Rarely in U.S. history has there been a greater need for increased cultural understanding and mutual respect among diverse populations. If the U.S. is to advance technologically and have the STEM workforce needed to compete globally, it will be necessary to prepare large numbers of students from diverse backgrounds that have been historically underrepresented in STEM fields. NASA’s long-term success will be directly related to the country’s progress in this area.

In year 2, the NASA STEM Educator Professional Development Collaborative (EPDC) strategically contributed by leveraging expertise of faculty who serve as Curriculum & Instruction consultants, STEM content experts, Researchers, and NASA Center-based Education Specialists. Our continued focus on culturally responsive teaching (CRT) has been effectively integrated into our content and well received. In year 2 we directly reached almost 34,000 educators through almost 250 face-to-face professional learning experiences and over 200 NASA webinars/webshops.

Direct, daily interaction between NASA STEM EPDC specialists and NASA translates into informed, highly motivated professionals who weave STEM content, NASA context, and educational and cultural best practices. The NASA STEM EPDC team also meets biannually for collaborative learning and teaching. In November, we visited Marshall Space Flight Center and learned about NASA cutting edge technologies and missions, including the newest most powerful rocket—the Space Launch System. In May, we traveled with faculty partners from the Minority Serving Institutions-Teacher Educator Network (MSI TEN) to the Kennedy Space Center. The University of South Florida hosted the event and shared expertise in Ethnic Identity and Mathematics Education best practices for English Language Leaners.

EPDC has continued to expand its work with Minority Serving Institutions (MSI). The MSI Teacher Education Network includes 9 partner institutions with the addition of University of Illinois at Chicago, Morgan State University, and Lehman College, City University of New York. The NASA Emerging Stars Network has launched and has more than 50 member institutions.

Our mission is to reach as many educators as possible with meaningful, standards-aligned content. NASA STEM EPDC offers a breadth of online learning opportunities to reach many educators who cannot visit a NASA Center. This January, we debuted the EPDC Digital Badging system with a limited number micro-certification courses. This infrastructure is an investment to utilize as we grow the number of badges offered and invite partners to build learning experiences.

In short, year 2 has been an action-packed year, and all indications are that Year 3 will be even more successful as we continue to increase both our face-to-face and online EPD offerings. We embrace the goal of leveraging NASA assets to provide high-quality STEM professional development for both formal and informal educators in schools, universities, and communities.
NASA STEM EPDC partnerships have shaped a vast, ever-expanding frontier to deliver culturally-responsive STEM content to all students.
### Foundational Principles

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impactful</strong></td>
<td>Commitment to create an innovative national impact evaluation model that gets to the heart of professional learning and behavior change.</td>
</tr>
<tr>
<td><strong>Culturally-Responsive</strong></td>
<td>Respect for the culture and language of the learner.</td>
</tr>
<tr>
<td><strong>Professional</strong></td>
<td>Attention to the educator across the professional continuum.</td>
</tr>
<tr>
<td><strong>Synergistic</strong></td>
<td>Openness to sharing, learning and harnessing power of scholar/expert partnerships.</td>
</tr>
<tr>
<td><strong>Cutting-Edge</strong></td>
<td>Boldness to leverage the potential of massive online learning and badging systems.</td>
</tr>
</tbody>
</table>
TWO THOUSAND SIXTEEN

YEAR 2

209 Online Webinars
196 On-Site Face-to-Face Events
7 Online Webshops
52 Off-Site Face-to-Face Events

TWO THOUSAND SIXTEEN

1,638 Informal
535 Administrators
1,189 Higher Ed
4,367 High School
8,198 Middle School
6,653 Elementary
2,109 Pre-Service

The NASA STEM EPDC Badging System awarded
1,004 DIGITAL BADGES totaling 5,587 HRS OF PD CREDIT

53 EMERGING STARS PARTNERS
09 MSI TEN PARTNERS

10 NASA STEM EPDC SPECIALISTS AT NASA CENTERS

34,209 EDUCATORS

Educators Served:

*educators have participated in professional development experiences ranging from 1-60 hours
Investments That Make a Difference

The NASA STEM EPDC program is a professional learning initiative resulting from a five year (2014–2019) cooperative agreement between NASA’s Minority University Research and Education Project (MUREP) and Texas State University’s LBJ Institute for STEM Education and Research. The NASA STEM EPDC program has implemented a comprehensive evaluation model that will help determine which educators are receiving NASA professional development services through what specific delivery mechanisms, as well as the topics, frequency and duration of the professional development in which they are engaging. These evaluation and research efforts will provide NASA with important insights on how best to expend resources in educator professional development to result in the desired impacts.

