OL-AC PHILLIPS LABORATORY MPD THRUSTER RESEARCH PROGRAM

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RESEARCH EMPHASIS:

IDENTIFY METHODS TO SIGNIFICANTLY INCREASE THE EFFICIENCY OF THE MPD THRUSTER

ACTIVITIES IN THE PAST YEAR:

- FACILITY CONSTRUCTION
- QUADRUPLE LANGMUIR PROBE MEASUREMENTS

PRESENT RESEARCH EFFORTS:

- HOLLOW/POROUS ANODE MPD THRUSTER
- THE MEASUREMENT OF THE IONIZATION FRACTION INSIDE OF THE MPD THRUSTER
- THE EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF MICROTURBULENCE ON MPD THRUSTER PERFORMANCE

Electric Propulsion Facility Layout....

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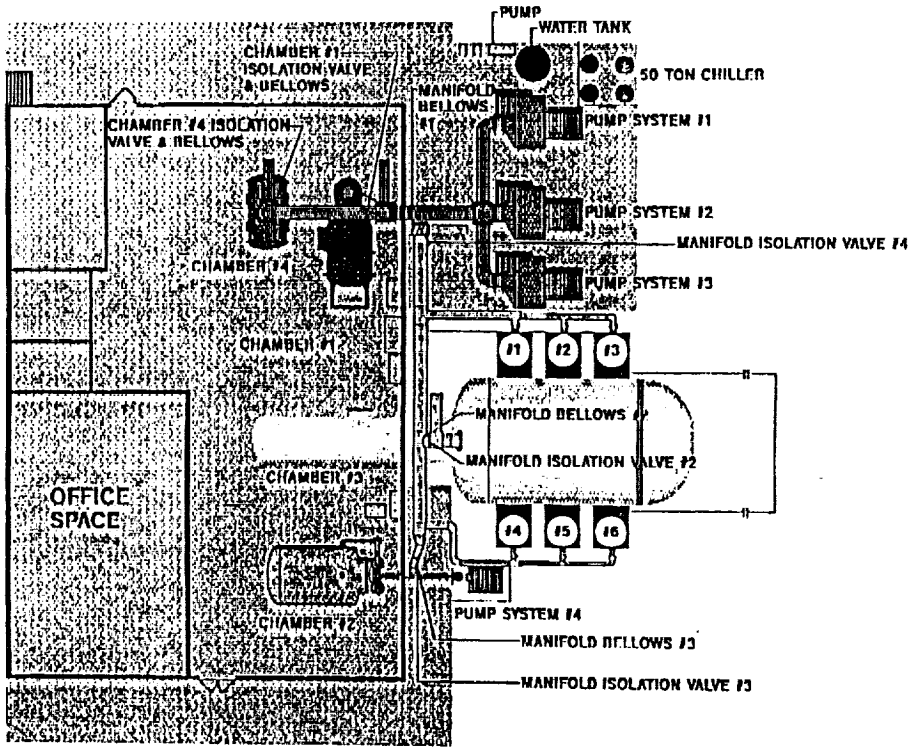
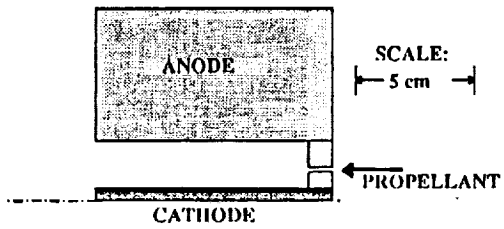
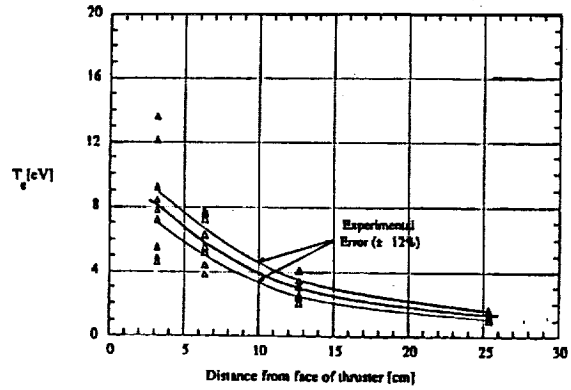
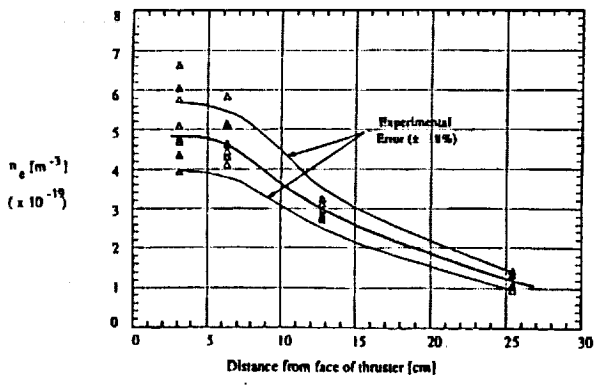
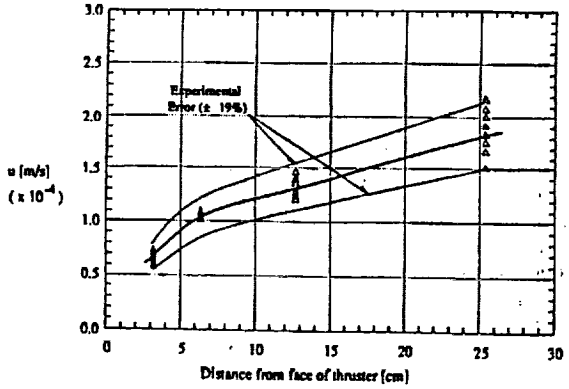


