



Higher Education

NASA Science Mission Design Schools

Learning Goals

The Science Mission Design Schools are designed to prepare early-career scientists and engineers for participation and leadership in space science missions of the future. A science mission can be thought of as an experiment (or set of experiments) designed to collect and analyze data to address scientific hypotheses of interest to NASA. The school leads the participants through an approach to developing both the scientific hypotheses and the experiments that address those hypotheses, which is the science mission.

The course embraces the philosophy that the best way to learn is to do. Therefore, the participants will develop and propose their mission in the same way that many actual science teams do: by responding to a NASA Announcement of Opportunity (AO). The course is designed to take the participants through steps that mirror those of a team actually proposing a mission to NASA. Any differences between the course content and reality are clearly explained.

Key learning goals

How NASA science missions are formulated, proposed, and selected.

- The participants will be working the process for NASA missions competed through an announcement of opportunity. The course content additionally discusses the formulation process for directed missions.

Best practices in converting the science goals of NASA into a mission implementation.

- Development of scientific hypotheses for a mission, Science Traceability Matrices, and linking them to NASA scientific objectives.
- State-of-the-art for developing mission concepts and mission point designs. Participants will be partnered with experienced mentors in one of more of NASA's concurrent design environments to develop their mission.

The teamwork required to develop a mission concept.

- Missions are a joint effort typically involving hundreds to thousands of participants, with expertise covering a wide range of disciplines. The design environments will expose you to an important subset of the disciplines involved with mission development.

- The course and the concurrent design environments are also designed to enhance the mutual understanding between scientists and engineers regarding their roles and perspectives. This understanding is a key part of successful mission development.

Best practices in responding to an announcement of opportunity.

- Key roles in the proposal process.
- Responding to the AO requirements, including requirements tracking.
- Strategies for crafting a winning proposal.
- How to present to a review board.

The NASA structure for developing missions.

- Mission development lifecycle.
- Mission roles and how they are organized.
- Realities and challenges of mission development.
- Key concepts such as requirements, risk mitigation, and descoping.
- Initial exposure to NASA jargon and acronyms.

Learning Goals (Continued)

The course week finishes with a presentation of the participants' mission concept to an experienced review board of NASA Headquarters and NASA Center experts. The review board provides instructional feedback on the mission presented by the participants, including key points to remember when proposing a real mission.

The Science Mission Design Schools are structured so that the quality of work going into the participants mission concept studies have the potential for contributions to wider science community interests and literature. For example, recent concepts from Planetary Science Summer Schools have been on par with the quality of some of the mission studies done for whitepaper inputs to the Decadal Surveys, and have been well received by the NASA Planetary Science assessment groups (OPAG and SBAG). Published journal articles exist from the studies in 2015-2018 and the 2019 class has a paper in preparation. See summaries on the [PSSS Research Gate project page](#). ■