Michigan Space Grant Consortium
University of Michigan
Dean Alec D. Gallimore
(734) 764-9508
www.mi.spacegrant.org
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LOB: NASA Internships, Fellowships, and Scholarships; Stem Engagement; Institutional Engagement; Educator Professional Development

*2017 – 2018 Funding Interval*

## 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 Program Consortium funded at a level of $760,000 for fiscal year 2017.

## 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 19.4%. 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.

**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 Precollege 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.

**PROGRAM/PROJECT BENEFIT 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:

Frederico Zegers participated in the Summer Research Opportunity Program at the University of Michigan. As mentioned in this report, the Summer Research Opportunity Program at the University of Michigan (SROP) is a long-standing minority student recruitment program for graduate schools and focuses on exposing rising sophomores, juniors, and seniors to on-campus research activities. Frederico Zegers majors in Mechanical Engineering and Mathematics and his summer project during the SROP experience was, *Stability of Connected Vehicle Systems*. "The SROP experience helped me to focus on my future careers goals," says Frederico. "By the end of the summer, I had decided that a Ph.D. in robotics and control theory was the route that was right for me."

**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:

*Geospace Connections* is a program led by Professor James Sheerin from Eastern Michigan University. The program was designed to integrate NASA mission data resources into an interdisciplinary course for pre-service teachers. Lesson modules were created and delivered centered around practical group activities using commonly available equipment and supplies, suitable for adoption into the elementary to high school science classroom. Each lesson module was crafted featuring integrated use of NASA mission data resources from the current geospace missions, the Van Allen Probes, the Magnetospheric Multiscale (MMS) mission, and NOAA-20 (JPSS-1); and prepared for upcoming NASA missions ICON and GOLD. "Students were trained to identify, obtain, manipulate, and incorporate NASA resources into lesson plans targeting the Michigan Science objectives including the understanding of Earth and its environment in the solar system, for potential use in their teaching practice," says Professor Sheerin. "Feedback collected from the students is being analyzed for refinements to be incorporated in future offerings of the course."

*Minimizing Security and Power Concerns in Cyber-Physical Systems*, an MSGC-awarded grant proposed by Professor Erik Fredericks from Oakland University. While many properties can negatively influence a system, extra-functional properties such as power and security are difficult to quantify and therefore problematic to optimize. Objectives 1.7 (transform NASA missions and advance the nation's capabilities by maturing crosscutting and innovative space technologies) and 3.3 (provide secure, effective, and affordable information technologies and services that enable NASA's mission) are particularly impacted by this proposal. To these ends, Dr. Fredericks and his research group are actively developing techniques for mitigating security concerns and optimizing power consumption in cyber-physical systems that have been realized as a smart home. "The techniques we develop using this proposal will form the cornerstone of our research for years to come," says Professor Fredericks. "Optimizing power and security concerns will have far-reaching impacts in terms of NASA's overall mission, enabling systems on spacecraft to function longer and more securely using existing hardware."

**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*. Informal Education: MSGC Informal Education Program. Highlights are provided below:

February 16 – 17, 2018 are on record as extraordinary days, as over 1,100 local students and community members attended the 2018 *Roger That!* public symposium on space exploration (named in honor of Grand Rapids native, Astronaut Roger B. Chaffee). The two-day symposium was organized by faculty at Grand Valley State University (GVSU), in collaboration with staff at Grand Rapids Public Museum (GRPM). "Thanks to an Informal Education grant from the MSGC, this year's symposium featured Dr. Guy Bluford, the first African-American to fly in space," says Professor Karen Gipson. Dr. Bluford delivered two well-attended presentations and interacted with hundreds of people during his visit. Children and adults, alike, lined up to receive personally autographed photographs of Dr. Bluford following his free presentation titled, *An Astronaut's Journey,* at GVSU Friday evening. His remarks were particularly inspirational for minority students in the audience; as one grandmother put it, "My grandson now wants to become an astronaut." Prior to Dr. Bluford's keynote presentation, the first day of the symposium included an academic conference at GVSU with sessions geared at an adult lay audience on scientific aspects and societal impact of space exploration, while younger students

benefited from a Design Challenge at GVSU, field trip experiences at GRPM, and classroom visits by speakers from the academic conference. The second day of the symposium featured family-friendly activities offered by GRPM staff as well as GVSU student groups doing STEM demonstrations at GRPM, with Dr. Bluford announcing the winners of the Design Challenge on stage at GRPM following his second keynote presentation titled, *Flying in the Space Shuttle.*

