

MOTIVATING UNDERGRADUATES IN SCIENCE AND TECHNOLOGY (MUST)

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

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PROJECT DESCRIPTION

MUST is a joint partnership between NASA, the Hispanic College Fund, the United Negro College Fund Special Programs, and the Society for Hispanic Professional Engineers. The MUST Project focuses on groups that are underrepresented and underserved in the science, technology, engineering, and math (STEM) workforce. MUST selects students who aspire to become tomorrow's researchers, scientists, and innovators, and provides them with a comprehensive program to ensure their completion of that goal. The Project provides undergraduates at the final stages of the NASA education pipeline with scholarships, internships, and professional development opportunities. Professional development includes mentoring, tutoring, and 21st century leadership development through the MUST Professional and Academic Support System (PASS).

PROJECT GOALS

MUST opens the door to future STEM career paths for ambitious undergraduates. The Project links its scholars with the resources necessary for the obtainment of a STEM degree, and for workforce-readiness at NASA and the aerospace industry. MUST brings together separate but essential factors of college success in STEM – internships, scholarships, mentorships, and professional development opportunities – that are otherwise challenging for young students to gain access to and leverage to the fullest extent.

The goals for MUST are as follows:

Project Goal 1: Develop STEM expertise leading to eventual degrees among groups that are currently underrepresented in the workforce

Project Performance

Since the program's inception in 2006, MUST has contributed to the development of the STEM workforce. Of those surveyed, 45% percent of alumni are pursuing an advanced STEM degree, 26% work or intern in the STEM industry (non-NASA), and 18% of MUST alumni work for NASA.

Project Goal 2: Provide support services such as tutoring and mentoring that ensure successful completion of coursework and encourage degree completion

Project Performance

100% of MUST scholars received mentorship at the peer, faculty, and graduate level. 17 scholars received funding for private tutoring, and 47% raised their GPAs as a result of this tutoring.

Project Goal 3: Provide hands-on research experiences that broaden interests in the aerospace industry

Project Performance

89% of MUST scholars completed a NASA or other STEM industry internship. 100% of interns completed a technical paper describing their experience, the results, and the impact on their future education and career goals.

PROJECT BENEFITS TO OUTCOME 1

Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals, through a portfolio of investments. The MUST project directly supports Outcome 1 of the NASA Education portfolio by contributing to the accomplishment of the following associated PART metrics:

- Number of underrepresented and underserved students participating in NASA education programs.
- Percentage of student participants employed by NASA, aerospace contractors, universities, & other educational institutions.
- Percentage of undergraduate students who move on to advanced education in NASA related disciplines.
- Percentage of higher education program participants who have participated in NASA elementary or secondary programs

MUST efficiently funnels high-achieving underrepresented and underserved college students into careers at NASA and the aerospace industry.

A unique aspect of the MUST Project is the MUST Professional and Academic Support System. As part of the MUST PASS, the Orientation and Leadership Symposium is held annually to give MUST scholars the skills they need to be competitive in the global climate of the 21st century. The symposium focuses on developing MUST scholar expertise in skill areas that are key to workplace advancement, including Oral and Written Communications, Collaboration/Teamwork, Leadership, Lifelong Learning/Self Direction, Professionalism/Work Ethic and Personal Financial Responsibility. Events at the 2008 symposium included workshops on STEM resume and vitae writing by STEM professionals, personal financial training from a CNN financial analyst, scholar presentations on NASA summer internships, and dedication to a STEM education strategy by a renowned STEM professional and author.

A more extensive component is the mentorship program, which students benefit from for the entire academic year. MUST Mentorship assists scholars in academic development and workplace

preparation, provides insight on graduate school, creates an extended support network for MUST scholars, and helps scholars identify additional funding sources for research and graduate education. Through mentorship, scholars are better positioned to maintain a high level of focus, persistence, readiness and excellence in taking the next step from college to STEM career.

