

Schwarz-1, Henry

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From: Palmer, Michael J [michael.j.palmer@usago.ksc.nasa.gov]  
Sent: Tuesday, January 14, 2003 7:55 AM  
To: Beil, Robert J ; Douglas, Tamara A ; Frazer, John W.  
Subject: WAVE Office 2000 version 5.0

If we can get this signed off by 10:30 or 11, we may be able to walk it on to PMRB today.



MPS-2-~1.DOC

ITEM

7

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MPS-2-28-1551  
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## SUSPECT BSTRA ASSEMBLY

Element/End Item: OV102  
Flow/Usage: FLIGHT 28/STS107  
Facility: OPF  
Design Center Concurrence: JSC  
Category:  
OPR:  
TTL ORG:



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The following signatures are for the Deferral disposition only.

| Organization | Name (Printed) | Name (Signature) | Date |
|--------------|----------------|------------------|------|
| OPR-MR       |                |                  |      |
| NASA-SE      |                |                  |      |
| ORB-LSS      |                |                  |      |
| QE           |                |                  |      |
|              |                |                  |      |

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PMRB Concurrence with the Disposition per rationale on page(s) \_\_\_\_\_

| Organization                              | Name (Printed) | Name (Signature) | Date |
|---|----------------|------------------|------|
| Shuttle Engineering,<br>KSC               |                |                  |      |
| Process Engineering,<br>KSC,PMRB Chairman |                |                  |      |
| LSS Engineering                           |                |                  |      |
| SSP Element Project<br>Office KSC         |                |                  |      |
| LSS System Integration                    |                |                  |      |
| SSP Engineering<br>Integration KSC        |                |                  |      |
| S & MA                                    |                |                  |      |
| Chief, MA<br>Engineering, KSC             |                |                  |      |
|   |                |                  |      |
|   |                |                  |      |
|   |                |                  |      |
| PMRB Chairman<br>Secretary                |                |                  |      |

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**1.0 INFORMATION****1.3 Operations List**

| Operation |          | Shop/<br>Cntl Rm.<br>Console | OPR | Haz<br>(Y/N) | Duration<br>(Hrs) |
|-----------|----------|------------------------------|-----|--------------|-------------------|
| No.       | Title    |                              |     |              |                   |
| 10        | Deferral | AFT/<br>NA                   | MPS | N            | 30                |

**2.0 SAFETY INFORMATION****2.4 Reference Safety Documentation**

| Number     | Rev | Title                             |
|------------|-----|-----------------------------------|
| KHB 1710.2 | LI  | KSC Safety Practices Handbook     |
| GSOP 5400  | LI  | Ground Safety Operating Procedure |

**3.0 STAGING REQUIREMENTS****4.0 PLANNING REQUIREMENTS**

OIR Required Yes [ ], No [X]

Predecessors:

Successors:

Configuration Required:

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## 5.0 CONFIGURATION ACCOUNTING AND VERIFICATION

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### OPERATION 10 Deferral

Shop: AFT  
Cntrl Rm Console: NA  
OPR: MPS  
Zone: 330  
Hazard (Y/N): N  
Duration (Hrs): 30

