

SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
On Track - Undergraduate Space Education (3)Author: Mr. Joachim Lohn-Jaramillo
New Mexico Tech, United StatesACHIEVING NEW HEIGHTS IN ENGINEERING EDUCATION THROUGH
UNIVERSITY-INDUSTRY COLLABORATION IN ROCKET DESIGN, DEVELOPMENT, AND
OPERATIONS**Abstract**

The Mechanical Engineering Department at the New Mexico Institute of Mining Technology (NMT) requires each student to participate in an intensive, four-semester design-team activity termed “Design Clinic,” as a requirement for graduation. Students engage in the Design Clinic by joining one of approximately 20 design teams in any given year, where teams are sponsored by national labs, faculty, and industry. The NMT Sounding Rocket Team (NSRT) was founded in 2012 under the auspices of the Design Clinic, unlike most universities where rocket teams are club based. The following summer, NSRT took first place in the Advanced Category of the Intercollegiate Rocket Engineering Competition of the Experimental Sounding Rocket Association. In 2015, NMT began developing ties with an industry partner, which in 2016 resulted in a student-driven change from annual design competitions to a decidedly long-term perspective. One particularly unique element of the academic program is that students gain the experience of planning and executing at least two launches at a spaceport using professional practices similar to those at NASA and test ranges. In 2016, the industry partner designed an outer mold line for a family of scalable suborbital rockets ranging from 6- to 18-inch diameters and had carbon-fiber shells built for a 6-inch version. This allowed student talent to focus on innovative subsystem design, such as non-pyrotechnic separation and ejecting launch shoes, among other innovations. The partnership has made realistic and achievable the long-term goal of designing a research-grade, Karman-Line capable suborbital rocket. Faculty members see the unique research opportunities offered by this platform; research is underway or contemplated in propulsion, structural health monitoring, aero-thermal modeling, and communications. This paper describes this ground-breaking, forward-looking program, including all program phases, and highlights how the program is taking students beyond academics and transitioning them to professional practice. The design phase involves mechanical and aerospace analyses, and addresses administrative, fiscal and communications’ requirements. The mission-planning phase involves mission analyses, subsystem testing, checklist development, and interfacing with government agencies and payload customers. The mission phase opens with a mission dress rehearsal; deploys an integrated team of students, professors, spaceport personnel, and industry launch crew; utilizes realtime meteorology and trajectory analysis; and concludes with a coordinated recovery operation and onsite hotwash. After-action reviews and post-flight analysis are conducted post-mission. Program success is quantifiable through the high rate of NSRT students taking jobs in the Aerospace Industry, especially New Space, and entering aerospace graduate programs.