Contribute toward national excellence in STEM instruction by preparing 100,000 excellent new k-12 STEM teachers by 2020 and supporting the existing STEM teacher workforce.

Contribute toward strengthening the STEM education and workplace pipeline by utilizing NASA’s missions and unique assets to prepare a robust and creative cohort of future STEM professionals to lead the way in solving scientific and engineering challenges not yet envisioned.

Texas State University
Headquartered in San Marcos, Texas at Texas State University, The LBJ Institute for STEM Education and Research, under the leadership of the College of Education and its Dean Dr. Stan Carpenter, coordinates the NASA STEM EPDC program and other grant-funded activities. The College of Education is the largest university producer of teachers in Texas, and the second largest nationally, preparing 800 to 1,000 teachers each year. Texas State is also welcoming a new Dean of the College of Science and Engineering, Dr. Christine Hailey.

NASA STEM EPDC Specialists
Since January 2015, our 10, carefully-selected EPDC Specialists have been the front-line EPDC service providers. At each of the 10 NASA Centers, there is an EPDC specialist assigned who is specifically qualified to leverage that center’s unique expertise and facilities in educational professional development materials and experiences. These specialists hold faculty of practice positions in Texas State University’s College of Education.
We expose educators to the abundance of NASA resources—assisting them to lead more engaging classroom experiences.

Michael Reason is studying secondary science education and hopes to teach biology to ninth and tenth graders. The NASA STEM EPDC program sounded like a great opportunity to gain a holistic perspective of the science field. Reason learned much more than he was expecting.

“We were at a local summer camp and the students were working in teams to build paper rocket launchers. The students learned material from NASA-based lessons, built their own rockets and were able to launch them in the field using empty soda bottles and pressure. This was a great assignment because we were able to vary instruction with data, videos, pictures, reading, and physically building a product. The assignment came together very well and students really got into it.”

Reason also took advantage of the various tools and resources available for use by educators.

“One particular resource shown to us, was the actual NASA educators website. There is a plethora of lesson plans, tools, materials, and data that a teacher can use to enhance their lessons with. I gained valuable resources in learning how to get students involved and excited about learning science and wanting to learn more. I truly feel this program has helped me become a better STEM educator...through experience and help from the program I know many more methods for engaging students.”

Through his involvement with the NASA STEM EPDC program, Reason has built a rapport with the NASA Educator Specialists and the technology available to him as a future teacher. Instead of scrambling to find new ways of engaging his classroom, Reason will be equipped with a surplus of choices early on. This will foster a classroom environment that will incubate future STEM learners and the industry’s workforce.
Dr. Barbara Buckner
Armstrong Flight Research Center

Ms. Susan Kohler
Glenn Research Center

Ms. Kelly Kohli
Goddard Space Flight Center

Dr. Brandon Rodriguez
Jet Propulsion Laboratory

Dr. Lester Morales
Kennedy Space Center

Ms. Marilé Colon Robles
Langley Research Center

Mr. John Weis
Marshall Space Flight Center

Mr. Stephen Culivan
Stennis Space Center

Dr. Karen Roark
Ames Research Center

Mr. Brandon Hargis
Johnson Space Center
A Focus On Diversity

NASA STEM EPDC has a strong commitment to the success of all students, and especially those who may be from disadvantaged backgrounds or who are members of groups that have historically been under-represented in STEM fields.

Utilizing NASA resources, NASA STEM EPDC’s professional development offerings provide educators of diverse students with specific instructional strategies and enhancements that capture the imagination of students of all backgrounds and help them connect with the content in meaningful ways that relate to their lives and personal experiences.

