CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: HST-PFR-2
NAME / QUANTITY: Yaw and Pitch Assy/1 each
DRAWING REFERENCE: [illegible]

PROJECT: HST
LRU NAME / QUANTITY: PFR/[illegible]
LRU PART NUMBER: [illegible]

SUBSYSTEM: N/A
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER: HST-PFR-2-4

CRITICALITY: 1R/2

FUNCTION

These joints allows the crew to configure the PFR platform in a desired position by rotating the user about the horizontal plain of the platform (or yaw plain of the user) and about the users pitch plain.

FAILURE MODE AND CAUSE

MODE

While attached to a STS-PFR socket in the orbiter payload bay, the yaw and/or pitch joint assembly inadvertently becomes unlocked and rotates when the crew member is in the HST PFR.

CAUSE(S)

1) Fatigue spring failure.
2) Linkage comes loose.

REDUNDANCY SCREENS	REMAINING PATHS
A - Pass B - Pass C - Pass	1) Crew is tethered preventing the crew from floating off.

MISSION PHASE	CORRECTIVE ACTION TIMES: TIME TO EFFECT	CORRECTIVE ACTION TIMES: TIME TO CORRECT
EVA	Minutes	Seconds

FAILURE EFFECT

END ITEM

PFR looses stability, cannot be used.

MISSION

No effect on mission objectives if failure occurs in payload bay.

CREW / VEHICLE

Possible damage to orbiter.

INTERFACE

None

RETENTION RATIONALE

I. Design Feature to Minimize the Chance of the Failure Mode

A. Design
All HST PFRs were designed to an ultimate structural safety factor of 1.4.

B. Tolerances
Sufficient tolerances were used in the HST PFR design to prevent jamming by expansion and contraction of material due to temperature extremes or on-orbit use.

C. Materials - Major Components

See material list (Table B-2).

II. Testing and Analysis

A. Acceptance Testing

1. PIA

A full pre-installation acceptance (PIA) test will be performed on each HST PFR before it is delivered to KSC to support any STS flight. The PIA will verify that the HST PFRs are functioning within tolerances and that the assembly is clean.

2. Vibration

The HST PFRs were exposed to qualification level vibration loads during user initial development in support of STS-31. The test verified that the HST PFRs were free of manufacturing defects and tolerance problems. (Reference LMSC Document number H177097-501.

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CRITICAL ITEMS LIST

REFERENCE DESIGNATION: HST-PFR-2
NAME / QUANTITY: Yaw and Pitch Assy/1 each
DRAWING REFERENCE: 617102

PROJECT: HST
LRU NAME / QUANTITY: PFR/2
LRU PART NUMBER: SE0030765B-301

SUBSYSTEM: N/A
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
HST-PFR-2-4	1R/2

FUNCTION

Those joints allows the crew to configure the PFR platform in a desired position by rotating the user about the horizontal plain of the platform (or yaw plain of the user) and about the users pitch plain.

FAILURE MODE AND CAUSE

MODE

While attached to a STS-PFR socket in the orbiter payload bay, the yaw and/or pitch joint assembly inadvertently becomes unlocked and rotates when the crew member is in the HST PFR.

CAUSE(S)

1) Fatigue spring failure.
2) Linkage comes loose.

REDUNDANCY SCREENS	REMAINING PATHS
A - Pass B - Pass C - Pass	1) Crew is tethered preventing the crew from floating off.

MISSION PHASE	CORRECTIVE ACTION TIMES	
	TIME TO EFFECT	TIME TO CORRECT
EVA	Minutes	Seconds

FAILURE EFFECT

END ITEM

PFR looses stability, cannot be used

MISSION

No effect on mission objectives if failure occurs in payload bay

CREW / VEHICLE

Possible damage to orbiter

INTERFACE

None

RETENTION RATIONALE

A. Acceptance Testing (continued)

The following vibration levels are per :

Frequency (Hz)	Slope (dB/oct.)	Constant Level G^2/Hz	Overall Grms
20			7.7
20-45	+7.0	.009	
45-600		.06	
600-2000	-6.0		
2000		.0054	

B. Certification Testing

1. Thermal Vacuum

The HST PFR was exposed to a cold temperature (-132°F) vacuum (1x10-5 torrs) environment. This test was used to check the tolerances of the linkages and locking pin. The operational requirement was -90°F (Ref. JSC-23550)

2. Functionals

The HST PFR was functionally operated prior to and immediately after all acceptance/certification tests to verify that the test environment did not degrade the hardware performance.

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CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: HST-PFR-2
NAME / QUANTITY: Yaw and Pitch Assy/1 each
DRAWING REFERENCE: [illegible]

PROJECT: HST
LRU NAME / QUANTITY: PFR/2
LRU PART NUMBER: SED53100955-301

SUBSYSTEM: N/A
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
HST-PFR-2-4	1R/2

FUNCTION

These joints allows the crew to configure the PFR platform in a desired position by rotating the user about the horizontal plain of the platform (or yaw plain of the user) and about the users pitch plain.

FAILURE MODE AND CAUSE

MODE

While attached to the HST, the pivot and/or roll joint assembly inadvertently becomes unlocked and rotates when the crew member is in the HST PFR.

