N93-26977

NEP TECHNOLOGY - FY 92 MILESTONES
(NASA LERC)

THRUSTERS

- o ESTABLISH 100 H TEST CAPABILITY FOR 100 KW MPD THRUSTERS
- o DEMO LIGHTWEIGHT 20-KW KRYPTON ION THRUSTER
- o OPTIMIZE THE DESIGN OF LOW-MASS POWER PROCESSOR TRANSFORMERS

NEP FACILITIES

- o COMPLETE EPL'S TANK 5 CRYOPUMP UPGRADE

Presented by: Jim Sovey
NASA Lewis Research Center

SPACE PROPULSION TECHNOLOGY DIVISION
NASA Lewis Research Center

NEP TECHNOLOGY - FY92 RESOURCES
(NASA LERC)

THRUSTERS

- o $129K, MPD THRUSTER TECHNOLOGY
- o $18K, TANK 5 CONSUMABLES
- o $23K, ION OPTICS
- o $30K, WITH $35K (BASE R&T) FOR PPU MAGNETICS, UNIVERSITY OF WISCONSIN

NEP FACILITIES

- o $40K, TANK 5 CRYOPUMP UPGRADE

NEP - ION THRUSTER TECHNOLOGY
(NASA LERC)

ACCOMPLISHMENTS.....THRUSTER

- PERFORMANCE OF VIBRATION WORTHY 50-CM DIAMETER THRUSTER DESIGN COMPARABLE TO SOA DESIGNS
- LIGHTWEIGHT 30-CM THRUSTER ASSEMBLED UNDER BASE R&T PROGRAM
- 16 PAIRS OF DISHED ACCELERATOR GRIDS ARE NOW BEING FABRICATED..... TESTING SCHEDULED FOR FEBRUARY 1993.

POWER PROCESSOR

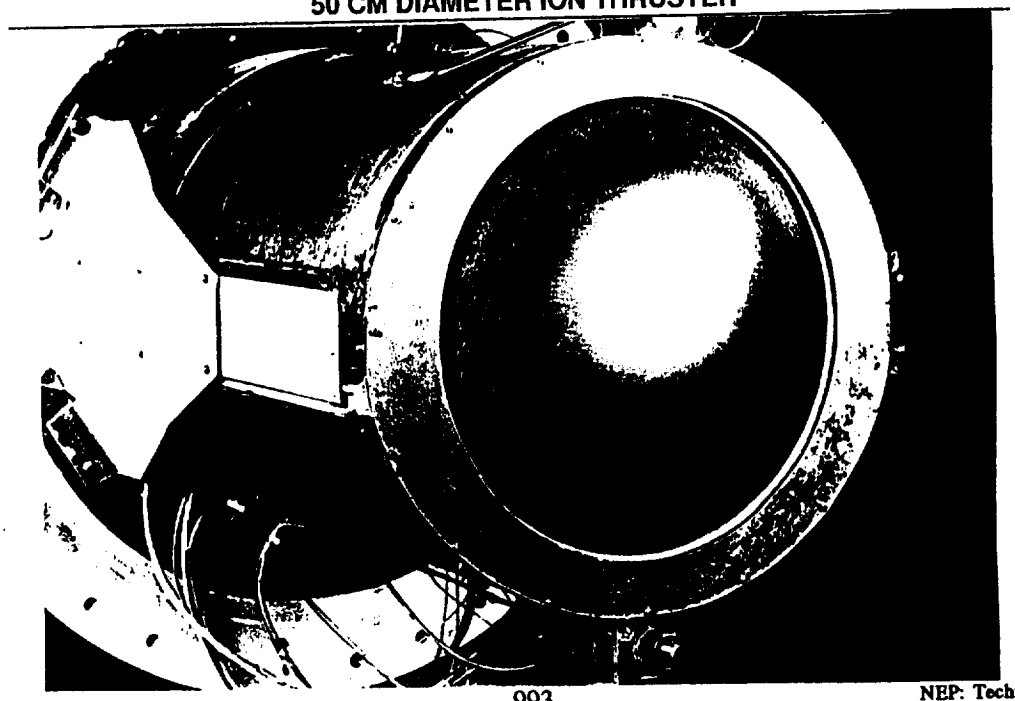
- ANALYSIS OF FULL-BRIDGE, LOW VOLTAGE DC/DC CONVERTER COMPLETE
- DETAILED ANALYSIS, TRADE-OFFS, AND DESIGN OF TRANSFORMERS COMPLETE
- FOLLOW-ON WILL PROVIDE CONVERTER HARDWARE