**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:

"Wayne State University's (WSU) College of Engineering developed the Young Men in Engineering Program to nurture the interest of underrepresented minority males in science, technology, engineering, and mathematics (STEM)," says Michelle Reaves, WSU Program Manager. "There is a desperate need to increase the number of underrepresented minority males that select engineering or other STEM fields as career options," she added. "We recruited 20 middle school underrepresented minority males to attend a two-week educational program focused Science, Engineering, and Math. We provided a highly intense academic curriculum, as well as, workshops to improve interpersonal skills while students are on campus. The instructors, who were all men, including some middle school teachers, acted as role models for the students. Courses offered were as follows: Science, Engineering, Chemistry, Technical Writing, and Life Skills."

## PROGRAM ACCOMPLISHMENTS

**The Fellowship and Internship Program (refer to API ED-15-1)**
**Goal:** Increase the number of proposals that 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 47 proposals in 2017 as compared to 58 in 2016. We received 26 proposals to the MSGC Undergraduate Fellowship Program and 21 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:** The number of students that received funding from the 2017 MSGC Fellowship Program was 36 and from the MSGC Internship Program was 17 as compared to 38 Fellowships and 13 Internships in 2016. More details will be provided in our longitudinal tables which will be provided within the next few months per NASA Headquarters' direction.

**Goal:** Competitively award graduate and undergraduate fellowships and internships with demographics as specified by NASA of 19.4% 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 2017, MSGC dedicated funds to 10 SROP students in order for them to participate in internships 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:** Our target is to award a minimum of 19.4% 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 2017, 28% of the fellowship and internship award recipients were underrepresented minority students; the amount of underrepresented minority students that we awarded in 2016 was 25%. During funding interval 2017, 45% of the fellowship and internship award recipients were women. The amount of women awarded in 2016 was 45%.

**The Higher Education and K-12 Educator Incentive Programs (refer to API ED-15-2)**
**Goal:** Increase the number of applications coming from outside of the Consortium for the Higher Education and K-12 Educator Incentive Programs.
**Metrics:** Record the number of applications that the MSGC receives from outside of the Consortium.
**Approach:** Some 8,000 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 2017 funding interval, we received 10 proposals from outside of the MSGC as compared to the 10 proposals we received during the 2016 funding interval.

**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:** During the 2017 funding interval, we received 5 proposals that directly targeted underrepresented minorities and/or women, compared to the 4 proposals that we received during the 2016 funding interval.

**The Research Seed Grant Program**

**Goal:** Improve participation in the Research Seed Grant Program across the MSGC.

**Metrics:** Compare the distribution of awards across the institutions within the MSGC.

**Approach:** Keep a record of the proposals we received overall as well as the distribution across the Consortium.

**Accomplishment:** During funding interval 2017 – 2018, we received proposal to the MSGC Research Seed Grant Program from 8 out of 11 affiliate universities as compared to 7 out of 11 affiliate universities in 2016.

**Goal:** Increase the diversity (underrepresented minorities and women) in the MSGC Research Seed Grant Program.

**Metrics:** Record the number of applicants each year by gender, ethnicity, and persons with disabilities.

**Approach:** Target announcements to college and university groups using e-mail, group meetings, and invitations from the director and campus representatives.

**Accomplishment:** During the 2017 funding interval, we received 5 proposals from women as compared to 6 in 2016. Three proposals from women were funded.

**The Precollege Education Program (refer to API ED-15-5)**

**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:** Some 8,000 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 2017 funding interval, we received 5 proposals from outside of the MSGC as compared to the 3 proposals we received during the 2016 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 the 2017 funding interval we received 8 proposals that directly targeted underrepresented minorities and/or women, compared to 7 proposals that we received for the 2015 funding interval.

**The Informal Education Program (refer to API ED-15-4)**

**Goal:** Increase the number of applications coming from outside of the Consortium.

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

**Approach:** Some 8,000 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 2017 funding interval, we received 3 proposals from outside of the MSGC, compared to the 3 proposals that we received during the 2016 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 the 2017 funding interval we received 2 proposals that directly targeted underrepresented minorities and/or women, compared to 8 proposals that we received for the 2016 funding interval.

## PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS

- **Diversity:** Benchmarks for diversity within the MSGC Fellowship and Internship Programs have consistently been met as reported within this and past ADP's. Over half of the Program proposals are targeted to underrepresented minorities or to women. Again this year, we beat our goal of 40% women (45%) and our goal of 19.4% underrepresented minorities (28%) in the fellowship and internship programs.

- **Minority-Serving Institutions:** The underrepresented minority enrollment for students attending Wayne State University and Eastern Michigan University is 36% and 20%, respectively, as compared to 4% - 13% at other MSGC-affiliated universities and colleges. The only historically black college that we have in the state of Michigan is Lewis College, a non-accredited business college in Detroit. 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 engineering programs are offered on these campuses. The tribal colleges in Michigan primarily focus on liberal arts and local economic development (casinos). There are no hispanic-serving universities or colleges in the state of Michigan. Our focus remains to recruit minority students and junior faculty members from MSGC institutions and through the SROP Program.

- ***Office of Education Annual Performance Indicators:**
  *Numbers will change as statistics come in and will be reflected on the OEPM for 2017.
  API 2.4.1 ED-16-1: 15/24/0 (# of NIFS to underrepresented, female, and disabled.)
  API 2.4.2 ED-16-2: 75 (# of educators.)
  API 2.4.4 ED-16-4: 50 (# of informal education events.)
  API 2.4.5 ED-16-5: 1500 (# of K-12 students.)

## IMPROVEMENTS MADE IN THE PAST YEAR

Dean Alec D. Gallimore, chaired the 21st Michigan Space Grant's Fall Conference that was held on November 11, 2017. Highlights are described below.

The MSGC hosted the fall conference on Saturday November 11, 2017. Dr. Ben Jorns was the keynote speaker. Dr. Jorns is an assistant professor in the Department of Aerospace Engineering at the University of Michigan. He is the co-director of the Plasmadynamics and Electric Propulsion Laboratory (PEPL), one of the leading academic centers for in-space, advanced propulsion research. PEPL was founded in 1992 by Dean Alec Gallimore. Dr. Jorns' presentations was titled, *Next Generation Propulsion for the Exploration of Space*. "Electric propulsion (EP) is a key technology for the future commercialization and exploration of space," said Dr. Jorns. "NASA, industry, and defense have all identified EP as a game changer for enabling more ambitious missions at a lower cost." An overview was given of the University of Michigan's work on EP systems with an emphasis on current activity. A brief discussion was also presented on active student efforts in the EP field, both a the University of Michigan and nationally.

Robotics Day was hosted by the MSGC and the National Center for Manufacturing Science on April 13, 2017. Michigan Governor, Rick Snyder, gave the welcoming remarks. "Michigan is leading the way in the creation and commercialization of robotics and autonomous technologies," said Governor Snyder. "Our state has many great universities and companies that are creating these advanced technologies but our most important asset, our competition edge, are the people that drive this innovation. This industry will benefit from these technologies as we transform our transportation, delivery, and logistic networks to save energy and optimize traffic flow. The innovations created by our students will be the foundation for products and services for the future." State Representative, Adam Zemke, gave the State Recognition of Michigan Robotics Day. Speakers were University of Michigan professors, Dr. Henry Liu and Professor Jessy Grizzle.

## CURRENT AND PROJECTED CHALLENGES

None at this time.

## PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

The MSGC Executive Board consists of the following members:

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: Mr. Michael Madison is an elementary school principal. Mr. Madison was recently elected President of the Ann Arbor Administrators' Association for a two-year term. He is also Executive Board member of the Ann Arbor Hands-On Museum, and Vice-President of the Pioneer High School Boosters.

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. Professor Gonthier recently won an NSF grant for his proposal, *Radio, X-Ray, and Gamma-Ray Emission from Neutron Stars*.

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. Garry Johns is Professor of Mathematics and also consults with high school mathematics teachers in the Buena Vista School District regarding best teaching practices and curriculum alignment. Buena Vista has a large African-American population.

University of Michigan (lead institution) • Public Ph.D. granting university: Dr. Alec Gallimore is the MSGC director, Arthur F. Thurnau Professor of Aerospace Engineering and Dean of the College of Engineering for the University of Michigan's College of Engineering.

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

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 holds the rank of Professor and teaches courses including 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 March 12, 2018,
Alec D. Gallimore, MSGC Director