

ITEM

10

# OV-103 LO2 17" Feedline BSTRA Ball Crack Investigation



KSC Ground Operations



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12/11/2002

USA Main Propulsion System

1

## Background

- During OV-103 17" feedline BSTRA inspections (OMDP requirement), a suspect crack on the feedline BSTRA ball nearest the manifold was detected via borescope inspections (ref PR MPS-3-J3-1589).



## Background

- BSTRA joints are located in the 2 upstream SSME 12" feedline joints and all 3 17" feedline flex joints. Total number of BSTRAs per orbiter: 18.
- BSTRAs provide internal structural support to the feedlines while allowing the line to articulate under cryogenic, pressurized, dynamic loading conditions.
- Each BSTRA consists of 2 hubs, suspended in the flow stream by 3 mounting legs, with a ball located inside the hubs.

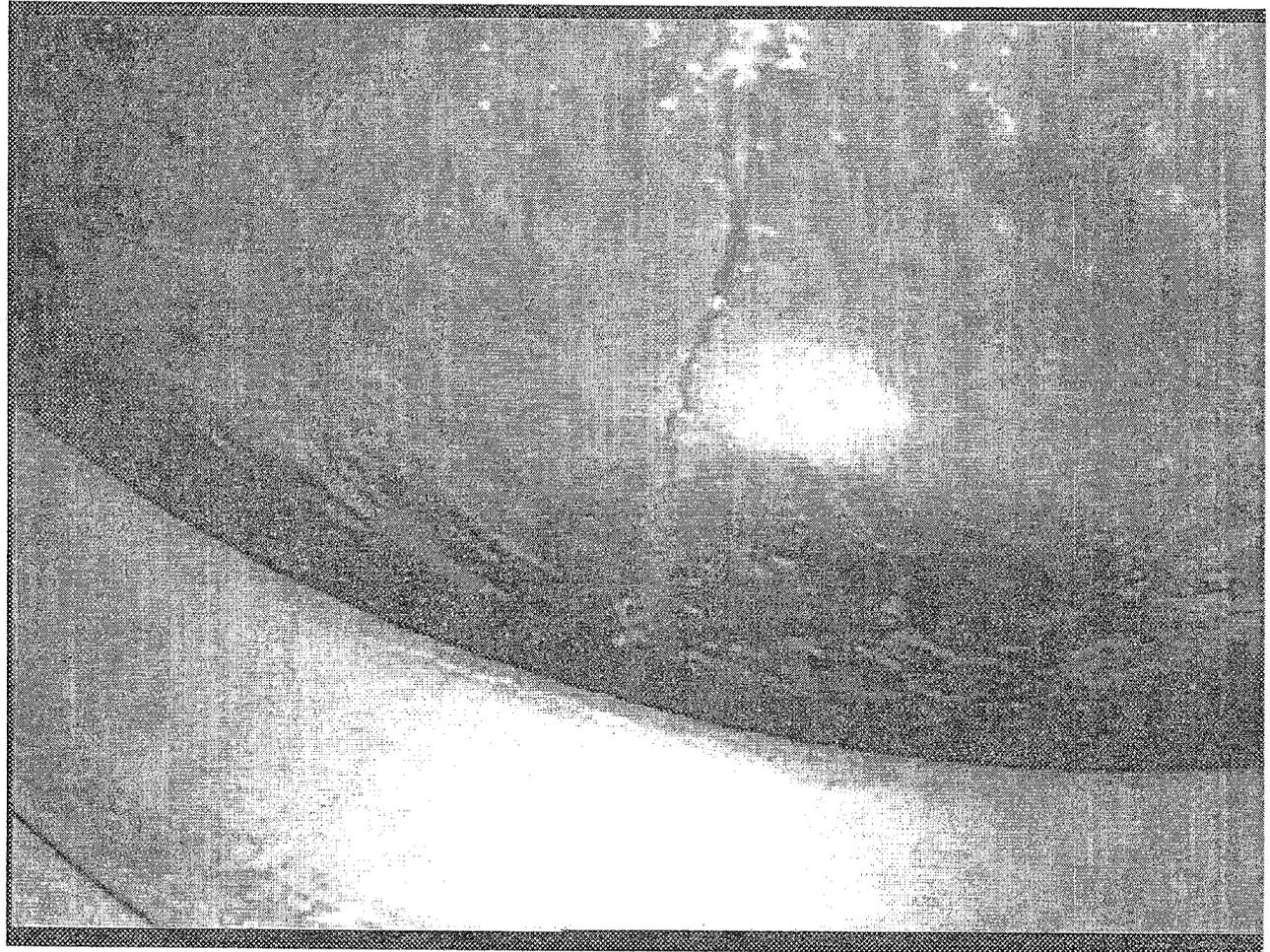


## Background

- BSTRA cups are Inconel 718
- The ball material is a vendor proprietary material “Stoody #2” which is an alloy of Co, Cr, W, Si, C, Fe, Mo
- The ball is coated with vitrolube
- Ball dimensions:
  - ◆ LO2 17” – 2.25”
  - ◆ LO2 12” – 1.75”
  - ◆ LH2 (all) – 1.25”