QUADRUPLE LANGMUIR PROBE MEASUREMENTS IN THE PLUME OF A MW LEVEL MPD THRUSTER. Argon, P=1.5 MW, J=11 kA, mdot=2 g/sec (in collaboration with S. DelMedico and R. Burton of U. of Illinois)









HOLLOW/POROUS ANODE MPD THRUSTER

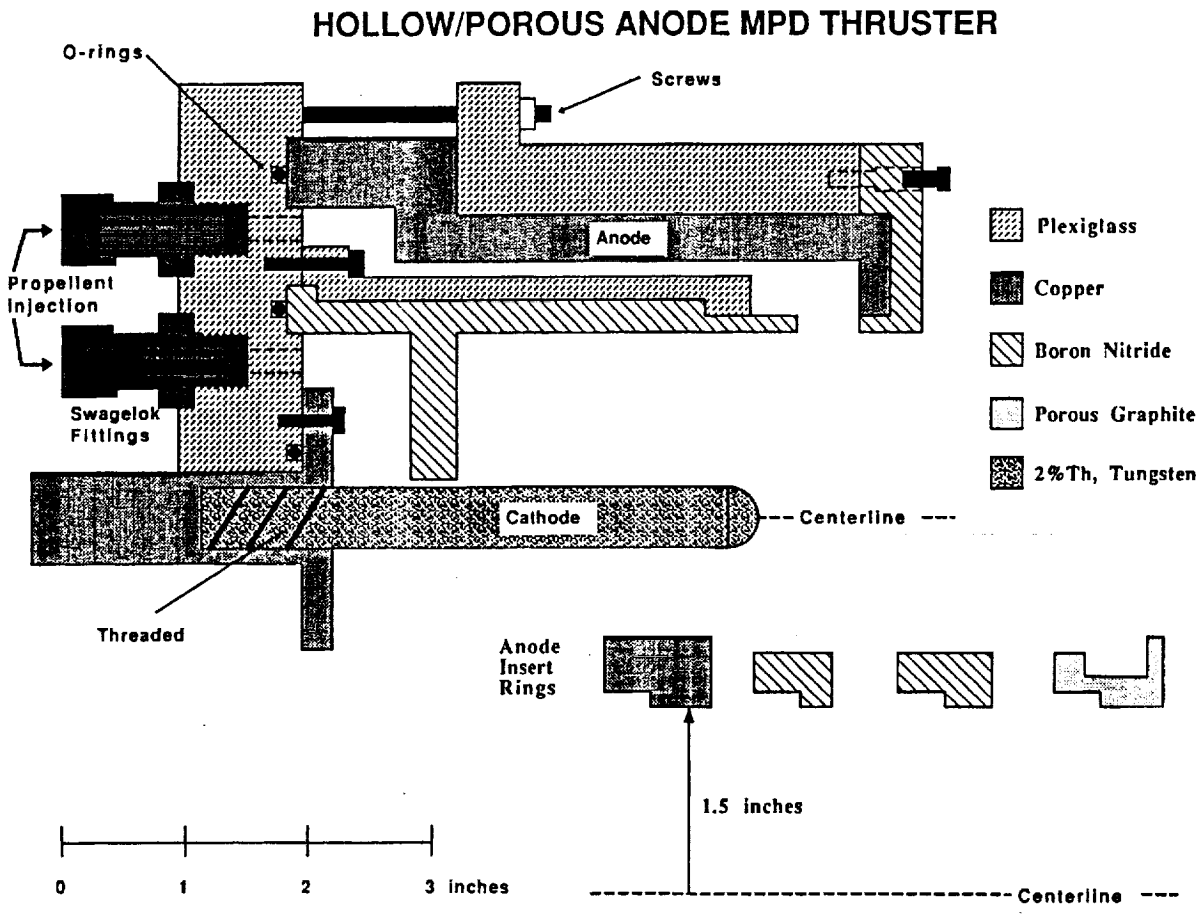
Objective: Investigate the effect of actively reducing the electron Hall parameter, Ω_e, in the anode region of the MPD thruster

Motivation: To significantly reduce the power flux to the anode surface

Approach:

- Design and test a Q.S. MPD thruster with propellent injection near the anode surface
- Measurements:
  - V-J curves versus propellant distribution fraction
  - Langmuir and Magnetic field probes will be used to verify a reduction of Ω_e and the fall voltage
  - Potential distribution throughout the thruster
  - Thrust measurements

(in collaboration with A. Gallimore of Univ. of Michigan)



IONIZATION PROCESSES

Objective: The measurement of the ionization fraction inside of the MPD thruster

Motivations:

- To provide insight into the ionization front phenomenon
- To evaluate the electrothermal instability model for the critical current
- To evaluate collision-radiative models for excited state distributions

Approach:

- Electron Temperature: Relative line intensities
- Electron number density: Stark Broadening
- Ground state neutral density: Absolute line intensities of excited states plus modelling

(in collaboration with M. Jolly and M. Martinez-Sanchez of M.I.T.)

MICROTURBULENCE

Objective: To experimentally investigate the effect of microturbulence on MPD thruster performance.

Motivations:

- To evaluate anomalous transport models
- To evaluate MHD codes incorporating anomalous transport
- To identify methods to reduce losses associated with microturbulence

Near-Term Approach:

- Experimentally determine the locations inside of a MW level MPD thruster where various forms of microturbulence operate. (in collaboration with E. Bowman and S.N.B. Murthy of Purdue Univ.)

Far-Term Approach:

- Experimentally measure, and compare with theory, the microscopic and macroscopic properties of the plasma affected by microturbulence (e.g., f_e, T_i, η)