



Mechanical and Aeronautical Engineering Department  
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## 2004-2005 Monthly Seminar Series on Space Research

21 October, 18 November, 20 January, 17 February, 21 April, 19 May  
3<sup>rd</sup> Thursday 4:00-5:00 pm

### ***Mars to Earth Transportation for Geology Samples***

John Whitehead, Ph.D.

*Lawrence Livermore*

Date: 21 April 2005 Thursday Time: 4:10-5:00 pm Location: 1062 Bainer

Refreshments will be provided at 4:00 p.m.

#### **ABSTRACT**

**Hosted by Professor Ron Hess**

If it was easy to build a miniature rocket to launch from Mars to Earth, sample return might have been part of the Viking project in 1976. Three decades later, Mars Sample Return (MSR) remains a future goal and a major challenge for NASA. This presentation will briefly review NASA's Mars exploration program and the nominal plan for a 270-kg solid rocket propelled Mars Ascent Vehicle (MAV).

Each kilogram of useful equipment sent to Mars represents a million dollars invested in terms of mission cost. The speaker is presently being funded by NASA to develop an alternative liquid rocket technology which may reduce the size of the MAV to as small as 100 kg, potentially saving hundreds of millions of dollars per MSR attempt.

A trajectory study shows that smaller vehicles require reduced acceleration, to avoid undue aerodynamic drag during Mars ascent. Liquid propulsion can offer optimum thrust, whereas conventional solid rockets accelerate rapidly, due to the natural burn rate of propellant. Unfortunately, small liquid propulsion systems, refined for satellites, have never had the kind of velocity change capability demanded by launch applications.

Ongoing work at LLNL is attempting to miniaturize launch vehicle propulsion by developing miniature pumps powered by high temperature gases from reacted propellant. Rocket engine pumps typically deliver their own mass in propellant each second, at pressures on the order of 1,000 psi. In launch vehicle engines, the pumps are a critical component, not an auxiliary part as is the case for fuel pumps used on other kinds of vehicles.

#### ***For more information about***

***SpaceED (Space Engineering Research and Graduate Program) or the seminars please contact***

***Professor Nesrin Sarigul-Klijn at (530)-752-0682 or [nsarigulklijn@ucdavis.edu](mailto:nsarigulklijn@ucdavis.edu)***

Members of the campus community and visitors from the region are welcome to attend the seminar series.

Sign-in is required at the event. SpaceED seminar will replace MAE297 seminar on 3<sup>rd</sup> Thursdays.

SpaceED seminars are supported in part by



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