THE NATIONAL SPACE GRANT COLLEGE & FELLOWSHIP PROGRAM

FISCAL YEAR 2020
ANNUAL PERFORMANCE REPORT (APR)

FUNDING SOURCE:
OFFICE OF STEM ENGAGEMENT
SPACE GRANT

MANAGING ORGANIZATION:
NASA HEADQUARTERS OFFICE OF STEM ENGAGEMENT

PROJECT MANAGER:
DR. RAJIV DORESWARMY
RAJIV.DORESWAMY@NASA.GOV

DEPUTY PROJECT MANAGER:
DR. ERICA J. ALSTON
ERICA.J.ALSTON@NASA.GOV

MARYLAND SPACE GRANT CONSORTIUM
LEAD INSTITUTION:
JOHNS HOPKINS UNIVERSITY

MARYLAND SPACE GRANT DIRECTOR:
RICHARD CONN HENRY
HENRY@JHU.EDU

COOPERATIVE AGREEMENT/GRANT NUMBER:
80NSSC20M0049

ACTIVITY DESCRIPTION: (100 – 250 words)

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 internship 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 Mission Directorates and each state's interests. Although it is primarily a higher education program, Space Grant encompasses the entire length of the education pipeline, including elementary/secondary and informal education. Maryland Space Grant Consortium (MDSGC) was one of the first seventeen Space Grants selected by NASA in 1989 and was funded at a level of $760,000 for fiscal year 2020.

ACTIVITY GOALS: (Bulleted list)
State the Consortium Goals and Objectives from your base proposal and augmentation proposal. The objectives should express quantitative targets when appropriate.

- **GOAL 1:** To offer financial support to higher education students enrolled in Maryland institutions who wish to pursue a career in science, technology, engineering, or math, or another space-related field.
    - **Objective 1.1**: Continue scholarship program at 8 campuses, recruit new students to sustain cohort.
        - **Metric 1.1.1:** The number of institutions at which students are receiving scholarship support. Target: 8.
        - **Metric 1.1.2:** The number of new scholarship awards. Target: 10-15.
        - **Metric 1.1.3:** The number of continuing scholarship awards. Target: 55-60.
        - **Metric 1.1.4:** The fraction of awards to students who are members of under-represented minorities exceeds the fraction of students enrolled in higher education programs in Maryland who are members of under-represented minorities, from the most recent National Center for Education Statistics report. Target: 43.3%.
        - **Metric 1.1.5:** Acquire input data for longitudinal tracking for directly funded students. Target: 100%.
    - **Objective 1.2**: Organize NASA event for scholarship recipients.
        - **Metric 1.2.1:** The number of events. Target: 1.
    - **Objective 1.3**: Continue the MDSGC Observatory Fellowship.
        - **Metric 1.3.1:** The number of awardees. Target: 1.
- **GOAL 2:** Provide significant, hands-on, real world experiences for student population described in Goal 1.
    - **Objective 2.1**: Sustain Summer Exchange internship program at 5 campuses.
        - **Metric 2.1.1:** Number of mentors and campuses participating. Targets: 10 and 5, respectively.
        - **Metric 2.1.2:** Number of interns supported. Target: 10.

- **Objective 2.2**: Sustain Community College Bridge internship program.
  - **Metric 2.2.1:** Number of interns supported. Target: 1-2.
- **Objective 2.3**: Continue support for summer NASA interns.
  - **Metric 2.3.1:** Number of interns supported. Target: 4-5.
- **Objective 2.4**: Ensure internships meet mentor and student goals.
  - **Metric 2.4.1:** Cumulative response rate for mentor evaluations and student feedback. Target: 75% or higher.
- **Objective 2.5**: Organize yearly MDSGC symposium.
  - **Metric 2.5.1:** Percentage of local interns and research students participating. Target: 90% or higher.
- **Objective 2.6**: Send students to RockOn workshop.
  - **Metric 2.6.1:** The number of student participants. Target: 6.

- **GOAL 3:** Fund programs that provide aerospace-related research and/or hands-on learning experiences for students.
  - **Objective 3.1**: Sustain Balloon Payload Program, recruit new students, make launch opportunities available consortium wide.
    - **Metric 3.1.1:** The number of new students involved. Target: 20 or more.
    - **Metric 3.1.2:** The number of successful launches/recoveries. Target: 4-6.
    - **Metric 3.1.3:** The number of payloads not from CTU or UMCP. Target: at least 1.
  - **Objective 3.2**: Train students to use the MDSGC Observatory.
    - **Metric 3.2.1:** The number of students trained. Target: 15 or more.
  - **Objective 3.3**: Conduct annual competition for summer student research proposals.
    - **Metric 3.3.1:** The number of proposals awarded. Target: 2 or more.
  - **Objective 3.4**: Conduct annual competitive proposal process for new and continuing projects.
    - **Metric 3.4.1:** The number of proposals awarded. Target: 10 or more.

