

GOVERNMENT CERTIFICATION APPROVAL REQUEST
NASA - Johnson Space Center

*J.S.M.
12-15-00*

Due: 8/15/00

Reference No.

G3814

PART NUMBER:		PART NAME:		SYSTEM:
A.	SEG46114550-302	Unit Assembly		HRF-B115
B.	SEG46115845-302	Keyboard Module		
C.	SEG46114535-301	Keyboard Cable Assembly		
D.	SEG46116113-301	Monitor Cable Assembly		
E.	SDG46114536-801	Transducer Assembly		
F.	SEG46117165-301 <i>STG-46117135-301</i>	Ultrasound Accessory Kit		
G.	SEG46117128-301	Transducer Probe Pouch		
H.	SEG46117128-303	Transducer Probe Connector Pouch		
ASSY. PART NUMBER:		ASSY. PART NAME:		
ITEMS A, B, C, D, E, G, & H are top assemblies ITEM F contains the following assemblies:				
a) SDG46114533-801		ECG Cable Assembly		
b) SEG46116900-301		Audio Cable Assembly		
c) SDG46116922-301		Audio Interface Assembly		
d) SDG46117020-801		Microphone Assembly		
e) SDG46117021-801		Headphone Assembly		
f) SDG46117319-301		Ultrasound Pouch		
g) 528-43074-1		Cable Strap, One Wrap (For Information Only)		
h) SDG46117952-801		M.O. Disk, 540 MB		
i) Not used (place holder)		Not Used		
j) SDG46117952-80x		5fxxxx Back Up Disk		
k) SDG46117953-801		Hi-8mm tape		
l) Not used (place holder)		Not Used		
m) SDG46117951-301		Echo Gel		
REV. LETTER: N/A		REVISION SUMMARY: N/A		
RETIRING CERTIFICATION: N/A				
SSM/PM: Liz Bauer		Phone: (281) 483 - 7304		Mail Code: EA5
MANIFEST CHANGE DIRECTIVE BOARD/PANEL NAME: HRF Configuration Control Board				
CERT. RQMTS. DOC. No. A-E, F(a,b,c,d,e,h,j,k,m): LS-71040-1 F(f,g),G,H: N/A		PROJECT RQMTS. DOC. A-E, F(a,b,c,d,e,h,j,k,m): LS-71040-1 F(f,g),G,H: N/A		ICD No. A: LS-71040-2 B-H: N/A
PMP No. LS-71000A				

Approvals: (Print and Sign)

Prepared by: <i>Geoffrey Coore</i> <i>GTRC Coore 9/1/00</i>	
Subsystem Manager: <i>L. Bauer</i> <i>L. Bauer 9/1/00</i>	structures: <i>G. Garbreath</i>
JSC GFE Assurance Engineer: <i>S. Nealson</i> <i>S. Nealson 12/15/00</i>	<i>Greg Gallant</i> <i>9/5/00</i>
JSC Safety Mgr.: (if required)	<i>L. Arnold</i> <i>9/5/00</i>

GOVERNMENT CERTIFICATION APPROVAL REQUEST
NASA - Johnson Space Center

*J.J.M.
12-15-00*

HRF Ultrasound Unit and Accessories

Date: 12/15/00

Reference No.

PART NUMBER:	PART NAME:	SYSTEM:
A. SEG46114550-302	Unit Assembly	HRF/B115
B. SEG46115845-302	Keyboard Module	
C. SEG46114535-301	Keyboard Cable Assembly	
D. SEG46116113-301	Monitor Cable Assembly	
E. SDG46114536-801	Transducer Assembly	
F. SJG46117135-301	Ultrasound Accessory Kit	
G. SEG46117128-301	Transducer Probe Pouch	
H. SEG46117128-303	Transducer Probe Connector Pouch	