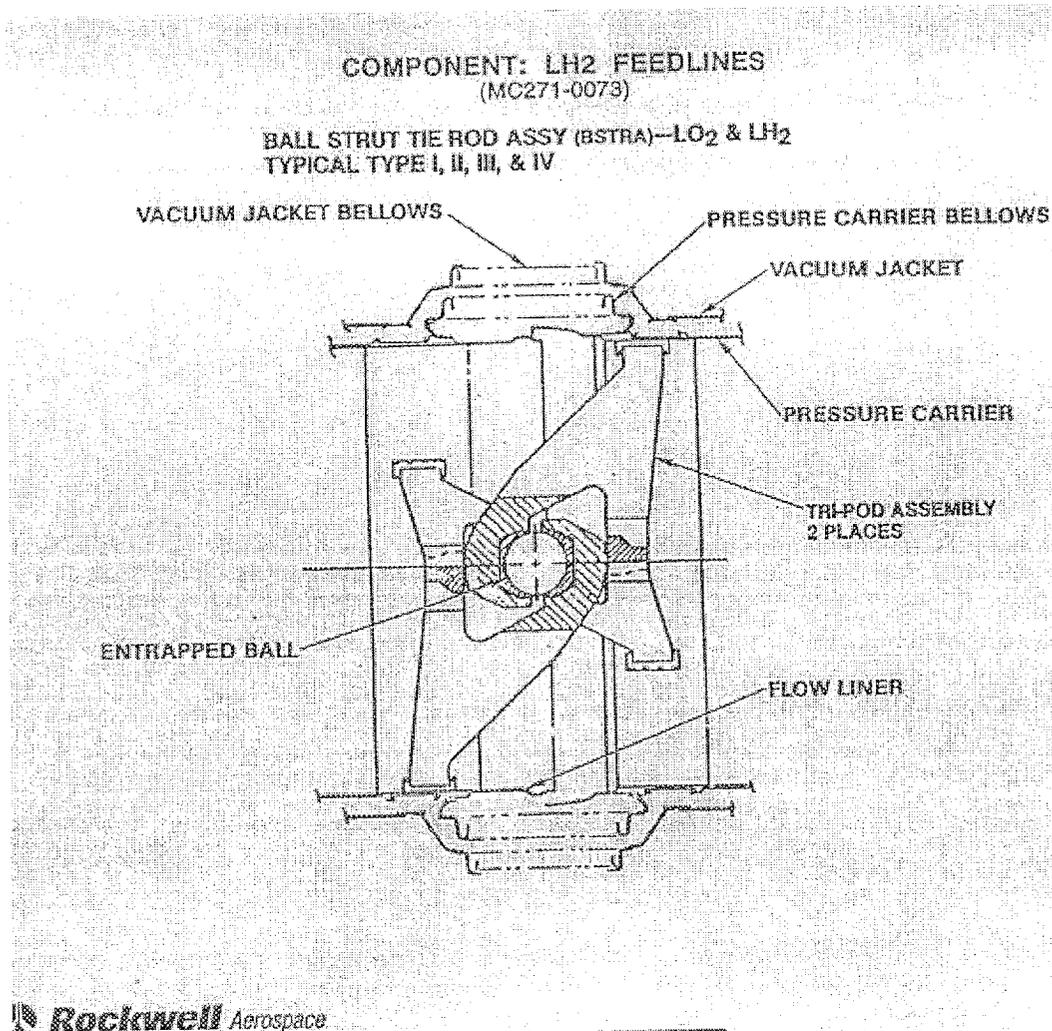


Figure 10-1 - Typical Ball-Strut-Tie-Rod-Assembly (BSTRA)  
(For Reference Only)

