

Development Status of the NASA MC-1 (Fastrac) Engine

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MC-1 Engine

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and Space Administration

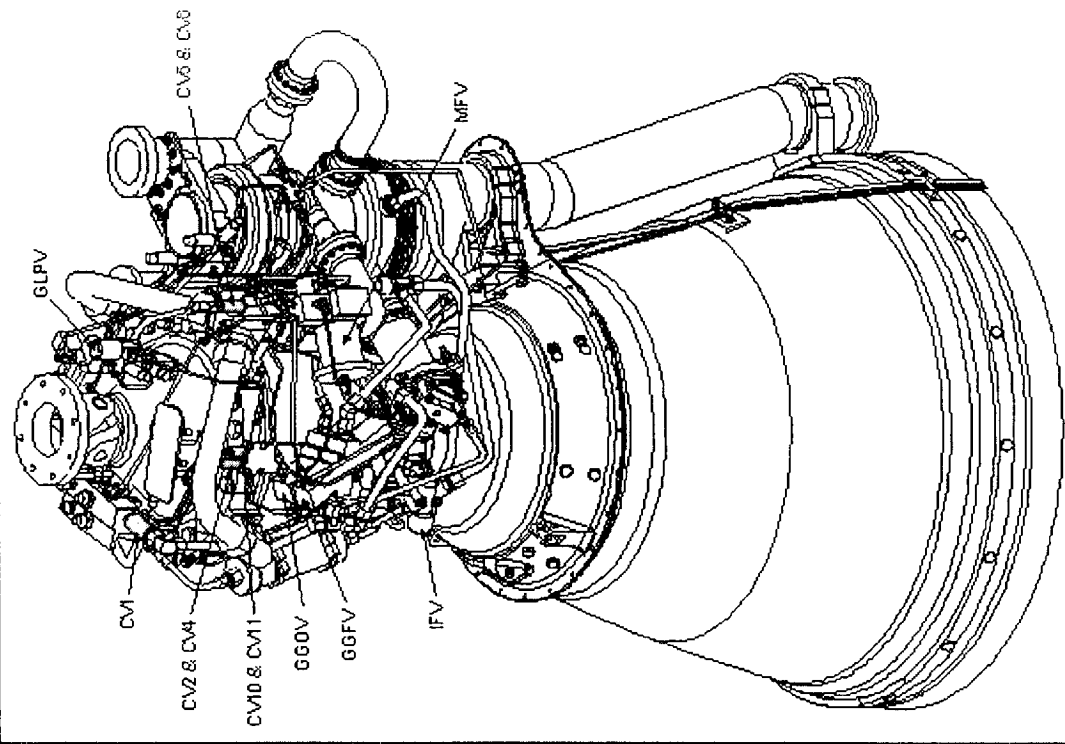
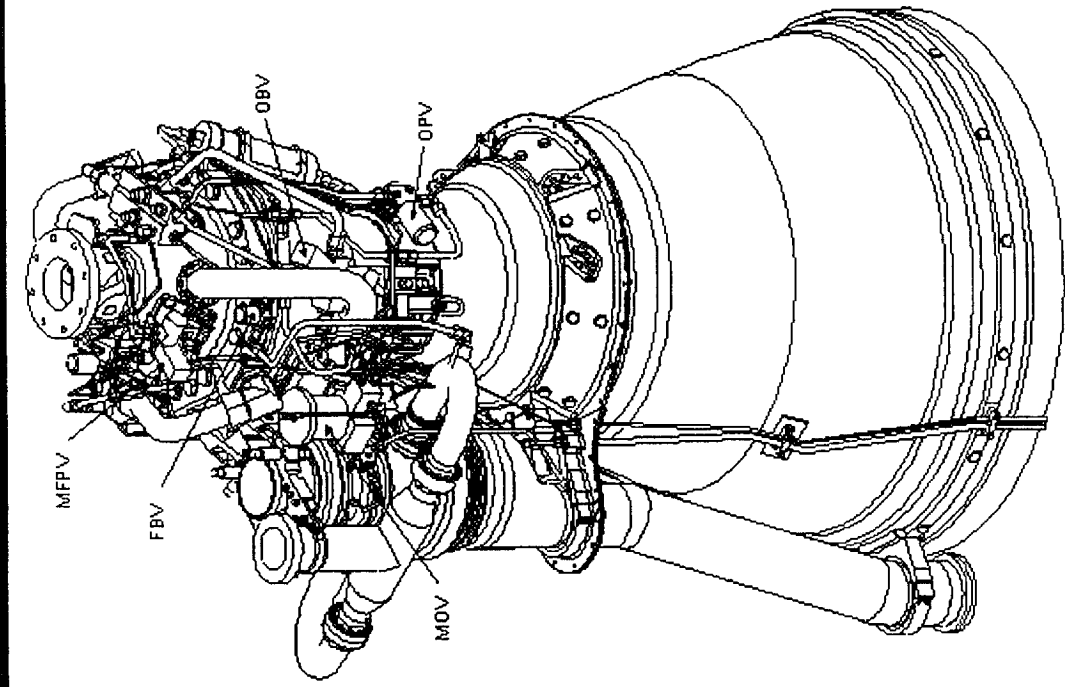
Ballistics
Flight Center