ASSY. PART NUMBER: ITEMS A, B, C, D, E, G, & H are top assemblies ITEM F (Kit) contains the following assemblies: a) SDG46114533-801 b) SEG46116900-301 c) SDG46116922-301 d) SDG46117020-801 e) SDG46117021-801 f) SDG46117319-301 g) 528-43074-1 (Certified, For Information Only) h) SDG46117952-801 i) Not used (place holder) j) SDG46117952-80x k) SDG46117953-801 l) Not used (place holder) m) SDG46117951-301	ASSY. PART NAME: ECG Cable Assembly Audio Cable Assembly Audio Interface Assembly Microphone Assembly Headphone Assembly Ultrasound Pouch Cable Strap, One Wrap M.O. Disk, 540 MB Not Used 5fxxx Back Up Disk Hi-8mm tape Not Used Echo Gel
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REV. LETTER: N/A	REVISION SUMMARY: N/A
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RETIRING CERTIFICATION: N/A	SSM/PM: Liz Bauer	Phone: (281) 483 - 7304	Mail Code: EA5
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MANIFEST CHANGE DIRECTIVE BOARD/PANEL NAME: HRF Configuration Control Board
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CERT. RQMTS. DOC. No. A-E, F(a,b,c,d,e,h,j,k,m): LS-71040-1 F(f,g),G,H: N/A	PROJECT RQMTS. DOC. A-E, F (a,b,c,d,e,h,j,k,m): LS-71040-1 F(f,g),G,H: N/A	ICD No. A: LS-71040-2 B-H: N/A	PMP No. LS-71000A
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PROGRAM	FUNCTIONAL CRIT.	HARDWARE CRIT	FMEA/CIL DOC. No.	CILs (Y or N)
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Approvals: (Print and Sign)

Prepared by:	
Subsystem Manager	
JSC GFE Assurance Engineer <i>Sean J. Nealon</i> 12-15-00 S. NEALON SJA	
JSC Safety Mgr. (if required)	

GOVERNMENT CERTIFICATION APPROVAL REQUEST
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PART NUMBER: A. SEG46114550-302 B. SEG46115845-302 C. SEG46114535-301 D. SEG46116113-301 E. SDG46114536-801 F. SJG46117135-301 G. SEG46117128-301 H. SEG46117128-303			PART NAME: Unit Assembly Keyboard Module Keyboard Cable Assembly Monitor Cable Assembly Transducer Assembly Ultrasound Accessory Kit Transducer Probe Pouch Transducer Probe Connector Pouch			SYSTEM: HRF/B115	
SHUTTLE:		N/A		N/A		N/A	
STATION:		3		N/A		A-E, F(a,b,c,d,e,h,j,k,m): LMSMSS-32067 F(f,g),G,H: N/A	
OTHER:		N/A		N/A		N/A	
Number of MISSIONS	Number of Yrs. On-ORBIT	Launch/Landing (Restrictions On)	SAR DOC. No.	LIMITED LIFE DOC. No.	WEIGHT	DIMENSIONS (LxWxH - inches)	
N/A	10	N/A	Processed through PSRP LS-71027-4	LMSMSS-32453 Rev.A	A: 76.971 kg B: 6.009 kg C: 433.1 g D: 529.7 g E: 1030.9 g H: 0.0454 g F: 0.0680 kg G: 1.4450 kg	A:27.6 x 24 x 28 B:21 x 13.6 x 3.5 C:72 x 0.8 D:72 x 0.8 E:100.3 x 0.4 x 5.1 F: 2.5 x 2.8 x 5 G: 2.5 x 5.3 x 5.5 H: 22.0 x 2.5 x 5.3	
OPERATIONAL INFORMATION:							
Installation Information: A: HRF Integrated Flight Rack 1 launched in the MPLM location Bay 4, Starboard B-H: Stowed in the MPLM							
Launch Location: A: HRF Integrated Flight Rack 1 launched in the MPLM location 4, Starboard. B-H: Stowed in the MPLM							
Landing Location: A: MPLM B-H: Stowed in the MPLM							
SSP Operational Location: N/A							
ISS Operational Location: A: U.S. Lab (LAS2), HRF Rack 1, C1 thru F1 (5A.1 Drawer location) [B1 to J1 & C2 to J2 also OK]; B-H used in promixity to US Lab (LAS2).							
<p>General Operational Information:</p> <p>The HRF Ultrasound System is a medical instrument that utilizes ultrasound energy to perform medical imaging and to measure flow rates. The system generates and receives ultrasound signals using hand-held probes. The system contains hardware and software to display and analyze sonographic information. The user controls the software and hardware with a user interface consisting of a keyboard, control switches, knobs and a trackball.</p> <p>During launch and landing and on-orbit operations, the main electronics unit shall be rack-mounted. During launch and landing, stowed items shall be contained in stowage drawers. During on-orbit operations, the keyboard is necessary for ultrasound operation. The keyboard interface cable shall be mated to the keyboard connector on the main unit. Other stowed items shall be deployed as required during on-orbit operations. The display interface cable shall be connected to the display connector on the main electronics unit and the common monitor. Three scanheads and 1 pencil probe can be deployed at once. One ECG cable shall be used to connect 3 disposable surface ECG electrodes to the main electronics unit. The headphones and microphone shall be connected to audio connectors on the keyboard.</p>							

