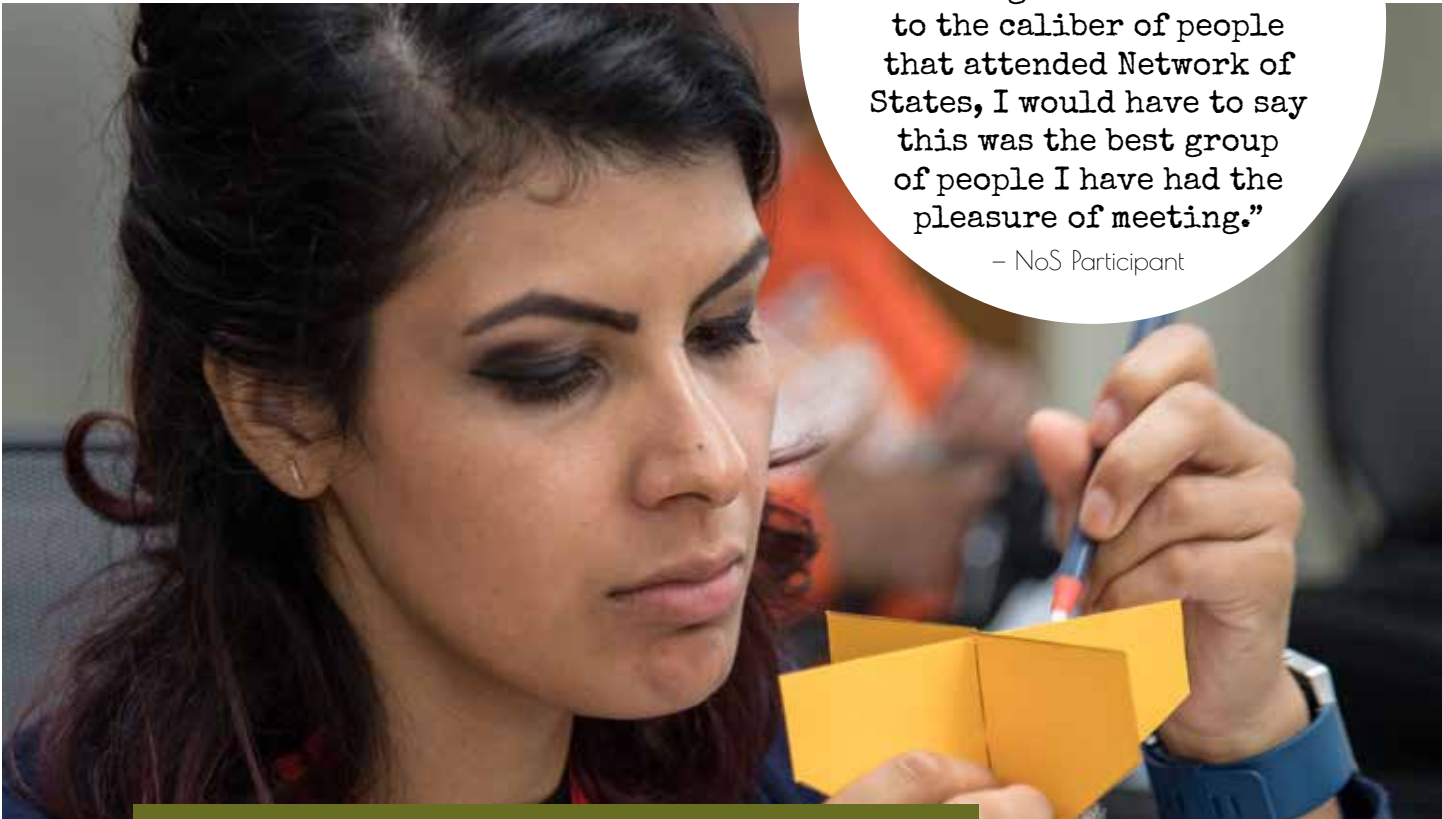
- Participants will submit Final Reports and Peer Reviews
- Research and pursue future funding opportunities
- Continue to build partnership with Microsoft
- Expanding activity timeline
- Provide more time for collaboration and software updates between prototype testing



## SOCIAL MEDIA

#NASACodes & #NASASUITS reached over **15 million** people on social media during its pilot year.





“From the extensive knowledge of the trainers to the caliber of people that attended Network of States, I would have to say this was the best group of people I have had the pleasure of meeting.”

