Michigan Space Grant Consortium
University of Michigan
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www.mi.spacegrant.org
Grant Number: NNX15AJ20H
LOB: NASA Internships, Fellowships, and Scholarships; Stem Engagement; Institutional Engagement; Educator Professional Development

2015 – 2016 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 **$575,000** for fiscal year 2015.

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.

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:

"Since my MSGC-supported internship, I've had the opportunity to continue working in Professor James Cutler's lab at UM (The Michigan Exploration Lab)," says Prince Kuevor. "The work that I'm doing on our current mission (CADRE) is a unique experience for an undergraduate, and I'm very grateful for the opportunity."
"My participation in the SROP internship influenced my decision to go to graduate school," says Gabrielle Maestas. "I was able to create a network amongst scientists in my field which helped me during the application process for my graduate degree."

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 and K-12 Educator Incentive Programs. Highlights are provided below:

A collaborative project between UM's College of Engineering and the School of Education has developed a professional development program that partners the UM with the Ypsilanti

Community Schools (YCS) High School STEMM (Science, Technology, Engineering, Mathematics and Manufacturing) Academy faculty to incorporate science and engineering design practices in the classroom. This new MSGC Teacher Training grant leverages several existing programs (including programs run through UM's Center for Engineering Diversity and Outreach and the NSF Noyce Scholars program) and builds on a project that was previously funded by a NASA Heliophysics Division Education and Public Outreach (EPO) Supplement. "The program has developed a science and engineering professional development program for the entire science faculty at YCS high school, which serves underrepresented populations," says Professor Moldwin, a UM faculty member. "The project has created a pathway for UM scientists, engineering and pre-service education graduate and undergraduate students to become engaged in initiatives aimed at improving science education within YCS. We have developed an IRB approved assessment program and have sought additional NSF funding to grow the project to other schools and school districts."

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:

Grades 3 – 12 students from all over the Upper Peninsula (UP) of Michigan competed in UP Math Championships. Students competed as individuals and as teams of four in three categories: elementary (3 – 5), middle school (6 – 8), and high school (9 – 12). "Students were challenged with high-level math tasks aligned to the Common Core State Standards for Mathematics," says Shawn Oppliger, director of the Western Peninsula Center for Science, Math, and Environmental Education. "MTU Scholarships were given to top ten individuals competing in the high school category. Trophies and Texas Instrument calculators were given to top individuals and teams competing in the middle school and elementary categories."

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:

The University of Michigan's (UM) K-12 Outreach Program is designed to supplement classroom activities with lessons we have developed on aerospace and space science along with hands-on activities. "We find that K-12 students bond with our staff of UM undergraduate and graduate students who are not much older than they are," says MSGC Director, Professor Alec Gallimore. "This combination has been successful for over 20 years, giving us the tools to spark the interest of students that have not connected to science and math in the past, and to foster those who have." Events range from activities held within an afternoon class to multi-day, all-day events working with the same group of students or different groups of students. A sampling of the activities provided are: model rocket building and launching, balsa wood glider design, air surface controls, tower building, down-on-the-moon, and lectures, such as, *Why is the Sky Blue?* and undergraduate and graduate students describing their path to the university STEM field that they are currently studying to earn a bachelors or graduate degree. Note: Augmentation funding was used to bring underrepresented and underserved students to the Michigan campus.

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 67 proposals in 2015 as compared to 51 in 2014. We received 30 proposals to the MSGC Undergraduate Fellowship Program and 37 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 2015 MSGC Fellowship Program was 31 and from the MSGC Internship Program was 13 as compared to 34 Fellowships and 20 Internships in 2014. 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 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 2015, 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 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 2015, 25% of the fellowship and internship award recipients were underrepresented minority students; the amount

of underrepresented minority students that we awarded in 2014 was 30%. During funding interval 2015, 50% of the fellowship and internship award recipients were women. The amount of women awarded in 2014 was 46%.

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 2015 funding interval, we received 10 proposals from outside of the MSGC as compared to the 11 proposals we received during the 2014 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 2015 funding interval, we received 3 proposals that directly targeted underrepresented minorities and/or women, compared to the 6 proposals that we received during the 2014 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 2015 – 2016, we received proposals to the MSGC Research Seed Grant Program from 8 out of 11 affiliate universities as compared to 10 out of 11 affiliate universities in 2014. We funded proposals from 7 of these universities as compared to 8 universities in 2014.