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G. SEG46117128-301	Transducer Probe Pouch	
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Operation of the Ultrasound System on-orbit requires a specific start-up format. The keyboard is deployed and mounted to the seat track using a restraint. The keyboard cable is then mated to the "Keyboard" connector on the front panel (Figure 3.1) and the "Front Panel" connector on the keyboard. The common monitor is deployed from its allocated stowage position and attached to the seat track using a multi-use bracket. The display cable is then mated to the connection designated as "Display" on the front panel.

The proper HRF Rack power bars are turned on using the power control switches at the top portion of the rack. Once the light emitting diodes (LEDs) at the top portion of the rack are lit and steady, indicating positive power to the rack power bars, the switch designated as "Main Power" on the front panel under the "ULTRASOUND" header is toggled to the "On" position. The LED designated as "Main Power" will light indicating power has been supplied to the power subsystem. The Ultrasound System is now in standby mode. The switch designated as "Keyboard Power" on the keyboard side panel, is toggled to the "On" position. The LEDs on the keyboard will flash as the Ultrasound System powers up from standby to active mode. The switch on the front panel under the "VIDEO TAPE RECORDER" header designated as "Power" is toggled to the "On" position. The LED designated as "Power" on the front panel under the "VIDEO TAPE RECORDER" header will light to confirm positive power to the common monitor and to the VTR. Toggling the monitor power switch to the "On" position will activate the common monitor. An LED on the common monitor will light and hold steady to indicate that power on status has been achieved for the common monitor. Deployment of the stereo headphones, microphone, ECG, scanheads, and other accessories will be experiment-unique.

OCAD No.: None

Operational Performance Requirements: The HRF Ultrasound System draws 33.5 amps at 28 VDC during nominal operations and draws 3.5 amps at 28 VDC during stand-by procedures. Nominal operations require the use of the keyboard and transducer at a minimum. Extended operations of the ultrasound system require the use of the audio cable, audio interface, headphones, microphone, and ECG cable. The display will provide both live ultrasound video and video playback from the VTR. The VTR itself requires an additional 0.5 Amps at 28 VDC and may be powered on independent of the main ultrasound unit.

The ultrasound system is capable of being easily upgraded with new software or modular hardware when available. The ultrasound system has the following imaging modes: real-time 2D, color Doppler, power imaging, M-mode, pulsed Doppler, CW Doppler, dual image capability, ECG display, respiratory trace display, 3D post-image reconstruction. The system performs functions to support the following applications: Cardiac ultrasound, Abdominal ultrasound (deep organ), Vascular ultrasound, Muscle and tendon ultrasound, Transcranial ultrasound, Small parts ultrasound, etc.

