

HERE TO OBSERVE (H2O): OPENING DOORS TO NASA PLANETARY SCIENCE DIVISION (PSD) MISSIONS & MENTORS FOR UNDERGRADUATES FROM UNDERREPRESENTED INSTITUTIONS.

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Motivation & History: NASA is fully committed to Diversity, Equity, Inclusion, and Accessibility (DEIA) for our workforce [1]. Underrepresentation in planetary science is a known issue, with low proportions for many groups compared to the racial and ethnic makeup of the U.S., including Hispanic or Latinx (5%), American Indian or Alaska Native (1%), Black or African American (1%), and Native Hawaiian or Other Pacific Islander (<1%) [2].

In 2021, PSD established a pilot program *Here to Observe (H2O)* for undergraduate students from Minority Serving Institutions (MSIs) to observe NASA mission team meetings and be inspired by planetary exploration. Through opening doors to NASA PSD missions with H2O, our goal is to spark and maintain an interest for underrepresented students considering STEM careers.



Approach: PSD initiated partnerships with 6 faculty advisors and 22 undergraduate students from Howard University (HU), Virginia State University (VSU), and the University of Puerto Rico (UPR) to co-create a 12-month H2O pilot program (July 2021-May 2022). Each institution was paired with a NASA PSD mission (Europa Clipper-UPR, Dragonfly-VSU, and Lucy-HU), with 30 mission mentors available for students. Missions provided a primary liaison to PSD for coordinating mission observing opportunities and other activities. Key aspects of the H2O pilot program included:

1. Encouraging a student-led program, aligned with student interests and needs.
2. Supporting meaningful mentorship activities [3].
3. Enabling cohort-building at the institution level.
4. Collecting program feedback and suggestions through regular student and mentor surveys.

Pre-Program Elements:

Eligibility. Participation was opened to undergrads from U.S.-based partner institution and limited to U.S. citizens and green card holders (due to ITAR). NASA encouraged students who were newly committed to STEM majors, particularly freshmen and sophomores.

Scope. 10-12 undergraduate students were selected from each partner MSI. The student selection method was led by the partner institution, including which academic departments to approach, communicating expectations and announcements, and managing the application process. Interest across institutions varied, with the largest number of applicants from UPR (a total of 119 UPR students applied to participate).

Self-Governance. Planning program activities was delegated to two undergraduate student leaders at each institution, with oversight by PSD, faculty advisors and mission liaisons. Slack channels were established as a primary method for internal communications.

Mentor-Matching and Upfront Documentation. Student observers provided short, 1-page Interest Statements to allow mission liaisons to identify mentors with the appropriate background or expertise. Welcome Packets and/or Rules of the Road were provided by the missions for students to gain initial context, mission history, and language definitions (instrument names, acronyms, org charts, etc). Students were also provided resources on NASA anti-harassment policies and rules for social media usage.

Orientation Seminars. Missions provided “101” and “lifecycle” overview seminars to the H2O students as background. Icebreaker-style meet & greets were conducted on Gathertown with H2O students and mission mentors for initiating relationships and getting the pilot program underway.

Examples of Core Program Activities: H2O activities were scoped on a non-interference principle (no-cost to missions; not disruptive to science team activities; not harmful to student/faculty academic commitments). To that end, activities usually lasted no more 1-hour per month, on average, to avoid overburdening. A total of 25 formal program activities took place during the pilot period, with several illustrative examples below:

- Lucy launch watch party, Oct 2021
- DART launch watch party, Nov 2021
- Clipper science lecture series, most Fridays
- Clipper Project Sci. Group (PSG)-11, Apr 2022
- Clipper Post-PSG-11 coffee hour, May 2022
- Software Dragonfly panel, Mar 2022
- VSU visit Applied Physics Lab (APL), Apr 2022

Program Metrics and Outcomes: Quarterly H2O surveys were sent to participating mentors and students (Oct 2021, Dec 2021, Feb 2022) to assess impacts and

collect suggestions. Feedback was largely positive in student surveys (combined program data, $N = 22$). We intend to continue surveys of past student observers for long-term outcomes (e.g., if alumni pursue graduate school or STEM careers).

H2O retained 18 of the 22 student participants during the pilot period. Four of the student observers (at least one from each participating university) were selected for paid planetary science summer internships at APL and the Jet Propulsion Laboratory (JPL), crediting their mentors for awareness of opportunities. NASA PSD provided a total of 5 travel awards (\$5k per award) to H2O student leaders for their service to the program. Travel awards were used for attending scientific conferences or visiting mission mentors.

Takeaways and Ongoing Challenges: Most of the H2O pilot program occurred during the COVID-19 global pandemic, where campuses and institutions were shut down for on-site activities. Thus, students were confined to the virtual world, and the same was true, to a large extent, for H2O events. Sensing “Zoom burnout” midway through the pilot with one institutional partner, an in-person field trip to APL was organized for motivating program participation. While virtual access remains beneficial in some aspects of H2O (ensuring that student observers can participate in PSD missions from anywhere, free of cost), the APL field trip and two other campus visits by NASA PSD to participating institutional campuses highlighted the irreplaceable value of in-person events. We now recognize this as an essential aspect of meaningful and effective engagement for H2O’s future.

A few other lessons learned by NASA PSD underscore the importance of co-creating with MSI partners and responding to their needs. H2O was rolled out as a small pilot program for this fundamental reason, allowing adjustments and refinement. For instance, course-loads and calendars were packed for students and faculty alike, with many student observers also having outside jobs. As such, coordinating H2O activities around school/work schedules proved to be a significant challenge. We relied on using Doodle polls for availability, we encouraged our missions to consider non-traditional days/times for events (including weeknights or weekends, well outside of their normal institutional business hours), and we often recorded events for future “on-demand” viewing. Two other areas were identified during the pilot program which still need improvement as H2O moves into the future: (1) setting the stage for mentoring, upfront, between students and mentors, particularly when pairings were with disparate identity groups; and (2) more ways of engaging student family members in the

program, including dialogues about planetary science career paths for participants in H2O.

Plans for the H2O Program: NASA PSD is committed to sustaining and cultivating partnerships with underrepresented institutions paired with our NASA missions to improve outcomes in DEIA [4]. To that end, we are continuing with a second H2O pilot year in 2023 (with UPR-Clipper and VSU-Dragonfly). Another year of learning will help scope a broader, sustainable program for the future that can include more partner institutions and PSD missions. We have selected a new cohort of students and brought back student leaders who were observers in Year 1, providing continuity and reducing the need for PSD to start from scratch with H2O planning and participation expectations.

We anticipate communicating details about an expanded H2O program, resources for support, and other information to the planetary science research community in late 2023. Our aim is to establish a reproducible, self-sustaining, scalable H2O program with broader mission involvement, and one that will nurture beneficial MSI partnerships and improved DEIA outcomes for our research community and missions of the future.

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