

## NASA's Student Launch Projects: A Government Education Program for Science and Engineering

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The recent Harris poll conducted for the American Society for Quality indicated that students are not interested in engineering, due to the perception that either their skills are not good enough or that it would not be an interesting career. Not only that, but the parents do not see it as a desirable career choice either. This lack of interest has been well documented, although the recent poll sheds some light on the cause. The National Aeronautics and Space Administration has been offering creative solutions to this problem for some time, and provides a model for other government agencies, communities and industry.

Among the many NASA education activities, the Student Launch projects are examples of how one agency has been working with students to inspire math, science and engineering interest. There are two Student Launch projects: Student Launch Initiative (SLI) for middle and high school students and the University Student Launch Initiative (USLI) for college students. The George C. Marshall Space Flight Center (MSFC) in Huntsville, Alabama, added SLI and USLI to the annual Moonbuggy and Robotics competitions in 1999. MSFC is the NASA Center responsible for propulsion engineering, and also performs Space Station and payload design and manufacturing. Employees at MSFC also perform many types of propulsion and scientific research and testing. The Academic Affairs Office draws upon this expertise to schedule in the coaching, mentoring and review of the students' work. SLI is a hands-on approach to science and engineering disciplines, and is focused toward the goal of designing, building and launching a rocket to one mile in altitude, with a science payload. Another requirement is a successful, controlled landing to allow for reusability-as is the case for much of the Space Shuttle hardware. Safety is a top priority for the program.

For SLI teams, the program begins in the Fall with a Request for Proposal from NASA, as with any other federal procurement or grant. The teams, who must have pre-qualified by placing in the top at the Team America Rocketry Challenge or the Rockets For Schools competition, submit written proposals describing their concept of how to approach the mission. The proposals are evaluated by NASA engineers, scientists and specialists, based on a rubric. For the 2008-09 school year, fourteen schools from seven states were accepted into the program. USLI teams must also submit proposals, but do not have to pre-qualify. Nineteen USLI teams were selected from thirteen states. Once accepted, the teams follow a schedule of design reviews and readiness reviews, during which they must describe and defend their designs in person or in a videoconference to a panel of engineers, scientists and specialists. Launch Day is scheduled for April 18 and 19, 2009 in the Huntsville area. The Huntsville Area Rocketry Association (HARA) is a significant partner in this effort. Members provide expert assistance during the design and readiness reviews, perform pre-flight inspections of the hardware, and conduct range operations on launch day. The teams submit a final report on the rocket performance and

payload experimental data, or analyze any failures. Some funding is provided by NASA or through the Space Grant Consortium, and the teams are encouraged to obtain community and corporate support. ATK Launch Systems is this year's corporate sponsor.

Over the course of the year, teams must calculate component and total weights, the required size of the rocket fuel grain to launch their particular rocket to a mile, and also stability, performance, and trajectory in order to achieve their objective. Safety is paramount, and the teams are required to learn the National Association of Rocketry (NAR) Safety Code, as well as how to safely handle paints, solvents, adhesives. Dedicated teachers and NAR or Tripoli mentors are also required. Proposals must include a description of how this effort will satisfy local math and science objectives, and all reports are expected to be well written. Some schools choose to make this part of the regular curriculum, while others sponsor it as extracurricular. This year, there is a 4H Club and a Boy Scout Troop participating in SLI.

Teams are required to provide a minimum of two outreach projects to engage younger students and teach the basics of rocketry. Many of the launch teams have worked with local schools, youth organizations, girl scouts, boy scouts, summer camps and an organization for girls called Expanding Your Horizons.

The teams establish a dedicated website to communicate their efforts, and to provide design information, reports, photos and videos of their activities. They are taught the basics of failure modes and effects analysis, hazard analysis, and risk assessment and management. In addition to keeping on track with budgets, schedules and requirements, they must continuously ask: how can the hardware fail, how can they protect the safety of the team, and what can go wrong to keep the effort from being successful, so that they can plan accordingly. The students learn valuable leadership, teamwork, problem-solving, critical thinking, and communication skills in the process.

Teams are required to test their designs at a component and scale model level. They must analyze their failures and redesign and retest if necessary. By the Flight Readiness Review in March, they must have a finished product that is proven by testing, and the hardware must pass a flightworthiness inspection by the HARA members prior to launch. The emphasis is on keeping it simple enough to be successful, yet unique enough to be truly their rocket and payload. The students are expected to do the work, so that they can discuss it with the review panels. Emails from the students along the way are always welcome, and excellence is encouraged in all aspects of the program.

Many of the students have gone on to study math, science, or engineering disciplines in college. A large number of girls and minorities participate in the program, often in leadership roles. Some schools have sustained interest in the program, and have come back for a second or third time. MSFC conducts a faculty workshop in the summer, during which the review panel members present and discuss the details of the project.

Launching rockets may not be feasible for all potential participants, however, this serves as an example of how an Agency can work with its unique resources in partnership with schools and communities to bring excitement to the classroom. There are a number of scientific and engineering projects that could be initiated by federal, state and local governments and the private sector, depending on their functions and area of expertise. A nine month hands-on project brings to light many concepts that cannot be taught on “take your child to work” day. As a final caveat, safety of the students can never be compromised in order for an endeavor like this to be successful.

For additional information, visit the following websites:

[www.nasa.gov](http://www.nasa.gov),

<http://www.rocketcontest.org/>

<http://www.rockets4schools.org>

<http://education.msfc.nasa.gov/sli>

<http://education.msfc.nasa.gov/usli>