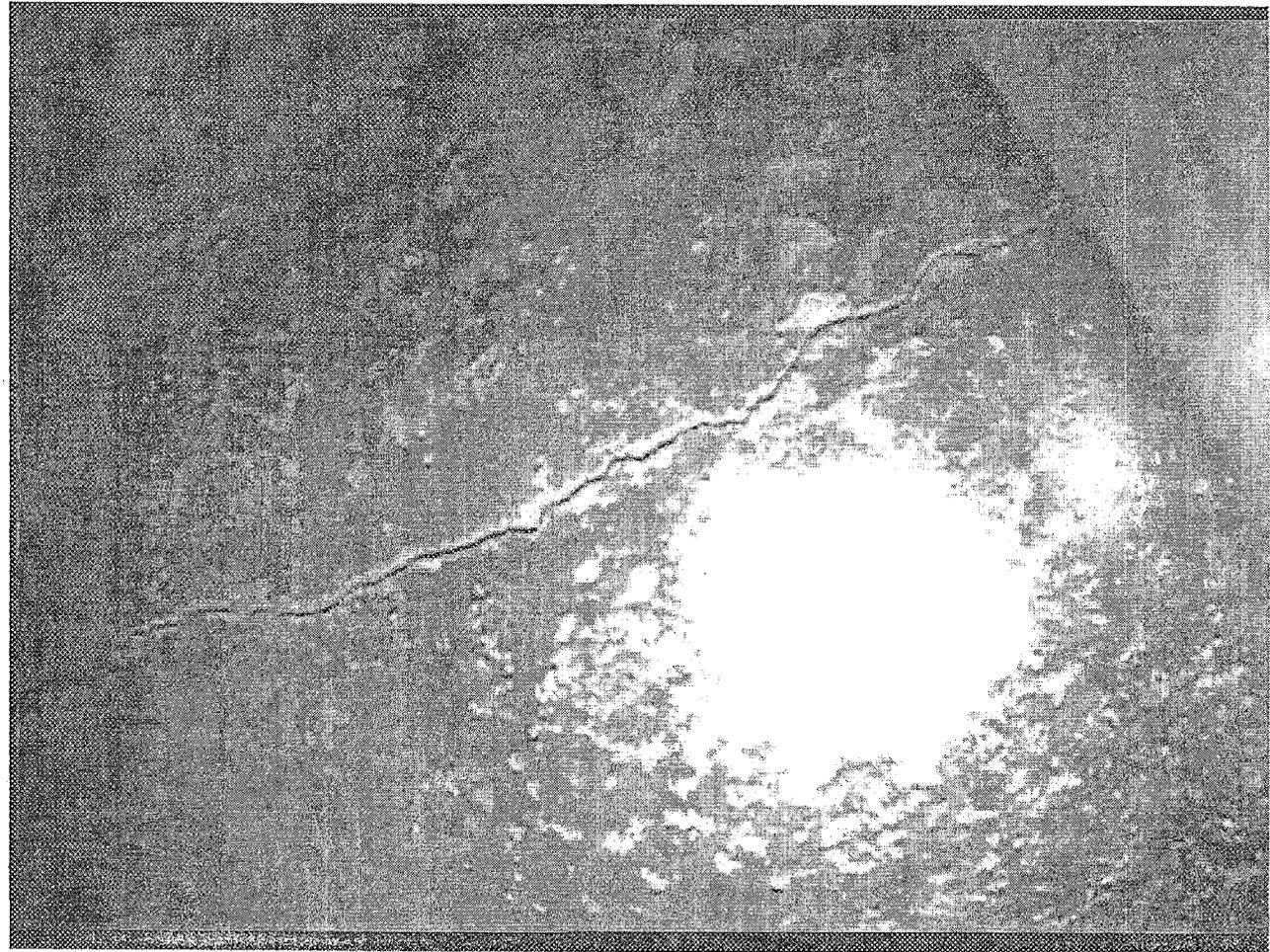
# OV-103 BSTRA Ball Crack Photo 1



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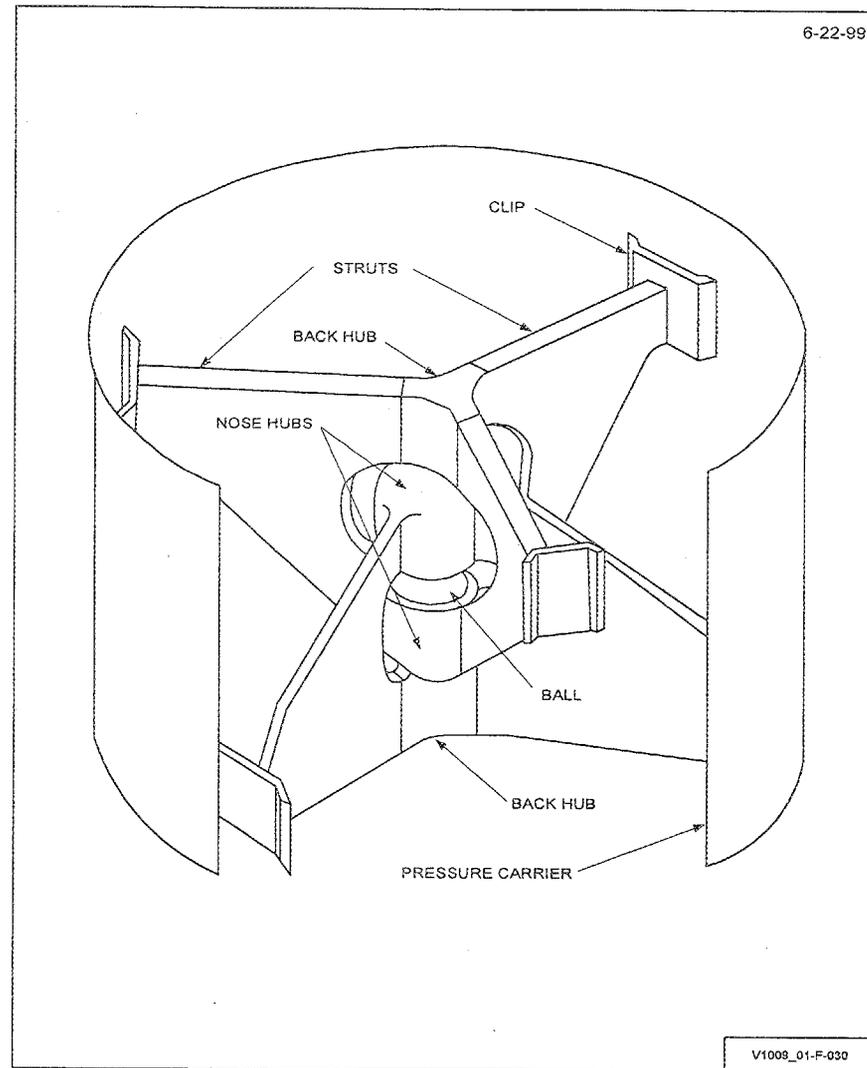
## OV-103 BSTRA Ball Crack Photo 2



