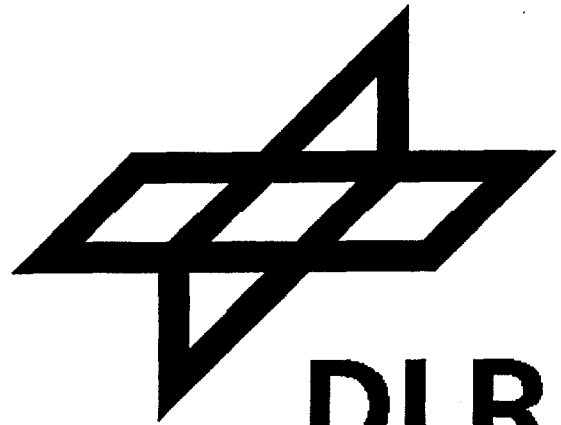
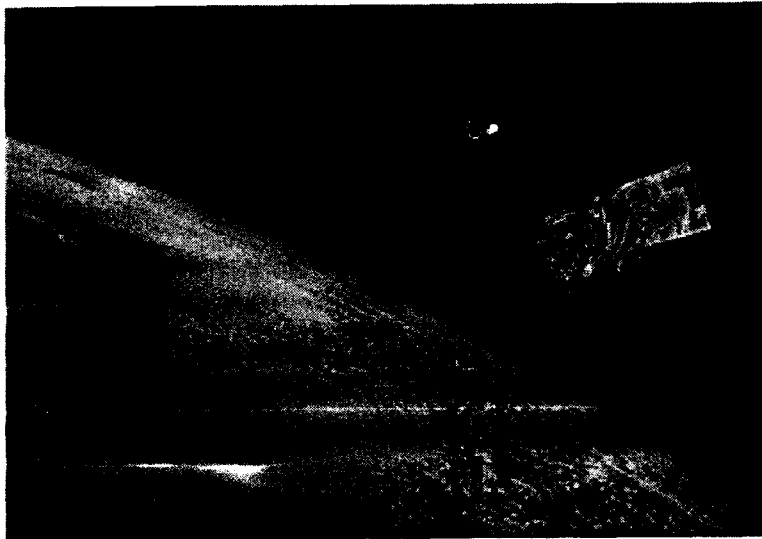


Institute of Space Sensor Technology and Planetary Exploration  
Berlin-Adlershof

3<sup>rd</sup> IAA SYMPOSIUM  
ON SMALL SATELLITES  
FOR EARTH OBSERVATION

Final Announcement

April 2 - 6, 2001



**DLR**

GERMAN  
AEROSPACE  
CENTER

INSTITUTE OF  
SPACE SENSOR  
TECHNOLOGY  
AND PLANETARY  
EXPLORATION

BERLIN, GERMANY

Composition photo: DLR

## **An Overview of MEMS-Based Micropropulsion Developments at JPL**

Juergen Mueller

*Jet Propulsion Laboratory  
California Institute of Technology  
Pasadena, CA 91109*

Interest in micropropulsion devices is on the rise as new missions with needs for small impulse bits and low thrust levels are beginning to emerge. Besides potential microspacecraft missions, such as those envisioned under the New Millennium ST-5 program, or currently designed, built and flown by several universities or European companies, other missions also would benefit from emerging micropropulsion technologies. These include interferometry or other constellation flying missions, requiring multiple spacecraft to be maintained in a precise formation, requiring small impulse bits and thrust values for positioning control, or large inflatable craft, required to off-set small but continuous solar pressure disturbance torques. Here, micropropulsion devices may be envisioned that could be integrated with the inflatable structures. In addition, size, weight and power limitations of future microspacecraft may require extremely miniaturized and highly integrated propulsion hardware.

Several micropropulsion development efforts are currently under investigation at JPL as well as other laboratories around the world to address these needs. This paper, after conducting a brief review of mission applications and the limited existing micropropulsion hardware, will review the work performed by the Advanced Propulsion Technology Group at JPL. Within that program, micropropulsion technologies are being explored utilizing novel microfabrication (Microelectromechanical Systems - MEMS) technologies to achieve unprecedented levels of miniaturization and integration between thrusters, valves, and control electronics in tightly packaged propulsion modules. Overall program goals as well as specific technologies will be reviewed. The latter include component work for a microfabricated so called Vaporizing Liquid Micro-Thruster, a Micro-Ion Engine, as well as valve development efforts, including a one-time opening micro-isolation valve and a micro-solenoid valve developed in cooperation with Moog Space Products division.