As a result of participation in MUST, scholars are additionally exposed to real-life work experience at a NASA center. The impact of the internship opportunity was highlighted by a recent MUST alumni when he said, “the experience I gained helped me to craft my ambitions for graduate school.” MUST scholars build directly on their internship experience in taking the next-steps to graduate school and, ultimately, professional employment in the STEM industry.

PROJECT ACCOMPLISHMENTS

2008/2009 MUST Scholar Demographics

- 63 Institutions
- Engineering Majors - 74%
- Ethnic Minorities – 86%
- Females – 45%
- Average GPA (on a 4.0 scale) 3.74

MUST Scholars attend institutions across the United States. They include:

- Massachusetts Institute of Technology
- Texas A & M University
- University of Puerto Rico-Mayaguez
- Embry Riddle Aeronautical University
- University of Alabama at Huntsville
- California Polytechnic State Univ.
- University of Virginia
- Fisk University
- Mississippi State University
- Ohio State University
- Stanford University
- University of Maryland

Figure 1.1 MUST Scholar University Affiliation Distribution

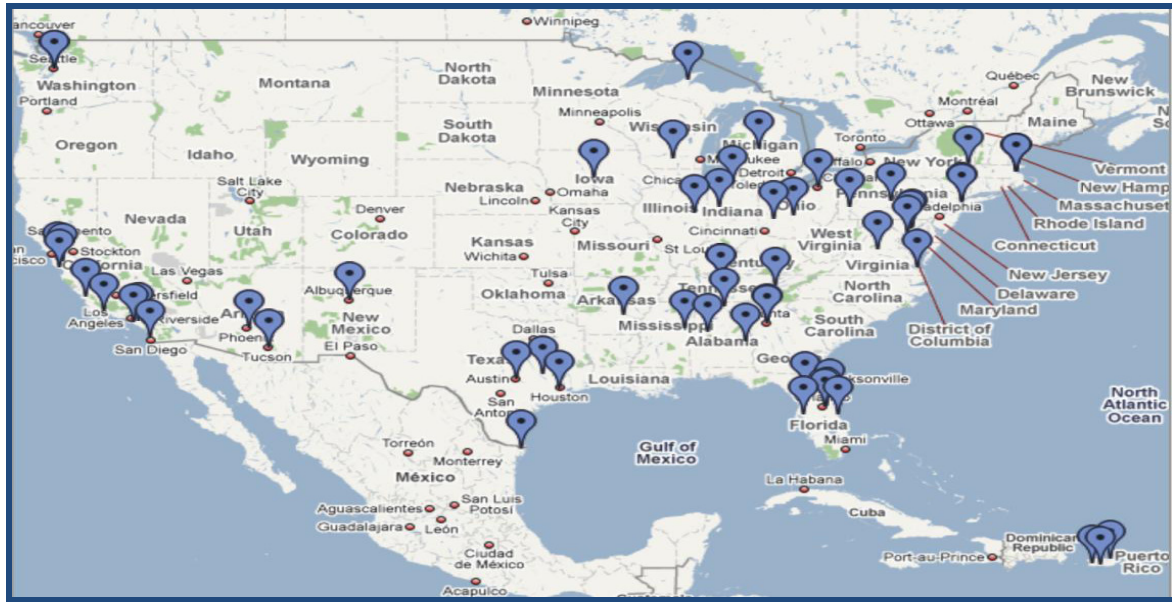
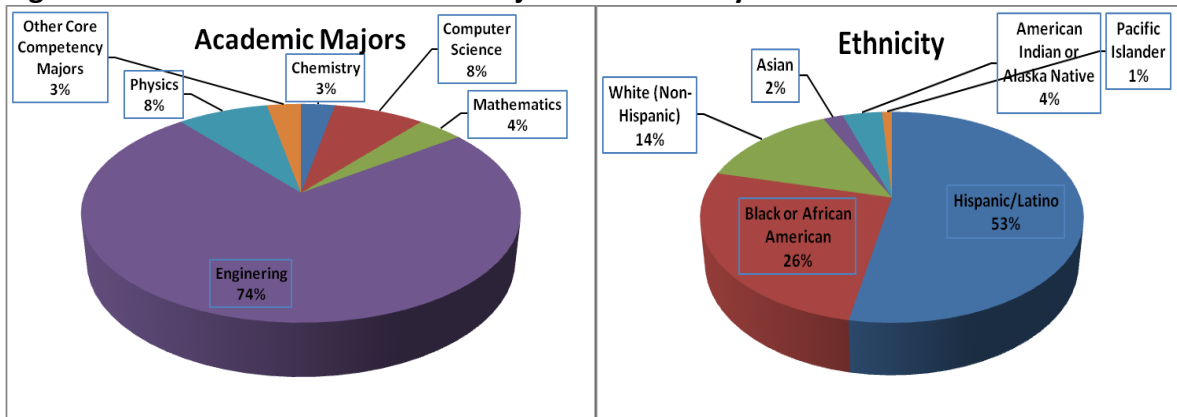