- LOX/RP-1 Propellants
- Nominal Key Performance Requirements
 - 652 psia Main Chamber Pressure
 - 1600°R Turbine Inlet Temperature
 - 2.17 Mixture Ratio
 - 63939 lbf Vacuum Thrust
 - 314.0 Vacuum Specific Impulse
- GG Power Cycle
- Single-shaft Integrated Turbopump Assembly
- Ablative Thrust Chamber/Nozzle

MC-1 Engine Views

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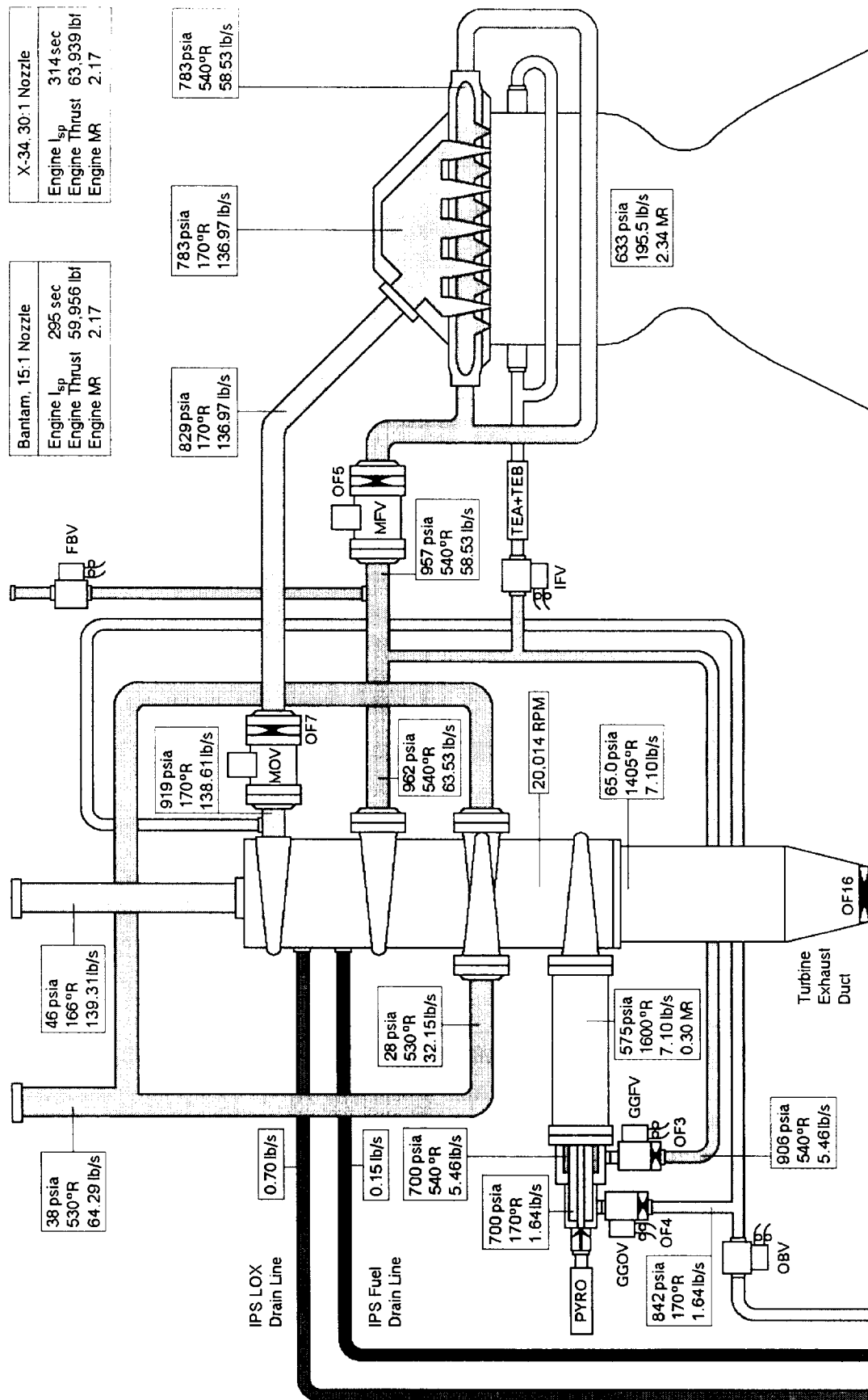
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MC-1 Engine Schematic