SPACE PROPULSION TECHNOLOGY DIVISION

NASA Lewis Research Center

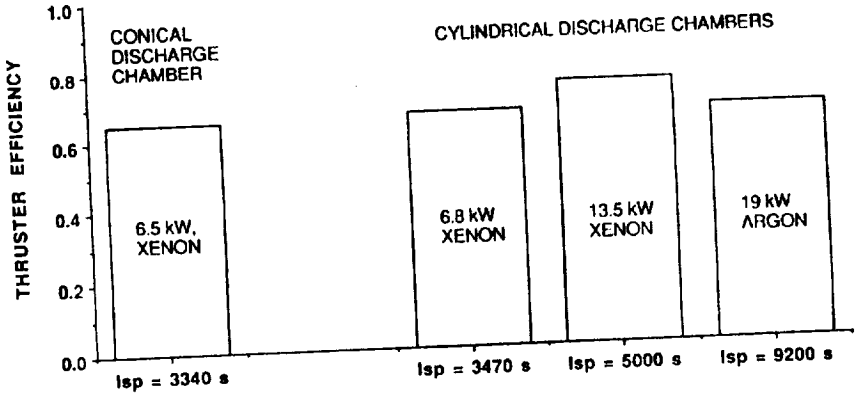
AEROSPACE TECHNOLOGY DIRECTORATE

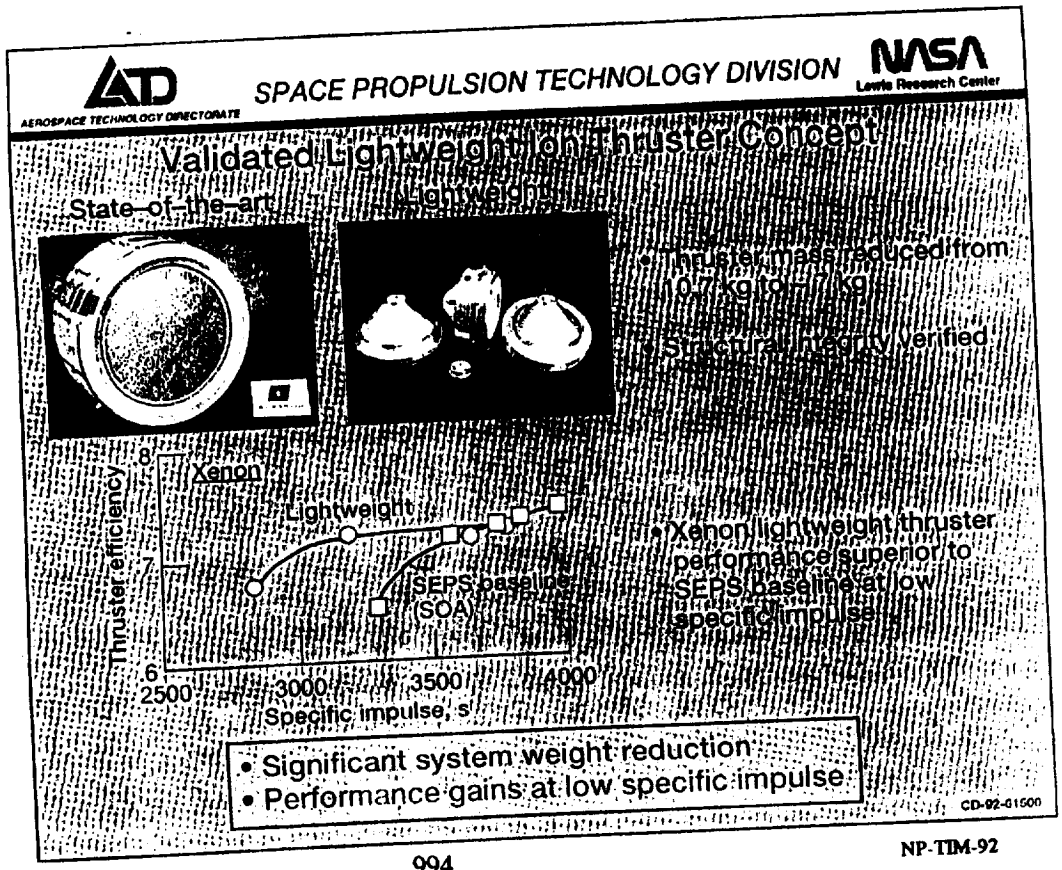
50 CM DIAMETER ION THRUSTER



50 CM DIAMETER ION THRUSTER PERFORMANCE

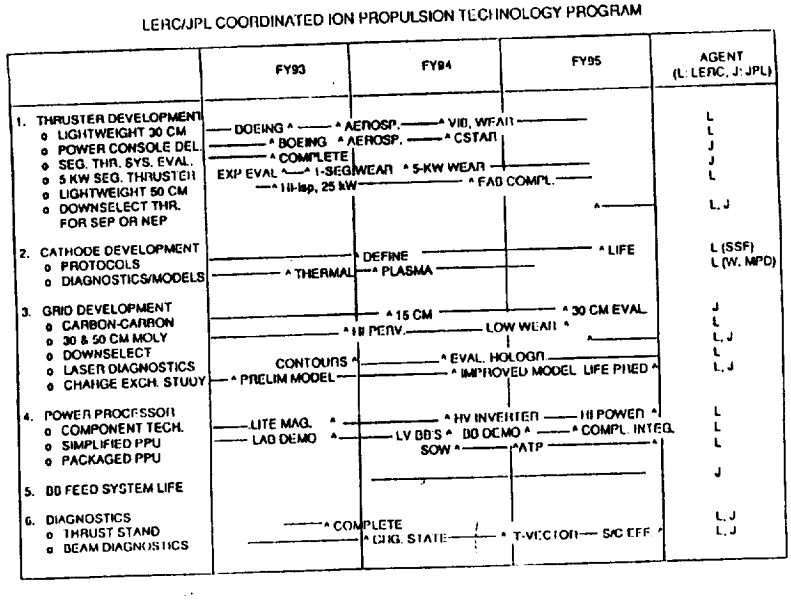
