

The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD – this document) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.

Maryland Space Grant Consortium
Lead Institution: Johns Hopkins University
Director: Dr. Richard Conn Henry
Telephone Number: 410-516-7350
Consortium URL: <http://md.spacegrant.org>
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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 Maryland Space Grant Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2014.

PROGRAM GOALS

Consortium Goals and SMART Objectives from your 2010 base proposal and budget (or as amended in subsequent annual report submissions)

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, and 3)

Provide concise, meaningful highlights or anecdotes (no more than three) that are directly related to work completed in 2014, highlighting student and/or project accomplishments. Specify alignment to each of the three Outcomes.

INTERNSHIPS, FELLOWSHIPS, AND SCHOLARSHIPS

GOAL I: To offer financial support to those higher education students enrolled in Maryland Institutions that wish to pursue a career in space-related STEM fields. Objective #1: The MDSG Scholarship Committee will continue to recruit qualified students for scholarships among the seven degree-granting institutions in the consortium, *viz.*, JHU, MSU, UMCP, TU, UMES, UMBC, CTU, and HCC. Objective #2: The Scholarship Committee will continue to emphasize the recruitment of students from groups

underrepresented in STEM disciplines. Objective #3: Continue to use the MDSGC Observatory, which is located on the roof of the Bloomberg Center for Physics & Astronomy on the Homewood campus of JHU, for student training and public outreach.

HIGHER EDUCATION

GOAL II: Provide Higher education students with opportunities to enhance their education in STEM areas and to promote their entry into aerospace related disciplines. Programs that provide relevant hands-on experience will be given high priority. Objective #1: Continue to support and enhance the MDSGC Balloon Payload Program (BPP) that provides students with access to near-space. Objective #2: Provide strong support to internships programs for undergraduate and graduate students on an ongoing basis, either through direct funding or through partnerships with organizations such as GSFC. Objective #3: Support a portfolio of programs that recruits students to STEM related studies and retains their interest to the point that it eventually carries over into employment in STEM careers in general, and especially careers needed by NASA and the aerospace community. Objective #4: Conduct longitudinal tracking of students who have received significant support from MDSGC, in order to determine the efficacy of our programs.

RESEARCH INFRASTRUCTURE

GOAL III: Support projects that provide opportunities for students to participate in aerospace-related research. Objective #1: Provide funding for programs that directly support students in gaining aerospace-related research experience. Objective #2: Ensure that research opportunities are made available to a diverse group of highly qualified students.

PRE-COLLEGE

GOAL IV: Support programs that provide substantive training to Maryland teachers that allow them to incorporate NASA-related content into effective teaching strategies. Objective #1: Facilitate the delivery of training that develops teachers' skills in the use of, and access to, earth and space science related data and discoveries, which will then inspire students to pursue careers in science, technology, engineering, and mathematics (STEM). Objective #2: Support programs that provide for hands-on, aerospace-related activities for middle school students and teachers.

INFORMAL SCIENCE

GOAL V: Increase the content knowledge of Maryland educators through training at informal science venues.

PROGRAM ACCOMPLISHMENTS

Refer directly to the consortium goals and SMART objectives in your 2010 base proposal when describing your accomplishments.

Outcome 1: *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals: (Discussion of achievements and progress related to your Fellowship, Scholarship, Internship, Higher Education and Research Infrastructure programs). (Employ and Educate)*

MDSGC continued three internship programs in 2014. Providing real-world, hands-on experience to students is a major goal for MDSGC.

1. Funding Maryland students for summer internships at NASA Centers. During 2014 MDSGC funded 8 interns at 3 NASA Centers.
2. MDSGC operates an internship program for the National Council of Space Grant Directors, which places interns at NASA missions that are not located at NASA Centers. In 2014 MDSGC placed one intern, supported by VASGC, at the Chandra X-Ray Center, and one intern, from North Carolina, at the OSIRIS-Rex mission in Tucson, Arizona. Both students received very positive reviews from their mentors. The student at OSIRIS-Rex produced a youtube video about the mission. An additional position at the Space Telescope Science Institute went unfilled.
3. MDSGC conducts an annual exchange of aerospace engineering students among three affiliates. The University of MD College Park and Eastern Shore campuses, along with Morgan State University, each sent a student to both of the other schools to serve a research internship with a mentor at that school. At the end of the summer the students presented their work at the Summer Research Symposium held at Morgan State University.

