
Introduction: Sponsored by NASA’s Planetary Science Division, and managed by the Jet Propulsion Laboratory (JPL), the Planetary Science Summer Seminar (*previously known as the Planetary Science Summer School) prepares the next generation of engineers and scientists to participate in future solar system exploration missions. Ten years after its inception in 1989 in a lecture format, JPL evolved the experience to focus on the process of developing a robotic planetary exploration mission concept into reality through concurrent engineering, mentored by members of JPL’s advance project design team “Team X”.

Participants and Diversity: Applicants are sought who have a strong interest and experience in careers in planetary exploration, and who are science and engineering post-docs, recent PhDs, doctoral or graduate students, and faculty teaching such students. Disciplines include planetary science, geoscience, geophysics, environmental science, aerospace engineering, mechanical engineering, and materials science.

Participants are selected through a competitive review process, with selections based on the strength of the application and advisor’s recommendation letter.

The majority of students come from top US universities with planetary science or aerospace-related engineering programs, representing over 50 different universities total since 1999.

Previous Studies. Recent previous studies, on the employment of alumni since 1999 and the impact of the PSSS experience on alumni’s careers, support our intended outcomes of positive influence on participants’ career choice and career progress, and long-term help in feeding the employment pipeline for NASA, aerospace, and related academia. A diversity study revealed gender and ethnic minority participation in PSSS tracks the general trend for PhD degrees in related fields. [1]

Diversity. We updated our diversity study in winter 2016/2017 to assess the gender and ethnic diversity of participants since 1999. On average, 40% of participants are women, which tracks with the findings from the Planetary Science Workforce Survey of departments offering degrees related to planetary science [2]. While waiting for the planned update to this survey, we used more recent data [3] on participation in the general fields of astronomy, chemistry, earth science, physics to extend the comparison into 2011-2015, and to add a comparison of women in the aerospace engineering field. We also updated the comparison of percentages of ethnic minorities participating 1999-2016 with the population of science and engineering PhDs earned for astronomy, chemistry, earth science, physics, as well as aerospace engineering, in 2005-2015 (a more recent and thorough comparison than that previously available) [3].

The Planetary Science Summer Seminar Experience: PSSS is an intensive one-week team exercise at NASA’s Jet Propulsion Laboratory’s Project Design Center, preceded by a series of about 10 weekly preparatory webinars and assignments (requiring 4-6 hours per week). Under the mentorship of a lead engineer and a lead scientist (most recently, Dr. Charles Budney and Dr. Karl Mitchell), students select, design, and develop a mission concept from the Planetary Science Decadal Survey, following the guidelines of the NASA New Frontiers Announcement of Opportunity.

Once at JPL, students participate in a series of Team X project design sessions — their mentors aid them in finalizing the design of their mission and instrument suite, and in making the necessary trade-offs to stay within the cost cap. Tours of JPL facilities highlight the end-to-end mission life cycle. At week’s end, students present their Concept Study to a “proposal review board” of JPL scientists and engineers and NASA Headquarters executives, who feed back the strengths and weaknesses of their proposal and mission design.

Authentic Learning Experience: PSSS is designed to provide an authentic learning experience in order to provide a connection between personal aptitude and professional practice of participant. PSSS is aligned with pedagogical approaches for authentic learning that “cognitively challenge learners to solve problems and to think the same ways as professionals working in real-world contexts” and provide “access to expert performances and the modeling or processes, multiple roles and perspectives, collaborative construction of knowledge, …, and authentic assessment…tied directly to the successful solution of the task” [4]. The PSSS model enables design thinking, "an analytic and
creative process that engages a person in opportunities
to experiment, create and prototype models, gather
feedback, and redesign". Design thinking is critical to
successful mission design since "the design process is
characterized as being iterative, exploratory, and some-
times a chaotic process. It starts from some abstract
specifications... Specifications may change in reaction
to proposals or to unexpected problems discovered
during the process. In this case, design follows cycles
of mutual adjustment between specifications and solu-
tions until a final solution is reached" [5].

Project Impact: Current Employment. 599 indi-
viduals have participated in the Team X-based PSSS
sessions since 1999. In winter 2016/2017, we con-
ducted an online search to update their current occupa-
tions (primarily through LinkedIn and university and
corporate websites, updating a search done in 2015).
Updated results by industry sector show the majority
are employed or conducting postdoctoral research at
NASA Centers; are employed at Federally-Funded
Research and Development Centers, science research
organizations and aerospace companies; or they are
university faculty or staff. A number of alumni, most
from cohorts from the most recent years, are students
or postdocs at universities. The majority of the re-
mainig alumni are employed in other technical fields.

Updated data show that alumni are conducting NASA
work not only at the Centers, but at universities, occu-
pying roles that include space and planetary science
mission and instrument Principal Investigators and Co-
PIs, mission participating scientists, Astrobiology In-
stitute and Solar System Exploration Research Virtual
Institute team members, and NASA Research Grant
PIs. Clearly, PSSS provides the benefit of feeding the
employment pipeline for NASA, aerospace, and relat-
ed academia. More detailed leadership studies of alumni have also been conducted - following studies from Rathbun, et al. [6] [7], data on participation of PSSS alumni of both genders in robotic spacecraft mission science teams has been collected and anal-

Implementation: The Planetary Science Summer
Seminar is implemented by the JPL Education Office
in partnership with JPL’s Team X Project Design Cen-
ter. URL: http://psss.jpl.nasa.gov

References:
http://lasp.colorado.edu/home/mop/resources/related-
links/planetary-science-workforce-survey/
ing Doctorates.
vironments, Handbook of Research on Educational
Communications and Technology. 401-412.
Thinking and Why is It Important? Review of Educa-
tional Research, 82, 330-348.
participation of women scientists in robotic spacecraft
missions. AAS DPS Meeting #47.
http://adsabs.harvard.edu/abs/2015DPS....4731201R
participation of women scientists in robotic spacecraft
mission science teams: effect of participating scientist
programs. AAS DPS Meeting #48.
http://adsabs.harvard.edu/abs/2016DPS....4833201R