IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

Author: Mr. Owen Marr
SEDS, United States

STUDENT-LED SPACECRAFT: THE EDUCATIONAL VALUE OF EMPOWERING STUDENTS TO DEVELOP SPACE RESEARCH PAYLOADS

Abstract

In the Fall of 2019, the University of Michigan purchased two payload bays on a New Shepard suborbital flight to space. It was not a professor or a research group, but a small group of undergraduate students who were given total authority on what to build. This paper examines the educational value of challenging students to build commercial-quality payloads with minimal faculty oversight, and the key findings from mission execution.

Satellites and space research payloads have historically been large-scale efforts taken on by government agencies, research institutions, and commercial organizations. Suborbital vehicles such as Blue Origin's New Shepard and Virgin Orbit's SpaceShipTwo represent a new way to conduct research at a significantly lower cost than orbital platforms. This was the key enabler for providing students an opportunity to lead their own space research project. The budget for purchasing two payload spots and developing two payloads became similar in cost to other project teams, allowing students to lobby for the project in the first place.

Once funded, students were responsible for communicating with Blue Origin to set up contracts and begin designing the payload. The student group split into two teams (one for each payload) of 8-10 students each. They had complete autonomy up until their Preliminary Design Review, where a panel of professors provided feedback on the design. Similar reviews were held for CDR and Flight Readiness Reviews.

There was little expectation from the faculty on how far along the projects would get, or what the students would learn along the way. Universities typically shy away from unstructured learning, focusing on course curriculum and structured research led by faculty. What we found throughout this process was that giving the students an open-ended project with clear deadlines and a sense of responsibility led to tremendous individual leadership, collaborative teamwork, and professionalism not usually demonstrated by undergraduate students.

The team delivered both payloads on time to Blue Origin on time, resulting in the two first student-built payloads from the University of Michigan reaching space. This program has continued at the University of Michigan, with other student-built payloads on future manifests. This paper examines the educational value of such a project, the proposed rationale for success, and the benefits of instituting similar programs at other educational institutions.