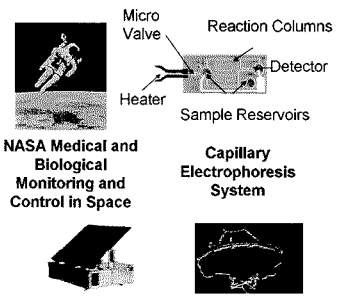
Variable Control MEMS Valve for Gas/Liquid Systems

Contact: Eui-Hyeok.Yang@jpl.nasa.gov (818) 354-7059

Applications:

- [illegible] (10 Kg Craft)
- Inflatable Reflector for Picosat
- Micro Cooler
- Miniature Chemical Labs for In-Situ Analysis
- Miniature Liquid Sample Collector
- LIGA GC/MS
- Micro Fuel Cell/Bio Reactor
- *Fluidic MEMS in general*



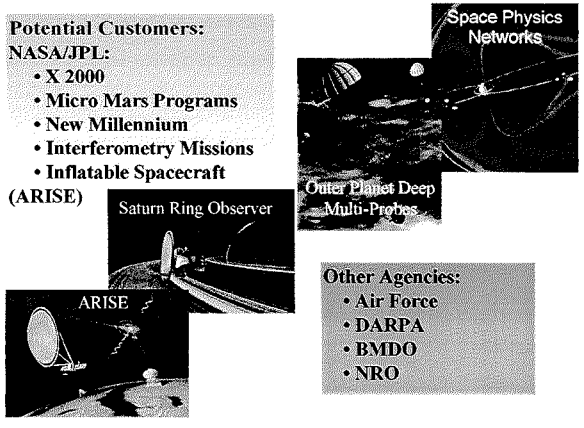
NASA Medical and Biological Monitoring and Control in Space

Capillary Electrophoresis System

Micro Spacecraft Concepts

Potential Customers:
NASA/JPL:

- X 2000
- Micro Mars Programs
- New Millennium
- Interferometry Missions
- Inflatable Spacecraft (ARISE)



Other Agencies:

- Air Force
- DARPA
- BMDO
- NRO

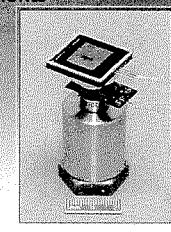
Benefits:

- Amenable to on chip integration schemes
- Proportional flow control
- Batch fabrication reduces component cost.
- Piezoelectric laminate actuator for higher force density and better sealing at low voltage operation.
- Integrated filtration to enhance reliability of sealing surfaces.

Valve Requirements for Micro Propulsion

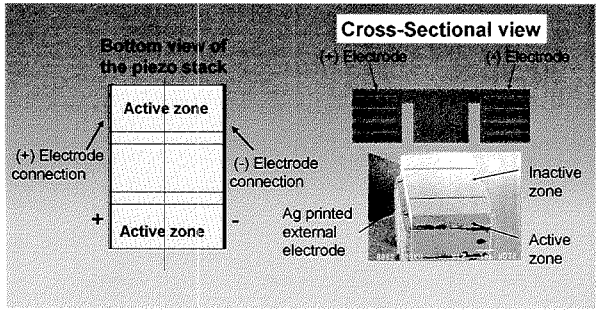
Typical Micro Propulsion Requirements for Gaseous Systems

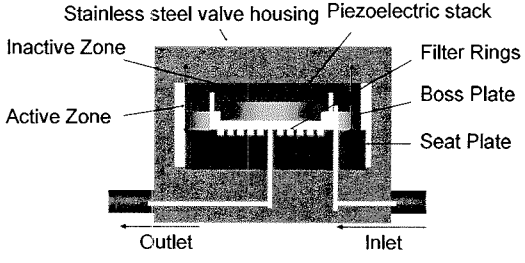
- Leak Rate - 0.3 scc/hr He
- Inlet Pressure - < 3000 psia
- Actuation Speed - < 10 ms
- Power - < 1 W
- Package Weight - < 10 gms
- Temperature - -120 to +200 °C



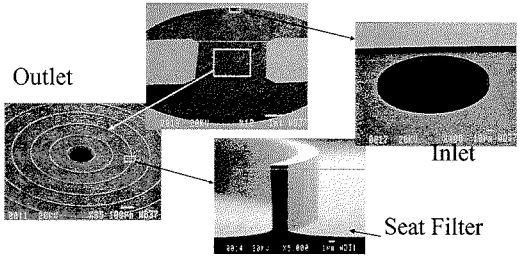
JPL's Piezo MEMS Valve

(for gaseous systems)

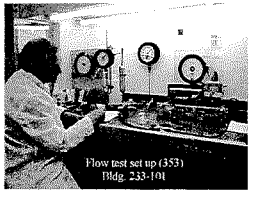


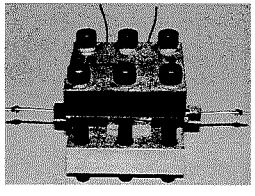


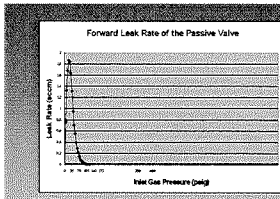
Fabricated Valve Seat



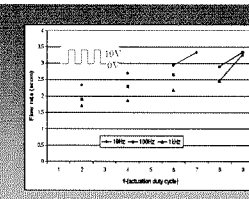
Gas Flow Test







Leak 1.9 sccm He @ 20 psig
Leak < 0.001 sccm @ 100 ~ 1000 psig
w/o actuator (passive valve)



Measured flow rates actuated in pulse width modulation at 20psig