

FY 2018 Year 4 Extension Annual Performance Document

Michigan Space Grant Consortium Lead Institution: University of Michigan

Director: Prof. Mark Moldwin
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Consortium URL: www.mi.spacegrant.org
Grant Number: NNX15AJ20H

Lines of Business (LOBs): NASA Internships, Fellowships, and Scholarships; STEM Engagement; Institutional Engagement; Educator Professional Development

A. PROGRAM DESCRIPTION:

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Michigan Space Grant Consortium is a Designated Consortium funded at a level of \$760,000 for fiscal year 2018.

B. PROGRAM GOALS:

API ED-15-1: *Provide significant, direct student awards in higher education to (1) students across all institutional categories and levels; 2) racially or ethnically underrepresented students; 3) women; and 4) persons with disabilities at percentages that meet or exceed the national percentages for these populations, as determined by the most recent, publicly available data from the U.S. Department of Education's National Center for Education Statistics for a minimum of two of the four categories.*

The MSGC Fellowship and Internship Program

Goal: Increase the number of proposals that the MSGC Fellowship Program receives.

Goal: Improve the longitudinal tracking of the MSGC Fellowship award recipients.

Goal: Competitively award graduate and undergraduate fellowships using the National Center for Education Statistics (NCES) Digest as a guide for setting diversity targets. The MSGC target is currently 20.3%. U.S. citizenship is required.

API-15-2: *Engage with at least 80,000 educators in NASA-supported professional development, research, and internships that use NASA-unique STEM content.*

The MSGC Higher Education and K-12 Educator Incentive Programs

Goal: Increase the number of applications coming from outside of the Consortium for the MSGC Higher Education and K-12 Educator Incentive Programs, with augmentation funds available to programs that target underrepresented minorities and women.

Goal: Award quality programs that target underrepresented minorities and women.

The MSGC Research Seed Grant Program

Goal: Award proposals that incorporate collaboration of two or more fields of study.

Goal: Award proposals that clearly align with NASA’s Strategic Goals and Objective and Lines of Business

API-ED-4: Maintain the NASA Museum Alliance and/or other STEM education strategic partnerships in no fewer than 30 states, U.S. Territories and/or the District of Columbia.

The MSGC Informal Education Program

Goal: Increase the number of applications coming from outside of the Consortium for the MSGC Informal Education Program with augmentation funds available to programs that target underrepresented minorities, women, and persons with disabilities.

Goal: Award quality programs that target underrepresented minorities and women.

Goal: Award quality programs that encourage Science, Technology, Engineering, and Mathematics education in informal settings; e.g., museums science centers, boy and girl scouts, etc.

API-ED-5: Engage with at least 600,000 elementary and secondary students in NASA STEM engagement activities.

The MSGC Pre-College Education Program

Goal: Increase the number of applications coming from outside of the Consortium for the MSGC Precollege Education and K-12 Educator Incentive Programs with augmentation funds available to programs that target underrepresented minorities and women.

Goal: Award quality programs that target underrepresented minorities and women.

C. PROGRAM/PROJECT BENEFITS TO PROGRAM AREAS:

API ED-15-1: Provide significant, direct student awards in higher education to (1) students across all institutional categories and levels; 2) racially or ethnically underrepresented students; 3) women; and 4) persons with disabilities at percentages that meet or exceed the national percentages for these populations. MSGC Fellowship and Internship Programs. Highlights are provided below:

Breeanne Marshall is not your everyday engineer. In addition to taking a full load of electrical engineering classes at Wayne State University, she works full time at the General Motors Technical Center. Even with so many things on her plate, Bree decided to apply for an internship at the NASA Kennedy Space Center at Cape Canaveral, Florida during the summer 2017. NASA thought so highly of Bree that they invited her to come back for

the summer of 2018, and MSGC was pleased to be able to provide the support for that experience. This past summer, Bree and her team were successful in developing a lightweight CubeSat that utilized solid-state batteries as the structural support of the satellite. Regarding the impact of the experience in her current work, Bree reports, “The internships helped me realize how much I enjoy working on batteries and how we can develop better batteries not only for space but for the world. Being in the automotive field and working with electric vehicles, it helped me think of different ways to get the most juice out of a battery for a vehicle.”