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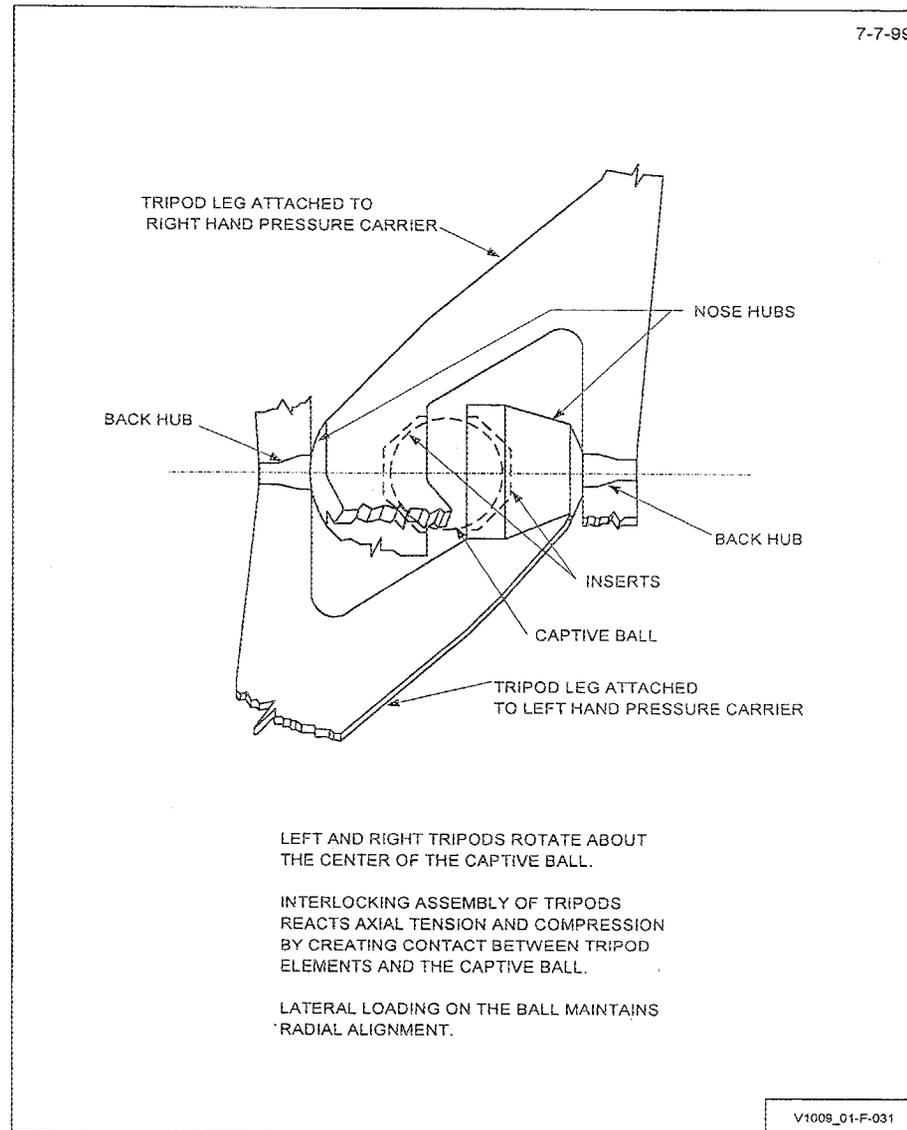
# BSTRA Figure 1