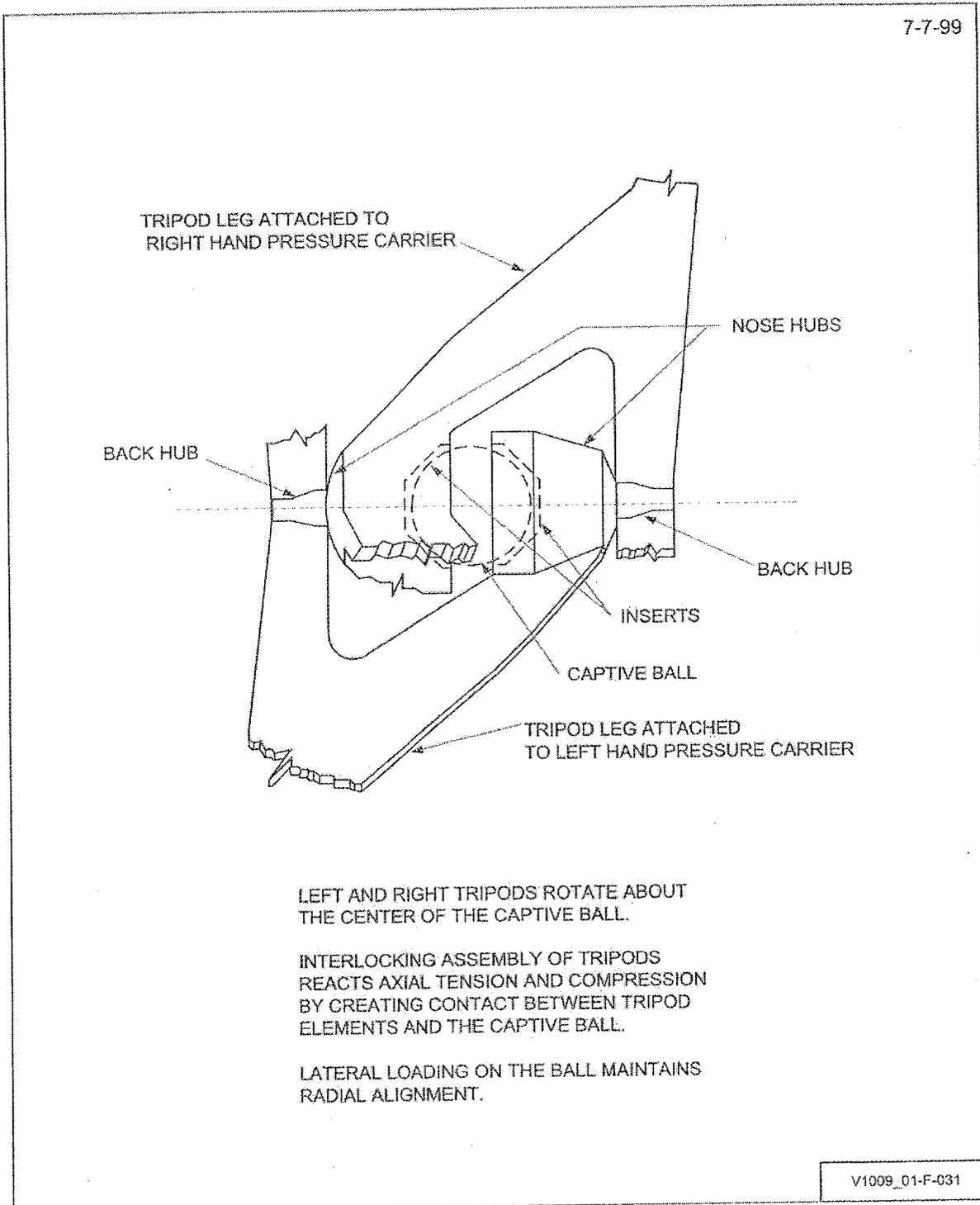


Figure 10-2 - Closeup of Captive Ball and Hubs  
(For Reference Only)