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Development Test Summary

- Development Testing Initiated at SSC on 24 Oct 1998
- Two Test Facilities Used at SSC B2 Complex
 - Horizontal Test Facility (HTF) – 9 Cold-Flows, 27 Hotfires
 - Propulsion Test Article –1 (PTA1) – 2 Cold-Flows, 3 Hotfires
- Currently Testing at Santa Susannah Field Lab (SSFL)
 - Alfa-1 – 2 Cold-Flows, 3 Hotfires
- 48 Tests Completed on 3 Engines (E1, E2, E3)
 - 33 Hot-Fires
 - 13 Cold-Flows
 - 2 Dry Countdown Demonstration Tests

Hotfire Test Summary

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- 33 Hotfire Tests Conducted
 - Programmed Durations Ranging from 2.5 to 159 secs
 - Horizontal and Vertical Orientation
 - Ambient and Cold-Soaked ($\pm 25^{\circ}$ F) Environment
 - Nominal and Conditioned Propellants
- 14 Premature Cut-Offs (PCO's)
 - 10 Engine-Initiated
 - 4 Facility-Initiated
 - 58% Test Success Rate for Achieving Full Duration

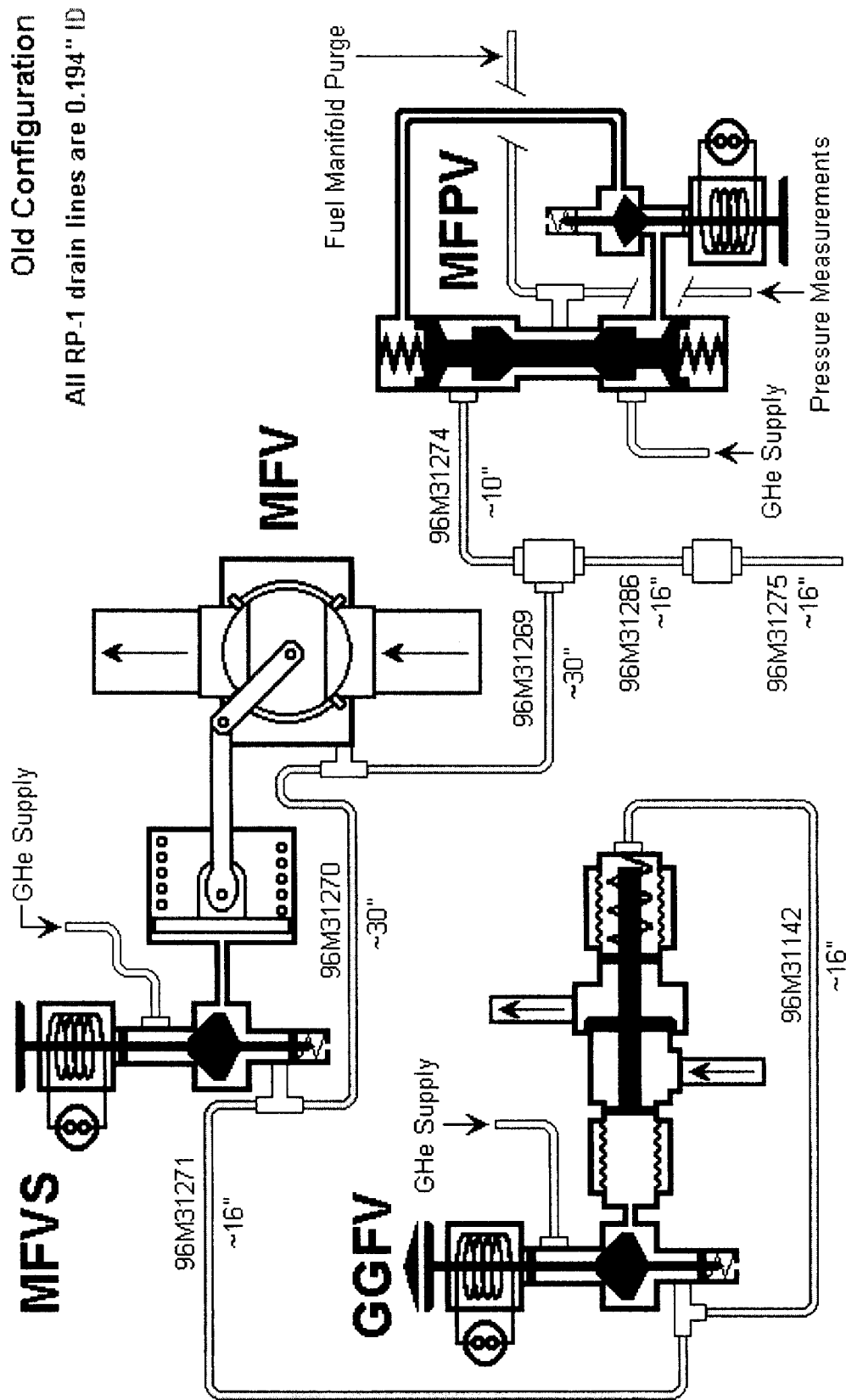
Lessons Learned During Testing

- MFV Cycling Anomaly (FRT Pre-H0-4R)
- Slow OBV Closure Performance
- MFV Seal Failure (Test H1-5b)
- GGFV Seal Failure (Test H3-1a)
- Start Sequence Modifications
- H4-3 Pop Anomaly

