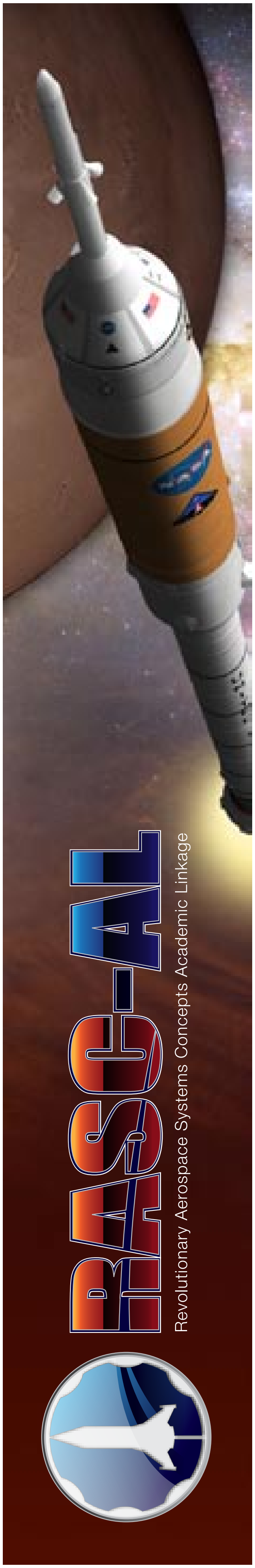
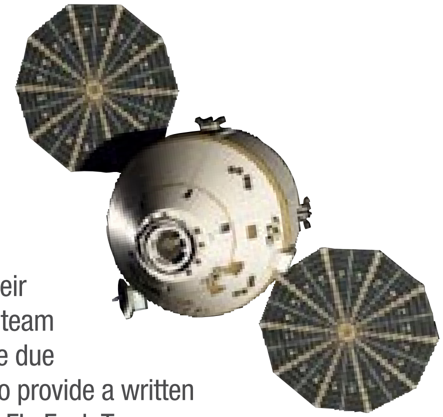


RASC-AL



Revolutionary Aerospace Systems Concepts - Academic Linkage, is a student design competition that is sponsored by NASA and managed by the National Institute of Aerospace.

RASC-AL is open to undergraduate and graduate university-level engineering students. RASC-AL projects allow students to incorporate their coursework into real aerospace design concepts and work together in a team environment. Project themes are announced in September, abstracts are due February 5, 2010, and selected Teams and a faculty advisor are invited to provide a written report and oral presentation at a competition, June 7-9, in Cocoa Beach, FL. Each Team receives a generous stipend to cover travel expenses to the competition, and the winning undergraduate and graduate Teams will be flown to a major aerospace conference to present their results. ***For more information, visit www.NIAnet.org/rascal.***

2010 NASA RASC-AL Themes

LUNAR OUTPOST TO SETTLEMENT

NASA's goal for a lunar outpost is to gain experience that will reduce risk for future human missions to Mars and establish core infrastructure from which economic development and permanent settlement could occur. The associated space transportation and lunar surface system infrastructure will need to be upgraded beyond NASA's current plans to improve habitat and research facilities for up to 30 full-time occupants. Although most recent NASA lunar outpost studies have focused on deployment at a polar location, an initial outpost at any location on the lunar surface can be assumed if there is sufficient rationale.

This topic allows your team to contribute ideas directly to the engineers tasked with developing solutions to these challenges. Some specific examples to be addressed are:

- Utilizing lunar, space, and other planetary resources for infrastructure development, power, and consumables to minimize the logistics supply chain needed from Earth
- Converting lunar oxygen, hydrogen, and water ice into propellants and transfer to a propellant depot in lunar orbit or at a libration point
- Lunar transportation system(s) for routine access to the settlement and for exploration of remote regions for discovery of new resources
- Durable lunar settlement designs and settlement layouts, including all required utilities and infrastructure
- Dramatically improved Earth-to-orbit and in-space transportation systems that can significantly reduce cost and improve safety
- A business plan on how to develop a self-sufficient lunar economy with unique utilization of lunar resources

All changes to the space transportation and lunar surface architectures should offer demonstrable improvements in safety reliability, performance, or affordability over the planned Constellation architecture which should be assumed as existing to support the initial lunar outpost deployment. Teams will need to show a viable path that leverages and evolves from the currently planned architecture to a sustainable 30 person settlement.