Figure 1.2 MUST Scholar Academic Majors and Ethnicity in Cohort 3



All MUST Scholars in Cohort 3 are pursuing degrees in a NASA core competency field. The majority of Scholars (74%) are in an engineering field. Hispanics/Latinos are the largest minority group represented, making up 53% of the Scholars. The other two largest ethnic segments are African Americans, representing 26%, and Caucasians, representing 14%.

NASA Summer Internship

Cohort 3 Scholars began the NASA MUST Project in fall 2008 and conducted their internship in summer 2009. Eighty-seven students fulfilled the summer internship requirement and completed a technical paper. Five MUST Scholars participated in summer school to improve their GPA. Six students did not meet the project requirements and were not able to continue as MUST Scholars.

Figure 1.3 MUST Scholar Internship Impressions

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My mentor/advisor was a good match with my academic interests.	4.8% (4)	8.3% (7)	8.3% (7)	27.4% (23)	51.2% (43)
My mentor/advisor was a good match with my career interests.	3.6% (3)	6.0% (5)	15.5% (13)	28.6% (24)	46.4% (39)
Overall, my internship was positive.	1.2% (1)	0.0% (0)	10.7% (9)	20.2% (17)	67.9% (57)

Source: Student End of Opportunity Experience Survey

Figure 1.2 shows that 88% agreed or strongly agreed that the internship was an overall positive experience. 75% of Scholars agreed or strongly agreed that their mentor/advisor was a good match with their career interests and 79% agreed or strongly agreed that the mentor/advisor was a good match with their academic interests. The MUST Project has implemented several measures to improve these results. MUST has made attendance to the Leadership Symposium mandatory so that all Scholars are able to interview with NASA POCs prior to completing the internship application. In this forum Scholars will be able to fully understand the core competencies at each NASA center and articulate their interests and needs to the NASA POCs. In addition, MUST has begun weekly Scholar updates regarding NASA and STEM education news and resources. MUST has also partnered with the Reduced Gravity Flight Opportunity to get students involved with NASA research and teamwork during the academic year.

Figure 1.4 MUST Scholar Post Internship Plans

After my NASA-related internship, I intend to:	
Continue education in a Science, Technology, Engineering or Mathematics (STEM) degree program	100.00%
Obtain employment with NASA/JPL	59.50%
Obtain employment with an aerospace contractor	16.70%

Obtain employment in a non-aerospace STEM field	14.30%
Obtain employment in a K-12 STEM academic field	1.20%
Obtain employment in a post-secondary STEM academic field	14.30%
Obtain other employment (e.g. non-STEM employment)	3.60%
Other	4.80%

Source: Student End of Opportunity Experience Survey

Figure 1.3 demonstrates that 100% of MUST Scholars plan to continue in a STEM degree program. Following graduation, 92% of MUST Scholars plan to obtain employment at NASA/JPL, with an aerospace contractor, or in a STEM academic field either at the K-12 or post-secondary level.