ACTIVITY CONTRIBUTIONS TO PERFORMANCE GOALS (PG) AND SUCCESS CRITERIA

List appropriate FY 2020 PGs and Success Criteria and write a brief description of the project activity's contribution to each.

PG 3.3.3: Provide opportunities for students to engage with NASA's aeronautics, space, and science people, content, and facilities in support of a diverse future NASA and aerospace industry workforce.

PG 3.3.3 Success Criteria: Meet or exceed the national average in two of the four categories of student diversity for NASA STEM enrollees in internships, fellowships, or other student engagement opportunities. Diversity Categories: (1) students across all institutional categories and levels (as defined by the U.S. Department of Education), (2) racially or ethnically underrepresented students (Hispanics and Latinos, African Americans, American Indians, Alaska Native, Native Hawaiians and Pacific Islanders), (3) women, and (4) persons with

disabilities at percentages that meet or exceed national averages for science and engineering enrollees, as determined by the most recent, publicly available data from the U.S. Department of Education's National Center for Education Statistics.

Response to PG 3.3.3 and/or PG 3.3.3 Success Criteria goes here:

MDSGC has always focused on recruiting a diverse pool of candidates for our scholarships and research internships, leveraging our partnerships with our two HBCU affiliates as well as minority-serving initiatives such as the Center for Minorities in Science and Engineering at UMD. We focus particularly on making our opportunities visible and attractive to students who are members of minorities under-represented in STEM and women. Within the FY2020 reporting period to date, of the students supported through our NIF awards, comprising internships, fellowships, and scholarships, 55.8% are members of URM groups (category 2) and 53.8% are women (category 3), both of which exceed the national averages for science and engineering enrollees in those categories.

PG 3.3.4: Enhance the effectiveness of education investments using performance assessment and evaluation-driven processes.

PG 3.3.4 Success Criteria: Discuss how the Consortium has or plans to implement evaluation-driven processes to assess the overall impact of the Consortium and its activities.

Response to PG 3.3.4 and/or PG 3.3.4 Success Criteria goes here:

Within the MDSGC internship programs and PI-led student research projects, we seek to ensure the best possible learning experiences for our students and the highest levels of engagement with NASA. In recent years, in response to student and mentor feedback as well as in adherence to best practices, we have organized a yearly summer research symposium to give our interns and other student researchers the opportunity to present their work in a professional setting, as well as to nurture our consortium's overall sense of community. We have also regularly solicited student and mentor feedback during and at the end of summer internships and have used the responses to formulate guidance to both mentors and students about how to make internships successful. We consider this an ongoing evaluation-driven cycle that serves to maintain and continuously improve the quality of student internships and research projects.

PG 3.3.5: Provide opportunities for students to contribute to NASA's aeronautics, space, and science missions and work in exploration and discovery.

PG 3.3.3 Success Criteria: Number of paper presentations and peer-reviewed research publications (and beginning in FY2021 to include student proposed solutions and products) resulting from STEM engagement investments. (Target number is 1,300)

Response to PG 3.3.5 and/or PG 3.3.5 Success Criteria goes here:

MDSGC places emphasis on support for undergraduate research, as well as supporting graduate researchers via fellowships. During the FY2020 reporting period to date, our students have been primary authors or co-authors on seven refereed publications (see references) and two additional paper presentations for a total numerical contribution of **nine** tangible research products toward this metric. (The number of paper presentations was suppressed during this period because of the reduction in conference participation attributable to the Covid-19 pandemic.)

NOTE: For the following categories, complete if applicable to your base award. If not applicable, indicate "Not Applicable".

BASE AWARD ACCOMPLISHMENTS: ***(250 – 500 words)***

The MDSGC scholarship program has continued during the FY2020 period, providing a total of 70 awards (17 new, 53 continuing – a small deviation from projections in favor of new awardees) across 8 campuses, with 59.5% of awards to students who are members of URM groups, and 100% of students input into longitudinal tracking; thus metrics 1.1.1—1.1.5 have been fulfilled. We plan a NASA engagement opportunity for our awardees in the March 2021 timeframe, satisfying metric 1.2.1. Two students have been supported on Observatory Fellowships, exceeded the target for metric 1.3.1. Our summer internship programs also successfully continued, albeit in virtual mode: The Summer Exchange supported 11 students working with 12 mentors across 6 campuses, and the Bridge program supported one student, satisfying metrics 2.1.1, 2.1.2, and 2.2.1. Because of Covid-19 only three NASA interns were supported, falling shy of metric 2.3.1. We successfully held our symposium virtually and attained 100% participation by supported students, fulfilling metric 2.5.1. Over 75% of internships resulted in at least one evaluation response, fulfilling metric 2.4.1.