MDSGC provides scholarships to students attending affiliate institutions. The students must meet GPA standards and major in a subject that is applicable to aerospace. The Scholarship Committee has one or more representatives from each school, and they serve to recruit and review applicants, and to monitor and report on their progress. The students participate in an annual meeting at an affiliate or partner's site, where they can network with each other, learn more about aerospace work in Maryland, and hear about other NASA opportunities and how to apply for them.

An observatory with a 0.5 m telescope was donated to MDSGC many years ago. It is housed on the roof of the Physics & Astronomy building on the Johns Hopkins campus. MDSGC supports a graduate student to serve as the Observatory Technician. In this role s/he takes care of the instrument, trains students in its use, and conducts regular public nights, including those in collaboration with MDSGC affiliate, the Space Telescope Science Institute. During the past year 25 students were trained to use the telescope. When their training is complete, the students use the telescope for their own projects.

Two Research Infrastructure projects were supported this year, both at the University of Maryland Eastern Shore. Both were extensions of previously awarded projects and were funded as a result of the competitive review process by the Program Committee. In one project students apply remote sensing techniques to conduct precision agriculture research. The second project supported a master's degree project to develop software for using water quality models of the Chesapeake Bay.

Outcome 2: *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty:* (Discussion of achievements primarily focused on your Higher Education programs not discussed in

Outcome 1 and your Precollege programs). (*Educate and Engage*)

The Balloon Payload Program is a core program of MDSGC. Students design and build payloads that are launched to near space on weather balloons. Currently three affiliates (UMCP, CTU, and MSU) are heavily involved, and the program is integrated into their engineering curriculum. During 2014 there were three launches, and two more are expected before the end of the grant period. The program also supports students who compete for berths on the NASA HASP balloon program.

The other Higher Education projects were supported as the result of successful proposals submitted to the competitive process conducted by the Program Committee. This year MDSGC funded:

1. A tethered balloon mapping program at Towson University that developed a package for use by schools.
2. A Rocksats X project to develop a payload for a sounding rocket, conducted by students at JHU.
3. A Rocksats C project to develop a payload for a sounding rocket launch, conducted by CTU.

MDSGC conducted three projects that were targeted towards middle school students and teachers.

1. Partial support for Maryland MESA to conduct a summer program in space science for students from underrepresented minorities. The project is coordinating with GSFC content.
2. Two programs for the Student Space Experiments Program, where student teams develop experiment concepts for the International Space Station. The teams participate in a realistic competition for the berth, and the winning team has its experiment flown on the Space Station. It is important to note that a given county school system is required to involve over 200 students and their teachers for this program. This year flight teams were supported from Montgomery and Prince Georges County. The PG County effort is being coordinated through the PG County School System's Owens Science Center, with active support from GSFC. Unlike most Space Grants that are involved in this program, MDSGC has focused exclusively on middle school students.

Outcome 3: *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission:* (Achievements and progress of Informal Education programs). (*Engage and Inspire*)

Goal V of the MDSGC strategic plan is specifically aimed at partnerships with informal science organizations. It was expected that one fund-worthy proposal might be received during 2014, but none were, so this goal was not fully met. This process is continuing. The Assistant Director is Vice Chair of the Scientific Council of the Maryland Science Center, the premiere informal science venue in the state, and has been working closely

with the staff and Director of MSC to provide mutual support and information flow on the Center and Consortium's programs and events.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Diversity:** *of institutions, faculty, and student participants (gender, underrepresented, underserved)*

MDSGC has 12 affiliate members, two of which are minority serving institutions. In addition, three of the others, UMCP, UMBC, and Capitol Technology University have substantial numbers of students who are from underrepresented groups. MDSGC has one community college and one military academy among its affiliates, as well as two of the nation's best known space science facilities (STScI and APL). Finally, the National Center for Earth and Space Science Education is a member. The university members range from very large (UMCP) to fairly small institutions such as CTU.