API-15-2: *Engage with at least 80,000 educators in NASA-supported professional development, research, and internships that use NASA-unique STEM content.* Elementary/Secondary Education: MSGC Higher Education, K-12 Educator Incentive Programs, and Research Seed Grant. Highlights are provided below:

Tiny initiatives can lead to terrific results. Through a K-12 Educator Incentive grant from Michigan Space Grant Consortium, teacher Amy Kuntz was able to supplement her current hands-on science curricular materials with tornado and earthquake simulators for a project about real world situations in Earth and space science. Amy has designed a month-by-month curriculum of challenges that will require students to use LEGO robotics, simple machines, and building brick challenges to create solutions to common issues faced during natural disasters as well as future issues in space exploration. After she received the funds from MSGC, Amy was able to apply for and receive even more funding through the local community foundation that valued the investment MSGC made in Amy’s efforts. After just a few years, her experientially-based lesson plans are well on the way to becoming her science curriculum throughout the year.

API-ED-5: *Engage with at least 600,000 elementary and secondary students in NASA STEM engagement activities.* MSGC Pre-College Education Program. Highlights are provided below:

Hope College’s 2018 Engineering the Future Academy provided 63 local area traditionally underserved students the opportunity to explore engineering design in a hands-on, problem solving context as well as professional development for in-service (4) and pre-service (2) teachers. Designed as a learning experience for students and a research and mentorship opportunity for undergraduate STEM and STEM education majors, this year’s efforts centered around two one-week 30 hour on-campus design challenges exploring alternative energy sources. This year’s challenges were developed collaboratively with the STEM teachers at HPS, with emphasis on building units of instruction that are transferable to the classroom in the upcoming school year. Throughout the academic year, the Holland Public School STEM teachers continue to receive curriculum support and new materials through regular interaction with the program staff. Additionally, new curriculum and supplies were provided to support the school's Advanced STEM class for 8th graders.

D. PROGRAM ACCOMPLISHMENTS:

- NASA Internships, Fellowships, and Scholarships (NIFS):

Goal: Increase the number of proposals the MSGC Fellowship Program receives.

Metrics: Compare the number of proposals received from year-to-year.

Approach: Provide brochures to all MSGC campus representatives to supplement the other ways (newsletter, website, postings, and e-mails) in which we announce the MSGC Fellowship and Internship opportunities.

Accomplishment: The MSGC flagship Fellowship Program received 44 proposals from which the 2018 awardees were chosen as compared to 47 proposals the previous year. We received 18 proposals to the MSGC Undergraduate Fellowship Program and 26 proposals to the MSGC Graduate Fellowship Program.

Goal: Improve the longitudinal tracking of the MSGC Fellowship and Internship award recipients.

Metrics: Track the next steps that students take after they are awarded fellowship funding from the MSGC.

Approach: With the contact information provided by Bonnie Bryant, Mark Fischer of Education Programs Support Services provides us with results from the surveys that he routinely sends to our Fellowship and Internship award recipients. Mentors of Fellowship and Internship award recipients are also contacted.

Accomplishment: Alternate email addresses were obtained for 75% of both undergraduate and graduate fellowship recipients awarded in 2018 compared to 36% for undergraduate and 71% for graduate fellowship recipients in 2017. 100% of 2018 NASA interns provided two email addresses.

Goal: Competitively award graduate and undergraduate fellowships and internships with demographics as specified by NASA of 20.3% underrepresented minority (NCES). U. S. citizenship required.

Metrics: Compare the number of proposals received each year by gender and ethnicity.