Below are two Scholar testimonials in regard to the internship experience:

“My expectations were surpassed in every aspect. The opportunity to work alongside of some of the nation’s top engineers and scientists on projects that will pioneer the future of American space exploration was not merely a technical learning experience.”

Frank Barnes, Aerospace Engineering

“Now, I know for certain that I would like to pursue a graduate degree. The research and milestones I accomplished at NASA have helped me to shape the vision of what I hope to be as a student and an aspiring aerospace engineer.”

John Carpenter, Mechanical Engineering

MUST Professional and Academic Support System (PASS)

MUST PASS ensures that MUST Scholars persist at a high level of academic performance and receive guidance in making the right post-graduate STEM decision through tutoring, mentoring, and professional development opportunities.

Tutoring Program - MUST Professional and Academic Support System (PASS)

MUST PASS provides funding to Scholars with a declining GPA for private tutoring. Scholars who experience difficulty in their STEM courses are given one semester to raise their GPA. Results from tutoring support offered in 2008 show that 47% of tutoring participants were able to continue in the MUST Project. Out of a total of 17 students who completed a semester of tutoring, 8 raised their GPAs, and 7 renewed into Cohort 4. Six students were not eligible for renewal, and 3 students graduated from the program as seniors.

Scholars also reported the following results from tutoring:

- 87% had an overall improvement in their grades

- 73% earned an A or B in the class for which they received tutoring
- 80% stated that tutoring helped them to organize their time and become more productive
- 33% admitted they would not have sought tutoring support if it were not required by the MUST Project

Below is what some Scholars had to say about their tutoring experience:

“Tutoring helped me to stay in my original major.”

“If it wasn’t required, I wouldn’t have been so consistent with it.”

“Tutoring gave me the extra edge to get an A.”

Mentorship - MUST Professional and Academic Support System (PASS)

The following data is reported and analyzed in the 2009 NASA MUST Summary of Spring Evaluation Activities, prepared and submitted by Paragon Tec, Inc.

The MUST Mentorship Program was implemented in 2009. Each scholar was paired with a peer, graduate, and faculty mentor. A Webinar hosted by Dr. Howard G. Adams providing information and training for all scholar and mentor participants was held in February 2009. There were 117 participants.

The orientation had five objectives:

- MUST Project purpose and goal.
- The terminology and philosophy of mentoring.
- Strategies for functioning in a mentoring alliance.
- How to use mentoring as a developmental strategy.
- Mentoring practices for implementing program goals.

Both mentors and scholars completed questionnaires at the end of the webinar. The questionnaires gathered data on the effectiveness of the Webinar in preparing the mentors and scholars for their roles, the program themes, and the suggestions for improvement. Feedback from the participants provides evidence that the MUST Scholars/Mentors Orientation Webinar was successful, with the majority ranking it as positive. More importantly, they perceived it to be helpful in preparing them for their respective roles as mentor and mentees. Results from the Webinar survey show the majority of the participants (81, 69.2%) did not think that the Webinar could be improved.

Throughout the academic year, most of the mentoring occurred within a 0-2 hour time frame each month. Scholars and mentors most frequently discussed STEM research and academics. Specifically, the topics discussed monthly related to STEM research opportunities, joining STEM professional organizations, advice on how to excel academically, and time management.

Representative comments from students regarding mentorship include:

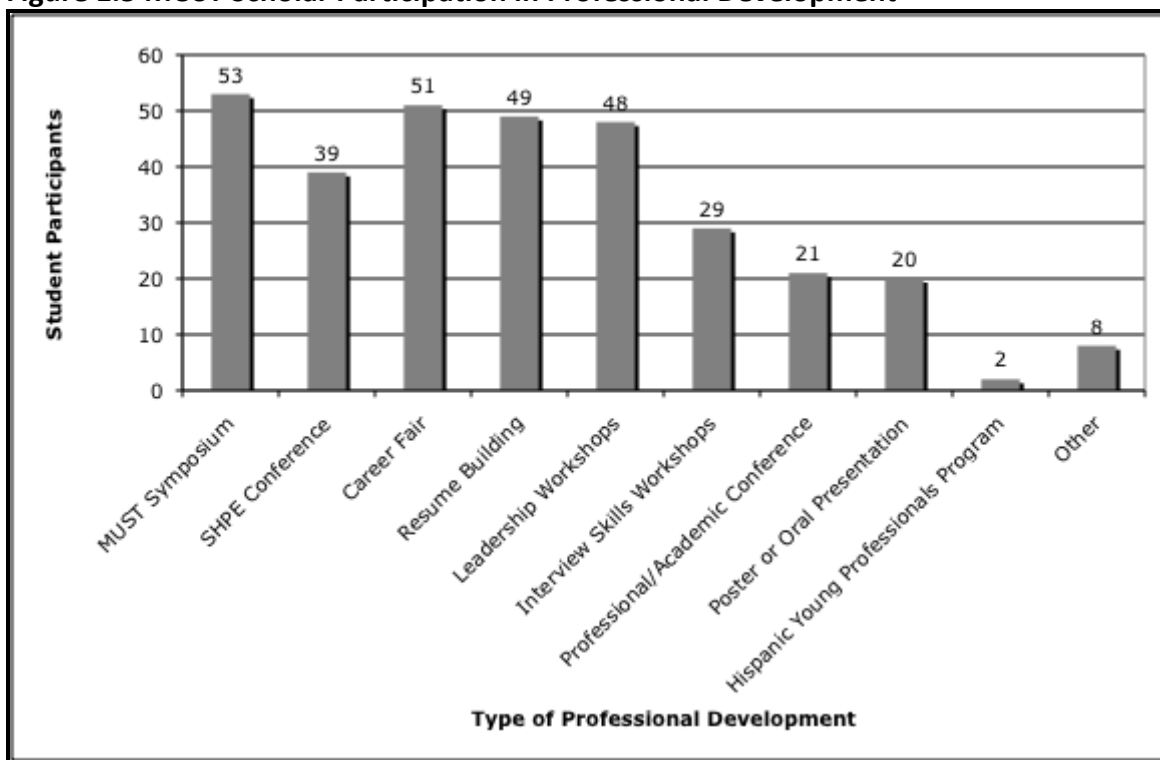
“My mentors have put faith on me and enabled me to pursue even greater goals.”

“I was NSBE General Body Member of the Year. Also, I made the Dean’s list for Winter Quarter 2009. Being in MUST helped me throughout the year because I had people who I could ask for help.”

Professional Development - MUST Professional and Academic Support System (PASS)

Seventy-eight percent of MUST Scholars participated in professional development activities, with 53 Scholars attending the MUST Symposium in November 2008. Many students participated in more than one professional development activity as shown below in Figure 1.5.

Figure 1.5 MUST Scholar Participation in Professional Development



Source: Higher Education Student End-of-Semester Questionnaire (May 2009)

More than 80% of the Scholars presented their NASA work at a conference. All students attending the NASA summer internship presented their work at an end-of-session conference; 31% of these students also presented at an external conference and 6% at the fall 2008 Leadership Symposium.

MUST Leadership Symposium

This three day conference provided MUST Scholars the opportunity to meet their peer mentors, prepare for their summer internships, and gain insight on what it takes to obtain a career at NASA and within the STEM industry. The MUST Leadership Symposium took place in Phoenix, Arizona from November 12-14, 2008.

The objectives included:

Providing students with an orientation into the NASA MUST Project.

- At least 90% of the attendees perceived the orientation activities to be extremely or highly valuable.

Providing students with the opportunity to meet with NASA field center representatives to learn about their specific research projects.

- 95% of attendees rated the Overview of Internship Expectations session either extremely or highly valuable.

Delivering 21st Century Leadership skills through workshops focused on networking skills, oral and written communications, professionalism and teamwork.