The MDSGC has four people who work regularly on the staff (mostly part time). Of these four, two are female and one is Native American.

There have been 51 students directly funded so far in this funding cycle. 39% were from racial or ethnic minorities and 27% were female. All told, 61% of the participants were from underrepresented groups.

Minority-Serving Institution Collaborations: *Summarize interactions with MSIs within the consortium, and describe projects/activities.*

Two of the nine institutions of higher learning that are affiliates of MDSGC, Morgan State University (MSU) and University of Maryland Eastern Shore (UMES), are HBCUs. As any affiliate, they are expected to, and do, participate actively in MDSGC activities and programs. They each provide a representative to the Program Committee, which advises on policy and program direction, reviews proposals for funding, develops new proposals for funding, and interacts with other institutions to broaden the MDSGC network. UMES has received numerous Research Infrastructure grants from MDSGC and serves our "anchor" for activities on the Maryland Eastern Shore (where they work regularly with Wallops Flight Facility). UMES has been very active in presenting these results at national conferences and increasing the exposure of Space Grant to a broader audience. MSU is one of the main participants in our Balloon Payload Program, where it is a regular part of their engineering curriculum. MSU also has ongoing research projects funded by MDSGC, where MSU students work with engineers at GSFC on systems engineering projects. In addition, both schools have representatives on the Scholarship Committee who recruit, select, and monitor students at their respective institutions. Each also provides a member of the Oversight Committee, which advises MDSGC about its overall performance and strategy. Both MSU and UMES participate in our Summer Exchange Program, where (typically two) students from each campus are sent to one of the other campuses for a summer internship in a NASA-related research project. The third participant in the exchange is University of Maryland College Park, which sends one student each to UMES and MSU. Each year, there is a research seminar

where these students present their work. Note that both universities were partners in the successful MERIT proposal to the Space Grant Innovative Pilot in STEM Education CAN, with MSU being the lead institution.

- **NASA Education Priorities:** *Accomplishments related to the “Current Areas of Emphasis” stated in the 2010 Space Grant solicitation. Report on areas that apply to work proposed in your proposal and budget.*

- Authentic, hands-on student experiences in science and engineering disciplines – the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA-related, STEM-focused questions and issues; the incorporation of real-life problem-solving and needs as the context for activities.

All of our internships, higher education and research infrastructure programs strongly fit this criterion. It is a fundamental deciding factor in grant funding decisions.

- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines (see above).

MDSGC has focused its Space Science Experiment Program support to school districts, explicitly targeted at middle school participation.

- Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.

The new bridge program with Hagerstown Community College is described above.

- Aeronautics research – research in traditional aeronautics disciplines; research in areas that are appropriate to NASA's unique capabilities; directly address the fundamental research needs of the Next Generation Air Transportation System (NextGen).

MDSGC has not typically received many proposals for support in aeronautical research. Note that the first student participating in the community college bridge program is interested in aeronautics, and this is the area in which his internship should be conducted.

- Environmental Science and Global Climate Change – research and activities to better understand Earth's environments.

MDSGC support of environmental science this past year was largely done through a successful proposal for the development of robotic boat platforms that collect water quality data in the Assateague Bay region.

IMPROVEMENTS MADE IN THE PAST YEAR

Succinctly describe improvements and/or adjustments made last year that demonstrate significant change(s) within the consortium. The improvements and/or adjustments that

brought about change may have been in management, resource allocation, project design, project evaluation, etc.

A new bridge program for students at Hagerstown Community College has begun. In this program, students who intend to pursue a four year degree in an aerospace-related major after completing their first two years at HCC and who have some idea where they would like to complete this degree are selected for an internship in the department of their intended major, at the target school. This occurs during the summer. The first pilot program has a student conducting aeronautical research at UMCP for this coming summer.

The Student Summer Exchange Program benefitted from a new approach to student presentations of their research. MDSGC partnered with its affiliate, Morgan State University, to join the effort of the Exchange Program interns to that of the much larger group of student interns in engineering for the summer at Morgan. This provided a broader exposure to many types of engineering research for the MDSGC students and a much wider networking opportunity. One of the MDSGC students was awarded first prize for the best paper presented at the symposium.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

List the institutions that comprise the consortium; include the name, type of institution, key characteristics, and role in consortium activities/operations.