The physical configuration of the Ultrasound System consists of a main electronics unit and stowed ultrasound items. The main electronics unit is a rack-mounted 16-panel unit (PU) assembly that contains the ultrasound system electronics, main electronics power supply modules, Hi-8 mm video tape recorder (VTR), and ventilation. The main electronics unit shall be compatible with the HRF Rack. The main electronics unit includes an internal hard disk that stores the operating system and is a possible data storage location. It also includes an MO drive for digital data storage. The main electronics unit also includes rear data sources for both real-time video and Ethernet. These allow for video and digital downlink.

Stowed items shall consist of a keyboard, keyboard and display cables, ultrasound probes, ECG cables, stereo headphones, microphone, Hi-8mm video cassettes, and 3.5" magneto-optical (MO) disks. The probes consists of a probehead, integral cable, and connector for interface to the main electronics unit. ECG cables shall be used to connect surface ECG electrodes to the main electronics unit. The headphones shall be used for Doppler flow measurements and includes a cable and connector for interface to the audio connector on the keyboard. The microphone shall be used for dictation and includes a cable and connector for interface to the audio connector on the keyboard.

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Operational Constraints: None

Crew Procedures Data Book: <http://voyager2.msfc.nasa.gov> Select "Inc2 Final" from the list. Enter the Username "INC2PODF", and Password "july*00" for read only access. Select "Document Tracking" from the menu on the left. Scroll down to "HRF Proc-Workstation" and click on it. Scroll down to locate procedures.

Flight Rules: None

Criticality Rationale Summary: There are no failure modes that will affect either the safety of the crew/vehicle or the completion of the mission.

Does test hardware configuration differ from flight hardware configuration?
Indicate Yes or No. If Yes, state differences. **NO**

MATERIALS INFORMATION

JSC Material Certification Memorandum No.:

A-E, a, b, c, d, e, h, j, k, m: MATL-99-182, *MATL-00-226*
F, f, G, H: MATL-00-209
g: N/A

MUA No.:

LM/ISS-18, S02, S06

Materials Compatibility:

Offgassing:

A-E, a, b, c, d, e, h, j, k, m: MATL-99-182
F, f, G, H: MATL-00-209
g: N/A

Flammability:

A-E, a, b, c, d, e, h, j, k, m: MATL-99-182
F, f, G, H: MATL-00-209
g: N/A

Other:

N/A

ELECTRICAL INFORMATION

ELECTRICAL INTERFACES: LS-71040-1, Section 3.1.5.2, See SIG46114534, Reference LS-71040-2

Power Interface Location HRF Rack 1 Power Supply	Circuit Protection 22 amp circuit breaker per Connection	Hardware Nominal Amps 33.5 amps total 0.5 amps VTR	Bonding Verification 7H9930170
Hardware Circuit Protection Two (2) 20 amp Circuit Breakers – Unit Assy One (1) 2.5 amp circuit breaker – VTR	Batteries Rayovac Li-CF (BR1225)	Battery Certification Sheet Attached (Y or N) Y	Other N/A

ELECTROMAGNETIC COMPATIBILITY INFORMATION

EMC/EMI Test:

See Appendix A: TPS # 7H0020377
Additional information (FYI) is provided on the Rack EMI test

Power Performance Test:

See Appendix A: TPS # 7H0020377

TEMPERATURE VALIDATION:

QTT Range: -7 °C to 54 °C

QTT Test: C-H: NA;

Cycles: 7.5

JSC Form 1296 (Rev Jan 99) (MS Word Aug 95)