- Over 90% of the participants viewed the following activities as extremely or highly valuable: 1) Dr. Howard G. Adams: "Setting the Bar High" (94%), 2) Robert Scott: "Global Leadership in a Flat World" (94%), and 3) Sylvia Thomas: "Your Word is Bond" (91%).
- All scholars that attended Dr. Ryan Mack's morning presentation considered "Money Matters for College" extremely or highly valuable.
- All scholars that attended the luncheon presentation by Dr. Woodrow Whitlow, Director of the NASA Glenn Research Center, ranked it as extremely or highly valuable.

Research presentations from summer 2008 MUST interns and NASA scientists.

- In 2008, 6 Scholars presented on their internship experiences. The overwhelming majority of attendees rated these presentations as highly or extremely valuable.

Scholars reported obtaining the following overall benefits from attending the symposium:

- Improved Professional and Peer Networks
- Increased Motivation to Meet Academic and Professional Goals
- Increased Leadership Skills
- Enhanced Written and Oral Communication Skills

Feedback from the attendees provides evidence that the MUST symposium was a highly successful event. Over 80% of attendees strongly agreed that the symposium was a great opportunity to network and make contact with individuals they plan to stay in touch with and also gave them a renewed sense of enthusiasm. A near majority believe they learned things during the symposium that they will apply to their studies or work. The most valuable activities in the eyes of the attendees were the 21st Century Leadership Sessions.

Scholar Communications

MUST Project Facilitators at the Hispanic College Fund are in constant communication with MUST Scholars to provide programmatic support, guidance, and reminders of project requirements. Topics discussed between Scholars and facilitators include:

- Academic successes
- Tutoring and mentoring needs
- Internship questions
- 21st Century Leadership Opportunities
- Scholarship and Financial inquiries
- NASA and other STEM news relevant to Scholars

End of Semester Survey

The MUST Higher Education Student End-of-Semester (HESES) Questionnaire was distributed to Scholars at the end of fall semester 2008 and spring semester 2009. According to (HESES) responses MUST Scholars are strongly supportive and optimistic that their involvement in the MUST Project will benefit them both professionally and academically.

The majority of Scholars are majoring in engineering and are enrolled in classes required by the curriculum. When asked if the MUST Project influenced their decisions to register for MUST courses for the spring semester, 56% of the Scholars responded no because as a STEM major their curricular plan is already established, while 41% percent responded yes. Even though for most Scholars the course curriculum is pre-determined, they indicated that involvement in MUST and the summer internship opportunities reinforced their passion for STEM, motivated them to do better in their courses, and inspired them to continue on the STEM path. Representative answers explaining how MUST influenced their curricular choices include:

“I have come to learn that now more than ever that science and engineering are important for our future. Especially when it comes to our environment and resources.”

“Yes. I want to be a part of the MUST Project for as long as I can. Taking STEM related classes will only help me in the MUST Project.”

The mentors also had an impact on the Scholars curricular choices as evidenced by the following comments:

“Yes, this semester I will be taking Algorithms, a class of third year, even though I will be in second year, I decided to take it with Statics, Physics and Calculus III to have more classes related with my field of study because of the advice my MUST mentors gave me.”

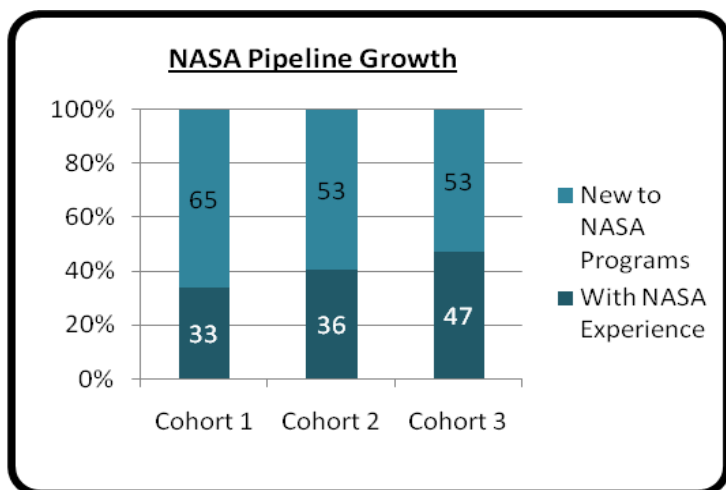
“Having an on-campus graduate student mentor has been amazing. She has introduced me to higher-level education, and has promoted academic excellence. Spending time with the MUST Program mentor has encouraged me to continue in engineering.”

