

# MOTIVATING UNDERGRADUATES IN SCIENCE AND TECHNOLOGY (MUST)

Administered by the Hispanic College Fund, Inc.  
Type of Agreement: Cooperative Agreement

Vanessa R. Webbs, MUST Project Manager  
Glenn Research Center  
216-433-3768

Data provided in this update may be found in two reports developed by MPR Associates, “Motivating Undergraduates in Science and Technology: 2010 – 2011 Evaluation” and in the “2011 Orientation and 21st Century Leadership Symposium Evaluation Report.” The update is also supported by MUST scholar records at the Hispanic College Fund.

## **PROJECT DESCRIPTION**

The NASA Motivating Undergraduates in Science and Technology (MUST) Project is managed by NASA John H. Glenn Research Center at Lewis Field and administered by the Hispanic College Fund (HCF). MUST is a multi-year initiative to develop undergraduate skill sets and expertise critical to the future Science, Technology, Engineering, and Math (STEM) workforce and mission of NASA. It is the only undergraduate scholarship program at NASA that is dedicated to underserved and underrepresented students and is renewable through college graduation.

Number of students served annually:	115
Age group:	Undergraduates
Project focus:	All groups underserved in STEM

## **RESEARCH-BASED PROJECT MODEL**

MUST offers proven and intensive interventions for underrepresented and underserved students in STEM. The National Academies report *Expanding Underrepresented Minority Participation: America’s Science and Technology Talent at the Crossroads* (2010) found that successful college retention and workforce entry programs include research experiences, professional development activities, mentoring, academic support and social integration. *Expanding Underrepresented Minority Participation* also offers three additional recommendations for a successful national effort to increase the participation and success of underrepresented minorities in STEM; they include *access and motivation, affordability,* and *academic and social support.*

### ***Access and Motivation***

*Individualized Student Support:* A dedicated team of two HCF staff members works on a personal level with each MUST Scholar to support them through college. They provide individual monthly follow up and a monthly newsletter highlighting scholar achievements,

opportunities in NASA education, in addition to professional development opportunities with STEM associations and conferences around the nation.

*NASA Internship Experience:* MUST Scholars participate in a 10-week internship at one of NASA's ten nationwide centers. Scholars are matched with a mentor, receive an internship stipend of \$6,000, and complete a technical paper on their research and experience.

### ***Affordability***

*Scholarships:* Project participants receive a scholarship of up to half of tuition and fees, not to exceed \$10,000 per year. The scholarship is renewable through to college graduation provided that all eligibility criteria continue to be met.

### ***Academic and Social Support***

*MUST Orientation and 21<sup>st</sup> Century Leadership Symposium:* The MUST Orientation and 21<sup>st</sup> Century Leadership Symposium offers scholars a project orientation and professional development workshops; MUST Scholars also have the opportunity to present their research, share experiences with their peers, and meet with NASA Center representatives to learn about internship opportunities. The MUST Orientation and Leadership Symposium is designed to meet four goals:

- 1) Students leave the event inspired to excel academically and have a plan to develop a broad skill set while an undergraduate student.
- 2) Students have an enhanced support network of MUST staff and fellow scholars who will support them throughout the year.
- 3) Students learn new skills and confidence, preparing them for life after college.
- 4) Students acquire knowledge about opportunities to pursue graduate school, employment at NASA and within the STEM industry.

**Mentorship and Tutoring:** Scholars receive tutoring support as requested. Students are only required to secure tutoring if their GPA falls below a 3.0. In this case, they are given one semester of tutoring to increase their GPA to the minimum 3.0 level necessary for MUST renewal.

The MUST mentorship program strives to: Assist scholars in academic development, prepare scholars to be competitive candidates in the workplace, create an extended support network, and provide insight on graduate school. All scholars have the option of being placed with as many as three mentors: faculty, graduate, and peer. First year participants must select at least one mentor, and may decide whether a faculty, graduate, or peer mentor is most appropriate to their needs.