– NoS Participant

Outcome: Educator Professional Development

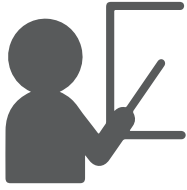
# NoS Network of States

Network of States (NoS) provides systemic, long-term support for NASA Centers and their communities by building strong regional networks for partner-delivered NASA educator professional development. Using the systemic structural design of a connected teaching model, Network of States builds an education network aligned with national standards and designed to enhance teaching practices by integrating NASA-unique STEM content and effective use of technology.

<https://www.nasa.gov/offices/education/seap-abstracts-network-of-states.html>



## METRICS / ACCOMPLISHMENTS



**815** educators reached through partner workshops



**7** members attended the first FY18 advisory committee meeting in November 2017



Advisory committee expanded from one to **three states**



## IMPROVEMENTS

- Aligned with current NASA Education goals and objectives by shifting the focus to STEM Engagement
- Elevated member engagement with new requirement for members to conduct NASA STEM engagement events in their communities
- Expanded the Advisory Committee to include representation in Oklahoma and South Dakota



## ON THE HORIZON

Each advisory committee member nominated 5 educators within their region to attend the workshop at the NASA Johnson Space Center. The workshop will immerse participants in future spaceflight exploration content as they interface with Orion Program experts and participate in activities aligned with local and national standards they can share with their communities.



“In the words of Astro Joe from my downlink question, ‘It was hard. We struggled EVERYDAY!!!’ We quote him EVERY, SINGLE DAY because my kiddos here in the Middle of Nowhere New Mexico struggle too!”

– New Mexico  
Science Teacher



Outcome: STEM Engagement

# SoS STEM on Station

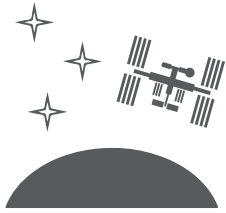
STEM on Station (SoS) uses the International Space Station (ISS), its crew and the onboard research to inspire, engage, and educate students and educators. STEM on Station works, “Off the Earth, for the Earth...and in the classroom” to advance NASA and the nation’s STEM education and workforce pipeline through NASA’s missions and unique assets including a comprehensive website, conversations with astronauts in space, and hands-on STEM activities developed through high-profile partnerships.


<http://www.nasa.gov/stemonstation>






## METRICS / ACCOMPLISHMENTS




Coordinated In-Flight Education Downlinks between astronauts aboard the ISS and students in **24** states + Washington D.C. and Puerto Rico 




Downlinks reached **40K+** educators and **150K+** students 



Downlinks increased by **186%** – yielding the highest number of education events in the history of the ISS 



The SoS website is one of NASA Education's most visited websites exceeding **64K+** views in the month of May 




## IMPROVEMENTS

- Collaboration with the ISS Science Program Office in providing astronaut talking points for research based questions during In-Flight Education Downlinks.
- Creation and implementation of automated process to track milestones on multiple In-Flight Education Downlink events
- Partnering with the NASA TV production staff to enhance In-Flight Education Downlinks with visually interesting graphics and props.