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		A-B: TPS# 7E9920099, CR# CR No. HLP1-HDC1-0004		
QTVT Range: N/A		QTVT Test: N/A		Cycles: N/A
Non Operating Temperature Limits: 2.2 °C to 18 °C and 30 °C to 48 °C		Operating Temperature Limits: 18 °C to 30 °C (64.4 °F to 86 °F)		
Survivable Mission Operational Time Limit: 10 Years				
Touch Temperature Test: TPS # 7H9920235				
ACCEPTANCE THERMAL/ANALYSIS:				
ATT Range: -7 °C to 54 °C (19 °F to 129.2 °F)		ATT Test: A, B: TPS# 7E9920070 B: TPS# 7H0020371 C-H: N/A		Cycles: 1.5
QATT Range: N/A		QATT Test: N/A		Cycles: N/A
ATVT Range: N/A		ATVT Test: N/A		Cycles: N/A
QATVT Range: N/A		QATVT Test: N/A		Cycles: N/A
STRUCTURAL VALIDATION: Stress Analysis Report (LM-EA9810) and Safety Margins				
Depress Testing: None, Reference LM-EA9810 Section 10		Repress Testing: None, Reference LM-EA9810 Section 10		
Factor of Safety for Test: 1.4 Ultimate, 1.1 Yield		Factor of Safety for Analysis: 2.0 Ultimate, 1.25 Yield		
Structural Integrity Verification Plan: LS-71012		Stress Analysis: LM-EA9810		
Fracture Control Summary Report: LM-EA9904		Fracture Plan: LS-71010		
QVT Amplitude : N/A (See LM-EA9905, Stress Analysis for Integrated Rack 1 Analysis)		QVT Test: N/A CR # HLP1-ST5102-5A.1-0001		Duration: N/A
20g Crash Test: None (Sensitive hardware)		Shock Test: Reference LM-EA9810		
Limit Loads: Reference LM-EA9810		Limit Loads Test: N/A		
Life Cycles: N/A		Life Cycle Testing: N/A		
PRESSURE SYSTEMS: N/A				
Proof Pressure: N/A		Burst Pressure: N/A		Sys. Operational Pressure Range: N/A
ACCEPTANCE VIBRATION:				
AVT Amplitude: X, Y, Z Axis: 20 Hz at .010 g ² /Hz 20 - 80 Hz at +3.0 dB/Oct 80 - 350 Hz at .04 g ² /Hz 350 - 2000 Hz at -3 dB/Oct 2000 Hz at .007 g ² /Hz Composite: 6.1 grams.		AVT Test: A: TPS# 7E9920046 B-H: N/A		Duration: 60 Seconds per Axis

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QAVT Amplitude: X, Y, Z Axis: 20 Hz at .017 g ² /Hz 20 - 80 Hz at +3.0 dB/Oct 80 - 350 Hz at .067 g ² /Hz 350 - 2000 Hz at -3 dB/Oct 2000 Hz at .0118 g ² /Hz Composite: 7.9 grams.	QAVT Test: TPS# 7E9920047	Duration: 120 Seconds per Axis
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ACOUSTICS/NOISE: Acoustic Engineering Evaluation	
O/A Db Level: N/A	Acoustics Test: TPS# 7H9920062

PERFORMANCE VERIFICATION:	
PDA Requirements Document: LS-71040-1 A, B: TPS #7H0020524 (Wt., CG, & SE) B, C, D: TPS# 7H0020764 (Wt, & CG) E, F, G, H: TPS # 7H0020765 (Wt. & CG) D: 7H9920908 (SE) C, E, F (a,b,c,d,e): 7H9920642 (SE) F: TPS# 7H0020681 (SE) F(h): TPS# 7H0020547 (SE) F(j): TPS # 7H0020505 (SE) F(k): TPS# 7H0020511 (SE) F(m): TPS# 7H0020510 (SE)	Interface Verification Test: TPS# 7F0020043 - SIR/BOB Test at KSC TPS# 7H0020561 - Fit Check; TPS# 7H0020707 - PVT; Appendix A: TPS# 7H9920267
Pre-flight Functional Checkout Requirements: LS-71040-5A	Other Functional Performance Testing: See Certification Matrix, IVT