When asked if their participation in MUST resulted in specific accomplishments during the spring 2009, 72% of the Scholars said yes and 34% said no. Those answering in the affirmative were asked to describe their accomplishments. These Scholars were inducted into honor societies, improved their GPAs, established professional STEM-related organizations on their college campuses, and gave conference presentations.

Scholars reported engineer as their top career choice followed closely by pursuing a career at NASA.

NASA Pipeline Participants

MUST recruits applicants from current NASA educational projects to connect participants to the next level of engagement. MUST pipeline participants increased by 3 students in 2007 and by an additional 11 students in 2008, as reflected in the chart below:



IMPROVEMENTS IN THE PAST YEAR

*MUST executed a highly successful symposium focused on developing 21st leadership skills in Phoenix Arizona. 53 Scholars received training in written and oral communication, professionalism, teamwork, and financial responsibility. Scholars also interviewed with representatives from ten NASA field centers in preparation for the summer internship.

*MUST launched the mentorship program. The majority of Scholars noted mentorship as the most beneficial component of MUST in spring 2009

*MUST launched the travel award. Fourteen Scholars were able to attend professional STEM conferences where they presented their NASA research and networked with students and professionals in their field. Continuing this award is contingent on funding.

*MUST increased the number of students at Minority Serving Institutions by 6%.

PROJECT PARTNERS AND ROLE OF PARTNERS IN PROJECT

The MUST Consortium, comprised of HCF, UNCFSP, and SHPE, is a dynamic collaboration of highly qualified and experienced minority non-for-profit organizations with applicable expertise to manage all facets of the MUST Project. Each member has an established track record of providing education and support services to Minority Institutions, faculty, and students. Each partner brings numerous strengths that, when combined, create a comprehensive portfolio of expertise in cultural competence, outreach, recruitment, scholarship administration, internship placement, student monitoring and tracking, mentoring, and professional development support.

The Hispanic College Fund (HCF)

HCF, the lead administrator for the MUST Project, is a national nonprofit organization dedicated to developing the next generation of Hispanic professionals. HCF focuses primarily on financially needy, high achieving Hispanic students majoring in Science, Technology, Engineering, Math, and Business who lead their community by giving back. Established in 1993 as a result of a student's letter to the editor of Hispanic Business Magazine, the organization began as a source of scholarships. Over the years, HCF has added additional programming to maximize scholarship impact, and now reaches high school students, college students, and professionals. HCF currently serves over 2,000 students a year, and is a recognized leader in Hispanic educational attainment.

Unique Skill Set

- Manages a large national network of Hispanic high school and college students
- Administers programs that identify high performing STEM career-minded Hispanic students
- Professional development expertise that support students from college to career
- Communication systems in place to broadcast program information to thousands of students
- Leverages an existing application system that can handle a large volume of applications.
- Leverages a staff that is trained to manage, process and screen a large volume of application documents
- Leverages a staff that is experienced in awarding scholarships and award tracking

Responsibilities

- Manage and house the student application, oversee the review and scholarship selection processes
- Process student documentation for the initial screening and selection of semifinalist pool
- Distribute scholarship, internship, and travel award checks
- Maintain Student records in a secure environment
- Coordinate tutoring for MUST Scholars
- Administer Mentorship Program
- Track progress and success of MUST Scholars through constant communication
- Create a technical publication of MUST Scholar internship experiences
- Coordinate recruitment of mentors, applicants and reviewers
- Manage the project deliverables
- Manage the project's costs and expenditures

