



Mechanical and Aeronautical Engineering Department  
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## 2002-2003 Monthly Seminar Series on Space Research

3<sup>rd</sup> Thursday 4:00-5:00 pm

### ***Manned Sub-Orbital Reusable Launch Vehicles***

***Dr. Marti M. Sarigul-Klijn***  
*University of California, Davis*

Date: **20 February 2003\_Thursday** Time: **4:10-5:00 pm** Location: **1065 Engineering II**  
Refreshments will be provided at 4:00 p.m.

#### **ABSTRACT**

There has been renewed interest in civilian manned sub-orbital space flight due in part to the X-Prize competition, which is offering a fully funded \$10 million prize to the first team that flies a Reusable Launch Vehicle (RLV) that can carry three people to a 100 kilometer (62 statute mile) altitude and back using private funds only. An overview of every significant method of launch and recovery for manned sub-orbital RLVs is presented in this talk. Launch methods are categorized as vertical takeoff, horizontal takeoff, and air launch. Recovery methods are categorized as wings, aerodynamic decelerators, rockets, and rotors. We conclude that both vertical takeoff and some air launch methods are viable means of attaining sub-orbital altitudes and wings and aerodynamic decelerators are viable methods for recovery. These conclusions are based on statistical methods using historical data coupled with time-stepped integration of the trajectory equations of motion. We also conclude that the preferred architecture for a manned sub-orbital RLV is Vertical Takeoff using hybrid rocket motor propulsion and winged un-powered Horizontal Landing onto a runway (VTHL) based on the additional factors of safety, customer acceptance, and affordability. There are over 20 teams registered for the X-prize, yet none have chosen a winged VTHL configuration that lands on a runway. Finally we present a conceptual design for a winged VTHL manned sub-orbital space plane capable of winning the X-Prize.

#### **ABOUT THE SPEAKER**

For the last 2 years Dr. Marti Sarigul-Klijn, Cdr, USN (ret) has been teaching courses at UC Davis as a Lecturer and has been participating in funded research activities with the SpaceED Program. From 1997 to 2000 he was the Chief Engineer and Test Pilot for the Roton's Atmospheric Test Vehicle Landing Demonstrator. Prior to this, he completed 20 years in the US Navy with the final rank of Commander of which 10 years was in flight test. He graduated from US Naval Test Pilot School and has over 5,000 hours in 70 aircraft types. During 1993-97, he led all Navy air to surface missile tests and the first launch of Minutemen second stage from a C-130 aircraft. He received his Ph.D. degree in 1990 from US Naval Postgraduate School. His technical publications are in rotorcraft, full scale flight-testing and launch vehicle system design areas.

***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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