### **NEW SCHOLAR DEMOGRAPHICS FOR 2011-2012**

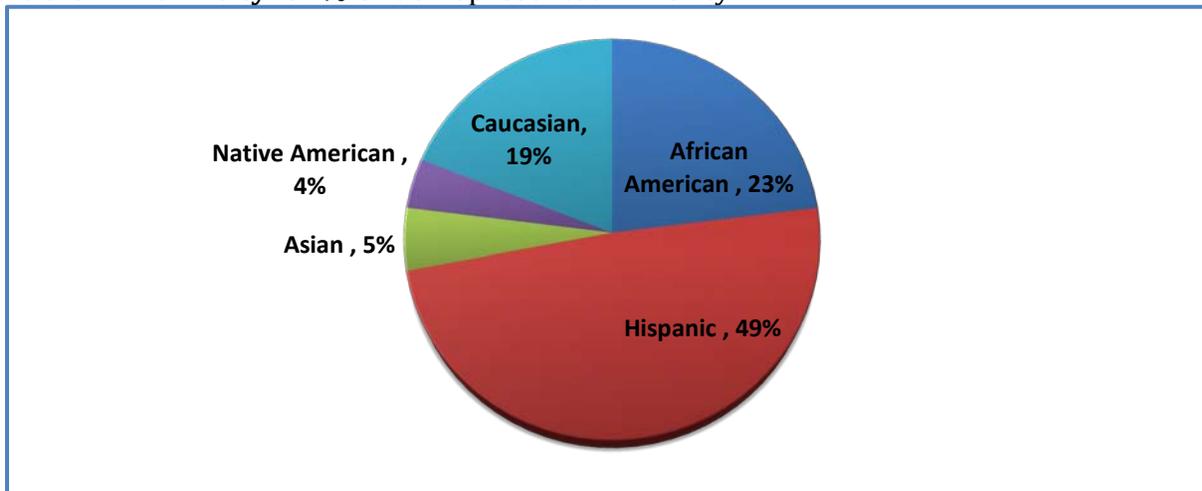
- Ninety-four percent of eligible scholars renewed from the 2010-11 academic year. Those not renewing chose to pursue an internship in the private sector.

- By class year, 43 percent of MUST participants are juniors, 36 percent seniors, and 21 percent sophomores.
- Females comprise 48percent of the new MUST cohort.
- Ten percent of students participating in MUST in the fall of 2011 are majoring in fields related specifically to space, such as Aerospace and Astrophysics. Another 50 percent were studying Engineering not tied explicitly to space and an additional 40 percent were pursuing a Science or Mathematics major.
- Sixty-three percent of participants have GPAs between 3.5 and 4.0. Only 37 percent of students entered MUST with a grade point average below 3.5. The median GPA was 3.62.
- Twenty-seven percent of students were the first in their family to attend college
- Nineteen percent of students attended a minority-serving institution
- MUST saw a dramatic 70percent increase in geographic diversity and currently serves students in 39 states and Puerto Rico, up from 23 states in 2010. The greatest number of MUST participants in the fall of 2011 came from Texas, California, New York, Florida and Maryland.
- Seven MUST scholars reported having a disability.

**MUST DEMOGRAPHICS FOR 2010-2011:**

- MUST students represented 64 college campuses across the nation.
- Sixty percent selected engineering as their primary degree field.
- Students at Minority Serving Institutions (MSIs) made up 21% of the MUST student body. The MUST cohort had a gender balance with 49% female students.
- Eighty-one percent of MUST scholars were ethnically and racially underrepresented in the STEM fields (Table 1).
- Ninety-seven percent of MUST scholars were underserved or underrepresented in STEM as women, minorities, or disabled students.
- Twenty-two MUST scholars graduated in 2011 with a STEM degree and four scholars received a NASA co-op position.

**Table 1 - Ethnicity:** 81% Underrepresented Minority



## **PROJECT GOALS**

**Goal One:** Support the development of STEM expertise leading to eventual degrees among groups that are currently underrepresented in the workforce, including women, minorities, persons with disabilities, and individuals from rural and low-income communities.

**Goal Two:** Provide support services such as mentoring to ensure that students successfully complete their coursework and encourage degree completion.

**Goal Three:** Provide hands-on research experiences that broaden interests in the aerospace industry.

**Goal Four:** Prepare students for a career in STEM by engaging them in holistic professional development experiences.

## **PROJECT BENEFIT TO STRATEGIC GOAL 6**

The MUST project directly supports Strategic Goal 6 of the NASA Education portfolio by contributing to the accomplishment of the following PAR metrics:

**Strategic Goal 6:** Share NASA with the public, educators, and students to provide opportunities to participate in our mission, foster innovation and contribute to a strong National economy.

**Outcome 6.1:** Improve retention of students in STEM disciplines by providing opportunities and activities along the full length of the education pipeline.

**Objective 6.1.2:** Provide NASA experiences that inspire student interest and achievement in STEM disciplines.

**Outcome 6.4:** Inform, engage and inspire the public by sharing NASA's missions, challenges, and results.

**Objective 6.4.1:** Use strategic partnerships with formal and informal educational organizations to provide NASA content to promote interest in STEM.