United Negro College Fund Special Programs Corporation (UNCFSP)

An independently established 501(c)(3) nonprofit organization, UNCFSP has a broad mandate of serving domestic and international Minority Institutions, including Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), and Other Minority Institutions (OMIs). UNCFSP currently manages eighteen capacity building, workforce development, and technical assistance programs, including a robust portfolio of STEM programs sponsored by NASA, the Department of Defense, and the Department of Energy. UNCFSP possesses strong expertise in recruitment; application receipt, review, and selection; internship placements, monitoring and tracking, evaluation, and dissemination.

Unique Skill Set

- Access to a large network of students, faculty and professionals who can support MUST as mentors, reviewers, speakers, etc.
- Years of experience in educational program development and administration
- Professional development expertise that support students from college to career
- Experts in professional development training at the
- UNCFSP Institute for Advancement (SPIA)
- Leadership Training Academy
- Experts in multimedia production (Public Service Announcements, participant spotlights, recruitment videos, etc.)
- Recognized program evaluation methodologies
- Experts in using integrated technology to communicate with program stakeholders (social networking, webinars, video conferencing, etc.)

Responsibilities

- Contribute to the development of marketing materials including the Annual Report Draft template of the MUST Scholar and Mentor Travel Award application
- Develop and complete MUST Leadership Symposium Evaluation Tool and Report
- Provide web space for MUST Scholar Orientation and MUST P.A.S.S. Mentor Training webinars
- Recruit applicants, mentors and application reviewers
- Disseminate information about MUST Project
- Provide scholarship and internship resources to the MUST Scholars
- Provide administrative support to ensure successful program implementation

Society of Hispanic Professional Engineers (SHPE)

SHPE is a national organization of professional engineers that serve as role models in the Hispanic community. SHPE has a strong independent network of 62 professional chapters and 235 student chapters throughout the United States and Puerto Rico. The largest Hispanic, engineering organization, SHPE has national programs for professional development initiatives that include a national conference and career fair, which allow corporations, government agencies and universities to host presentations and recruit SHPE members. SHPE AHETEMS focuses, improves and expands SHPE's pre-college through Ph.D. educational programs organized into three areas: 1) Pre-College Programs, 2) Undergraduate Programs, and 3) Graduate Programs.

Unique Skill Set

- Expertise in Professional Development programs that guide students from high school to professional (Executive Level)
- Expertise in outreach to Hispanic youth and their parents
- Access to SHPE chapters and several professional organizations
- Access to graduate, professional, and faculty mentors and reviewers
- Offer expertise in recruiting in Hispanic Serving Institutions and Universities with SHPE chapters, i.e. MIT, Stanford
- SHPE Magazine articles and program highlights provided to SHPE student networks, pre-college SHPE, Jr. chapters, university deans, teachers, company sponsors

Responsibilities

- Recruit for applicants, mentors and reviewers
- Coordinate the symposium logistics and student travel
- Provide administrative support and feedback on all projects
- Program promotion, advertisement through press releases, online news, e-newsletters, SHPE magazine

Paragon TEC, Inc.

Paragon TEC is a premier management consulting firm with a strong passion and outstanding past performance in the area of knowledge transfer; which they define as building understanding and expertise through the use of technology, education and communication.

Unique Skill Set

They have a broad range of expertise as it relates to seven major vehicles of knowledge transfer:

- Training
- Educational Programs
- Project Management
- Organizational Assessment
- Conference and Event Planning
- Marketing and Consulting
- Information Technology

Responsibilities

- Conduct a project evaluation for each area of MUST
- Provide feedback on strengths and areas for Project improvement
- Create an interactive MUST PASS Website
- Provide 21st Century online Curriculum
- Access to graduate, professional, and faculty contacts for the purpose of building bridges between universities and NASA MUST
- Provide applicant recruitment services