

**THE DRAGONFLY STUDENT AND EARLY CAREER INVESTIGATOR PROGRAM: BROADENING PARTICIPATION ON PLANETARY MISSION TEAMS.** Lynnae C. Quick<sup>1</sup>, Scott L. Murchie<sup>2</sup>, Elizabeth P. Turtle<sup>2</sup>, Shannon M. MacKenzie<sup>2</sup>, Richard Miller<sup>2</sup>, Jorge I. Núñez<sup>2</sup>, Mark P. Panning<sup>3</sup>, Melissa G. Trainer<sup>1</sup>, Jason W. Barnes<sup>4</sup>, Andrea Bryant<sup>5</sup>, Karla Negrete<sup>6</sup>, Brianna Wylie<sup>7</sup> and the Dragonfly Team, <sup>1</sup>NASA Goddard Space Flight Center, Greenbelt, MD 20771, Lynnae.C.Quick@nasa.gov, <sup>2</sup>Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723, <sup>3</sup>Jet Propulsion Laboratory, Pasadena, CA 91109, <sup>4</sup>University of Idaho, Moscow, ID 83844, <sup>5</sup>University of Chicago, Chicago, IL 60637, <sup>6</sup>University of Maryland Baltimore County, Baltimore, MD 21250, <sup>7</sup>Florida Agricultural and Mechanical University, Tallahassee, FL 32307.

**Introduction:** Past studies have shown that the scientific output of a mission may be substantially enhanced by increasing participation in mission science activities [1]. The purpose of the *Dragonfly* Mission's Student and Early Career Investigator Program is to formally extend opportunities for students and postdocs to participate in Dragonfly science activities and investigation development. Building continuity on mission science teams, while ensuring that the next generation of researchers is being mentored and trained, is particularly important for the long-duration missions to the outer solar system [2]. Accordingly, the program's overarching goals are to:

- encourage broader participation on planetary mission teams by making it easier for students and postdocs who do not have a connection to *Dragonfly* or other NASA missions to gain mission experience
- serve as an "on-ramp" to provide networking opportunities for early career researchers
- expand training of the next generation of mission team members and leaders

**Program Scope:** The initial phase of the *Dragonfly* Student and Early Career Investigator Program is administered through the Johns Hopkins University Applied Physics Laboratory's (APL) internship office and is currently open to graduate students from U.S. institutions. Annual calls for the Student and Early Career Investigator Program from Phases B through E will ensure that early career scientists play a role in investigation and science analysis in support of mission and instrument development (Phases B-D) and during Titan approach and surface operations (Phase E). Accordingly, student and early career involvement will proceed as follows:

*Phase B-D Investigation Development:* Annual calls will result in three (3) participants being selected each year through 2027. Each participant will be mentored by one or more *Dragonfly* team member(s) at their respective home institutions and will serve a 2-year term, with the potential to continue their work on the mission once their official tenure is complete. Over ~7

years of Phase B through launch, this portion of the program would make it possible for 21 students or postdocs to participate in mission development activities over the project life cycle.

*Phase E Approach and Operations:* Annual calls will result in ten (10) participants being selected each year from 2035 through 2038. Each participant will be mentored by one or more *Dragonfly* team member(s) at their respective home institutions and will serve a 2-year term, with the potential for continuation. Over ~4 years of Phase E, this portion of the program would make it possible for 40 students or postdocs to participate in science and mission activities at Titan's surface.

*Program Support:* Participants receive 0.3 FTE/year (~3.6 months/year) of support for their participation in *Dragonfly* activities over the duration of their terms. Additionally, participants receive annual funding for: (1) travel to *Dragonfly* Science Team Meetings (2) travel to present the results of their work at technical conferences (3) publication costs.

**Broadening Participation on Planetary Mission Teams:** Applications are widely solicited to facilitate participation of groups that have been historically underrepresented in planetary science and on planetary mission teams, and to encourage participation of students from a broad range of STEM disciplines and universities. As the path to planetary science and planetary mission work may be unclear for students who are pursuing STEM degrees at colleges and universities where there is no planetary science, geology or astronomy department, the calls for applications are widely disseminated to ensure that students who attend universities without large planetary science or related programs are well-represented in our applicant pool. In addition to advertising program calls on the *Dragonfly* mission website and at planetary meetings such as DPS and LPSC, calls are also advertised at technical conferences that serve STEM students and professionals from backgrounds that have been historically underrepresented in planetary science and on planetary mission teams, such as the annual meetings of the National Society of Black Physicists (NSBP) [3] and the Society for Advancement of Chicanos/Hispanics and

Native Americans in Science (SACNAS) [4]. In the future, we intend to advertise at additional conferences, including, but not limited to, Women In Planetary Science and Exploration (WPSE), and the American Indian Science and Engineering Society (AISES) conferences. Moreover, we are careful to advertise program calls on social media via groups that cater to scientists and engineers from underrepresented groups.

In an effort to further broaden our applicant pool, each *Dragonfly* mentor crafts projects that can be successfully completed by STEM students that are new to the field of planetary science and on which students could make effective progress in Year 1 while being virtually mentored from their home or home institution. Accordingly, we carefully tailor the language in the respective project descriptions to attract students from a wide range of disciplines. The 2020 Cohort was selected based on evidence of: (1) academic success and (2) successful completion of past research, including but not limited to internships, senior capstone projects, relevant employment, and/or departmental research with a current or former faculty advisor. Special care was taken not to disqualify students who may not have had these opportunities.

**Cohort #1:** Details pertaining to our initial Cohort of *Dragonfly* Student Investigators and their projects are presented in Table 1. These high-achieving students represent a broad range of universities, including a large private university and two medium-sized institutions, one of which is an HBCU. Additionally, the projects that these students have undertaken during their tenure represent the broad range of science, engineering, and instrument development opportunities that early career members of our community may participate in through this program. The *Dragonfly* team is currently accepting applications for our second cohort of student investigators:

<https://dragonfly.jhuapl.edu/Student-Opportunities/>

We anticipate that this program will open to postdoctoral fellows in the future.

**References:** [1] Prockter, L. M., et al. (2017) *National Academy of Sciences*, [https://www.lpi.usra.edu/analysis/reports/Value\\_of\\_Participating\\_Scientist\\_Programs\\_to\\_NASA\\_white\\_paper\\_final.pdf](https://www.lpi.usra.edu/analysis/reports/Value_of_Participating_Scientist_Programs_to_NASA_white_paper_final.pdf). [2] Quick, L. C. et al. (2020) *DPS*, 502.10.[3] Quick, L. C. , et al. (2020) *NSBP*, EPSS1.C.4. [4] Núñez, J. I., et al. (2020) *SACNAS*.

**Table 1.** Cohort 1 of the *Dragonfly* Student and Early Career Investigator Program.

Project	Dragonfly Team Mentor(s)	Student Investigator
Spectral/compositional library for interpretation of DragonCam/DraGNS measurements	Shannon MacKenzie and Richard Miller, APL	Karla Negrete Ph.D. Student Mechanical Engineering University of Maryland Baltimore County (UMBC)
Development of the DragonCam microscopic imager multispectral LED arrays	Jorge Núñez, APL	Brianna Wylie Ph.D. Student Mechanical Engineering Florida Agricultural and Mechanical University (FAMU)
Seismic investigation of Titan's interior using full waveform modeling	Mark Panning, JPL	Andrea Bryant Ph.D. Student Physics University of Chicago