CAUSE(S)

1) Fatigue spring failure
2) Linkage comes loose

REDUNDANCY SCREENS	REMAINING PATHS
A - Pass B - Pass C - Pass	1) Crew is tethered preventing the crew from floating off

MISSION PHASE	CORRECTIVE ACTION TIMES	
	TIME TO EFFECT	TIME TO CORRECT
EVA	Minutes	Seconds

FAILURE EFFECT

END ITEM

PFR looses stability, cannot be used

MISSION

No effect on mission objectives if failure occure in payload bay

CREW / VEHICLE

Possible damage to orbiter

INTERFACE

None

RETENTION RATIONALE

C. Certification Analysis
All HST PFR components were be analyzed to the following induced environments to verify that the assembly can withstand the environment levels:

1. Requirements	Source
a. Shock	
- Functional	NSTS-07700 VOL. XIV
b. Vibration (Flt. Levels)	
- Acoustics	NSTS-07700 VOL. XIV
c. Structures	
- Ult. (fs = 2.0)	NSTS-07700 VOL. XIV
- Fracture	NSTS-07700 VOL. XIV
d. Acceleration	
- Flight	MF0004-014D
- Crash	MIL-STD-810, Meth. 516, Proced. I
e. Temperature	
- Hot (+250°F)	NSTS-07700 VOL. XIV, Appendix 7
- Cold (-90°F)	JSC-23550

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PREPARED BY: Morgan Garner
REVISION: A
SUPERSEDING DATE: 8/1/96
DATE: 8/16/96

CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: HST-PFR-2
NAME / QUANTITY: Yaw and Pitch Assy/1 each
DRAWING REFERENCE: 4177102

PROJECT: HST
LRU NAME / QUANTITY: PFR/2
LRU PART NUMBER: [illegible]-301

SUBSYSTEM: N/A
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
HST-PFR-2-4	1R/2

FUNCTION

These joints allows the crew to configure the PFR platform in a desired position by rotating the user about the horizontal plain of the platform (or yaw plain of the user) and about the users pitch plain.

FAILURE MODE AND CAUSE

MODE
While attached to the HST, the pivot and/or roll joint assembly inadvertently becomes unlocked and rotates when the crew member is in the HST PFR.

CAUSE(S)

1) Fatigue spring failure
2) Linkage comes loose

REDUNDANCY SCREENS	REMAINING PATHS
A - Pass B - Pass C - Pass	1) Crew is tethered preventing the crew from floating off

MISSION PHASE	CORRECTIVE ACTION TIMES: TIME TO EFFECT	CORRECTIVE ACTION TIMES: TIME TO CORRECT
EVA	Minutes	Seconds

FAILURE EFFECT

END ITEM

PFR looses stability, cannot be used

MISSION

No effect on mission objectives if failure occurs in payload bay

CREW / VEHICLE

Possible damage to orbiter

INTERFACE

None

RETENTION RATIONALE

III. Inspection

A. Manufacturing

1. The HST PFR components were inspected prior to build-up for conformance to their applicable drawings.

2. All fracture critical piece parts were and will be inspected as described on their applicable drawings.

B. Assembly

1. HST PFR will be cleaned and inspected to the levels described in JSC 5322B Once cleaned, the HST PFR will be bagged to prevent any contamination from entering the unit.

C. Testing

1. The hardware was fully inspected for any signs of loose parts as a part of the pre/post functional tests performed prior to and immediately after all certification and acceptance tests (reference LMSC H177097-501).

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CRITICAL ITEMS LIST

REFERENCE DESIGNATION: HST-PFR-2
NAME / QUANTITY: Yaw and Pitch Assy/1 each
DRAWING REFERENCE: 4177108

PROJECT: HST
LRU NAME / QUANTITY: PFR/2
LRU PART NUMBER: SED39M7858-301

SUBSYSTEM: N/A
EFFECTIVITY: - ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
HST-PFR-2-4	1R/2

FUNCTION

These joints allows the crew to configure the PFR platform in a desired position by rotating the user about the horizontal plain of the platform (or yaw plain of the user) and about the users pitch plain

FAILURE MODE AND CAUSE

MODE

While attached to the HST, the pivot and/or roll joint assembly inadvertently becomes unlocked and rotates when the crew member is in the HST PFR.

CAUSE(S)

1) Fatigue spring failure
2) Linkage comes loose

REDUNDANCY SCREENS	REMAINING PATHS
A - Pass B - Pass C - Pass	1) Crew is tethered preventing the crew from floating off

MISSION PHASE	CORRECTIVE ACTION TIMES	
	TIME TO EFFECT	TIME TO CORRECT
EVA	Minutes	Seconds

FAILURE EFFECT

END ITEM

PFR looses stability, cannot be used

MISSION

No effect on mission objectives if failure occurs in payload bay

CREW / VEHICLE

Possible damage to orbiter

INTERFACE

None

RETENTION RATIONALE

IV. Failure History

A. None, HST PFR flew on STS-31, but was not used during the mission.

V. Operations

A. Effects of Failure
Loss of stability, Possible damage to orbiter.

B. Crew Actions
None

C. Training
Crew must be tethered during operation in the HST PFR.

D. Mission Constraints
None

E. In flight Check-Outs
None

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PREPARED BY: Morgan Garner

REVISION: A

SUPERSEDING DATE: 6/3/96

DATE: 9/1/88