## **PROJECT ACCOMPLISHMENTS FOR 2010-2011**

### ***Project Performance for Goal One:***

#### ***Scholarships:***

- MUST scholars were awarded \$605,004.49 in scholarships.

### *Scholar Profiles:*

- MUST served a diverse group of students in 2010–11 (81 percent minority, 27 percent first generation, representing 64 universities, across 23 states and Puerto Rico).
- Underserved and underrepresented minority, female, and disabled students comprised 97 percent of MUST scholars.
- Sixty percent were majoring in engineering, 40 percent in science or math, and 10 percent in a space related major (aerospace, aeronautics, astronautics, and astronomy).

### *Academic and Professional Interests:*

- Just under half of participants felt that participating in MUST positively influenced their course selections.
- Thirty-six percent reported wanting to work in Aerospace, 22 percent in engineering, 13 percent in Computers, 15 percent other science, 6 percent in Education, and 8 percent other.

### ***Project Performance for Goal Two:***

#### *Mentorship:*

- About one-third of mentors worked with their mentees for more than 2 hours per month.
- The most commonly discussed topics by mentors with scholars were graduate school, stem-related research and professional opportunities, and how to excel academically.
- The vast majority of mentors rated the quality of the interaction with the mentees as satisfying (83 percent).
- More than half the mentors (61 percent) were satisfied with the frequency of their interactions with their mentees.
- Mentors, particularly faculty mentors, rated their scholars' ability highly.
- Some mentors wanted more communication and support about expectations from NASA MUST.
- Most of the MUST mentors found the mentorship experience to be valuable and wished to continue working with their mentees. In particular, mentors appreciated the opportunity to contribute to the development of young, promising scholars, offering advice and first-hand experience.
- Both MUST mentors and students expressed a great desire to meet face-to face throughout the year, as part of the one-on-one mentorship experience, as well with the whole MUST community.
- Students thought that the mentoring relationship was very helpful and many scholars praised and valued the support and guidance their mentors offered.
- Students reported that having a mentor made them feel that there were people who would support them. They also indicated that this relationship helped them see more options for their future, set higher expectations for themselves and improved their communication skills.

*MUST Community:*

- MUST participants in 2010–11 highly prized the support and opportunity offered by the project’s community of scholars, mentors, and staff.
- MUST scholars value and want an increase in community and communication.

***Project Performance for Goal Three:***

*NASA Internship Experience:*

- Eighty-seven scholars were involved in internships during the summer of 2011, 80 percent in a NASA sponsored experience.
- Twenty-six scholars participated in NASA research during the academic year.
- Students involved in NASA-sponsored research highlighted the value of the professional connections they made, the enhancement of their STEM content knowledge, and their access to conferences and other professional events and organizations.
- The majority of scholars (80 percent) reported that their NASA-related internship helped them clarify their career plans.
- Students frequently mentioned that participation in research projects enhanced their understanding of content knowledge relevant for their coursework or areas of interest.
- The majority of scholars (86 percent) reported that their NASA-related internship had a positive impact on their current course of study.
- Scholars felt that their NASA related internship helped them to better understand their capabilities in technology (79 percent), engineering (77 percent), science (73 percent), and to a lesser extent, math (54 percent).

***Project Performance for Goal Four:***

*Professional Development Activities:*

- All but one scholar in the fall sample and all of the scholars in the spring indicated that they participated in at least one professional development activity that semester.
- Roughly three-quarters of scholars participated in at least two professional development activities; half participated in at least three activities; and one-third participated in four or more activities.
- Interview training, attending professional conferences and career fairs, and cultural competence training were the top three types of professional development experienced across the year.
- MUST scholars attributed accomplishments in the fields of leadership and outreach, academic focus and grades, and research experiences to their involvement with MUST.
- All scholars engaged in a NASA related internship presented their research publically.
- Forty-three percent of MUST scholars presented at a conference during the academic year.

- Seven MUST scholars received a Travel Award to attend a professional conference.
- About 60 percent of scholars reported engaging in outreach activities in the spring semester. The majority of these activities were mentoring or tutoring younger students in STEM fields.

