

## CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: TBA-4  
 NAME / QUANTITY: LAP PANEL (1)  
 DRAWING REFERENCE: 19121-2011001

PROJECT: NBT  
 LRU NAME / QUANTITY: LAP PANEL (1)  
 LRU PART NUMBER: 19121-2011001

PAGE 1 OF 5  
 SUBSYSTEM: TOOL BOX  
 EFFECTIVITY: ALL ORIGINERS

FAILURE MODE NUMBER HST-TBA-4-1	CRITICALITY 1R/2	FAILURE EFFECT	RETENTION RATIONALE
<b>FUNCTION</b> Lap panel folds down in front of the crewmember. Within the lap panel are various tools for use.		<b>END ITEM</b> Cannot stow lap panel or close doors for reentry.	<b>DESIGN</b> I. Design Feature to Minimize the Chance of the Failure Mode A. Design All tool box components were designed to a structural safety factor of 2.0 B. Tolerances Sufficient tolerances will be used in the lap panel positioning system and hinge design to prevent jamming by expansion and contraction of material due to temperature extremes or on-orbit use. C. Materials - Major Components 1. Positioning System: AL Bronze 830, 6061-T651, CRES 304 Cond. A, 7075-T7351 2. Lap Panel Hinges - 7075-T7351, 15-5PH 1025 II. Testing and Analysis A. Acceptance Testing 1. PDA A full pre delivery acceptance (PDA) test will be performed on the tool box assembly before it is delivered to JSC for the beginning of the certification process. The PDA will verify that the lap panel positioning system and hinges are operating correctly and that the assembly is clean. 2. Vibration The flight tool box will be exposed to acceptance vibration loads while it is in flight configuration. The test will verify that the lap panel positioning system or hinge assembly will withstand the vibration loads.
<b>FAILURE MODE AND CAUSE</b> <b>MODE</b> Lap panel stuck in the deployed position. <b>CAUSE(S)</b> 1.) Galling in lap panel hinge. 2.) Panel positioning system is jammed due to: a.) Piece part failure. b.) Contamination.			
<b>REDUNDANCY SCREENS</b> A - Pass B - N/A C - Pass	<b>MAINTENANCE PAINS</b> 1.) Remove 7/16" hex-head bolts at hinges and/or positioning system.	<b>CREW / VEHICLE</b> Possible damage to the orbiter if lap panel or box doors become loose in payload bay during reentry.	
<b>MISSION PHASE</b> EVA		<b>INTERFACE</b> None	
<b>CORRECTIVE ACTION TIMES</b>			
	TIME TO EFFECT Minutes	TIME TO CORRECT Seconds	

PREPARED BY: J.F. FAIRK

REVISION: 1A/BC

SUPERSEDING DATE: NONE

DATE: 2582

## CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: TBA-4  
 NAME / QUANTITY: LAP PANEL (7)  
 DRAWING REFERENCE: 10101-0010

PROJECT: HIT  
 LRU NAME / QUANTITY: LAP PANEL (1)  
 LRU PART NUMBER: 10101-0010-01

PAGE 1 OF 5  
 SUBSYSTEM: TOOL BOX  
 EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER HST-TBA-4-1	CRITICALITY 1R/2	FAILURE EFFECT	RETENTION RATIONALE																														
<b>FUNCTION</b> Lap panel folds down in front of the crewmember. Within the lap panel are various tools for use.		<b>END ITEM</b> Cannot close lap panel or close doors for reentry.  <b>MISSION</b> Mission objectives are complete.  <b>CREW / VEHICLE</b> Possible damage to the orbiter if lap panel or box doors become loose in payload bay during reentry.  <b>INTERFACE</b> None	<b>DESIGN</b> A. <u>Acceptance Testing (continued)</u> The following vibration levels are per SMD memo ES42-92-134: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Frequency (Hz)</th> <th>Slope (dB/oct)</th> <th>Constant Level (G<sup>2</sup>/Hz)</th> <th>Orbit Gms</th> </tr> </thead> <tbody> <tr> <td>20-50</td> <td>+3.0</td> <td rowspan="2">.04</td> <td rowspan="2">6.1</td> </tr> <tr> <td>50-350</td> <td>-3.0</td> </tr> <tr> <td>350-2000</td> <td>-3.0</td> <td rowspan="3">.08</td> <td rowspan="3">7.7</td> </tr> <tr> <td>20-45</td> <td>+10.0</td> </tr> <tr> <td>45-600</td> <td>-8.0</td> </tr> <tr> <td>600-2000</td> <td>-8.0</td> <td rowspan="3">.05</td> <td rowspan="3">7.0</td> </tr> <tr> <td>20-70</td> <td>+4.0</td> </tr> <tr> <td>70-900</td> <td>-8.0</td> </tr> <tr> <td>900-2000</td> <td>-8.0</td> <td></td> <td></td> </tr> </tbody> </table> B. <u>Certification Testing</u> 1. <u>Thermal Vacuum</u> The Tool Box will be exposed to the following thermal vacuum environment. Push button actuation, lap panel operation, and contingency bolts operation will be a part of the test plan.  a. <u>Temperature</u> - Cold Side Only (amb. to -90°F)  b. <u>Pressure</u> - ATM to 1x10 <sup>-5</sup> Torr	Frequency (Hz)	Slope (dB/oct)	Constant Level (G <sup>2</sup> /Hz)	Orbit Gms	20-50	+3.0	.04	6.1	50-350	-3.0	350-2000	-3.0	.08	7.7	20-45	+10.0	45-600	-8.0	600-2000	-8.0	.05	7.0	20-70	+4.0	70-900	-8.0	900-2000	-8.0		
Frequency (Hz)	Slope (dB/oct)			Constant Level (G <sup>2</sup> /Hz)	Orbit Gms																												
20-50	+3.0			.04	6.1																												
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<b>FAILURE MODE AND CAUSE MODE</b> Lap panel stuck in the deployed position.  <b>CAUSING</b> 1.) Galling in lap panel hinges. 2.) Panel positioning system is jammed due to: a.) Piece part failure. b.) Contamination.																																	
<b>REDUNDANCY SCHEMES</b> A - Pass B - N/A C - Pass	<b>REPAIRABLE PATHS</b> 1.) Remove 7/16" hex-head bolts at hinges and/or positioning system.																																
<b>MISSION PHASE</b>		<b>CONNECTIVE ACTION TIMES</b>																															
		TIME TO EFFECT	TIME TO CORRECT																														
EVA		Minutes	Seconds																														