VIBRATION WORTHY CONICAL DIACHARGE CHAMBER DESIGN HAS PERFORMANCE COMPARABLE TO SOA CYLINDRICAL DESIGN





LERC/JPL COORDINATED ION PROPULSION PROGRAM
SUPPORTED UNDER BASE R&T STARTING FY93

LERC/JPL COORDINATED ION PROPULSION TECHNOLOGY PROGRAM

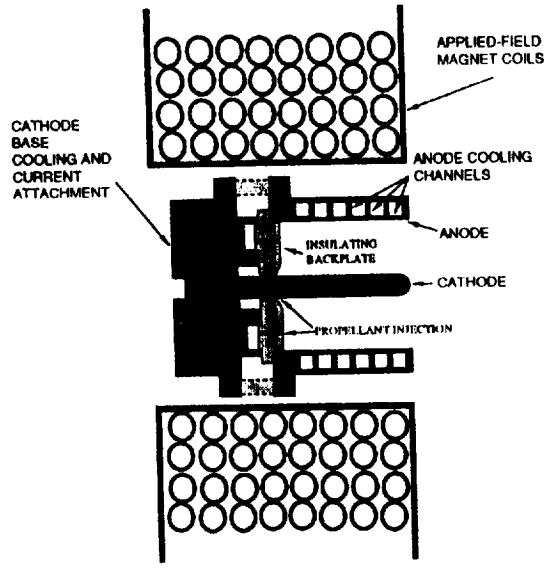


NEP - MPD THRUSTER TECHNOLOGY

FY 92 Milestone: Establish 100 hr test capability at 100 kW

Background:

- Base Technology Program supported extensive testing of
  - argon MPD thrusters to 240 kW
  - hydrogen thrusters to 100 kW
- Extensive performance data base established



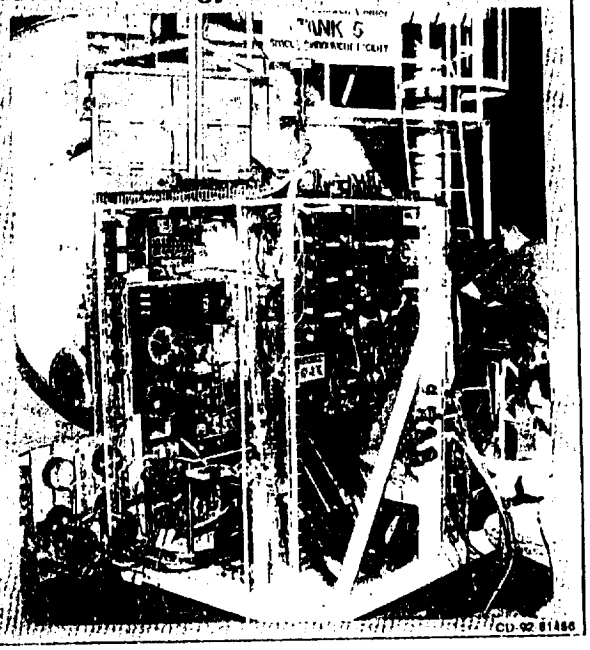
Applied-Field MPD thruster schematic
Anode and cathode lengths of 7.6 cm. Cathode radius =0.64 cm, anode radii of 2.54, 3.81, and 5.1 cm. Thrust exit plane was even with solenoid exit plane.

SPACE PROPULSION TECHNOLOGY DIVISION

NASA Lewis Research Center

High Power Electric Propulsion
MPD Thruster Technology

- New facility established
  - Helium cryopumping
  - 350 kW power
  - Plume diagnostics
  - Electrode power diagnostics
- MPD thruster tested to 240 kW