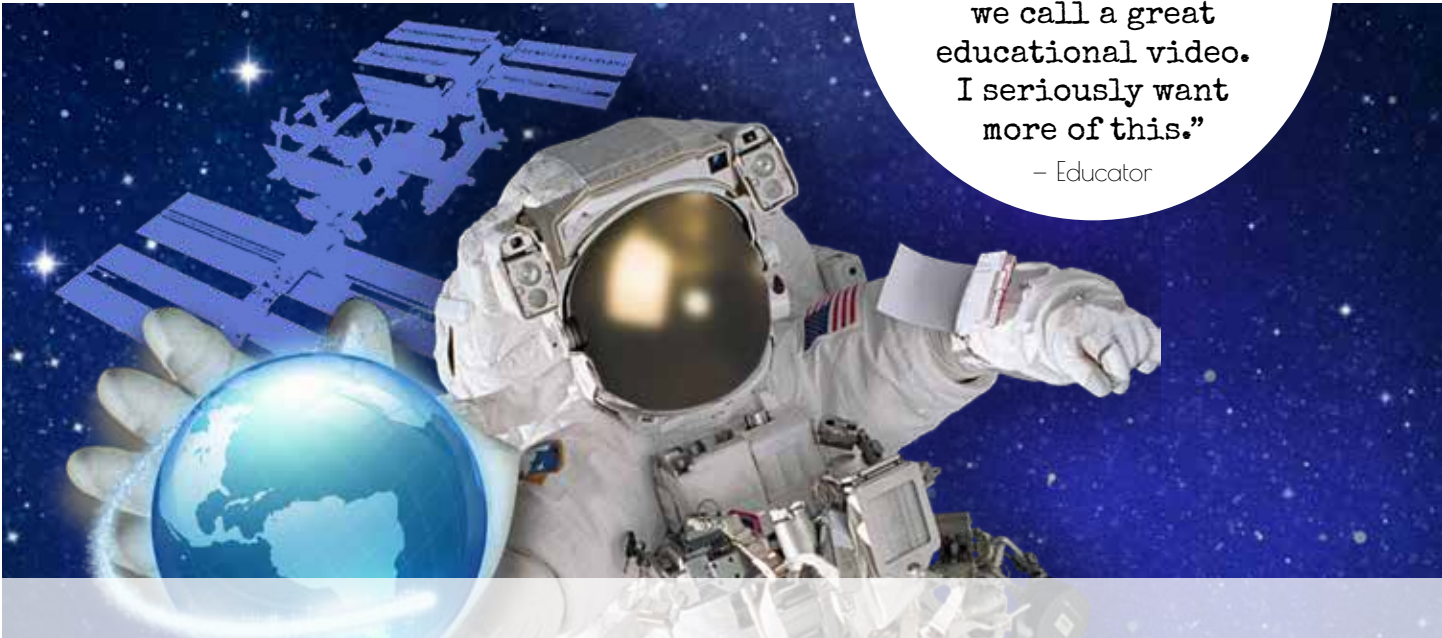


## ON THE HORIZON

- Complete 23 additional In-Flight Education Downlinks before the close of FY18
- Collaborate with NASA's Kennedy Space Center to begin work on a student challenge focused on ISS food harvesting research
- Complete two NASA Educator guides designed to leverage astronaut training facilities enhancing STEM learning 

**“He was able to show our kids the skills he is using in space apply to what we are trying to do in our STEM program. Things such as being a creative thinker, a problem solver, and having grit to get through when things are tough.”**

– School Principal



“Now this is what we call a great educational video. I seriously want more of this.”

– Educator

# YES

Outcome: STEM Engagement

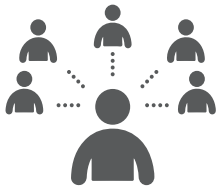
## Year of Education on Station

The September 2017 launch of astronaut and former classroom teacher Joe Acaba and his crewmates kicked off A Year of Education on Station (YES), NASA’s celebration of an almost constant presence of an educator aboard the International Space Station (ISS) during the 2017-2018 school year. Joe was aboard the ISS through February 2018, and fellow teacher/astronaut Ricky Arnold launched in March 2018 and will remain aboard through September 2018. YES included opportunities for thousands of students and teachers across the nation to speak directly with astronauts in space through an open application process allowing formal and informal organizations to host an In-flight Education Downlink. Another component of YES is a series of lessons from space conducted by astronauts on the ISS and aligned with Next Generation Science Standards (NGSS).

<http://www.nasa.gov/stemonstation>



## METRICS / ACCOMPLISHMENTS



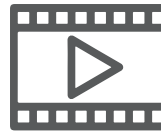
**Collaboration** with all NASA Centers and activities an agency-wide implementing campaign



Partner with industry powerhouses **Google, Microsoft, Boeing,** and more extending the reach of YES



Implementation of **#ThankATeacher** social media campaign – the hashtag received more than **177,250,500** views!



Release of **5** STEMonstrations along with corresponding lessons/multi media designed as grab-and-go packages for educators



## SOCIAL MEDIA

#TeacherOnBoard reached over **512 million** people on social media



## ON THE HORIZON

- Continue script development, filming, and editing for up to 10 additional STEMonstrations
- Fulfill the partnership commitment with the Challenger Center to film Christa McAuliffe's lost lessons.
- Wrap up A Year of Education on Station with a Facebook Live Event featuring astronauts in space