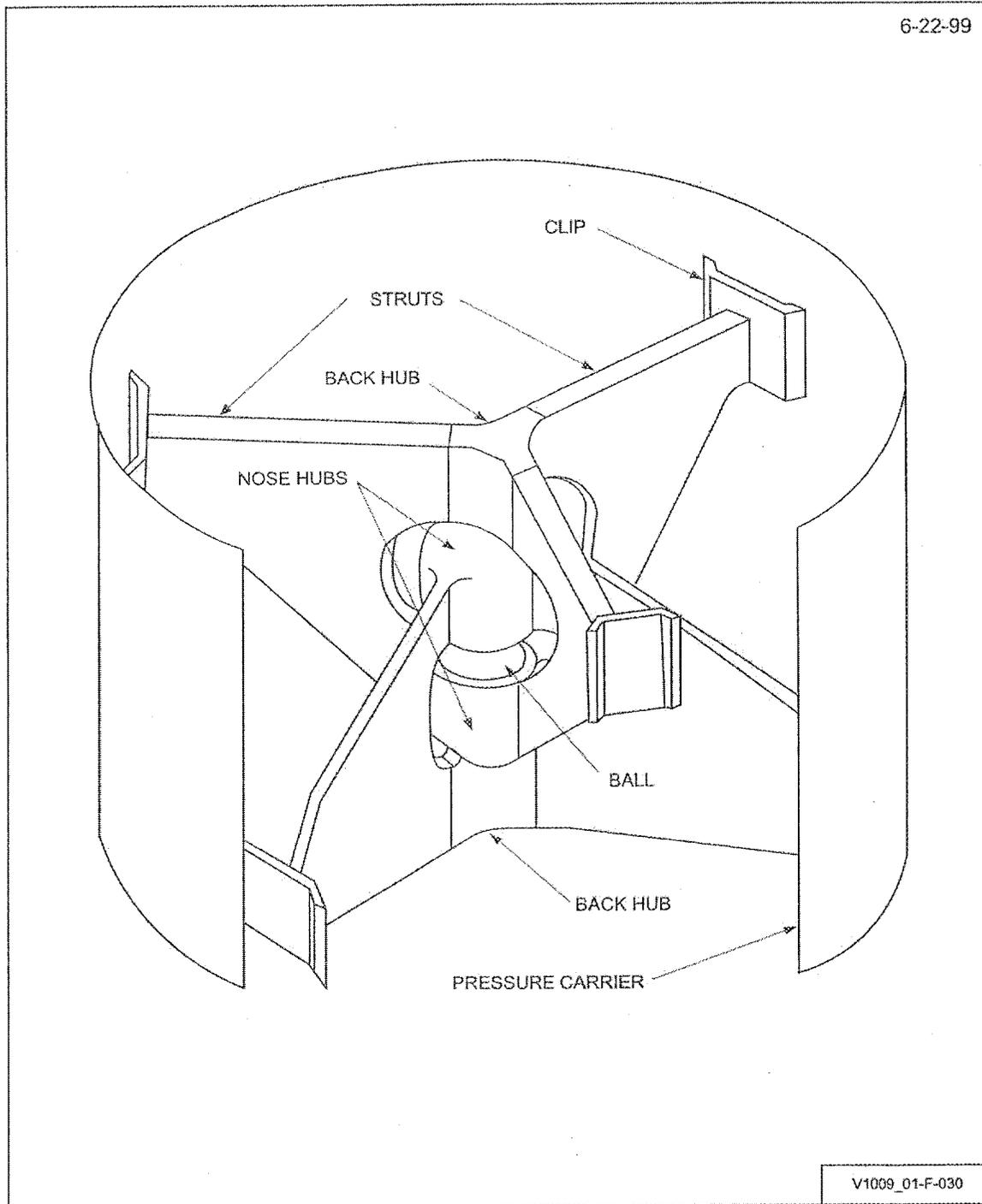


Figure 10-3 - Three Dimensional View; Ball-Strut-Tie-Rod-Assembly (BSTRA)  
(For Reference Only)

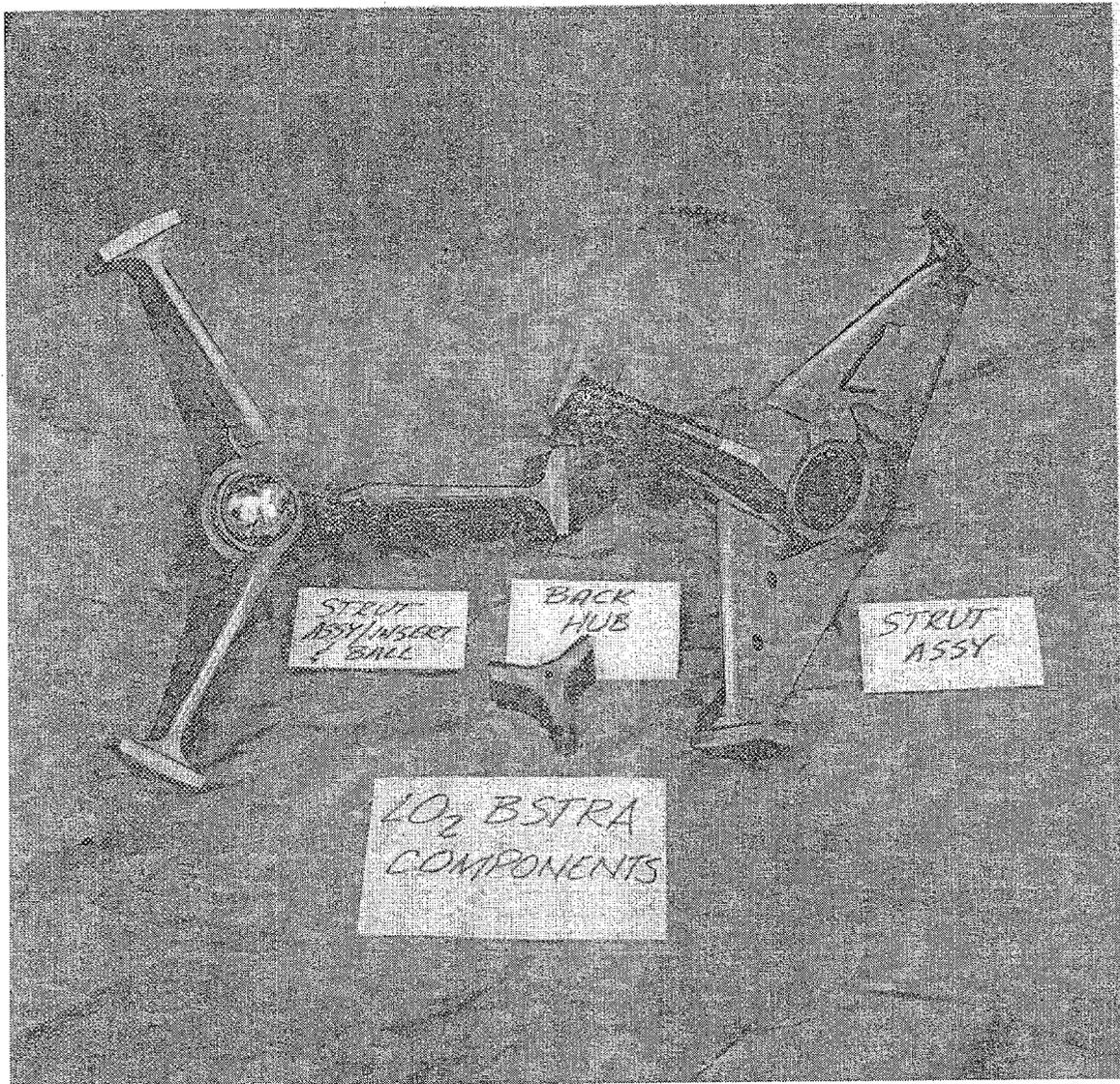
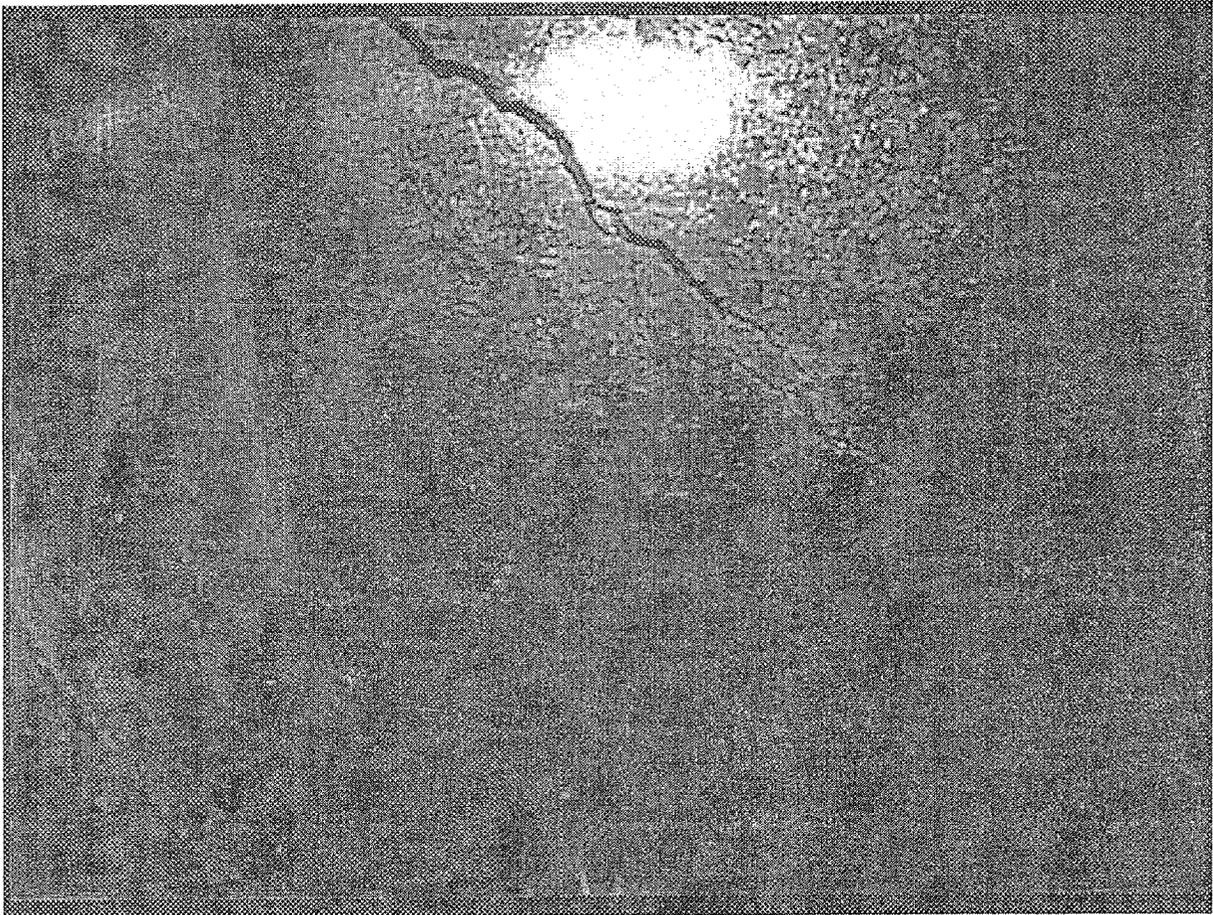