It is NASA STEM EPDC’s goal for these NASA resources, coupled with the culturally-responsive instructional strategies, to serve as a bridge for students, and to pave their way to a lifetime of STEM engagement and success.

The MSI Teacher Educator Network

Minority Serving Institutions (MSIs) from across the U.S. are not only essential partners in the preparation of the next generation of STEM teachers, but faculty in these institutions have a wealth of expertise to share about working with diverse learners and the integration of culturally relevant instructional strategies that promote the STEM success of all students.

The MSI Teacher Educator Network (MSI TEN) is comprised of STEM faculty members from Texas State University and nine partner universities that provide specialized expertise in the field of culturally responsive teaching in STEM. The MSI TEN faculty identify NASA curriculum activities that can be strengthened and develop new content for diverse student populations. They also revise undergraduate and graduate courses to include additional NASA resources and to emphasize culturally-responsive teaching.

The MSI TEN partner institutions

- Texas State University
- California State University Northridge
- Morgan State University
- Norfolk State University
- Lehman College
- University of South Florida
- UIC
- North Carolina Central University
NASA's educator and professional goals are ones shared by Dr. Kianga Thomas, an assistant professor of elementary education at Norfolk State University in Norfolk, Virginia. For Dr. Thomas, exposing pre-service teachers to new resources such as those provided by the NASA STEM EPDC program will significantly help them post-graduation.

“When we expose students to the type of work we’re doing—gathering data and such—we are building a stronger workforce.”

The data-gathering that Dr. Thomas references is an added benefit to university educators who become involved with the NASA STEM EPDC program.

After being involved with the program, Dr. Thomas has taken full advantage of all the resources available to him to grow his pedagogy. However, it took him some time getting used to seeing NASA and education together.

“I’ll be the first to admit, I was naïve about NASA’s education initiatives, but now going through the EPDC program, I understand and see the value we are giving to students.”

Aside from learning the resources available through the NASA STEM EPDC program, Dr. Thomas has learned another interesting facet about education he didn’t expect to learn.

“I have gained a better respect for cultural responsive education. My awareness has increased with being involved with this program and I am not only learning how to incorporate it into my teaching, but I’m teaching my students—future teachers—how to incorporate it in their classrooms.”
Career-long professional growth

Professional development is a career-long process for educators spanning from their pre-service programs, through entry into the teaching profession, and continuing throughout their in-service careers which often lead them to leadership positions in education. At each step of the way, there are educators that prepare and guide the ongoing professional development of those charged with educating our children.

NASA STEM EPDC has a commitment to provide tailored professional learning for educators at every phase of their careers, as well as for those educators who prepare and support the continued professional development of these educators.

PRE-SERVICE TEACHERS

Pre-service teachers—or students in educator prep programs—strengthen their content knowledge in STEM and build their portfolio of skills and resources when they become involved with the NASA STEM EPDC program. This builds their confidence to create a more impactful STEM education experience in their future classrooms.

PRE-SERVICE TEACHERS

Kianga Thomas
University Faculty

Nancy Royer
Informal Educator

Michael Bresk
In-Service Teacher

UNIVERSITY FACULTY

The preparation of K-12 STEM teachers seems to yield the greatest benefit when collaborating with faculty from departments of Science, Technology, Engineering, Mathematics, and Teacher Education. The dedication and work of these faculty is critical to encourage and nurture the young minds of the workforce of tomorrow.
The responsibility to inspire students to pursue careers in STEM fields largely depends on the guidance of the K-12 teacher. The NASA STEM EPDC program aims to guide these in-service teachers toward a wealth of resources to enhance their teaching of STEM subjects and sound culturally responsive teaching approaches.

In addition to K-12 and university educators, other professionals in our society fulfill an educational role in providing clients with important learning opportunities. The informal educator who works in community organizations, after school and summer programs, or museums are examples of such professionals that NASA STEM EPDC is committed to serving.
STEM Education Partnerships

In order to have a robust and creative STEM workforce who can lead the way in solving scientific and engineering challenges not yet envisioned, it is necessary for students at all levels to be provided with high quality STEM experiences that build upon the foundation for future academic and career successes. Given the diversity of the U.S. student population, this ambitious endeavor requires the expertise of educators from different STEM fields working in tandem with teacher educators, researchers and scholars who specialize in the science of learning and culturally responsive instructional practices.