Because of the Covid-19 pandemic, we were unable to send students to RockOn and were also unable to hold the usual fall workshop to recruit new students for our Balloon Payload Program (BPP), so neither metric 2.6.1 nor 3.1.1 was met this year. However, the BPP has continued to operate and carry out launches with skeleton crews, meeting metric 3.1.2. Several payloads are awaiting the next opportunity to launch, anticipated in mid-spring, meeting metric 3.1.3. Covid-19 has also forced us to halt events at the MDSGC Observatory, so no students have been trained during the FY2020 period. This has resulted in a large backlog of demand that we will begin to meet as soon as conditions permit a resumption of normal operations. Our competitive projects have seen increased demand during this period and have provided vital flexibility in adjusting operations to the realities of the pandemic, with three successful summer student research proposals (exceeded metric 3.3.1) and a total of over a dozen proposals awarded through our annual competitive process (satisfying metric 3.4.1).

NCAS AND SPACE GRANT PILOT ACCOMPLISHMENTS (If applicable): ***(250 – 500 words)***

Not applicable.

BIG Idea FY2020 ACCOMPLISHMENTS (If applicable): ***(250 – 500 words)***

Not applicable.

FIRST NATIONS LAUNCH (If applicable): ***(250 – 500 words)***

Not applicable.

ACTIVITY IMPROVEMENTS MADE IN THE PAST YEAR:
(*e.g. activity management, cost efficiencies) (100 – 250 words)*

The restrictions imposed by the Covid-19 pandemic during the FY2020 reporting period have resulted in large changes to our operations, by driving many formerly in-person activities and meetings into

virtual mode. Video conference software has finally come into its own as we have all been compelled to log many hours learning its ins and outs. For our organizational meeting such as those of the MDSGC Program Committee, the reduction in overhead and travel time has resulted in higher attendance and more efficient meetings, and we anticipate continuing to operate these meetings mainly as video conferences in the future. For internships and our summer symposium, the forced transition to virtual mode has proved, at least, the possibility of shifting some fraction of future activities online, where travel or logistics are otherwise prohibitive.

ACTIVITY PARTNERS AND ROLE OF AFFILIATES IN ACTIVITY EXECUTION:
Bulleted list or table. Should include a brief description of how affiliates were involved in the project activity.

- The **Johns Hopkins University** (JHU), one of the foremost research universities in the country, has served as MDSGC's lead institution since the establishment of the national Space Grant program. MDSGC staff offices are located on the JHU Homewood Campus, as is the MDSGC Observatory. The Director and Deputy Director represent JHU on the Program Committee. A financial aid officer serves JHU on the Scholarship Committee, which is led by the MDSGC staff.

- **Capitol Technology University** (CTU) is a four-year institution with undergraduate and graduate programs, with specialties in spacecraft operations, robotics, and cyber security. CTU provides an active member on the Program Committee. CTU receives scholarship funds and contributes a member to the Scholarship Committee. CTU is an active participant in the Balloon Payload Program and MDSGC internship programs.

- **Hagerstown Community College** (HCC) is a two-year community college located in Western Maryland. It has representatives on both MDSGC committees. MDSGC scholarship funds for HCC are largely spent on a bridge program that places HCC students in internships at four-year colleges that are affiliates of MDSGC.

- **Johns Hopkins University Applied Physics Laboratory** (APL) is a research institution affiliated with JHU. Major NASA missions such as New Horizons and the Parker Solar Probe have been developed and built at APL. APL regularly hosts MDSGC events, contributes a member to the Program Committee, and runs the Maryland Math Engineering Science Achievement (MESA) program.

- **Morgan State University** (MSU) is a founding member of MDSGC and therefore one of the longest-standing affiliates of Space Grant. It is an HBCU. It is an active participant in MDSGC programs, receives MDSGC scholarship funds, and contributes members to all MDSGC committees. Morgan State is one of the participants in the Summer Exchange Program and has frequently partnered with MDSGC for student summer engineering symposia. MDSGC participates in the Baltimore MUREP Aerospace Academy (BMAA) STEM Extravaganza that is hosted each year at Morgan State and draws several hundred local students and their families to participate in hands-on STEM activities.

- **National Center for Earth & Space Science Education** (NCESSE) is a national institution that has its headquarters in Maryland. Its purpose is to promote hands-on, real world experiences for students and teachers that engage them in earth and space science. NCESSE provides a member on the Program Committee. Through its partnerships NCESSE 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** (STScI) is a research institute that conducts the science operations for the Hubble and Webb space telescopes. STScI has a representative on the Program Committee and is a frequent partner in MDSGC outreach activities. In the past STScI has hosted interns for the Science Mission Directorate-Space Grant internship program.