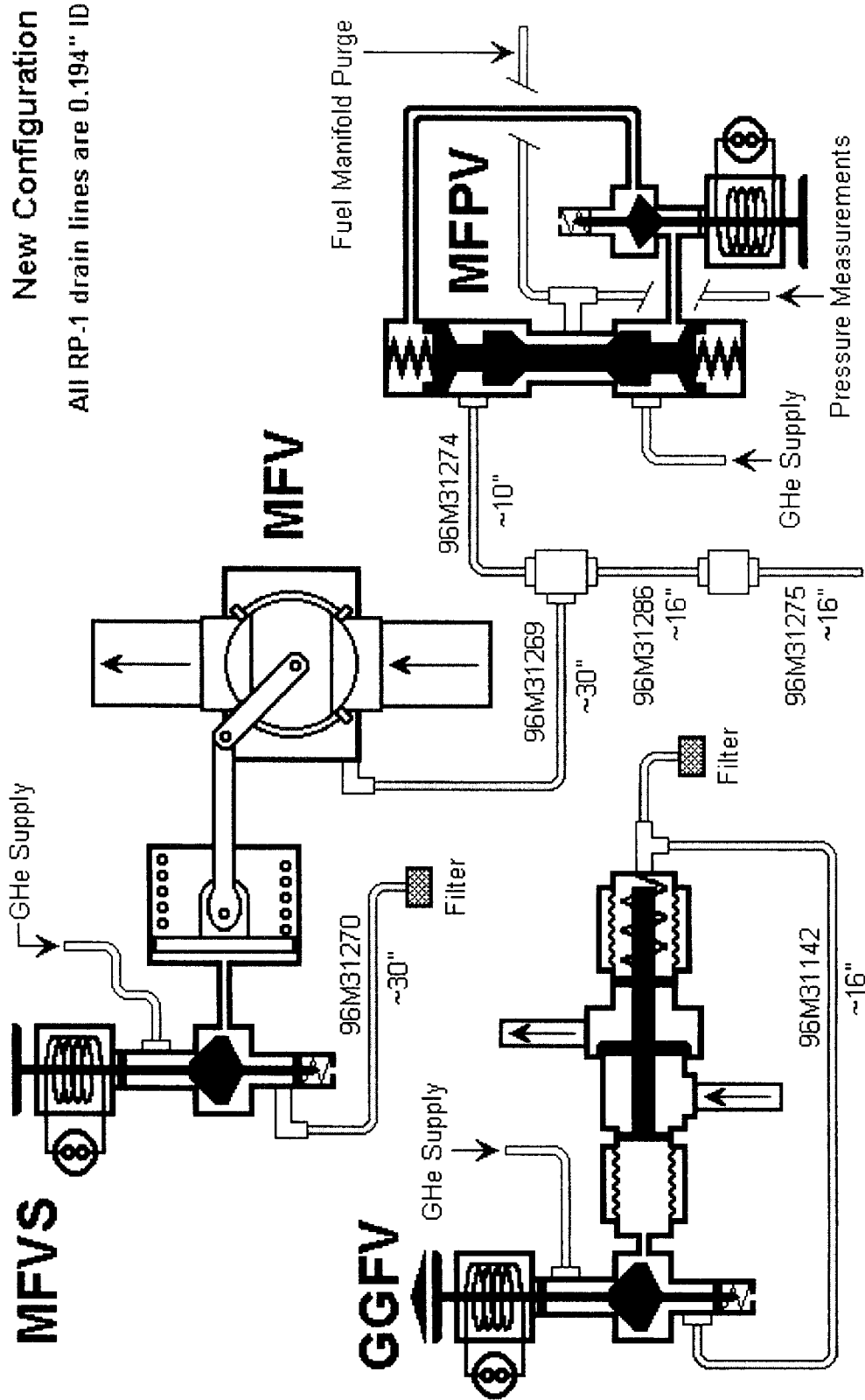
MFV Cycling Anomaly

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MFV Cycling Anomaly

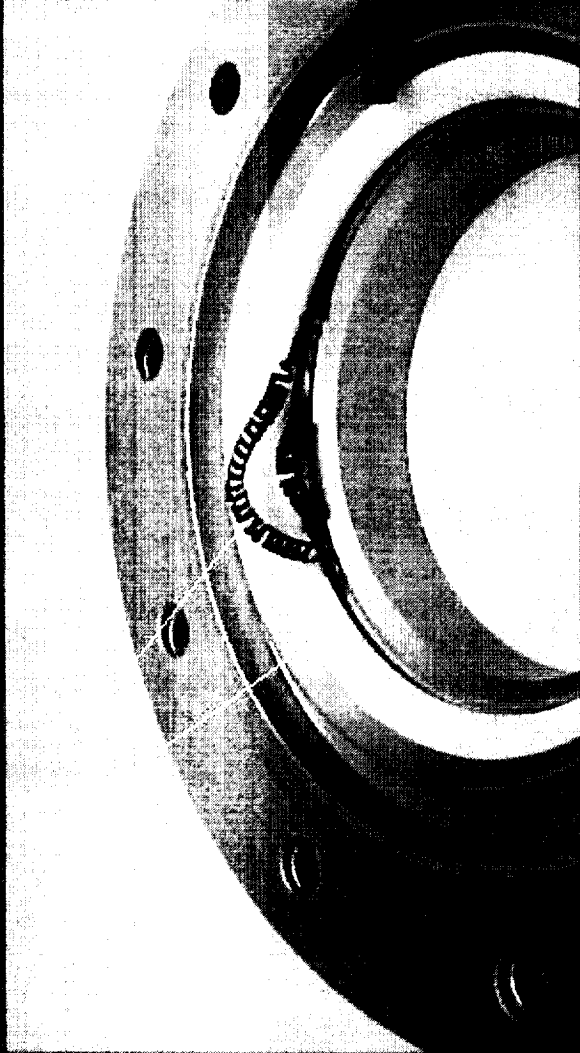




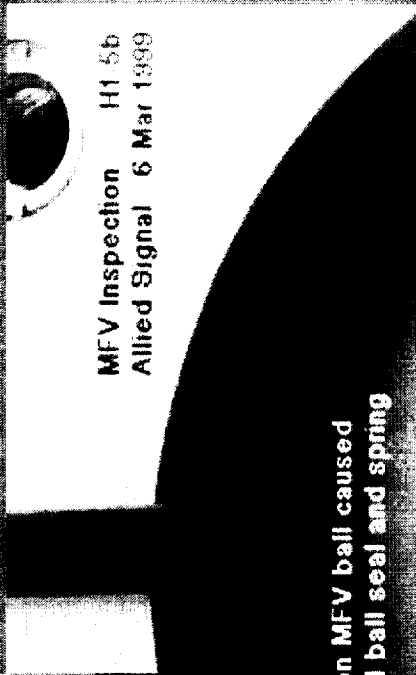
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MFV Seal Failure

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Scratches on MFV ball caused
by extruded ball seal and spring



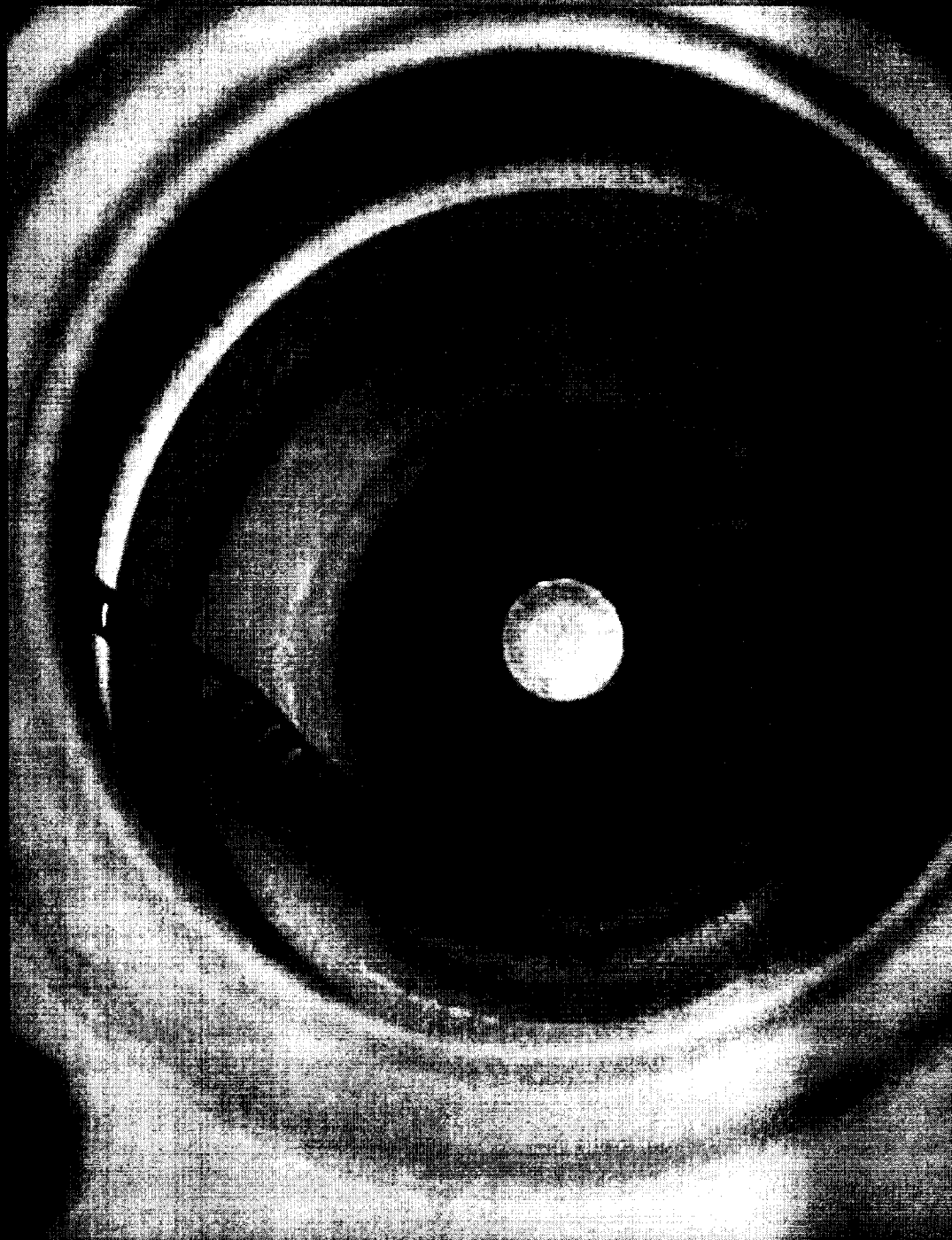
MFV Inspection H1 5b
Allied Signal 6 Mar 1999