PREPARED BY: J. F. PARK

REVISION: BASIC

SUPERSADING DATE: NONE

DATE: 110092

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## CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: TBA-4  
 NAME / QUANTITY: LAP PANEL (1)  
 DRAWING REFERENCE: 10191-0010

PROJECT: HHT  
 LRU NAME / QUANTITY: LAP PANEL (1)  
 LRU PART NUMBER: 10191-0010-01

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 SUBSYSTEM: TOOL BOX  
 EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER HST-TBA-4-1	CRITICALITY 1R/2	FAILURE EFFECT	RETENTION RATIONALE
<b>FUNCTION</b> Lap panel folds down in front of the crewmember. Within the lap panel are various tools for use.		<b>END ITEM</b> Cannot stow lap panel or close doors for reentry.  <b>MISSION</b> Mission objectives are complete.  <b>CREW / VEHICLE</b> Possible damage to the orbiter if lap panel or box doors become loose in payload bay during reentry.	<b>DESIGN</b> B. <u>Certification Testing (continued)</u>  2. Functionals  The tool box components like the lap panel positioning system will be functionally operated prior to and immediately after all certification test to verify that the test environment does not degrade the hardware performance.  C. <u>Certification Analysis</u> The lap panel positioning system and hinges will be analyzed to the following included environments to verify that the assembly can withstand the environment levels:  1. Requirements      Source a. Shock - Functional      NSTS-07700 VOL. XIV  b. Vibration (Fh Levels) - Acoustics      NSTS-07700 VOL. XIV - Modal            JSC-14040  c. Structures - Lift (n = 2.0)    NSTS-07700 VOL. XIV - Fracture        NSTS-07700 VOL. XIV  d. Acceleration - Flight            MF0004-014D - Crash            ML-STD-010, Method 510, Procedure 1  e. Temperature - 100 (+250°F)    IIST S/A/D (10191-10001A)
<b>FAILURE MODE AND CAUSE MODE</b> Lap panel stuck in the deployed position.  <b>CAUSE(S)</b> 1.) Galling in lap panel hinges. 2.) Panel positioning system is jammed due to: a.) Piece part failure. b.) Contamination.			
<b>REDUNDANCY SCREENS</b> A - Pass B - N/A C - Pass	<b>REPAIRING PATHS</b> 1.) Remove 7/16" hex-head bolts at hinges and/or positioning system.		
<b>MISSION PHASE</b>	<b>CORRECTIVE ACTION TIMES</b>		
	TIME TO EFFECT	TIME TO CORRECT	
EVA	Minutes	Seconds	
		<b>INTERFACE</b> None	