WAIVERS OR REQUIREMENTS DEVIATIONS:		
Requirement Waived: (HRD 8.2.3) Qualification Vibration Test (QVT) (HRD 8.2.4) Qualification Thermal Test (QTT)	CR No. HLP1-HDC1-0004 CR No. HLP1-ST5102-5A.1-0001	CILs: NONE

NCR No. N/A

LIMITED CERTIFICATION DATA:
If this certification is NOT for 100 Missions, or is less than 15 years on orbit or is restricted in the number of launch/landings, then these limitations must be supplied. State the reason for the limitation and if applicable, the required action. Indicate if the design is limited or each serial number is limited.

The HRF Program (requirements document), and the ISS Payloads Office (OZ) required a 10-year life for facility class payloads, i.e. an integrated rack. The HRF Ultrasound unit was designed to meet this 10-year life for HRF. The top assembly part number (itself) is an Orbital Replacement Unit (ORU). Test and analyses have indicated that through direct replacement on orbit this design will meet the 10-year life. A MUA (LM/ISS-18) for corrosion also requires a periodic inspection (every 3 years) of the hardware. In the event of a failed inspection the drawer will be replaced.

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LIMITED LIFE DATA: LMSMSS-32453 Rev. A					
Part Number/Name	Time/Cycle Sensitive Item	Age Sensitive Item	Required Action	Requirements	Remarks
ITEM F(m) SDG46117951-301 / Echo Gel	N/A	YES	Replace	2 Year Shelf Life	This is a consumable item.

SOFTWARE INFORMATION	
Software Operating System Version: 127.05 (TPS 7H0020535)	
Software Release Version:	
COTS: (Y or N): Yes, Level 127.05 TPS 7H0020535	
Firmware: (Y or N): Y	Version: 127.05 (TPS 7H0020535)
Software Verification Test:	
Software Requirements Specification: LS-71040-1 HRF Ultrasound Hardware Requirements Document LS-71040-10 HRF Ultrasound Software Design Document	
Software Test Plan: LS-71040-5 HRF Ultrasound Functional Test Procedures LS-71040-6 HRF Ultrasound Software Test Plan	
Software Test Report: PDA TPS: 7H0020103, 7H9920267	
Software Waiver or Requirements Deviations: N/A	VDD No. LS-71040-7
Software Requirement Waived: N/A	
Software NCR No.: N/A	
Software Comments: This GCAR certifies part number SDG46117952-80x where x denotes 4 through 7. These parts are identical in nature, from a design, software and materials standpoint evolving from an identical part number. Each disk is keyed to support a specific Ultrasound System (S/N 1001-S/N1004). Please reference LS-71040-7, VDD.	

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When a SAR is not a separate document list potential hazards.

PART NUMBER:							
HAZARD No.	SAFETY RQMT.	HAZARD CATEGORY	CAUSE/EFFECT	CONTROL	VERIFICATION	SEVERITY LIKELIHOOD	MISS. PHASE

GOVERNMENT CERTIFICATION APPROVAL REQUEST
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APPENDIX A

Date:

Modification to GCAR Reference No.:

PART NUMBER:	PART NAME:	SYSTEM:
SOFTWARE INFORMATION		
Software Operating System Version:		
Software Release Version:		
COTS: (Y or N)		
Firmware: (Y or N)	Version:	
Software Verification Test		
Software Requirements Specification:		
Software Test Plan:		
Software Test Report:		
Software Waiver or Requirements Deviations:	VDD No.:	
Software Requirement Waived:		
Software NCR No.:		
Software Comments:		

Approvals: (Print and Sign)

Prepared by:	
Subsystem Manager:	
JSC GFE Assurance Engineer:	
JSC Safety Mgr.: (if required)	