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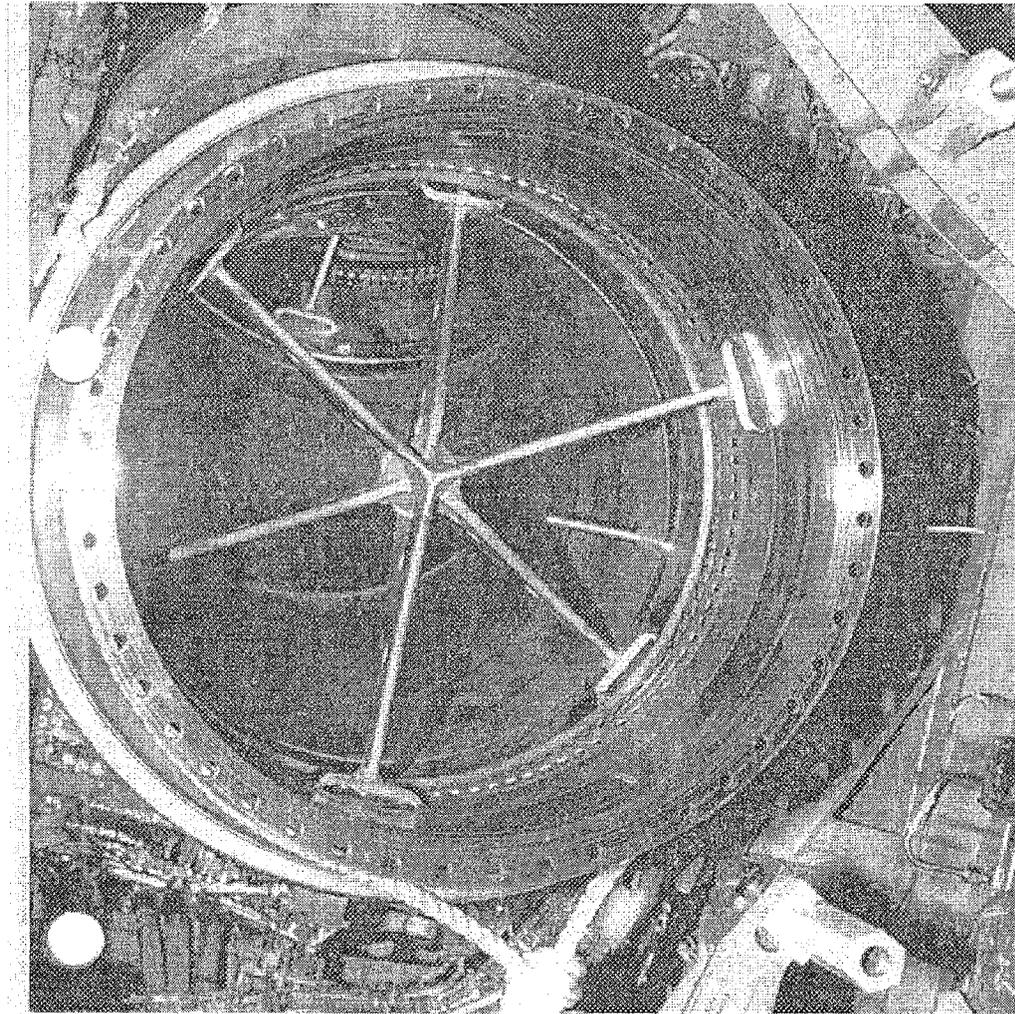
## BSTRA Figure 2