Approach: The Summer Research Opportunity Program (SROP), a long-standing minority student recruitment program for graduate school, focuses on exposing rising sophomores, juniors, and seniors to on-campus research activities. The Council of Graduate Schools, a *Big Ten Plus* consortium of graduate schools that routinely brings dozens of high-achieving underrepresented minority undergraduates to its campuses each summer supports the SROP Program. SROP runs through the graduate school at UM and at MSU. In 2018, MSGC dedicated funds to 10 SROP students in order for them to participate in fellowships at the University of Michigan. The MSGC also offers a fellowship program targeted to undergraduate, underrepresented minority students. In this program, strong mentorship is required. Mentors qualify for \$1,000 per student. A mentor may have up to two underrepresented minority students on his/her team. A \$500 incentive is offered to mentors of underrepresented students not eligible for this program, for example, underrepresented graduate students.

Accomplishment: The target from the augmentation proposal was to award a minimum of 20.3% underrepresented minority students in our fellowship program. The target is derived from the underrepresented minority student enrollment percentage for the state of Michigan as per the NCES Digest. Our commensurate minimum for women is 40%. During funding interval 2018, 21% of the fellowship and internship award recipients were underrepresented minority students and 52% were women.

- Higher Education projects:

Goal: Award proposals that develop new or revised courses, hands-on activities, and other higher education projects.

Metrics: Document details of new or revised courses, hands-on activities, and other higher education projects.

Approach: Require Principal Investigators to provide details on new or revised courses, hands-on activities, and other higher education projects.

Accomplishment: During the 2018 funding interval, we received 6 funding proposals from outside of the MSGC. This was fewer than the previous year. However, MSGC also initiated the pilot funding of two student groups engaging in hands-on learning rooted in NASA-related, STEM-focused questions.

Goal: Encourage quality programs that target underrepresented minorities and women.

Metrics: Record the number of programs targeted to underrepresented minorities and women.

Approach: Announce that augmented support will be available to those programs that target underrepresented minorities and women. Within the announcement add that to be considered for augmented support, an additional page describing in detail why added funds are necessary to assure the success of program targeting underrepresented minorities and/or women.

Accomplishment: For the 2018 funding interval, we received 4 teacher training proposals that directly targeted underrepresented minorities and/or women, compared to 5 proposals that we received during the 2017 funding interval.

Goal: Award proposals that incorporate collaboration of two or more fields of study.

Metrics: Document how PIs incorporate the collaboration of two or more fields of study in their research project.

Approach: Require principal investigators to provide details on how collaborations took place.

Accomplishment: MSGC will improve tracking of collaborations.

- Research Infrastructure projects:

Goal: Award proposals that incorporate collaboration of two or more fields of study.

Metrics: Document how Principal Investigators incorporate the collaboration of two or more fields of study in their research project.

Accomplishment: No significant accomplishment this year. It is an area for improvement.

Goal: Award proposals that clearly align with NASA's Strategic Goals and Objective and Lines of Business

Metrics: Document how awarded research projects aligned to the priorities of NASA and to which of the Strategic Goals and Objectives and Lines of Business.

Accomplishment: MSGC requires that Research Seed Grant proposals explain how they align with NASA strategic interests, as specified in the [NASA Strategic Plan 2014](#). This is one of the major criteria that the proposals are evaluated on.

- Precollege projects:

Goal: Increase the number of applications coming from outside of the Consortium for the Precollege Education Program.

Metrics: Record the number of applications that the MSGC receives from outside of the Consortium.

Approach: Thousands of brochures are sent to public and intermediate school districts, including high, middle, elementary, charter along with the Boy and Girls Scouts, museums and after-school clubs.

Accomplishment: During the 2018 funding interval, we received 3 proposals from outside of the MSGC as compared to the 5 proposals we received during the 2017 funding interval. Efforts to build relationships with museums and science centers are underway.

Goal: Encourage programs that target underrepresented minorities and women.

Metrics: Record the number of programs targeted to underrepresented minorities and women.

Approach: Announce that augmented support will be available to those programs that target underrepresented minorities and women. Within the announcement we added that to be considered for augmented support, an additional page describing in detail why additional funds are necessary to assure the success of program targeting underrepresented minorities and/or women.

Accomplishments: During the 2018 funding interval we received 7 proposals that directly targeted underrepresented minorities and/or women, compared to 8 proposals that we received for the 2017 funding interval. This is therefore quite steady.