- **Towson University** (TU) is a four-year educational institution for both undergraduate and graduate students. It receives MDSGC scholarship funds and has representatives on all MDSGC committees. The Program Committee representative from Towson was also a leader in the Maryland site for Project Astro, which was started with seed money from MDSGC. Recently TU has become more involved with MDSGC-supported summer internships.

- **United States Naval Academy** (USNA) 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 Committee. It does not receive scholarship funds, as they are not needed or accepted at that institution. MDSGC has supported summer internships and middle-school and high-school outreach events in recent years at the USNA STEM Center.

- **University of Maryland Baltimore County** (UMBC) is a four-year university with both undergraduate and graduate degree programs. It receives MDSGC scholarship funds and has a representative on all MDSGC committees. UMBC is a member of the expanded Summer Exchange.

- **University of Maryland College Park** (UMCP) is the flagship of the University of Maryland system. It is a four-year university with both undergraduate and graduate degree programs. It provides a representative to the Program 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 Engineering. UMCP leads the Balloon Payload Program and participates in the Summer Exchange.

- **University of Maryland Eastern Shore** (UMES) is a four-year university with undergraduate and graduate degree programs. It is an HBCU. UMES receives MDSGC scholarship funds and contributes members to all MDSGC committees. UMES is a participant in the Summer Exchange. MDSGC has recently funded programs at UMES that focus on student retention and technical proficiency, as well as research and training programs built around robotics and remote sensing in support of "smart" agriculture and environmental monitoring.

CURRENT AND PROJECTED CHALLENGES:

Identify any current or projected challenges in the implementation or execution of activities. Explain how the management team is working to address the challenges identified and/or how National Program Staff can assist.

During the FY2020 period, our usual mundane challenges have all been dramatically eclipsed by the Covid-19 pandemic. The pandemic has forced traditional in-person educational, outreach, and research activities to be reimagined for remote modalities, abide by unpredictable stop-and-start orders, adapt to new and changing restrictions to on-campus presence and group gatherings, and in many cases to be

paused or postponed until conditions improve, if not simply be cancelled outright. To say the least, it has been a difficult year. We have adapted to the best of our ability by shifting in-person activities into virtual spaces, often requiring significant changes to the nature and goals of the activities, as for instance in the case of internships. In some activities, such as our summer symposium, this has resulted in cost savings and possibly greater efficiency, albeit at some cost to the quality and value of the experience for students. However, many of our other ongoing efforts that truly require hands-on, in-person involvement are essentially in survival mode, trying to persevere long enough to pick up where they left off when we ultimately emerge out of the restrictions imposed by the pandemic. We are grateful for the flexibility afforded by the previously issued government Covid-19 guidance and hope for additional flexibility in permitting re-budgeting, re-scheduling, re-scoping, and if necessary, reductions in performance targets.

REFERENCES (optional – include only if needed):
(APA style reference list)

Hamer, J. H. & Schlaufman, K. C. (2020) Ultra-short-period Planets are Stable Against Tidal Inspiral. *The Astronomical Journal*, *Vol. 160(3)*, p. 138. https://doi.org/10.3847/1538-3881/aba74f

Hwang, H.-C., Hamer, J. H., Zakamska, N. L., Schlaufman, K. C. (2020) Very wide companion fraction from Gaia DR2: A weak or no enhancement for hot Jupiter hosts, and a strong enhancement for contact binaries. *Monthly Notices of the Royal Astronomical Society, Vol. 497(2)*, pp. 2250-2259. https://doi.org/10.1093/mnras/staa2124

Junghenn Noyes, K. T., et al. (2020) Wildfire Smoke Particle Properties and Evolution, From Space-Based Multi-Angle Imaging II: The Williams Flats Fire during the FIREX-AQ Campaign. *Remote Sensing, Vol. 12(22)*, p. 3823. https://doi.org/10.3390/rs12223823

Overduin, J. M., Glazer, K., McClelland, K., Genus, A., & Miskiewicz, C. (2020), Solar eclipses as a teaching tool in introductory phyics. *The Physics Educator 2*, 2050010. https://doi.org/10.1142/S2661339520500109

Overduin, J. M., Pettaway, T., Clark, H., & Edmonston, M. (2020) Rolling railgun: a lab activity for introductory electromagnetism. *The Physics Educator 4*, 2050017. https://doi.org/10.1142/S2661339520500171

Overduin, J. M., Ali, H., & Walz, F. (2021) Constraints on Kaluza-Klein Gravity within the Framework of the Standard-Model Extension. *Galaxies*, in press.

Overduin, J. M., Perry, J., & Weinreb, A. (2021) New vacuum solutions of Einstein's field equations in five dimensions. *Universe*, in press.