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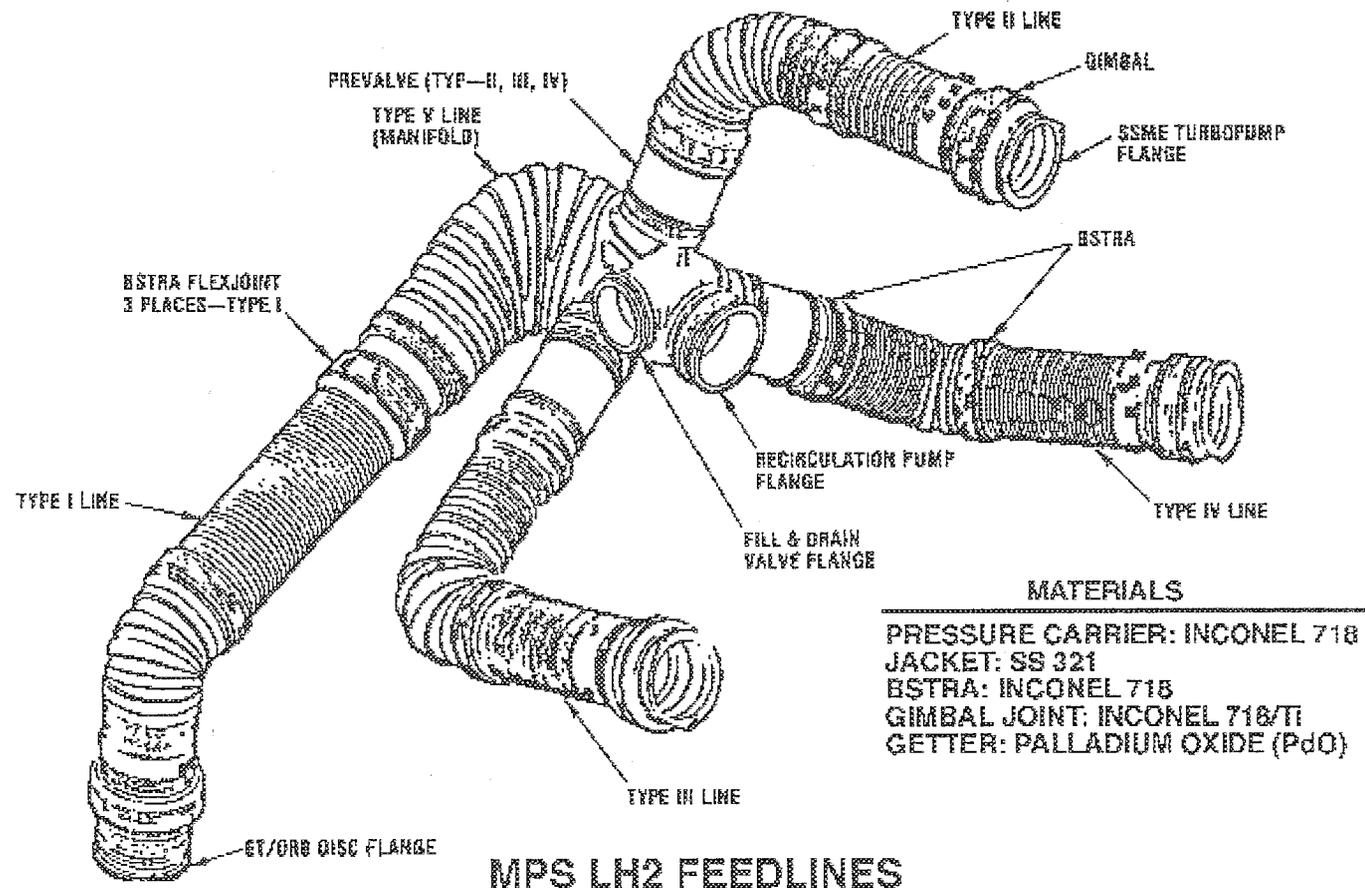
# BSTRA Photo Typ. 1