EPDC has created a number of intertwined networks that bring educators from different disciplines together to work collectively on the design and delivery of culturally responsive STEM instruction using NASA resources. The EPDC specialists working at the 10 NASA Centers are supported by the work of the EPDC MSI Teacher Education Network and the EPDC Emerging Stars Network.

The Community Ambassadors Initiative
In this EPD online initiative, teachers serving middle grade underrepresented student populations will earn Ambassadorships. SIXTY EDUCATORS will participate each year (for a total of 300 over the life of the project) in a series of 12-week online STEM Education courses and in doing so will become members of a dynamic online community of educators. As Ambassadors, participating teachers serve as a STEM Education resource to other teachers in their communities and promote the use of NASA resources and innovation instructional techniques in addressing the needs of all students.

The Emerging Stars Network
These MSI institutions are committed to enriching their STEM teacher preparation programs and value professional development in STEM education for their faculty. EPDC Specialists at the NASA Centers frequently provide online and face-to-face professional development for the Emerging Stars institutions. FIFTY-THREE NASA MSI EMERGING STARS Network Member Institutions have joined since 2015.
Nancy Royer is the Learning Center Director at WACO Air Museum in Troy, OH who became a member of the NASA STEM EPDC program in January 2014. She has hosted NASA Educator Specialists on a regular basis and continues to be in awe of the vast resources provide by the program.

“I believe there are as many NASA resources for educators as there are galaxies, I could never browse them all in my lifetime.”

Not only are NASA’s assets, resources, and educator professional development opportunities plentiful but they are offered free of charge.

“This type of training is extremely valuable for informal educators who are a part of a non-profit. It allows us training that is worth a high dollar amount at a fraction of a normal professional development seminar or even free.”

The NASA STEM EPDC program’s instructional model provides a richer learning experience for the educators who in turn create a richer experience for their audiences.

“The program has inspired me to be inquisitive myself. By becoming a student for the day and running the experiments themselves, an educator can see what will work in their classroom. Teachers can brainstorm together for a particular age group, region, or learning environment. We want to reach students, of course, but we also want to assist and train our teachers and inspire adults to support lifelong learning”

By providing informal educators with the same professional development opportunities as formal educators, the NASA STEM EPDC program is supporting learning opportunities for citizens of all ages within a wide variety of different settings, aiding to create a more STEM-focused culture.
NASA MEI
NASA Minority University Research and Education Project (MUREP) provides the opportunity for Minority Serving Institutions (MSIs) to participate in 5-day MUREP Educator Institutes (MEIs) at each of the 10 NASA Centers to help educators develop instructional practices that will enhance STEM instruction for all students.

NASA MAA
Minority Serving Institutions (MSIs) create and implement a NASA MUREP Aerospace Academy (MAA) to increase participation and retention of historically underserved and underrepresented K-12 youth in the areas of Science, Technology, Engineering, and Mathematics (STEM).

NCAS
NASA Community College Aerospace Scholars (NCAS) gives community college STEM students an authentic NASA experience and encourages them to finish a 2-year degree or transfer to a 4-year university to pursue a NASA-related field or career.

NASA BEST
NASA's Beginning Engineering, Science and Technology (BEST) initiative brings the principles of engineering alive to younger audiences through supplemental curricula during the school day or as afterschool programs.
Flexible Content Delivery

In addition to high-quality face-to-face professional development, EPDC is also leading the way to provide educators with synchronous and asynchronous NASA professional development offerings. These options provide the flexibility that busy educators need to tailor their own professional learning to meet their unique educational needs and interests. NASA STEM EPDC offers a comprehensive program of NASA webinars for educators, as well as provides longer duration professional development through a collaboration of course offerings through U.S. Satellite offered for graduate credit. In addition, the EPDC Digital Badging System allows educators to select from a variety of STEM topics and work at their own pace to earn a digital badge that represents a micro-credential in a specific STEM area.
Michael Bresk is an algebra and geometry teacher at Suwannee High School in Live Oak, FL. After going through the NASA STEM EPDC program and executing some of the lessons he has learned, Bresk has seen a change in his classroom for the better.