Goal: Encourage teachers to engage in STEM educational enhancement activities
Metrics: Record the type of conferences and workshops that teachers are attending and detail what they are bringing back to the classroom.
Approach: Thousands of brochures are sent to public and intermediate school districts, including high, middle, elementary, charter schools and museums. Email announcements are sent when enhancement activities are announced from other Space Grant consortia.
Accomplishments: During the 2018 funding interval thus far, MSGC has received 6 requests for funding from individual K12 teachers. In addition, MSGC is collaborating with Michigan Science Teachers Association, supporting scholarships for approximately 20 teachers to attend the MSTA 66th Annual Conference in March 2019.

- Informal Education projects:

Goal: Encourage the proposal of programs that offer informal education.
Metrics: Record where informal programs are held, e.g., conferences, workshops, non-technical courses, and science fairs.
Approach: Thousands of brochures are sent to public and intermediate school districts, including high, middle, elementary, charter along with the Boy and Girls Scouts, museums and after-school clubs.
Accomplishment: During the 2018 funding interval, we received 3 proposals from outside of the MSGC, compared to the 3 proposals that we received during the 2017 funding interval.

Goal: Encourage programs that target underrepresented minorities and women.
Metrics: Record the number of programs targeted to underrepresented minorities and women.
Approach: Announce that augmented support will be available to those programs that target underrepresented minorities and women. Within the announcement we added that to be considered for augmented support, an additional page describing in detail why additional funds are necessary to assure the success of program targeting underrepresented minorities and/or women.
Accomplishments: During both the 2017 and 2018 funding interval, 2 proposals that directly targeted underrepresented minorities and/or women were received.

E. PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE

GOALS:

Include summary data for the bulleted list below:

- **Diversity:** *Describe diversity of institutions, faculty, and student participation.* Benchmarks for diversity within the MSGC Fellowship and Internship Programs have consistently been met as reported within this and past ADP's. Approximate 40% of the

Program proposals funded in 2018 are targeted to underrepresented minorities or to women. Again this year, we beat our goal of 40% women and our goal of 20.3% underrepresented minorities in the fellowship and internship programs.

- **Minority Serving Institution Collaborations:** The underrepresented minority enrollment for students attending Wayne State University and Eastern Michigan University is 22% and 25%, respectively, as compared to approximately 5 - 10% at other MSGC-affiliated universities and colleges. There are no historically black colleges in the state of Michigan. Bay Mills Community College, Keweenaw Bay Ojibwa Community College, and Saginaw Chippewa Tribal College are the three tribal colleges located in Michigan, but at this time, no STEM majors are offered on these campuses. The tribal colleges in Michigan primarily focus on liberal arts, education, and local economic development. There are no Hispanic-serving universities or colleges in the state of Michigan. Our focus remained to recruit minority students and junior faculty members from MSGC institutions.

- **Office of Education Annual Performance Indicators:**
 - API 3.3.3: STEM-18-1 46/10/24/1
 - API 3.3.5: STEM-18-5 45 (from OEPM FY2018)

F. IMPROVEMENTS MADE IN THE PAST YEAR:

The end of FY2018 marked the beginning of a transitional year within MSGC. Dean Alec Gallimore stepped down as Executive Director, handing the role to Mark Moldwin as a professor in the department of Climate and Space Sciences and Engineering with extensive experience in STEM educational initiatives ranging from local to national. During summer 2018, changes at MSGC commenced, which include:

- Steps have been taken to expand partnerships with non-profit STEM educational groups and organizations (eg., Michigan Science Center), industry, community colleges, school districts and state and local governments.
- MSGC has widened programming to include opportunities for student groups to participate in NASA design challenges and competitions.
- MSGC has a brand-new logo, and a new website is in development.
- Improved narrative reporting requirements for MSGC award recipients have been implemented.
- An improved process for verifying US citizenship for NIFS is now in place.
- MSGC held a 1.5-day strategy meeting with the board in August 201, which was followed-up by three monthly teleconference calls throughout the fall.

G. CURRENT AND PROJECTED CHALLENGES:

As a result of some historical characteristics of Space Grant, MSGC is in the position where its programs funded by a given budget year are awarded that year but performed during the next budget year. One major advantage of this approach is that MSGC could support valuable summer programs. This approach created challenges, however, with NASA reporting.