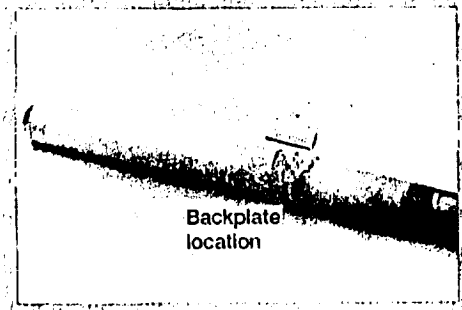


CD-92-61466

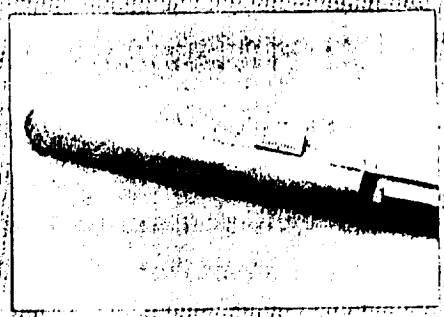
SPACE PROPULSION TECHNOLOGY DIVISION

NASA Lewis Research Center

MPD Thruster Lifetime
Cathode Erosion



- Low purity Argon (99.995%)
- No vacuum purge



- High purity Argon (99.999%)
- With vacuum purge

Major cause of cathode erosion eliminated

CD-92-61459

Applied-Field MPD Thruster Geometry/Operation Point Selection

Cathode

- Testing showed hollow cathode temperature was ~ 1000 K below rod cathode

Boron Nitride Backplate

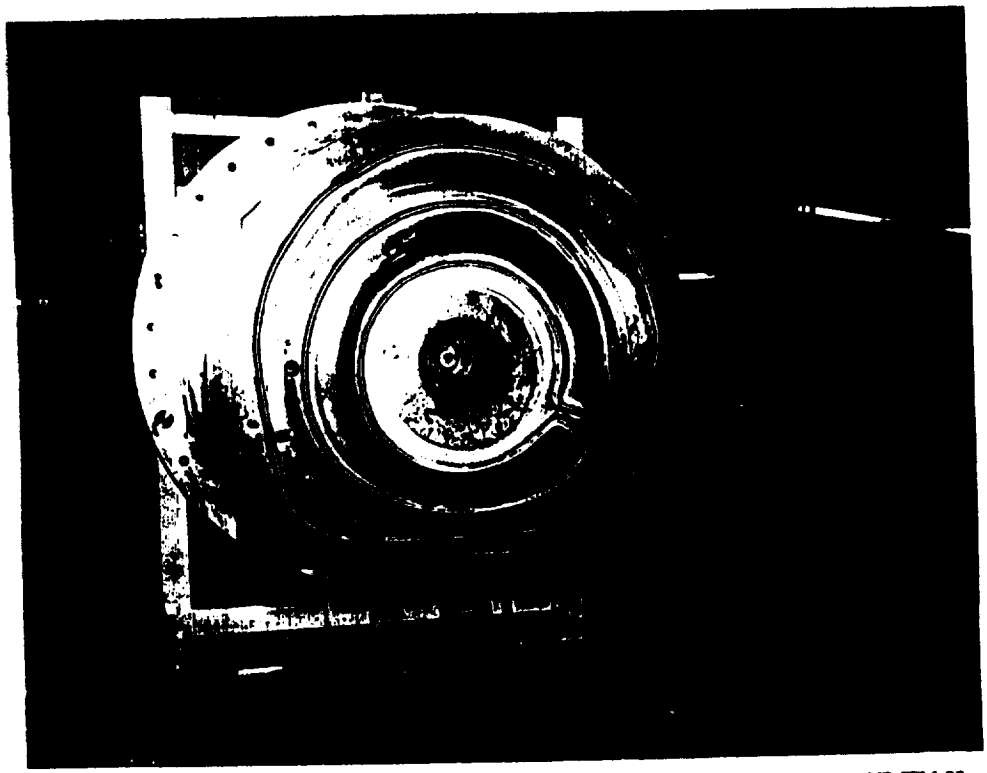
- Increasing cathode-to-backplate separation improved insulator life

Anode

- 5.1 cm radius, 15 cm long anode to reduce power density

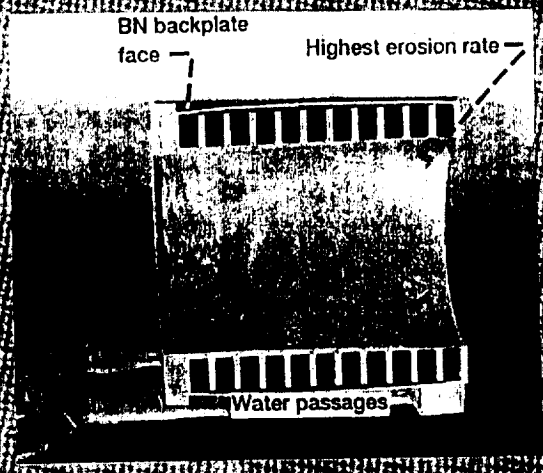
Operating point

60 kW: 1400 amps, 47 volts
0.14 g/s argon



MPD Thruster Lifetime Anode Erosion

- Extended test conducted to identify first-order lifetime limits



- Sputtering by argon propellant identified as major cause of erosion
  - fundamental limit for Isp's of interest

Program emphasis shifted toward light propellants and refractory metal anodes