*MUST Orientation and 21st Century Leadership Symposium:*

- Eighty-two percent of scholars strongly agreed that the orientation helped them understand what they could gain from MUST while only 17.8 percent agreed with that statement.
- Eighty-one percent strongly agreed that the orientation helped them understand how to take advantage of the opportunity afforded by the MUST Scholarship while only 18.2 percent agreed with that statement.
- Over 90 percent of scholars agreed or strongly agreed that the MUST Symposium inspired them both to excel academically and to plan to develop their skill sets.
- Over 90 percent strongly agreed or agreed that 7 of the 9 workshops were inspirational and useful.
- Over 80 percent of scholars agreed or strongly agreed that the MUST Symposium enhanced their support network for the coming academic year.
- Scholars believed that the social events at the Symposium helped them a lot or a great deal to network during the Symposium.
- Almost all respondents felt that the Symposium gave them new skills and confidence and preparation for life after college.
- Scholars believed that the conference contributed to their resume-writing skills, capacity for leadership, and understanding of how to network.
- Over 90 percent of scholars agreed or strongly agreed that the goal of having new knowledge to pursue graduate school was met. In fact, the student presentation on graduate school was the most highly rated of student presentations as was the adult-led session on graduate school.
- Seventy-nine percent of scholars agreed or strongly agreed that the goal of having knowledge about NASA was met.
- Nearly 90 percent of scholars agreed or strongly agreed that the goal of having new knowledge about employment opportunities within STEM was met.

## **PROJECT CONTRIBUTIONS TO STRATEGIC GOAL 6**

***Project Contribution to Outcome 6.1:*** The MUST Project supported this outcome by providing 100 students with scholarships, matching scholars with appropriate peer, graduate, and faculty mentors, and providing professional development opportunities during the Orientation and Leadership Symposium as well as through the MUST Newsletter. The result was a 94% renewal rate, 22 STEM college graduates, and four MUST scholars transferring to the NASA Co-op program.

***Project Contribution to Objective 6.1.2:*** Eighty percent of MUST scholars were involved in a NASA internship during the summer of 2011. The NASA experience helped to make STEM courses more relevant for scholars, increased their overall STEM capabilities, and supported them in developing a career plan.

***Project Contribution to Outcome 6.4:*** MUST scholars participating in a NASA internship shared their experience with STEM professionals, college students, and the k-12 community across the national via professional conferences and outreach events.

***Project Contribution to Objective 6.4.1:*** MUST scholars informed and engaged numerous individuals within the k-12 and university community. Forty-three percent of MUST scholars presented at a conference during the academic year and 60 percent of scholars reported engaging in outreach activities in the spring semester; the majority of these activities were mentoring or tutoring younger students in STEM fields. In addition, nine MUST scholars served as panelists for the NASA One Stop Shopping Initiative (OSSI) to inform potential STEM students about opportunities at NASA.

## **IMPROVEMENTS IN THE PAST YEAR**

The MUST Project continuously strives to provide students with a stronger support system and to demonstrate its outcomes to stakeholders. As a result, HCF formed a partnership with MPR and Associates. MPR's work combines deep content expertise, a thorough understanding of data and analysis and innovative techniques for making data and research accessible to many audiences. Their work focuses on college and career preparation; postsecondary education, including community colleges; and adult education.

Utilizing the MUST 2010 project evaluation, MUST Project Managers determined various reports and student resources to offer a more effective and data-driven program. They include:

***Resource Manual: Study Abroad Programs in STEM:*** MUST students show interest in studying abroad but have difficulty finding programs that meet MUST requirements. The increasingly global economy that we live in encourages their interest.

This report facilitates student success in selecting a study abroad program that builds both 21st century skill sets and STEM expertise. It includes information on study abroad programs that meet all the NASA MUST criteria as well as the pros and cons of studying abroad. Descriptions of the programs available include the necessary details to allow students to explore programs with different characteristics and make an informed choice.

***Resource Manual: MUST Presentation Opportunities:*** A desired outcome of this resource manual is to increase the number of applications for the MUST travel award. The 2009-10 evaluation report found that although about two-thirds of MUST students conduct NASA research only 19% presented their work at a

professional or academic conference in the fall, and 15% did so in the spring. The 2009-10 evaluation report also reported finding that students who were Hispanic, attended MSIs, or were the first-in their family to go to college were more likely to present than their counterparts. It's therefore particularly important that students who are not part of these groups are made aware of opportunities to present.

This guide lists professional and academic conferences focused on STEM where MUST scholars can improve their oral presentation skills and share their NASA experience with a larger community. It lists conferences by field of study and region and includes a range in the type and size of conferences so that students can choose a conference that will allow them to demonstrate their particular expertise or interest in a comfortable venue.

***Alumni Survey and Report:*** MUST graduates will be consistently and systematically tracked to promote results to stakeholders. Alumni will receive the survey for the first time when they graduate from college. Students will then receive the survey yearly for four more years. This survey will collect information to determine how MUST participation affects the decisions that students make for graduate school and their career. The group studied in the first report will include all MUST alumni from 2009-2011.