Programs typically have been reported based on the budget year that funded the programs. However, that pattern was discontinued this year for two reasons – (i) NASA moved ahead the OEPM reporting deadline to January from June and (ii) NASA stressed the importance of most closely aligning reporting with performance.

The OEPM reporting for this year was optimized as much as possible, but it meant reporting on some programs from one MSGC budget year and some programs from another MSGC budget year. This is not an ideal situation.

H. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION:

The MSGC Executive Board consists of the campus representatives at the following member institutions. Campus representatives have the same general role within MSGC, achieving ultra-high equity among the board members. The campus representatives further MSGC's mission and vision on their campus, helping students and ensuring that administrative procedures are followed during the application process. They evaluate and advise MSGC leadership on policies and procedures. They review individual funding applications, their varied individual expertises provide the ability to evaluate applications across a broad spectrum of subject areas. They also meet in February to arrive at final decisions on awards.

Calvin College • Private four-year liberal arts college: Dr. Jason Smolinski is an Assistant Professor of Physics and Astronomy with research in the field of globular star clusters.

Ann Arbor Public Schools • Tom Pachera is the STEAM Coordinator for Ann Arbor Public Schools, has also joined the MSGC executive board this year as an expert in K-12 education. He has taught Technology Education for 29 years and currently teaches Introduction to Engineering Design, and Engineering Design & Development courses for Skyline High School. Key figure in evaluation of Precollege programs.

Eastern Michigan University • Public Ph.D.-granting university: Dr. James Sheerin is a Professor of Physics and Astronomy and is active in space physics research and in developing science courses for non-majors and pre-service teachers.

Grand Valley State University • Public Master's-granting university: Dr. Bopaiah Biddanda is an Aquatic Microbial Ecologist interested in the Carbon Biogeochemistry of natural waters. In his research, he addresses questions of carbon flow driven by microorganisms in nature.

Hope College • Private four-year liberal arts college: Dr. Peter Gonthier is an astronomer and Professor of Physics with deep ties to NASA centers, especially Goddard.

Michigan State University • Public Ph.D. granting university: Dr. Michael Velbel is a Professor of Geological Sciences where he investigates the geological, mineralogical, geochemical, and geomorphic factors that control mineral alterations at the Earth's surface.

Michigan Technological University • Public Ph.D. granting university: Dr. Lorelle Meadows is the dean for MTU's Pavlis Honors College.

Oakland University • Public Ph.D. granting university: Dr. Laila Guessous is an Associate Professor of Mechanical Engineering with research in the field of computational fluid dynamics and computational heat transfer.

Saginaw Valley State University • Public Master's-granting University: Dr. Khandaker Abir Rahman is the Chair and Associate Professor of Computer Science & Information Systems. Abir became familiar with MSGC through supervising multiple MSGC-funded undergraduate student research projects over several years.

University of Michigan (lead institution) • Public Ph.D. granting university: Dr. Mark Moldwin is the MSGC director, Arthur F. Thurnau Professor of Climate and Space Sciences and Engineering within the University of Michigan's College of Engineering. He is also Faculty Director of UM's M-STEM's M-Engin_program, and President of the American Geophysical Union's (AGU) Education Section.

University of Michigan • Public Ph.D. granting university: Dr. Cinda Davis is the director of the Women in Science and Engineering Program. Key figure in evaluation of Precollege programs.

Wayne State University • Public Ph.D. granting university: Dr. Jeffrey Potoff is the Associate Dean of Academic and Student Affairs Wayne State University. He is currently on the faculty of the Chemical Engineering Department where he teaches courses on material and energy balances, thermodynamics, and numerical methods and programming.

Western Michigan University • Public Ph.D. granting university: Dr. Massood Atashbar is Professor of Electrical and Computer Engineering and the director of Advanced Smart Sensors and Structures and the Sensor Technology Laboratory.

Respectfully submitted on February 26, 2019

Dr. Mark Moldwin, MSGC Director