TECHNOLOGY-ENABLED HUMAN MARS MISSION

NASA is interested in eventual human mission to the Martian surface. Current Mars design reference architectures that use chemical or nuclear thermal propulsion require several years to complete, a large number of heavy lift launches and over 500 days on the surface the first time humans visit the planet. The durations associated with this type of mission increase the risk to the crew from galactic radiation and system failure. Innovative technologies and system approaches that lower the cost and risk of Mars missions are of great interest. Examples of technologies and systems include: in situ resource utilization systems, inflatable entry and aerocapture devices, efficient Mars transfer propulsion systems (reusability is an option), advanced habitation approaches, etc. Key mission constraints to be met by any of the design proposals are: 4 crew, 30 day minimum surface stay, maximum 2-year total mission, use of no more then 5 launches of a 125-mT(LEO) payload launch vehicle with a 10-meter-diameter payload shroud. Mission benefits (e.g., lowering cost) of specific technologies should be clearly demonstrated through systems analysis of the entire mission. Approaches that lead to sustainable human Mars exploration leading up to the establishment of an outpost are encouraged.

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RASC-AL

Revolutionary Aerospace Systems Concepts Academic Linkage

BRINGING THE WORLD ALONG WITH PARTICIPATORY EXPLORATION

An important element of NASA's exploration program is engaging the general public in human exploration missions. To capture the attention of a large cross section of the general population, NASA must use a variety of innovative and diverse approaches. A potential example might be the development of high-definition cameras on the rovers and in the habitats, with the ability to control rovers or monitor experiments from Earth. This would not only require a communications infrastructure that would enable the transmission of high-definition images from the Moon, but would also require the use of satellites and ground stations to provide communications connections and interfaces. Other potential activities could include: fly-along experiments on a lunar lander, remote controlled rover races or other competitions, near real-time use of the general public and scientific community in exploration data analysis, prizes like the Google-X prize, innovative use of the Google Moon application, new multimedia program content for NASA TV or web sites, and use of immersive virtual reality in exploration. Opportunities for commercial involvement and funding are strongly encouraged. Teams should develop an integrated approach that begins in 2010 that defines how NASA must implement participatory exploration into its thinking, programs and missions. The approach should also identify investments required in enabling technologies, support infrastructure and the potential impact of "participatory sensors" on destination systems. The approach should yield a cultural shift in and outside of NASA that results in awareness and excitement about what NASA is doing at the moment, not what it did in the past.

COMMON LUNAR SORTIE / NEAR-EARTH OBJECT (NEO) MISSION DESIGN

NASA is interested in architecture approaches that provide cost-effective Earth neighborhood exploration with minimal infrastructure. One approach would be to perform sortie-class human missions to the lunar surface for 60 days at a time to study particular sites of interest rather than being limited to a particular lunar outpost location. The lunar mission of interest would be to transport a crew of 2 to 4 to the far side of the Aiken Basin region on the lunar surface for a 60 day mission. The Mission would require a minimum of 1,000 kg of usable cargo to be transported with the crew and at least 10 mT of cargo to be transported without crew to pre-implace infrastructure to support the 60 day mission. This same set (or subset) of hardware would also be used to support a 60~120 crewed mission to a Near Earth Object (NEO). Assuming that commonality with currently planned Constellation architecture elements is not required, what low-cost options are available to accomplish such a mission?

Attention should be given to synergistic applications of NASA's initially planned mission or system elements and infrastructure for exploration, innovative combinations of the planned elements, and unique combinations of the planned elements with new innovative capabilities and/or technologies to support the robotic and crewed exploration of the solar system. Scenarios should address novel and robust applications, with an objective of NASA sustaining a permanent and exciting space exploration program.

Key evaluation criteria elements that each RASC-AL project should address are:

- Scientific evaluation and rationale of mission destinations for the development of an exciting and sustainable space exploration program;
- Synergistic application of innovative capabilities and/or new technologies for an evolutionary architecture development to enable future missions, reduce cost, or improve safety;
- Systems analysis of requirements and infusion and utilization of emerging technologies from all sources;
- Technical readiness level (TRL) of mission-enabling technologies and a technology roadmap outlining the development activities required for low-TRL technologies; and
- Realistic assessment of project cost/schedule and reliability/safety of the proposed architecture or system.