MR-103D 1N (0.2-lbf) ROCKET ENGINE ASSEMBLY

Design Characteristics
- Propellant: Hydrazine
- Catalyst: S405
- Thrust/Steady State: 1.02 – 0.22 N (0.230 – 0.05 lbf)
- Feed Pressure: 27.6 – 6.2 bar (400 – 90 psia)
- Chamber Pressure: 23.4 – 5.9 bar (340 – 85 psia)
- Expansion Ratio: 100:1
- Flow Rate: 0.5 – 0.09 g/sec (0.001 – 0.0002 lbm/sec)
- Valve: Dual Seat
- Valve Power: 8.25 Watts Max @ 28 Vdc & 21°C
- Valve Heater Power: 1.54 Watts Max @ 28 Vdc & 21°C
- Cat. Bed Heater Pwr: 3.93 Watts Max @ 28 Vdc & 21°C
- Mass: 0.33 kg (0.73 lbm)
  - Engine: 0.13 kg (0.28 lbm)
  - Valve: 0.20 kg (0.45 lbm)

Performance
- Specific Impulse: 224 – 209 sec (lbf-sec/lbm)
- Total Impulse: 186,000 N-sec (41,828 lbf-sec)
- Total Pulses: 275,028
- Minimum Impulse Bit: 0.027 N-sec @ 6.9 bar & 15 ms ON
- Steady State Firing: 5,000 sec – Single Firing
- Cumulative: 111.4 hrs

Status
- Flight Proven

Reference
- SC00-2000-XI-1
MR-103G 1N (0.2-lbf) ROCKET ENGINE ASSEMBLY

Design Characteristics
- Propellant: Hydrazine
- Catalyst: S405
- Thrust/Steady State: 1.13 – 0.19 N (0.253 – 0.043 lbf)
- Specific Impulse: 224 – 202 sec (lbf·sec/lbm)
- Feed Pressure: 28.3 – 4.8 bar (420 – 70 psia)
- Chamber Pressure: 23.8 – 4.5 bar (345 – 65 psia)
- Expansion Ratio: 100:1
- Flow Rate: 0.5 – 0.09 g/sec (0.0011 – 0.0002 lbm/sec)
- Valve: Dual Seat
- Valve Power: 8.25 Watts Max@28 Vdc & 21°C
- Cat. Bed Heater Pwr: 6.32 Watts Max@28 Vdc & 21°C
- Mass: 0.33 kg (0.73 lbm) Engine, 0.127 kg (0.28 lbm) Valve

Performance
- Total Impulse: 97,078 N·sec (21,825 lbf·sec)
- Total Pulses: 835,017
- Minimum Impulse Bit: 0.0133 N·sec@0.015sec ON & 6.9 bar (0.003 lbf·sec@0.015sec) (ON & 100psi)
- Steady State Firing: Single firing...... 300 sec  1,000 sec
- Cumulative: 23.8 hrs — 40.6 hrs

Status
- Flight Proven

Reference
- AIAA-2005-3952

Approved for public release and export
MR-103M 1N (0.2-lbf) ROCKET ENGINE ASSEMBLY
Minimum Impulse Thruster (MIT)

Design Characteristics
- Propellant: Hydrazine
- Catalyst: S405
- Thrust/Steady State: 0.99 – 0.28 N (0.22 – 0.06 lbf)
- Feed Pressure: 27.6 – 6.9 bar (400 – 100 psia)
- Chamber Pressure: 20.7 – 5.9 bar (300 – 85 psia)
- Expansion Ratio: 100:1
- Flow Rate: 0.45 – 0.14 g/sec (0.001 – 0.0003 lbm/sec)
- Valve: Single Seat
- Valve Power: 7.1 Watts @ 28 Vdc & 21°C
- Cat. Bed Heater Pwr: 3.8 Watts @ 28 Vdc & 21°C
- Mass: 160 gm (0.35 lbm)
  - Engine: 135 gm (0.30 lbm)
  - Valve: 25 gm (0.05 lbm)

Performance
- Specific Impulse: 221 – 206 sec (lbf-sec/lbm)
- Total Impulse: 121,817 N-sec (27,387 lbf-sec)
- Total Pulses: 515,344
- Minimum Impulse Bit: ~670E-6 N-sec @ 1.6 ms ON (~150E-6 lbf-sec @ 1.6 ms ON)
- Steady State Firing: 30,000 sec – Single Firing
  - 60 hrs – Cumulative

Status
- Qualified

Reference
MR-111C 4 N (1.0-lbf) ROCKET ENGINE ASSEMBLY

**Design Characteristics**
- Propellant: Hydrazine
- Catalyst: S405
- Thrust/Steady State: 5.3 – 1.3 N (1.2 – 0.3 lbf)
- Feed Pressure: 27.6 – 5.5 bar (450 – 50 psia)
- Chamber Pressure: 12.1 – 3.4 bar (200 – 35 psia)
- Expansion Ratio: 74:1
- Flow Rate: 2.4 – 0.6 g/sec (0.0053 – 0.0014 lbm/sec)
- Valve: Dual Seat
- Valve Power: 8.25 Watts Max @ 28 Vdc & 21°C
- Valve Heater Power: 1.54 Watts Max @ 28 Vdc & 21°C
- Cat. Bed Heater Pwr: 3.85 Watts Max @ 28 Vdc & 21°C
- Mass: 0.33 kg (0.73 lbm)
  - Engine: 0.13 kg (0.28 lbm)
  - Valve: 0.20 kg (0.45 lbm)

**Performance**
- Specific Impulse: 229 – 215 sec (lbf-sec/lbm)
- Total Impulse: 260,000 N-sec (58,500 lbf-sec)
- Total Pulses: 420,000
- Minimum Impulse Bit: 0.08 N-sec @ 6.9 bar & 15 ms ON (0.0171 lbf-sec @ 100 psia & 15 ms ON)
- Steady State Firing: 5,000 sec min – Single Firing

**Status**
- Flight Proven

**AIAA-1999-2469**
**MR-111E 2N (0.5-lbf) ROCKET ENGINE ASSEMBLY**

**Design Characteristics**
- Propellant: Hydrazine
- Catalyst: S405
- Thrust/Steady State: 2.2 – 0.5 N (0.5 – 0.11 lbf)
- Feed Pressure: 25.5 – 4.1 bar (370 – 60 psia)
- Chamber Pressure: 14.1 – 3.1 bar (204 – 45 psia)
- Expansion Ratio: 200:1
- Flow Rate: 1.2 – 0.3 g/sec (0.0022 – 0.0005 lbm/sec)
- Valve: Dual Seat
- Valve Power: 8.25 Watts Max @ 28 Vdc & 21°C
- Valve Heater Power: 1.54 Watts Max @ 28 Vdc & 21°C
- Cat. Bed Heater Pwr: 3.85 Watts Max @ 28 Vdc & 21°C
- Mass: 0.33 kg (0.73 lbm) Engine; 0.13 kg (0.28 lbm) Valve; 0.20 kg (0.45 lbm)

**Performance**
- Specific Impulse: 224 – 213 sec (lbf-sec/lbm)
- Total Impulse: 260,000 N·sec (58,500 lbf·sec)
- Total Pulses: 420,000
- Minimum Impulse Bit: 0.02 N·sec @ 6.9 bar & 15 ms ON
  (0.006 lbf·sec @ 100 psia & 15 ms ON)
- Steady State Firing: 15.5 hr – Single Firing; 26.7 hr – Cumulative

**Status**
- Flight Proven
MR-106E 22N (5.0-lbf) ROCKET ENGINE ASSEMBLY - 28 Vdc

Design Characteristics
- Propellant: Hydrazine
- Catalyst: LCH-227/202
- Thrust/Steady State: 30.7 – 11.6 N (6.9 – 2.6 lbf)
- Feed Pressure: 24.1 – 6.9 bar (350 – 100 psia)
- Chamber Pressure: 12.4 – 4.5 bar (180 – 65 psia)
- Expansion Ratio: 60:1
- Flow Rate: 13.1 – 5.0 g/sec (0.0289 – 0.011 lbm/sec)
- Valve: Dual Seat
- Cat. Bed Heater Pwr: 6.53 Watts Max @ 28 Vdc & 21°C
- Valve Heater Power: 3.27 Watts @ 28 Vdc & 21°C
- Valve Power: 25.3 Watts Max @ 28 Vdc & 21°C
- Mass: 0.635 kg (1.4 lbm) Max

Performance
- Specific Impulse: 235 – 229 sec (lbf-sec/lbm)
- Total Impulse: 36,000 N-sec, 125,000 N-sec, 90,587 N-sec
- (26,958 lbf-sec), (28,044 lbf-sec), (20,366)
- Total Pulses: 12,405, 186, 66,631
- Minimum Impulse Bit: 0.46 N-sec @ 12.8 bar & 16 ms ON
- (0.103 lbf-sec @ 185 psia & 16 ms ON)
- Steady State Firing: 2,000 sec – Single Firing
- 4,670 sec – Cumulative

Status
- Flight Proven

Reference
- AIAA-2001-3632
- AIAA-1999-2469

*Mars Odyssey Test Program – December, 2000

Approved for public release and export
**MR-106E 22N (5.0-lbf) ROCKET ENGINE ASSEMBLY - 70 Vdc**

**Design Characteristics**
- Propellant: Hydrazine
- Catalyst: LCH-227/202
- Thrust/Steady State: 30.7 – 11.6 N (6.9 – 2.6 lbf)
- Feed Pressure: 24.1 – 6.9 bar (350 – 100 psia)
- Chamber Pressure: 12.4 – 4.5 bar (180 – 65 psia)
- Expansion Ratio: 60:1
- Flow Rate: 13.1 – 5.0 g/sec (0.0289 – 0.011 lbm/sec)
- Valve: Dual Seat
- Valve Power: 39.52 Watts Max @ 70 Vdc & 21°C
- Valve Heater Power: 3.27 Watts @ 70 Vdc & 21°C
- Cat. Bed Heater Pwr: 6.36 Watts Max @ 70 Vdc & 21°C
- Mass: 0.52 kg (1.14 lbm)
  - Engine: 0.23 kg (0.50 lbm)
  - Valve: 0.29 kg (0.64 lbm)

**Performance**
- Specific Impulse: 235 – 229 sec (lbf-sec/lbm)
- REA ‘A’
- REA ‘B’
- Mars*
- Total Impulse: 120,000 N-sec 125,000 N-sec 90,587 N-sec
  - (26,958 lbf-sec) (28,044 lbf-sec) (20,366)
- Total Pulses: 12,405 186
- Minimum Impulse Bit: 0.46 N-sec @ 12.8 bar & 16 ms ON
  - (0.103 lbf-sec @ 185 psia & 16 ms ON)
- Steady State Firing: 2,000 sec – Single Firing
  - 4,670 sec – Cumulative

**Status**
- Flight Proven
*Mars Odyssey Test Program – December, 2000

**Reference**
- AIAA-2001-3632
- AIAA-1999-2469

Approved for public release and export
MR-106L 22N (5.0-lbf) ENGINE ASSEMBLY - 28 Vdc

Design Characteristics
- Propellant............................. Hydrazine
- Catalyst.............................. S405/LCH-202
- Thrust/Steady State............... 34 – 10 N (7.7 – 2.3 lbf)
- Feed Pressure..................... 27.6 – 5.9 bar (400 – 85 psia)
- Chamber Pressure................. 13.4 – 4.1 bar (195 – 60 psia)
- Expansion Ratio.................... 60:1
- Flow Rate......................... 14.7 – 4.5 g/sec (0.032 – 0.010 lbm/sec)
- Valve................................. Dual Seat
- Cat. Bed Heater Pwr........... 13.2 Watts Max @ 28 Vdc & 21°C
- Valve Heater Power............ 4.0 Watts @ 28 Vdc & 21°C
- Valve Power...................... 24.5 Watts Max @ 28 Vdc & 21°C
- Mass................................. 0.590 kg (1.3 lbm) Nom

Performance
- Specific Impulse.................. 235 – 229 sec (lbf-sec/lbm)
- Total Impulse..................... 561,388 N-sec (126,205 lbf-sec)
- Total Pulses....................... 120,511
- Minimum Impulse Bit........... 0.15 N-sec @ 5.9 bar & 16 ms ON (0.034 lbf-sec @ 85 psia & 16 ms ON)
- Steady State Firing.............. 4,000 sec

Status
- Qualified: Integrated on 3 Spacecraft

Reference
- AIAA-2005-3954
MR-107S 275N (60-lbf) ROCKET ENGINE ASSEMBLY

Design Characteristics
- Propellant: S-405 / LCH-202
- Catalyst: Hydrazine
- Thrust/Steady State: 360 – 85 N (81 – 19 lbf)
- Feed Pressure: 35 – 7 bar (500 – 100 psia)
- Chamber Pressure: 14 – 4 bar (197 – 45 psia)
- Expansion Ratio: 21.5:1
- Flow Rate: 154.7 – 36.3 g/sec (0.341 – 0.08 lbm/sec)
- Valve: Single Seat
- Valve Power: <34.8 Watts @ 28 Vdc & 20°C
- Mass: 1.01 kg (2.23 lbm)
  - Engine: 0.67 kg (1.48 lbm)
  - Valve: 0.34 kg (0.75 lbm)

- Specific Impulse: 225 – 236 sec (lbf-sec/lbm)
- Total Impulse: 337,620 N-sec (75,900 lbf-sec)
- Total Pulses: 30,300
- Steady State Firing: 41 sec @ 360N (81-lbf)
  - 100 sec @ 236N (53-lbf)
  - 30 sec @ 285N (64-lbf)

Status
- Qualified
MR-107T 110N (25-lbf) ROCKET ENGINE ASSEMBLY

Design Characteristics
- Propellant: S-405 / LCH-202
- Catalyst: Hydrazine
- Thrust/Steady State: 125 – 54 N (28 – 12 lbf)
- Feed Pressure: 37 – 7 bar (500 – 100 psia)
- Chamber Pressure: 4.7 – 1.8 bar (69 – 26 psia)
- Expansion Ratio: 21.5:1
- Flow Rate: 55.8 – 22.7 g/sec (0.123 – 0.05 lbm/sec)
- Valve: Single Seat
- Valve Power: <34.8 Watts @ 28 Vdc & 20°C
- Mass:
  - Engine: 1.01 kg (2.23 lbm)
  - Valve: 0.67 kg (1.48 lbm)
  - 0.34 kg (0.75 lbm)

- Specific Impulse: 222 – 228 sec (lbf-sec/lbm)
- Total Impulse: 92,967 N·sec (20,900 lbf·sec)
- Total Pulses: 14,300
- Steady State Firing: 100 sec @ 125N (28-lbf)
  100 sec @ 54N (12-lbf)

Status
- Qualified
MR-107V 220N (49.5-lbf) ROCKET ENGINE ASSEMBLY

Design Characteristics

- Propellant: Hydrazine
- Catalyst: S-405 / LCH-202
- Thrust/Steady State: 220 – 67 N (49.5 – 15 lbf)
- Feed Pressure: 26 – 5.5 bar (377 – 80 psia)
- Chamber Pressure: 8.4 – 2.6 bar (122 – 38 psia)
- Expansion Ratio: 21.5:1
- Flow Rate: 98 – 31 g/sec (0.216 – 0.07 lbm/sec)
- Valve: Single Seat
- Valve Power: <34.8 Watts @ 28 Vdc & 20°C
- Mass: Engine 1.01 kg (2.23 lbm), Valve 0.67 kg (1.48 lbm), 0.34 kg (0.75 lbm)