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 2015 funding interval, we were pleased to receive 9 proposals from women as compared to 7 in 2014. Three proposals from women were funded. No underrepresented proposers were awarded this year (three were two applicants but their proposals were not of high quality).

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 2015 funding interval, we received 3 proposals from outside of the MSGC as compared to the 4 proposals we received during the 2014 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 2015 funding interval we received 6 proposals that directly targeted underrepresented minorities and/or women, compared to 10 proposals that we received for the 2014 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 2015 funding interval, we received 3 proposals from outside of the MSGC, compared to the 3 proposals that we received during the 2014 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 2015 funding interval we received 3 proposals that directly targeted underrepresented minorities and/or women, compared to 4 proposals that we received for the 2014 funding interval.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **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, an unprecedented amount of women proposed to the MSGC Research Seed Grant Program.

- ***Office of Education Annual Performance Indicators:**
  *Numbers will change as statistics come in and will be reflected on the OEPM for 2015.
  API ED-15-1: 11/21/0 (# of NIFS to underrepresented, female, and disabled students.)
  API ED-15-2: 75 (# of educators.)
  API ED-15-4: 50 (# of informal education events.)
  API ED-15-5: 1500 (# of K-12 students.)

IMPROVEMENTS MADE IN THE PAST YEAR

During the fall of 2015 we welcomed two new MSGC Executive Board members, Dr. Jason Smolinski, Calvin College, and Dr. Lorelle Meadows, Michigan Technological University.

Dr. Smolinski won an MSGC Research Seed Grant entitled, *Expanding the Search for Multiple Populations within Milky Way Globular Star Clusters*, aligned with NASA Strategic Goal 2.4: *Discover how the universe works, explore how it began and evolved, and search for Earth-like planets*. This project seeks to pursue the modern investigation of distinct stellar populations within old Milky Way star clusters as a means of understanding their formation and evolution. "The outcomes of this proposal's work will add observational constraints to stellar populations within several clusters that have not yet been well studied, while also ascertaining the extent to which the Calvin College Observatory in Rehoboth, NM can be utilized in this work," says Dr. Smolinski. "The data will be used to motivate a follow-up NSF proposal and requests for spectroscopic observations."

Robotics Day was co-hosted by the MSGC and the National Center for Manufacturing Sciences on April 9, 2015. Congresswoman Debbie Dingell (D-13) was the keynote speaker. "I think it's really important that we focus young people on the importance of math and science and engineering and that we talk about the new jobs that are being created," noted Dingell. "I want to see more young people getting excited and engaged in STEM, and wanting to be at the forefront of where we're going to go as a state and a country leading innovation and technology for the world."

The MSGC Annual Fall Conference was held on Saturday, October 31, 2015. Dr. J.P. Sheehan was the keynote speaker and is an Assistant Research Scientist in the Department of Aerospace Engineering at the University of Michigan. The presentation was entitled, *Big Propulsion for Small Satellites*. The rapid growth of small satellite launches, especially CubeSats, in recent years is a testament to their applicability to a huge variety of academic, government, and industry missions," says Sheehan. "Although many satellite technologies have been successfully scaled down to CubeSat sizes, propulsion remains a major technology gap due to difficulties in miniaturization, but providing a CubeSat with 10s, 100s, or even 1000s of m/s of delta-v would enable a huge variety of new missions for those satellites."

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: 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: 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: 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: 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: 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: Lorelle Meadows is the dean for MTU's Pavlis Honors College.

Oakland University • Public Ph.D. granting university: 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: 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: Alec Gallimore is the MSGC director, Arthur F. Thurnau Professor of Aerospace Engineering and was recently named Associate Dean for Academic Affairs (ADAA) 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: R. Darin Ellis is the Associate Dean of Academic and Student Affairs Wayne State University. He is currently on the faculty of the Industrial Engineering Department where he holds the rank of Associate Professor and teaches courses including statistics, human factors in product development, work design, and ergonomics.

Western Michigan University • Public Ph.D. granting university: 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 16, 2016,

Alec D. Gallimore, MSGC Director