Figure 10-4 - Ball-Strut-Tie-Rod-Assembly (BSTRA) Components  
(For Reference Only)



**Figure 10-5 - Cracked Ball on OV103  
(For Reference Only)**

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**ACTION REQUESTED - RESTRICTED LIFE DEFERRED "USE AS IS"**Ref. Item #   1  

Recommend Deferral approval, acceptance of disposition for Restricted Life "Use as is".

[X] One Flight, [ ] Future Flight \_\_\_\_\_.

**Rationale:**

During OV103 OMDP borescope inspections of the Ball-Strut-Tie-Rod-Assemblies (BSTRA), a crack was found in the ball LO2 17" feedline aft BSTRA. Consequently, suspect PR's were initiated on all orbiters. Subsequent borescope inspections of all BSTRA balls in OV103, OV104, and OV105 found no other indications. OV102 could not perform these inspections at the Pad, however, the same video borescope inspections were performed prior to its last flight (STS-109) at Palmdale. No anomalies were noted during the investigation and a review of the videotape reveals no apparent indications.

The BSTRA is an internal support mechanism for the bellows assemblies of the LO<sub>2</sub> and LH<sub>2</sub> 17 inch and 12 inch feedlines. Each 17 inch feedline has three BSTRA assemblies, each 12 inch feedline has two. Reference figures 10-1 through 10-5 for hardware description.

Upon discovery of the crack, testing to better understand the material properties of the BSTRA balls was accomplished. Tests included subjecting BSTRA balls to extreme cryogenic conditions in conjunction with load forces. The environments the test specimens were subjected to were extreme when compared to the flight environment the balls typically are exposed to (i.e.: bare balls thermally shocked at cryogenic temperatures, dynamic portion of each loading cycle represents approximately 4X actual environment, higher thermal gradients). The following conclusions have been drawn from recent testing: cracks arrest, BSTRA ball cracks do not limit functionality, many features (islands, branching, fines, and FOD) were observed, and no FOD greater than 400 micron equivalent size has been produced.

M&P Team has observed metallurgical characteristics in the test specimens and concluded that the indication of the jagged nature of the fracture provides a locking feature to preclude large island liberation. The size of the particulate generated has been evaluated by Rocketdyne and is within operational experience and design limits of the SSME. Any particulate could readily be ingested by the engine and is not a concern.

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The model developed by the Stress Team agrees with test, analysis, and observations and substantiates the conservatism of testing. Boeing stress analysis concludes that the orbiter will fly safely even with the appearance of cracks.

Based on Boeing design, USA, Boeing and NASA test and analysis, and the absence of indications from the review of the most recent OMDP borescope inspection, OV102 has been approved for one flight by PRCB. This PR will be deferred to flight 29 of OV102 when further inspections will take place.

This deferral action does not invalidate the basis for certification.

This deferral action does not impact the Critical Items List (CIL) retention rationale or hazard controls.

10-1

QE

Route this PR to PMRB for approval.

QE: \_\_\_\_\_

10-2

OQCV

Transfer this PR to OV-102, Flight 29.

WC: \_\_\_\_\_

**Post flight disposition summary**

Post flight disposition will include a thorough inspection of the BSTRA balls using video borescope. If access permits, a ball manipulation tool in conjunction with the GSE struts to rotate the balls within the BSTRA's will be used.

\*\*\* End of Operation 10 \*\*\*