- Specific Impulse: 229 – 223 sec (lbf-sec/lbm)
- Total Impulse: 337,175 N-sec (75,800 lbf-sec)
- Total Pulses: 30,275
- Steady State Firing: 100 sec @ 111 N (25-lbf)

Status

- Qualification Testing in 2007
MR-104A/C 440N (100-lbf) ROCKET ENGINE ASSEMBLY

Design Characteristics
- Propellant: Hydrazine
- Catalyst: S405 / LCH-202
- Thrust/Steady State: 572.5 – 204.6 N (128.7 – 46 lbf)
- Feed Pressure: 28.9 – 6.9 bar (420 – 100 psia)
- Chamber Pressure: 10.7 – 3.9 bar (155 – 56 psia)
- Expansion Ratio: 53:1
- Flow Rate: 240.4 – 90.72 g/sec (0.53 – 0.20 lbm/sec)
- Valve: Single Seat
- Valve Power: 30 Watts @ 28 Vdc & 21°C
- Cat. Bed Heater Pwr: 13.1 Watts @ 28 Vdc & 21°C
- Mass: 1.86 kg (4.11 lbm)
- Engine: 1.44 kg (3.17 lbm)
- Valve: 0.43 kg (0.94 lbm)

Performance
- Specific Impulse: 239 – 223 sec (lbf·sec/lbm)
- Total Impulse: 693,900 N·sec (156,000 lbf·sec)
- Total Pulses: 1,742
- Minimum Impulse Bit: 8.23 N·sec @ 24.13 bar & 22 ms ON
  (1.85 lbf·sec @ 350 psia & 22 ms ON)
- Steady State Firing: 2,000 sec – Single Firing
  2,654 sec – Cumulative

Status
- Flight Proven
MR-80B 3,100 N (700-lbf) THROTTLING ROCKET ENGINE ASSEMBLY

Design Characteristics

- Propellant ...................................... Hydrazine
- Catalyst ........................................... S405
- Vacuum Thrust/Steady State ........ 3780 – 31 N (850 – 7 lbf)
- Feed Pressure .............................. 41.7 Bar (605 psia)
- Chamber Pressure ......................... 20.4 – 0.14 Bar (296 – 2 psia)
- Expansion Ratio ............................ 16.7:1
- Cat. Bed Heater Pwr .............. 6.3 Watts/Element Max @ 30 Vdc
- Valve Heater Power ................. 9.45 Watts/Element @ 30 Vdc
- Valve .............................................. Cavitating Throttle
- Valve Power ............................... 168 Watts Max @ 28 Vdc
- Weight .......................................... 8.51 kg (18.76 lbm)
- Engine .......................................... 6.92 kg (15.26 lbm)
- Valve ............................................. 1.59 kg (3.50 lbm)

Performance

- Vacuum Specific Impulse .......... 225-200 sec (lbf-sec/lbm)
  - Dev. #1 8
  - Dev. #2 8
  - Dev. #3R 12
  - Qual. 8
- Total Throughput .................
  - Dev. #1 (644 lbfm)
  - Dev. #2 (405 lbfm)
  - Dev. #3R (995 lbfm)
  - Qual. (680 lbfm)
- Total Firing Time .................
  - Dev. #1 334 sec
  - Dev. #2 418 sec
  - Dev. #3R 806 sec
  - Qual. 560 sec
- Longest Single Firing ...........
  - Dev. #1 76 sec
  - Dev. #2 117 sec
  - Dev. #3R 137 sec
  - Qual. 214 sec