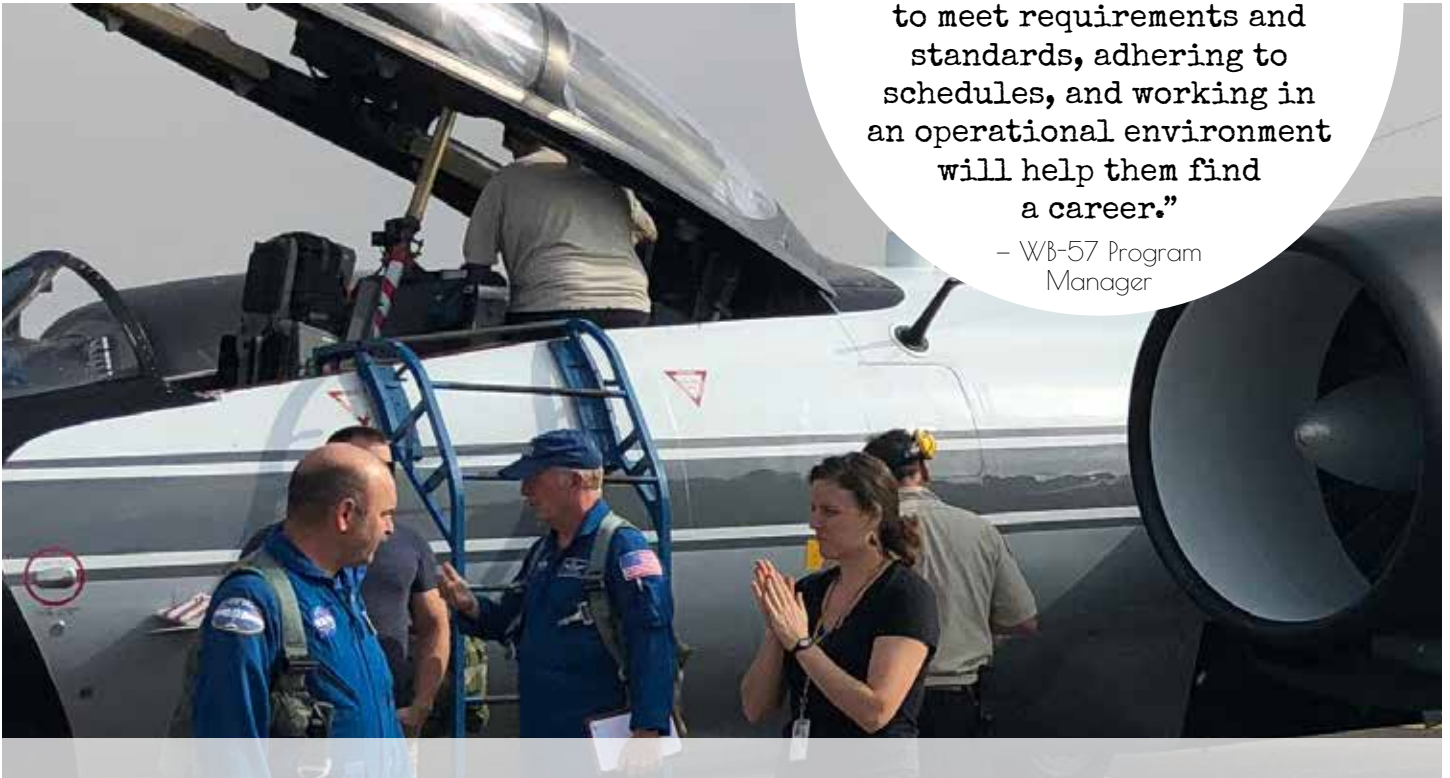


**“This was a very concise explanation of the 2nd Law of Motion, which can be a little tough to grasp.”**

– Educator

“The experience gained by future engineers designing to meet requirements and standards, adhering to schedules, and working in an operational environment will help them find a career.”

– WB-57 Program Manager



# SOAR

Outcome: Institutional Engagement

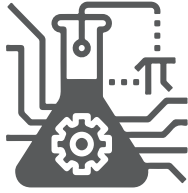
Student Opportunities in Airborne Research, or SOAR, a pilot design challenge which uses the NASA WB-57 High-Altitude Aircraft. The activity targets specific technical needs in airborne research as identified by NASA JSC Flight Operations. SOAR challenges high school and undergraduate students to design and test experiments related to atmospheric and ground mapping, cosmic dust collection, thermal management and control systems, rocket launch support, and test bed operations for future airborne or space-borne systems.

Student Opportunities in Airborne Research





## METRICS / ACCOMPLISHMENTS



### Experiments

included research related to DNA, radiation exposure, urban traffic patterns, and environmental data recorders



130

participants in the pilot year



43% of participants represented Minority Serving Institutions



50+ students traveled to JSC to test their experiments



## SOCIAL MEDIA

#NASASOAR reached over **8 million** people on social media during the launch of year one.



## ON THE HORIZON

- Seeking collaboration with NASA Mission Directorates to establish year two funding





Oklahoma State University  
**OSU NASA Education Projects**  
228 Scott Hall  
Stillwater, OK 74075  
<https://education.okstate.edu/>