***Student Exit Interviews:*** This evaluation strategy is to facilitate continuous program improvement. It involves the collection of information from students who leave MUST during the academic year for a variety of reasons. MPR will conduct interviews by phone with any students who notify HCF that they are not continuing in the MUST Project. The information collected through this survey will be used to implement supports for students who seem to be at risk of dropping out and increase likelihood of retention.

A summary of the aggregate findings from all exit interviews would be given at the end of each year after all interviews are conducted to ensure student confidentiality and make it difficult to link responses to one particular student.

***MUST Orientation and Leadership Symposium:*** The NASA MUST Orientation and Leadership Symposium has supported MUST Scholar development and retention since its inception in 2008. Each year the symposium works to motivate scholars for the academic year, prepare them with skills for the workforce, and create a support system of resources and encouragement to keep them strong in their pursuit of a STEM degree. The impact and improvements to the Symposium are demonstrated in student GPAs and renewal rates. In 2008, 18 scholars received GPA Waivers with 11 earning renewal eligibility; that number fell to 3 in 2010 with all scholars earning renewal eligibility. In addition, the MUST Orientation and Leadership Symposium has helped staff to form stronger relationships with students, therefore better supporting them during the academic year. Scholar renewal rates have increased sharply from 77% in 2008 to 94% in 2011.

***MUST Newsletter and Facebook:*** MUST began publishing a newsletter that offers valuable information to students on how to develop their skills and workforce readiness. The

newsletter includes dates of important events, NASA information and opportunities, helpful links, scholar highlights, professional development materials, and more.

The MUST facebook page has 151 members who are current scholars, project alumni, and MUST Project staff. The page shares information with its members on employment at NASA, education and professional development opportunities at NASA, STEM news articles, and highlights MUST scholar accomplishments.

***MUST Scholar Website:*** Scholars in the MUST Project have shown consistent dedication to other underserved and underrepresented students in need of encouragement and opportunity. They work to inspire the next generation in STEM by using their background and NASA experience to reach youth in a unique and impactful way. MUST scholars serve as tutors, mentors and organize outreach activities that undoubtedly make a difference for young people around the country. With support from HCF, scholars are developing a MUST Outreach Website that will allow them to record their activities and share their successes with the greater MUST community.

***MUST Scholars Showcasing their NASA Experience as Panelists:*** Several MUST scholars participated in NASA Awareness Workshops on behalf of the One Stop Shopping Initiative to share their first hand experience in NASA MUST and its role in their professional development. Scholars gave recommendations to prepare and apply for a NASA opportunity. Participating MUST Scholars included: Michael Barnes, Nayomi Plaza, Heriberto Reynoso, Jaseft Canales-Oppenheimer, Juan Carlos Lopez, Mario Rubio, Denice Calderon, Ricky Fernandez, and Ann Dietrich.

## **PROJECT PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION**

With the launch of the NASA One Stop Shopping Initiative (OSSI), the Hispanic College Fund (HCF) collaborated with United Negro College Fund Special Programs (UNCFSP), American Indian Higher Education Consortium (AIHEC), and the Institute for Broadening Participation (IBP) to share information on NASA MUST to students at all institution types. Several targeted events were conducted at Minority Serving Institutions including: 23 at HSIs, 13 at PBIs, and 12 and TCUs.

In addition to working through OSSI, the MUST Project established a partnership with the Association for Higher Education and Disability (AHEAD) to begin a long term relationship including advertisements in their newsletter and sharing MUST opportunities and highlights with AHEAD members via email. Additionally, MUST staff from both HCF and NASA attended the 34th Annual Conference on Sustainable Access through Partnership. They exhibited and distributed materials on MUST and OSSI to all conference attendees at registration. Conference attendance is estimated at over 1,000 individuals who work directly with students with disabilities in higher education settings.

AHEAD is actively involved in all facets of promoting full and equal participation by individuals with disabilities in higher education; and supporting the systems, institutions, professions, and professionals who attend to the fulfillment of this important mission. They boast more than 2,500 members throughout the world. AHEAD members represent a diverse network of professionals who actively address disability issues on their campuses and in the field of higher education.

A new partnership with the Thurgood Marshall College Fund began in 2010. The MUST Project was advertised on their website during the application period. The mission of the Thurgood Marshall College Fund is to help develop a new generation of leaders by providing scholarships, leadership development opportunities, and resources to 47 public Historically Black Colleges and Universities. According to the National Science Foundation, relative to their enrollment levels, HBCUs produce a disproportionate number of African-American women and men who go on to earn Ph.D.'s in STEM fields.