Status

- Flight Qualified

Reference

- 2007-AIAA-5481
MRM-103D 1N (0.2-lbf) ROCKET ENGINE ASSEMBLY

Design Characteristics

- Propellant .................................................. Hydrazine
- Catalyst ....................................................... S405
- Thrust/Steady State .................. 1.02 – 0.22 N (0.230 – 0.050 lbf)
- Feed Pressure ...................... 27.6 – 6.2 bar (400 – 90 psia)
- Chamber Pressure .............. 23.4 – 5.9 bar (340 – 85 psia)
- Expansion Ratio .................. 100:1
- Flow Rate .......... 0.45 – 0.09 g/sec (0.001 – 0.0002 lbf-sec)
- Valve ............................................ Dual Seat
- Valve Power (per Valve) .................. 8.25 Watts Max @ 28 Vdc & 20°C
- Mass ........................................... 1.27 kg (2.8 lbm)
- Bed Heaters and Temp. Sensors
- REM Plate Htrs (Thermostat Controlled) & Temp. Sensor
- MLI Blanket
- Electrical Interface: 1016 – 1118 mm (40 – 44”) Leadwires

Performance

- Specific Impulse .................. 224 – 209 sec (lbf-sec/lbm)
- Total Impulse ..................... 125,700 N-sec (28,263 lbf-sec) *
- Total Pulses ...................... 210,238 *
- Minimum Impulse Bit .................. 0.03 N-sec @ 6.9 bar & 15 ms ON
- Steady State Firing .................. 0.8 hr* – Single Firing
- Cumulative 176.9 hr* sec – Cumulative

Status

- Flight Proven

*As qualified for the MRM-103D
Basic MR-103D qualified to slightly higher levels.
MRM-106C 40N (9.0-lbf) ROCKET ENGINE MODULE

Design Characteristics
- Propellant: Monopropellant Hydrazine
- Catalyst: LCH-207/202
- Thrust/Steady State: 40 N (9.0 lbf)
- Feed Pressure: 31 bar (450 psia)
- Chamber Pressure: 16 bar (237 psia)
- Expansion Ratio: 61:1
- Flow Rate: 17.7 g/sec (0.039 lbm/sec)
- Valve: Single Seat
- Valve Power: 15 Watts Max @ 28 Vdc & 20°C
- Mass:
  - Axial: 0.12 kg (0.259 lbm)
  - Lateral: 0.36 kg (0.801 lbm)
  - Engine: 0.15 kg (0.319 lbm)
  - Valve: 0.20 kg (0.440 lbm)
- No Catalyst Bed Heaters or Valve Heaters
- 22 Pin Electrical Connectors

Performance
- Specific Impulse: 231 sec (lbf-sec/lbm)
- Total Impulse: 136,000 N-sec (30,618 lbf-sec)
- Total Pulses: 1,570
- Minimum Impulse Bit:
  - 2.62 N-sec @ 31 bar & 60 ms ON
  - (0.59 lbf-sec @ 450 psia & 60 ms ON)
- Steady State Firing: 1,000 sec – Single Firing
  - 2,991 sec – Cumulative

Status
- Flight Proven
MRM-106D 27/40N (6.0/9.0-lbf) ROCKET ENGINE MODULE

Design Characteristics
- Propellant ................. Monopropellant Hydrazine
- Catalyst ..................... LCH-207/202
- Thrust/Steady State .................. per Axial Rocket: 27 – 17 N (6.0 – 3.8 lbf)
- .................. per Lateral Rocket: 40 – 21 N (9.0 – 4.7 lbf)
- Feed Pressure ........... 31 – 13.8 bar (450 – 200 psia)
- Chamber Pressure .... Axial: 11.0 – 6.9 bar (160 – 100 psia)
- ............... Lateral: 17.2 – 8.6 bar (250 – 125 psia)
- Expansion Ratio .................. 61:1
- Flow Rate ...................... Axial: 11.8 – 7.51 g/sec (0.026 – 0.017 lbm/sec)
- .................. Lateral: 17.7 – 9.52 g/sec (0.039 – 0.021 lbm/sec)
- Valve .................. Single Seat, Non-Sliding Fit
- Valve Power ............. 20.1 Watts Nominal @ 28 Vdc & 21°C
- Mass .................. 4-Engine REM: 2.7 kg (5.96 lbm)
- .................. 2-Engine REM: 1.5 kg (3.34 lbm)
- No Catalyst Bed Heaters or Valve Heaters
- 10 Pin Electrical Connectors on 4-Engine REM
- 6 Pin Electrical Connectors on 2-Engine REM