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BSTRA Figure 3



**MATERIALS**

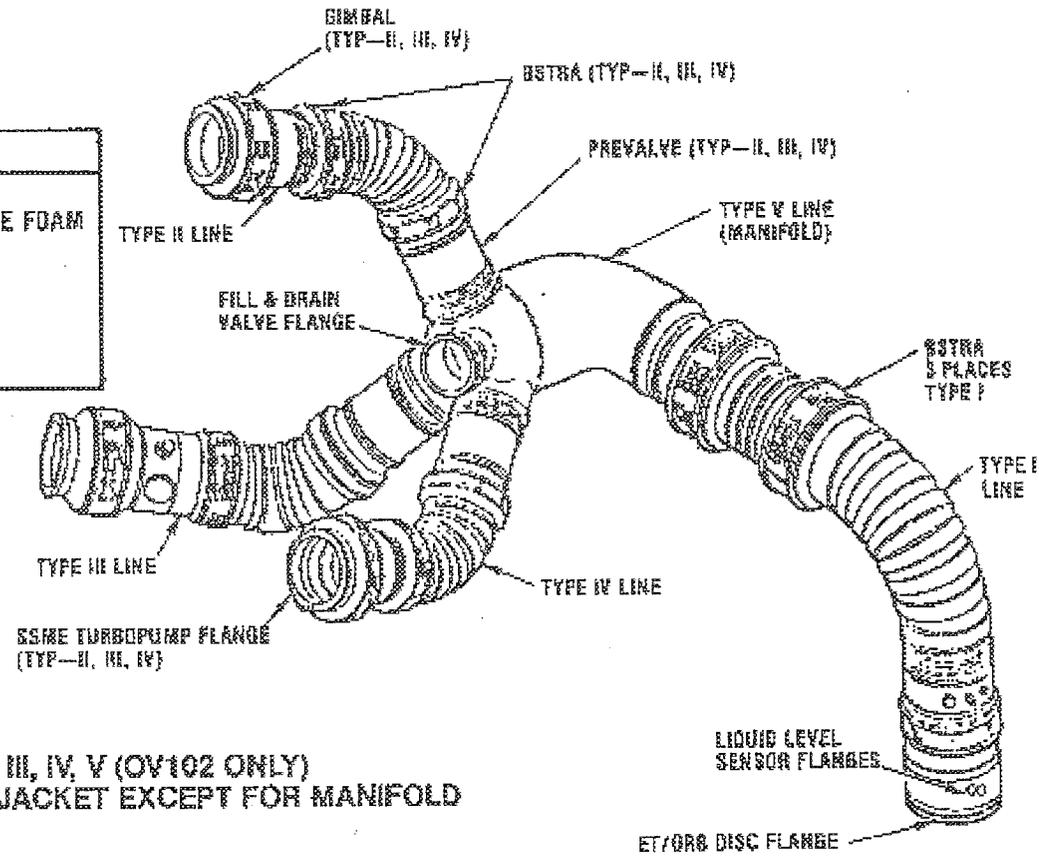
PRESSURE CARRIER: INCONEL 718  
 JACKET: SS 321  
 BSTRA: INCONEL 718  
 GIMBAL JOINT: INCONEL 718/TI  
 GETTER: PALLADIUM OXIDE (PdO)