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GGFV Seal Failure

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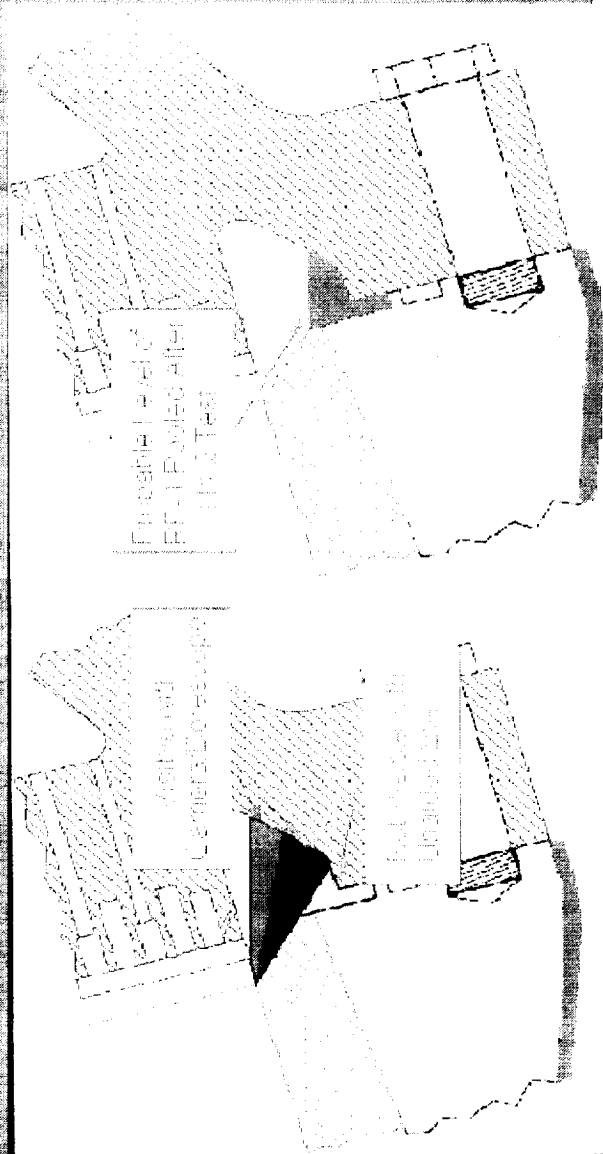
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H4-3 Pop Anomaly

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Failed Primary Seal (moved
aside to show damaged land)

Post H4-3 Engine 2 Disassembly
(showing sheared-off land between
the primary and secondary chamber
seal cavities) 11 Nov 1999