PREPARED BY: J. F. PARK

REVISION: BASIC

SUPERSEDING DATE: NONE

DATE: 05/89

## CRITICAL ITEMS LIST

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 SUBSYSTEM: TOOL BOX  
 EFFECTIVITY: ALL ORDERS

REFERENCE DESIGNATOR: TBA-4  
 NAME / QUANTITY: LAP PANEL (1)  
 DRAWING REFERENCE: 10181-20010

PROJECT: HST  
 LRU NAME / QUANTITY: LAP PANEL (1)  
 LRU PART NUMBER: 10181-20010-01

FAILURE MODE NUMBER HST-TBA-4-1	CRITICALITY 1R/2	FAILURE EFFECT	RETENTION RATIONALE
<b>FUNCTION</b> Lap panel folds down in front of the crewmember. Within the lap panel are various tools for use.	<b>FAILURE MODE AND CAUSE</b> <b>MODE</b> Lap panel stuck in the deployed position.  <b>CAUSE(S)</b> 1.) Galling in lap panel hinge. 2.) Panel positioning system is jammed due to: a.) Piece part failure. b.) Contamination.	<b>END ITEM</b> Cannot stow lap panel or close doors for reentry.  <b>MISSION</b> Mission objectives are complete.  <b>CREW / VEHICLE</b> Possible damage to the orbiter if lap panel or box doors become loose in payload bay during reentry.	<b>DESIGN</b>  <b>III. Inspection</b>  <b>A. Manufacturing</b> 1. The lap panel positioning system and hinge components will be inspected prior to build-up for conformance to their applicable drawings. 2. All machining critical piece parts will be inspected as described on their applicable drawings.  <b>B. Assembly</b> 1. Internal assemblies will be cleaned and inspected to the levels described in section 3.53.5 of the HST S/AD (10181-10081A). Once cleaned, the tool box will be completely bagged to prevent any contamination from entering the box.  <b>C. Testing</b> 1. The assembly will be fully inspected and functionally operated during IIVAs and PIAs. 2. The hardware will be fully inspected for any signs of galling as a part of the pre/post functional tests performed prior to and immediately after all major certification and acceptance testing.
<b>REDUNDANCY SCREENS</b> A - Pass B - N/A C - Pass	<b>REPAIRING PATHS</b> 1.) Remove 7/16" hex-head bolts at hinges and/or positioning system.	<b>INTERFACE</b> None	
<b>MISSION PHASE</b>	<b>CORRECTIVE ACTION TIMES</b>		
	<b>TIME TO EFFECT</b>	<b>TIME TO CORRECT</b>	
EVA	Minutes	Seconds	

PREPARED BY: J. F. PARK

REVISION: BASIC

SUPERSUCCESSOR DATE: NONE

DATE: 12/23/92

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## CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: TBA-4  
 NAME / QUANTITY: LAP PANEL (1)  
 DRAWING REFERENCE: 10991-0001B

PROJECT: HBT  
 LRU NAME / QUANTITY: LAP PANEL (1)  
 LRU PART NUMBER: 10991-0001B-01

PAGE 5 OF 5  
 SUBSYSTEM: TOOL BOX  
 EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER HST-TBA-4-1	CRITICALITY 1F/2	FAILURE EFFECT	RETENTION RATIONALE			
<b>FUNCTION</b> Lap panel folds down in front of the crewmember. Within the lap panel are various tools for use.		<b>END ITEM</b> Cannot stow lap panel or close doors for reentry.	<b>DESIGN</b> IV. Failure History A. There have been no failures associated with the lap panel positioning system or the hinges. V. Operations A. <u>Effects of Failure</u> Cannot stow the lap panel if the positioning system is jammed. B. <u>Crew Action</u> To activate the redundant path, the EVA crew will attach the EVA power tool or wrench to disengage the 7/16" hex-head bolts at the lap panel hinges and the check bar attachment location. C. <u>Training</u> As part of the certification testing, crews will activate the redundant systems during the thermal vacuum tests. Additional training will occur in the WETF. D. <u>Mission Constraints</u> None E. <u>Inflight Check-Out</u> None			
<b>FAILURE MODE AND CAUSE MODE</b> Lap panel stuck in the deployed position.						
<b>CAUSE(S)</b> 1.) Galling in lap panel hinges. 2.) Panel positioning system is jammed due to: a.) Piece part failure. b.) Contamination.						
<b>RELIABILITY SCREENING</b> A - Pass B - N/A C - Pass	<b>REWORKING PATHS</b> 1.) Remove 7/16" hex-head bolts at hinges and/or positioning system.					
<b>MISSION PHASE</b>		<b>CREW / VEHICLE</b> Possible damage to the orbiter if lap panel or box doors become loose in payload bay during reentry.				
<b>CORRECTIVE ACTION TIMES</b>						
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">TIME TO EFFECT</th> <th style="width: 50%;">TIME TO CORRECT</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Minutes</td> <td style="text-align: center;">Seconds</td> </tr> </tbody> </table>		TIME TO EFFECT	TIME TO CORRECT	Minutes	Seconds	<b>INTERFACE</b> None
TIME TO EFFECT	TIME TO CORRECT					
Minutes	Seconds					
<b>EVA</b>						

PREPARED BY: J. F. PARK

REVISION: BASIC

SUPERSEDING DATE: NONE

DATE: 11/30/92

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