

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS (D2)  
New missions enabled by Extra-large launchers (8)

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A STUDENT-DESIGNED MARS SAMPLE RETURN MISSION WITH AN ARES V LAUNCH  
VEHICLE

**Abstract**

The planned heavy-lift launch capability of an Ares-V class launch vehicle will enable the opportunity for many new and exciting missions that are either currently not possible, or not feasible, within current cost, schedule, risk, and/or design constraints. To explore the technical, programmatic, and scientific dimensions of these missions, The University of Alabama in Huntsville, College of Charleston, Southern University and AM College, and ESTACA (Ecole Supérieure des Techniques Aéronautiques et de Construction Automobile) Ecole d'Ingenieurs are collaborating in an innovative design program for students, providing them an opportunity to plan and design future NASA missions. The first iteration of this design program was held in the Spring 2010 semester, with future iterations being in the Fall 2010 semester. In the program, science and engineering students learn more about how their communities operate together in the real world, and how to communicate effectively between these two communities.

In this paper, we present the results of a student-designed Mars Sample Return (MSR) Mission, which proceeds from the baseline assumption of a single Ares V launch to execute the mission. Within this launch vehicle's parameters, the students' designs shall fit all the mission elements required to reach the Martian surface, gather samples, and return them safely back to Earth, thereby achieving the scientific objectives. The complexity of an MSR mission requires students to become familiar with techniques to mitigate the difficulties resulting from concurrent engineering design, and total product lifecycle management. The students' exposure to the complex practices of distributed, concurrent engineering design, and product lifecycle management, will better prepare them for work in the 21st century.