Performance
- Specific Impulse ............... 234 – 227 sec (lbf·sec/lbm)
- Total Impulse (Axial & Lateral) .... 91,200 N·sec (20,500 lbf·sec)
- Total Pulses ..................... >7,629 (Lateral) >1,500 (Axial)
- Minimum Impulse Bit ........ 0.63 N·sec @ 31 bar & 20 ms ON
- .................. (0.142 lbf·sec @ 450 psia & 20 ms ON)
- Steady State Firing ............... 1,000 sec – Single Firing

Status
- Flight Proven
**MRM-106E 22N (5.0-lbf) ROCKET ENGINE MODULE (REM)**

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**Design Characteristics**
- Propellant: Hydrazine
- Catalyst: LCH-227/202
- Thrust/Steady State: 30.7 – 11.6 N (6.9 – 2.6 lbf)
- Feed Pressure: 24.1 – 6.9 bar (350 – 100 psia)
- Chamber Pressure: 12.4 – 4.5 bar (180 – 65 psia)
- Expansion Ratio: 60:1
- Flow Rate: 12.1 – 5.0 g/sec (0.0289 – 0.011 lbm/sec)
- Valve Power: 25.3 Watts Max @ 28 Vdc & 21°C
- Mass: 4.1 kg (1.86 lbm) Max

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**Performance**
- Specific Impulse: 235 – 229 sec (lbf·sec/lbm)
  - REA ‘A’
  - REA ‘B’
  - Mars*
- Total Impulse: 120,000 N-sec 125,000 N-sec 90,587 N-sec
  - (26,958 lbf·sec) (28,044 lbf·sec) (20,366 lbf·sec)
- Total Pulses: 12,405 186 66,631
- Minimum Impulse Bit: 0.46 N-sec @ 12.8 bar & 16 ms ON
  - (0.103 lbf·sec @ 185 psia & 16 ms ON)
- Steady State Firing: 2,000 sec – Single Firing
  - 4,670 sec – Cumulative

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**Status**
- Flight Proven

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* *Mars Odyssey Test Program
December 2000*

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Approved for public release and export
MRM-106F 40N (9.0-lbf) ROCKET ENGINE MODULE

**Design Characteristics**
- Propellant: Monopropellant Hydrazine
- Catalyst: LCH-207/202
- Thrust/Steady State (per Rocket): 40 N (9.0 lbf)
- Feed Pressure: 31 bar (450 psia)
- Chamber Pressure: 16 bar (237 psia)
- Expansion Ratio: 61:1
- Flow Rate: 17.7 g/sec (0.039 lbm/sec)
- Valve: Single Seat, Non-Sliding Fit
- Valve Power: 20.1 Watts Nominal @ 28 Vdc & 21°C
- Mass: <2.23 kg (4.9 lbm) per REM
- No Catalyst Bed Heaters or Valve Heaters
- 22 Pin Electrical Connector

**Performance**
- Specific Impulse: 231 sec (lbf·sec/lbm)
- Total Impulse: 136,000 N·sec (30,618 lbf·sec)
- Total Pulses: 1,570
- Minimum Impulse Bit: 2.62 N·sec @ 31 bar & 20 ms ON (0.59 lbf·sec @ 450 psia & 60 ms ON)
- Steady State Firing: 1,000 sec – Single Firing, 2,991 sec – Cumulative

**Status**
- Flight Proven