“I no longer introduce a topic in my math class without an incredible lesson or video from NASA or about NASA…I have become more of a let−my−students−explore math teacher and there have been many more moments where my students say ‘ah−ha, I get it.’”

With the content available online by the NASA STEM EPDC program, it is easy to meet students in a space that is familiar to them: the digital space.

“My students were especially interested in the ‘Seven Minutes of Terror’ video, which spurred an in depth conversation about the distance and rate of speed of the landing vehicle. It is much easier for me as a teacher to reach my students via online content as they are truly ‘digital citizens’ and relate well to online content.”

For Bresk, however, involvement in the NASA STEM EPDC program was something that hit closer to home:

“The fact that [my fellow teachers and I] live in Florida—a state which hosts many launches and has a rich history of space travel—lends itself to teaching about the rich history and goals of the space program.”

In the summer of 2016, Bresk worked for the Summer Astro Camp at Kennedy Space Center and is grateful for the journey his involvement with NASA STEM EPDC has taken him:

“I am very thankful for these webinars and onsite training—I consider them to be life changing. I am grateful for the EPDC program and the fact that it has enabled me to accomplish so much.”

The combination of webinars and on-site training creates a robust learning environment that’s flexible and effective, for busy teachers.
Etouches & Reporting
Etouches is our event registration system that streamlines registration and certification processes and collects a wide range of data needed for NASA Office of Education Performance Management (OEPM), monthly progress reports and other studies.

Etouches provides:
» Easy event registration and tracking
» Participant surveys
» Completion certificates for CE credit
» A wide variety of reports detailing participant breakdown and statistics
» Record-keeping of individual participation across subjects

Digital Badging platform developed by Penn State
NASA STEM EPDC also operates the Digital Badging System that is hosted by Pennsylvania State University’s Center for Online Innovation in Learning (COIL). The EPDC Digital Badging System allows educators to earn badges as part of their ongoing personal professional development in many of NASA’s STEM content areas. The badges can be converted into CEUs for certified teachers, allowing educators to receive recognition from their employers and state teacher licensure boards.

BADGES EARNED BY EDUCATORS SINCE FEB 2016 LAUNCH:

1,004 BADGES representing 5,587 HOURS OF PD CREDITS
NASA STEM EPDC advances NASA Strategic Goal 2 (objective 2.4) and enhances NASA's contribution to Goal 1 of the Federal STEM Education 5-Year Strategic Plan put forth by the Committee on STEM Education, National Science and Technology Council.

These goals include:

- **Advance understanding of Earth and develop technologies** to improve the quality of life on our home planet. (NASA Strategic Goal 2).
- **Advance the nation’s STEM education and workforce pipeline** by working collaboratively with other agencies to engage students, teachers and faculty in NASA’s missions and unique assets (objective 2.4).
- **Improve STEM instruction** by preparing 100,000 excellent new K–12 STEM teachers by 2020 and supporting the existing STEM teacher workforce (Committee on STEM Education Goal 1).

**Looking Forward**

In line with these goals, the EPDC is honored to maintain and build upon the best of the existing NASA professional development offerings and to work closely with NASA subject matter experts, educators and staff. In its first two years of operation, EPDC has consistently made significant contributions to these goals.

For example, since inception EPDC has conducted more than 850 professional learning events that have impacted more than 120,000 educators and educational stakeholders. EPDC has a strong commitment to making online professional learning opportunities available year-round to all U.S. educators. Toward this end, EPDC launched the new EPDC Digital Badging System in 2016 and already educators have earned more than 1,000 digital badges representing a total of 5,587 hours of professional development credit.

In year 3, NASA STEM EPDC will remain committed to the advancement of NASA strategic goals through continued development of high-impact approaches that extend NASA PD services to new audiences of formal and informal educators, with a special emphasis on communities with the highest need.
This material is based upon work supported by NASA under grant or cooperative agreement award number NNX14AQ30A.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.