The **Johns Hopkins University** is the Lead Institution for MDSGC. The MDSGC offices are located on the Homewood Campus. The Director and Assistant Director work at this location. JHU is one of the premiere research institutions in the country. JHU receives scholarship funds from MDSGC and contributes a representative to the Scholarship Committee, as well as two members of the Oversight Committee (one from Arts & Sciences and one from Engineering).

Capitol Technology University is a four-year institution with both undergraduate and graduate programs. They have well-known specialties in spacecraft operations, robotics, and cyber security. CTU provides active members in the Program Committee and Oversight Committee. CTU receives scholarship funds and contributes a member to the Scholarship Committee. CTU is an active participant in the Balloon Payload Program. It is also one of the participants in the MERIT Program.

Hagerstown Community College is a two-year community college located in the Western Maryland Panhandle. It has representatives that actively participate in the Program Committee and the Oversight Committee. Scholarship funds for HCC are spent on a bridge program that takes HCC students and places them in internships at four-year colleges that are affiliates of MDSGC. HCC hosts a Girls in Engineering Program during the summer.

Johns Hopkins University **Applied Physics Laboratory** is a research institution affiliated with JHU. Major NASA missions such as MESSENGER and New Horizons have been developed and built at this facility. APL contributes active members to the Program Committee and Oversight Committees.

Morgan State University is a charter member of MDSGC and therefore one of the oldest affiliates of Space Grant. It is an HBCU. It is an active participant in MDSGC programs and contributes members to the Oversight, Program and Scholarship

Committees. It is one of the participants in the Balloon Payload Program and the Principal Investigator for the MERIT program is at Morgan. Morgan State is also one of the participants in the Summer Student Exchange Program

National Center for Earth & Space Science Education is a national institution that has its headquarters in Maryland. Its purpose is to promote hands-on, real world experience for students and teachers that engage them in earth and space science. NCESSSE provides a member for the Oversight and Program Committee. Through its many partnerships NCESSSE has provided the access for many students, including Maryland students supported by MDSGC, to send experiments to the International Space Station.

Space Telescope Science Institute is a research institute that conducts the science operations for the Hubble Space Telescope and the James Webb Space Telescope. They conduct one of NASA's premiere education and public outreach programs. STScI is very active in all MDSGC programs and has representatives on the Program and Oversight Committees.

Towson University is a four-year educational institution for both undergraduate and graduate students. The Program Committee representative from Towson is also the leader of the MarylandView portion of AmericaView, a key project for using satellite remote sensing data for practical applications. Towson is also the home of the Maryland Project Astro, which was started with seed money from MDSGC.

United States Naval Academy is the military academy for the United States Navy. It provides undergraduate training in STEM fields to its students. The Academy has a representative on the Program and Oversight Committees. It does not receive scholarship funds, as they are not needed at that institution.

University of Maryland Baltimore County is a four-year university with both undergraduate and graduate degree programs. It receives scholarship funds and has a representative on the Scholarship Committee. In addition, it has people who serve on the Program Committee and Oversight Committees. UMBC is a part of the MERIT Program.

University of Maryland College Park is the flagship of the University of Maryland system. It is a four-year university with both undergraduate and graduate degree programs. It provides representatives to the Program and Oversight Committee. Due to the large size of UMCP it has a more extensive participation in the Scholarship Committee, with a member or two from the College of Arts and Sciences, and two members from the Center for Minorities in Science and Education. UMCP participates in the Summer Student Exchange Program, the MERIT Program, and is the lead in the Balloon Payload Program.

University of Maryland Eastern Shore is a four-year university with undergraduate and graduate degree programs. It is an HBCU. UMES contributes members to the Oversight, Program and Scholarship Committees. UMES is a participant in the Summer Student Exchange Program. It is a part of the MERIT program. UMES has conducted programs that support remote sensing in support of precision agriculture and robotic water quality data collection.