**MPS LH2 FEEDLINES  
 (MC271-0073)  
 TYPES I, II, III, IV & V**



# BSTRA Figure 4

MATERIALS	
PRESSURE CARRIER:	INCONEL 718
MANIFOLD INSULATION:	POLYURETHANE FOAM MBO 130-146
JACKET:	SS 321
BSTRA:	INCONEL 718
GIMBAL JOINT:	INCONEL 718/TI
GETTER:	PALLADIUM OXIDE (PbO)



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# Next Steps

- OV-102 (Flight 28, STS-107):
  - ◆ A detailed borescope inspection of the BSTRA assemblies was completed during J3 OMDP (prior to flight 27). No anomalies were detected. Video analysis is in work.
  - ◆ Video of the BSTRA assemblies available from the feedline flowliner crack investigation is inconclusive when specifically addressing the BSTRA balls.



# Next Steps

- OV-102 (Flight 28, STS-107) Cont'.:
  - ◆ If flight rationale will not support STS-107 without further investigation:
    - ★ Borescope access to 17" LO2 feedline BSTRA assemblies is available by removal of LO2 ECO sensor (approx 1.4" opening). Access to the manifold end ball will be difficult. Borescope access to 17" LH2 feedline BSTRA assemblies (if deemed necessary) is available by removal of latch borescope inspection port plug (3/4" port). Access to the manifold end ball will be limited.
    - ★ Borescope access to 12" feedline BSTRA assemblies is available by removal of LO2/LH2 feedline instrumentation port transducers and 102 unique pogo plates. Access to the prevalve end ball will be difficult.



# Next Steps

- OV-104 (Flight 27, STS-114):
  - ◆ BSTRA borescope inspections were last performed during J2 OMDP (1998, prior to flight 21).
  - ◆ Video from flight 26 feedline flowliner crack investigation will be reviewed.
  - ◆ Borescope access to 17" feedline BSTRA assemblies is available if deemed necessary via open disconnect in the OPF.
  - ◆ Borescope inspections of the 12" feedline BSTRA joints can be performed via open SSME feedline. SSME installation is scheduled to begin today (12/10/02), which is currently constrained by this issue.



# Next Steps

- OV-105 (Flight 20, STS-115):
  - ◆ BSTRA borescope inspections were last performed during J1 OMDP (flight 12) and are scheduled to be worked this flow.
  - ◆ Video from flight 19 feedline flowliner crack investigation will be reviewed.
  - ◆ Borescope access to 17" feedline BSTRA assemblies is available if deemed necessary via open disconnect in the OPF.
  - ◆ Borescope inspections of the 12" feedline BSTRA joints can be performed via open SSME feedline.



# Next Steps

- OV-103 (Flight 31, STS-121):
  - ◆ Borescope access to 17" feedline BSTRA assemblies is available via open disconnect. Inspections are being reperformed, with M&P inspection support.
  - ◆ LH2 17" BSTRA inspections are complete with no anomalies.
  - ◆ Borescope inspections of the 12" feedline BSTRA joints are continuing.
  - ◆ OV-103 BSTRA inspections were last performed during J2 OMDP (flight 22, 1995). The video is being reviewed.
  - ◆ More to follow on suspect ball crack...



## Next Steps - Actions from 12/10 Meeting

- OV-103:
  - ◆ Complete inspections of all BSTRAs.  
Re-perform inspection of suspect ball using previously used borescope to determine detectability of anomaly.
- OV-104:
  - ◆ Perform inspections of all BSTRAs.  
Priority on SSME feedlines (constraint to SSME installation).
- OV-102:
  - ◆ Continue to investigate access options for borescope inspections at the PAD.



## Next Steps - Actions from 12/11

- OV-103:

- OV-104:

- OV-102:

