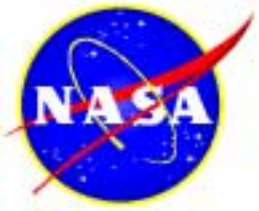
OCTOBER 2000



National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

HRF Flight Rack One Integration Test Procedure VII: Acoustic, Airflow and Thermal Testing

LS-71139-7B

PROJECT DOCUMENT APPROVAL SHEET		
DOCUMENT NUMBER LS-71139-7B	**DATE** 10/31/00	**NO. OF PAGES**

HRF Flight Rack One
Test Procedure VII:
Acoustic, Airflow and Thermal Testing

Approved: _____ _____
Ed Strong — Date
NASA/SF HRF Rack Integration Manager

Approved: _____ _____
NT3/GFE Assurance Branch — Date

DATE	PREPARED BY	CHANGE APPROVALS	CHANGE NUMBER

Report Number LS-71139-7B **Date:** 10/31/00

HRF Flight Rack One
Test Procedure VII:
Acoustic, Airflow and Thermal Testing

Prepared by: _____ _____
Mary Trenolone — Date
HRF SE&I Book Manager

Approved: _____ _____
Todd Leger — Date
Sub Task Order Manager
Flight Rack Integration

Approved: _____ _____
Sharad Bhaskaran — Date
Dept. Manager Systems Integration
and Development

Approved: _____ _____
George Harvey — Date
Section Manager, SEAT, SS, R&M

Prepared by
Lockheed Martin Space Operations
Houston, Texas
for
National Aeronautics and Space Administration
Johnson Space Center

REVISION/CHANGE APPROVALS

Date	Revision Letter	Change Number	Prepared By	Approved By:	
				Unit Manager	Projects Manager

DOCUMENT NUMBER LS-71139-7B	**DOCUMENT CHANGE/ REVISION LOG**	PAGE 1 OF 1

CHANGE/ REVISION	DATE	DESCRIPTION OF CHANGE	PAGES AFFECTED
BASIC	1/00	Baseline Issue	ALL
Rev. A	3/00	Information was incorporated to include additional certification testing and test equipment.	Pgs. i,ii,iii,iv,v,1-1 thru1-4,2-1,2-2,3-1,3-2,5-1 thru 5-11,6-1 thru 6-6,A-1,A-2,B-2,B-7 thru B-17
Rev. B	10/00	Information was incorporated to include additional test equipment, procedures, updated thermal logs and redlines that resulted from preliminary acoustic certification testing.	Pgs. i, ii, IV, 1-1 thru 1-2, 2-1 thru 2-2, 3-3, 4-1, 5-4 thru 5-12, A-10 thru A-11, B-2, B-3, B-15 thru B-18

Altered pages must be typed and distributed for insertion.

JSC FORM 276 (REV APR 81)

ABSTRACT

This document provides the necessary procedures for acoustic, airflow, and thermal testing of the Human Research Facility (HRF) Rack, ground support equipment, and payload hardware.

The primary purpose of this procedure is to outline the necessary steps for successful data collection in support of acoustic, airflow, and thermal requirements for HRF Flight Rack One.

A Test Readiness Review (TRR) will be held prior to the start of the verification activity. The TRR Board, Quality Engineering, and the Payload Test Conductor will agree to proceed with the individual tests listed in this document.

KEY WORDS

Human Research Facility
International Space Station Program

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AR	As Required
A-wtd	A-weighted
COTS	Commercial-Off-The-Shelf
DR	Discrepancy Report
EMI	Electromagnetic Interference
EXPRESS	Expedite the Processing of Experiments to Space Station
FOD	Foreign Object Damage
ft	Foot
GASMAP	Gas Analyzer System for Metabolic Analysis of Physiology
GSE	Ground Support Equipment
HRF	Human Research Facility
ID	Identifier
ITCS	Internal Thermal Control System
JSC	Johnson Space Center
MEIT	Multiple Element Integrated Test
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
P/N	Part Number
PRCU	Payload Rack Check-out Unit
PRM	Payload Retention Mechanism
QA	Quality Assurance
RAMS	Random Access Mass Spectrometer
R&M	Reliability and Maintainability
RIC	Rack Interface Controller
SE&I	System Engineering and Integration
SEAT	Science, Engineering, Analysis, and Test
STEP	Suitcase Test Environment For Payloads
TPS	Task Performance Sheet
TRR	Test Readiness Review
VRDS	Verification Requirements Data Sheet

1.0 INTRODUCTION

1.1 PURPOSE

This document outlines parameters for collecting acoustic, airflow, and thermal data to establish the baseline operating procedures used during acoustic, airflow, and thermal testing on HRF Flight Rack One. The expected end-product of this activity is the determination of which acoustic abatement methods provide the greatest reduction of acoustic levels while maintaining airflow and thermal requirements of HRF Flight Rack One.

1.2 SCOPE

This document provides task sequencing to satisfy the test requirements as detailed in the document “Rack One HRF Unique Payload Verification Plan” in SSP-57400, “Human Research Facility Unique Payload Verification Plan for Rack 1, International Space Station Program”. The details listed herein describe the necessary hardware, configuration, test equipment set-ups, instrumentation requirements, data requirements, safety concerns, and all other details necessary to perform the appropriate procedure.

This procedure applies to the subsystems and components of the HRF Flight Rack and encompasses the HRF Rack operations to be performed by Lockheed Martin HRF personnel, and other agencies described herein.

1.3 DOCUMENT OVERVIEW

This document details the test setup, test tear down, and necessary test operation. The procedure is divided into three (3) Sections:

Section 6.1 AIRFLOW/THERMAL EVALUATION
Section 6.2 ACOUSTIC/AIRFLOW/THERMAL EVALUATION
Section 6.3 ACOUSTIC EVALUATION

1.3.1 Document Hand-Write Change Control

This document presents baseline procedures for acoustic, airflow, and thermal testing. It is therefore assumed that this document is subject to hand-write changes while in use in the test area. Hand-write entries will be controlled and documented in this procedure. All hand-writes must be approved by Quality Engineering and the Test Conductor prior to implementation. Quality Assurance validates all hand-writes. If safety is affected, then Safety Personnel must also approve changes. The personnel that have Task Performance Sheet (TPS) signature authority are authorized to make hand-write changes to this document. Hand-written changes to this

document will be done using deviation sheets (See Appendix A). This document will be revised to include permanent hand-written changes.

1.3.2 Warnings And Cautions

Prior to performing any operation, test personnel must be familiar with all "General Notes, Warnings, Cautions, Special Instructions and Safety Precautions" contained in the reference documents and drawings unless otherwise specified within this procedure.

1.3.3 Task Sequencing

The procedures outlined in this document are written to ensure technical completion of a specified task and are not necessarily sequenced to provide optimum crew/tool equipment utilization or rack build-up. The work is to be accomplished sequentially, or in parallel. The responsible Test Conductor must first evaluate any change to ensure no degradation of technical requirements, system safety, personnel safety, scheduling, etc. The responsible Test Conductor may give verbal authorization to perform steps non-sequentially. Sequencing changes require concurrence from Quality Assurance.

1.3.4 Repeat Operations

Prior to proceeding, operations requiring repetition are approved by the Test Conductor and Quality Assurance. All repetitive operations must be documented in the Repetitive Operations Log in Appendix A.

1.3.5 Discrepancies

If any discrepancy occurs in the form of an equipment failure, hazard, or emergency, the personnel concerned takes appropriate action to ensure personnel and equipment safety, and reports to a Quality Assurance Specialist. The Test Conductor notifies the National Aeronautics and Space Administration (NASA) facility manager to act as focal point if any further effort is required. If required, a Discrepancy Report (DR), Johnson Space Center (JSC) form 2176 will be initiated by Quality Assurance, and tracked and worked as described in document NT1-CWI-003(See Appendix A).

1.3.6 Safety Support

JSC Safety & Health Requirements established in document JPG 1700.1 Version H, will be strictly adhered to throughout all phases of test activities. All hazardous activities will be coordinated with the appropriate facility personnel.

1.3.7 Emergency/Accident Procedure

The following procedures are to be used in the event of an emergency situation, (i.e. smoke or fire) or in the case of an accident involving personal injury.

Emergency procedures provide pre-planned and approved guidelines for handling potential hardware/software malfunctions and hazardous situations. If a hazardous situation occurs, the following definitions state the actions necessary to maintain control of the situation and personnel safety. Actions required for the situations not covered by these procedures shall be provided by the Test Conductor real-time, based on his/her best judgment.

Definitions

Abort Test: Take immediate and rapid actions for restoration of safe conditions removal or rescue of test personnel, notification of the appropriate personnel about the hazardous situation, and shutdown of all systems. This action is taken in catastrophic critical hazard conditions such as fire, smoke, or serious personnel injuries.

Terminate Test: Discontinue test per the standard shutdown procedures provided. This action is required when the situation prevents further compliance with the test objectives.

Hold and Evaluate: Maintain current test conditions or proceed to safe mode to allow time to review system status and impacts of the situation. This action is required in the event of a hardware/software malfunction.

Emergency/Accident Reporting

The Facility Engineer has the primary responsibility of initiating the notification process. General Emergency Instructions:

(1) Sound the alarm and evacuate the area.
(2) If safe, render/de-energize energy systems.
(3) Initiate Flash reporting sequence (See Appendix A).
(4) Establish emergency response team to support follow on action.

Figure 1-1 shows the JSC Emergency Number and Reporting Sequence. This number is a coordinated number for the emergency related medical, fire and security groups at JSC.

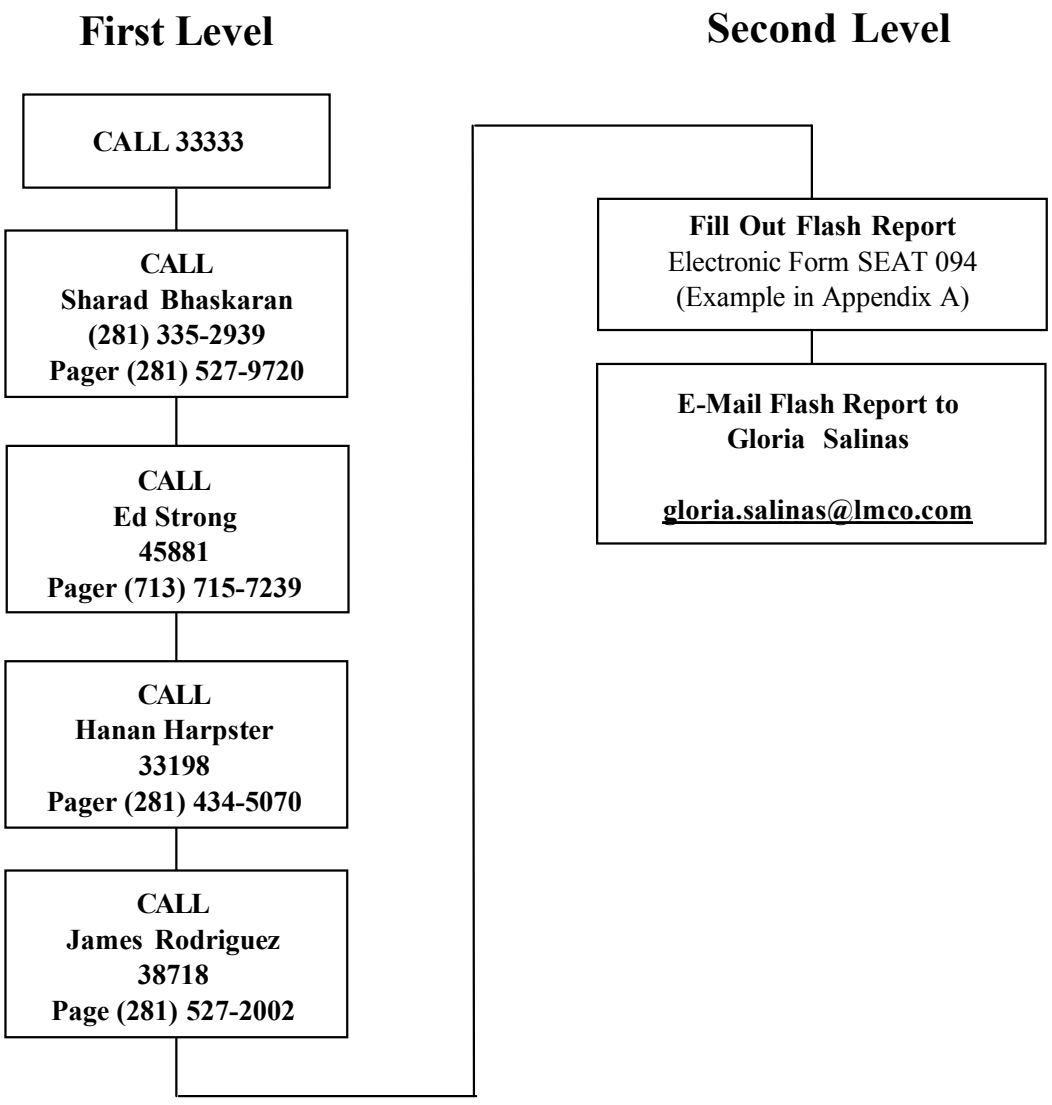


Figure 1-1 JSC Emergency Number and Reporting Sequence

Systems Emergency Procedures

The following procedures are to be carried out by the Test Conductor and Test Personnel in accordance with the condition as defined below:

CONDITION	RESPONSIBILITY	ACTION
Fire/Visible Smoke in Test Area	Test Conductor/Technician	Abort Test

(1) Sound the alarm: Activate alarm at pull box and/or phone in emergency.
(2) Do not move injured personnel unless necessary to prevent further injury.
(3) If safe, attempt to de-energize system, i.e. thermal, electric, etc.
(4) Initiate notification process. This may be conducted away from the situation via telephone.

CONDITION	RESPONSIBILITY	ACTION
Electrical burn/smoke odor	Test Conductor/ Technician	Terminate Test

(1) Shutdown all electrical test equipment systems.
(2) Locate nearest fire extinguisher.
(3) Investigate/Isolate the source of odor.
(4) If required, perform steps associated with a Fire/Smoke situation.

CONDITION	RESPONSIBILITY	ACTION
Loss of Facility Power	Test Conductor/ Technician	Hold & Evaluate

(1) Evaluate the situation and impact to the test. Investigate the cause and potential frequency of occurrence. Take appropriate steps to restore the failed systems to their nominal/safe operating conditions.

Personnel Emergency/Accident Procedures

CONDITION	RESPONSIBILITY	ACTION
Serious Personal Injury	Test Conductor/ Technician	Terminate Test

(1) To prevent further injury, do not move the injured personnel unless necessary.
(2) Render the area safe, then administer first aid as required.
(3) Initiate notification process.
(4) Do not leave injured personnel alone until emergency personnel arrive.

CONDITION	RESPONSIBILITY	ACTION
Minor Personal Injury	Test Conductor/ Technician	Hold & Evaluate

(1) Render the area safe, then administer first aid as required.
(2) Initiate notification process.
(3) Take injured individual to medical treatment facility.

1.3.8 Hazardous Waste Handling

Hazardous material identification, labeling and storage at Building 241 shall be done according to JSC Form 1161, “Disposal Inventory for Miscellaneous Hazardous Wastes.” Disposal containers, transportation and disposal will be provided by the designated JSC waste management service. All Internal Thermal Control System (ITCS) waste disposal in Building 241 should be coordinated through the Facility Manager.

2.0 APPLICABLE DOCUMENTATION

The following documents form a part of this Verification Plan to the extent specified. Tasks and activities referenced in pre-test, post-test, and procedural sequences may be performed using the most recent revision of the document stated.

NASA Documents:

Number	Rev.	Title
JHB 5322	C	Contamination Control Requirements Manual
JPG1700.1	H	JSC Safety & Health Requirements Handbook
KHB 1700.7	LI	Space Shuttle Payload Group Safety Handbook
LS-71135-3	A	Human Research Facility Integration Flight Prototype Rack Interface Verification Test
NT1-CWI-001	Base-line	Task Performance Sheet (TPS) NT/Occupational Safety and Institutional Assurance Division
NT1-CWI-003	A	Quality Assurance Record Center Discrepancy Reporting and Tracking Systems
SSP57400		Human Research Facility Unique Payload Verification Plan for Rack One (1), International Space Program
LS-71139-2	B	HRF Flight Rack One Integration Test Procedure II: Payload Rack Checkout Unit Mechanical Operations and Fluid Sampling
LS-71139-5	B	HRF Flight Rack One Integration Test Procedure V: Rack Activation/Deactivation
LS-71139-6	A	HRF Flight Rack One Integration Test Procedure VI: EMI Testing

2.1 APPLICABLE SOFTWARE

The following software provides the configuration data used in this test setup:

HRF Rack Configurations are based upon:

Software Item	Version
Rack Interface Controller (RIC)	EXPRESS -9
EXPRESS Laptop	Integrated Build 6 EXPRESS HH

Suitcase Test Environment For Payloads (STEP) Software Configurations are based upon:

Software Item	Version
STEP Sun Workstation	683-21451-3A or higher

HRF Software Configurations are based upon:

Software Item	Version
Common Software	Block 2.1
Commercial-Off-The-Shelf (COTS) Applications	Windows NT/95
Instrument Applications	N/A
Experiment Applications	N/A
HRF Workstation Software	Integrated Build 6
Ultrasound Software	Rev 108.17
Gas Analyzer System for Metabolic Analysis of Physiology (GASMAP) Software	I/F Shell: 1AX20 RAMS: 1AX60

3.0 TESTING PROCESS OVERVIEW

3.1 TESTING OBJECTIVE

The test objectives are as follows:

- Establish baseline acoustic, airflow and thermal parameters for the HRF Flight Rack.
- Evaluate acoustic abatement methods and determine effects on airflow and thermal parameters for the HRF Flight Rack.
- Perform acoustic testing for the HRF Flight Rack, in support of the Human Research Facility Unique Payload Verification Plan for Rack One, SSP 57400.

3.2 TEST REQUIREMENTS

The following paragraphs describe the specific test requirements conducted and may include references to the specific Verification Requirements Data Sheet (VRDS) to be completed.

3.3 TEST CONDITIONS

3.3.1 Test Conduct Ground Rules

The rules as defined in the following subparagraphs are followed during all test activities.

3.3.2 Roles And Responsibilities

The Test Conductor is responsible for the overall management and integration of all verification testing at the systems level. The Test Conductor ensures all test team members are knowledgeable of the subsystems required for the verification test to be performed. The conductor acquires and assigns test resources and is responsible for the adequacy of test documentation. Additional responsibilities are:

- Test schedule coordination
- Test resource management
- Assurance of efficient test conduct
- Data and reports coordination

The Test Engineer is responsible for conducting the specific verification testing, including the coordination of test materials and personnel. The Test Engineer provides the test configuration, test plan and required paperwork/procedures. The Test Engineer is the principal technical

focal point for a given test. The Test Engineer coordinates all test data processing and supports the Test Conductor in the preparation of the post test report.

The Facility Engineer is responsible for ensuring that the required instrumentation is calibrated, installed and conditioned to provide the data necessary to meet the test objectives. The Facility Engineer is responsible for the coordination of certified Test Technician/Test Operator support.

The Test Technician/Test Operator is responsible for selection, setup, operation, maintenance and configuration of the test equipment in accordance with the approved test plan and procedure.

3.3.3 Test Area Requirements

Special emphasis is to be given to testing flight articles. The following rules will be incorporated into test documentation and compliance is the responsibility of all test team members. Repeated non-compliance may be grounds for denial of access to the test facility.

3.3.3.1 Test Area Cleanliness

Room 100H in Building 241 is certified as a level 100K clean room. Requirements for working in such an environment are detailed in Contamination Control document, JHB 5322C. All test team members with access to room 100H shall be familiar with these requirements and may undergo pre-access training or certification at the discretion of the Facility Engineer. The following rules shall be maintained at all times while in the test facility:

- Smocks, head and beard covers, shall be worn at all times.
- Test Area will be kept clean and orderly at all times.
- All debris created during test preparation, conduct, or tear down will be continuously removed to prevent Foreign Object Damage (FOD) contamination.

Test area cleanliness does not apply to activities conducted in JSC Building 14.

3.3.3.2 Test Area Access

Access to all test areas shall be limited during test operations. Only essential personnel shall be admitted. The test area, surrounding test consoles, and test instrumentation shall be controlled to restrain visitors and prevent tampering with the test article or test equipment.

Determination of essential personnel will be made by the Test Conductor or Test Engineer, and enforced by the Facility Engineer.

3.3.4 Work Area Rules

The following work rules shall be observed for the duration of testing:

- All work stands shall have toe boards sufficient to prevent any item from being accidentally dropped into a test article.
- All work stands shall have the side accessing the test article padded to prevent test article damage in the event the stand comes in contact with the test article.
- Rings and watches must be taped or removed.
- Hard hats must be worn by personnel during forklift operations.
- Forklift operations shall be limited to certified operators only.

3.3.5 Temporary Changes

Temporary changes to the Test Article configuration will be accomplished and documented as described in document NT1-CWI-001 TPS NT/Occupational Safety and Institutional Assurance Division.

4.0 TPS AUTHORIZED PERSONNEL

The TPS Authorization is comprised of two (2) types:

- Type A – A Task Performance Sheet that changes the temporary or permanent configuration of the "Flight" (Class I) or Ground Support Equipment (GSE) test hardware. These documents must be reviewed and agreed upon by the customer before obtaining a NASA Signature. Absolutely no work is to be performed without having the proper paperwork in hand with the appropriate signatures.

- Type B – A Task Performance Sheet that does not change the configuration of the hardware which is being tested. These documents do not require a NASA Signature, and are to be coordinated with the customer and submitted for signature.

All documents must have the signature of the Lockheed Martin engineer authority in charge of verification.

If documents require hardware to be pulled out of bond; the appropriate signature authority for the bond room must be included. This list is for reference purposes only, verify before using. The official list is provided in NASA EA5 memo.

LIST OF AUTHORIZED SIGNATURES

Project ID	Project Name	New Project ID	New Project Name	NASA Technical Monitor	Mission Assigned	Other Authorized Signatures
HPMHPMS1	Integration Hardware Definition & Development/Ground Rack Design and Build	HPMS	High Fidelity Mockup/Ground Development Facility/Launch Integration Facility/Payload Rack Checkout Unit	Ed Strong	HRF	Sharad Bhaskaran Robert Henneke Bob Trittipo Tom Wiggins Elton Witt
HPM1	Ground Facilities Development	Deleted – Content moved to HPMS				
HPM3	Water Cooled Rack Development	HPM3	Flight Prototype Rack Integration/Flight Rack Integration	Ed Strong	HRF	Carlos Aquilar Sharad Bhaskaran Todd Leger Kevin Upham
HPCP	HRF Launch Package 1 Hardware Design	Deleted – Content moved to HPM3				
MEIT	Multiple Element Integration Test (MEIT)	Deleted – Content moved to HPM3				

5.0 TEST SET UP

5.1 THERMAL TEST SETUP

5.1.1 Introduction/Overview

Thermal parameters of the integrated HRF Rack are recorded using a Molytek data acquisition system with a strip chart recorder and thermocouples. Each thermocouple is labeled with a number corresponding to the numbers on the Molytek. Thermocouples will be mounted internal to the Rack and external to payload hardware, completing installation over two (2) intervals. Procedure Steps 1.0 - 3.0 shall be completed before payload hardware is integrated into the Rack, and Procedure Steps 4.0 – 5.0 shall be completed after payload hardware is integrated into the Rack. Figure B-1 provides an illustration of the Thermal Test Setup.

5.1.2 Parts List

The items below or an equivalent, are necessary to complete the Thermal test setup procedure documented in Section 5.1.3. The calibration number and due date may be recorded below if applicable.

Qty	P/N	Description	Calibration #	Due Date
1	3702P22031301	Molytek, strip chart recorder		
32		Thermocouple		
AR	5419-X	Kapton Tape		
AR		Paper		
AR	TT-T-20	Thermocouple Wire		

5.1.3 Procedure

STEP#	ACTIVITY
1.0	Temporarily mount thermocouple in the Rack using Kapton Tape as necessary per Figures B-2 and B-3.
2.0	Repeat Step 1.0 for the remaining thermocouples to be mounted inside the Rack.
3.0	Locate the thermocouple to be mounted to payload hardware in the proper location.
4.0	Mount the thermocouple on payload hardware using Kapton Tape per Figure B-2 and B-3.

STEP#	ACTIVITY
5.0	Repeat Step 4.0 for remaining thermocouples to be mounted on payload hardware.
6.0	Route thermocouple wires out of the Rack.
7.0	Connect thermocouples to the Molytek.

T: ____ QA: ____

5.1.4 Data Acquisition

The Molytek strip chart recorder shall be programmed to record temperature data (degrees F) from each thermocouple at a minimum of three (3) minute intervals. Figure B-4 provides a sample of the Molytek Data Output.

5.2 AIRFLOW TEST SETUP

5.2.1 Introduction/Overview

Air velocity parameters of the HRF Rack are recorded using air velocity transducers and a laptop computer. Each air velocity transducer is labeled with a number corresponding to a graph on the laptop computer. Figure B-5 provides an illustration of the Air Velocity Test Setup.

5.2.2 Parts List

The items below or an equivalent, are necessary to complete the Airflow test setup procedure documented in Section 5.2.3. Calibration number and due date may be recorded below if applicable.

Qty	P/N	Description	Calibration #	Due Date
1	TPS-2000D	Power Supply (TE Instruments)		
2	8475-03	Omni-directional Probe (0 to 500 ft/min)		
2	FMA-603-V	Non-adjustable Probe (0 to 1000 ft/min)		
2	FMA-602-V	Non-adjustable Probe (0 to 500 ft/min)		
1	FMA-903-V-S	Non-adjustable Probe (10 to 1000 ft/min)		

Qty	P/N	Description	Calibration #	Due Date
AR	VRT-16S-M	Tie Wrap		
1	IBM Thinkpad 760XD	Laptop Computer		
1	CB-5DLP	Air Velocity Test Fixture (DAQ Interface)		
1	182799B-OR5	DAQ1200 Interface Cable		
AR	5419-X	Kapton Tape		

5.2.3 Procedure

STEP#	ACTIVITY
1.0	Temporarily mount air velocity transducer in Rack using tie wraps and Kapton tape as necessary per Figure B-2 and/or B-3.
2.0	Repeat Step 1.0 for remaining air velocity transducers.
3.0	Route air velocity cables out of the Rack.
4.0	Connect air velocity cables to Air Velocity Test Fixture.
5.0	Connect DAQ1200 interface cable between the air velocity test fixture and laptop computer.
6.0	Connect the Power Supply to the air velocity test fixture.
7.0	Configure Power Supply to provide 15 Vdc and 2 Amp.

T: ____ QA: ____

5.2.4 Data Acquisition

Labview data acquisition software on the IBM laptop computer plots data points from the air velocity transducers. The data points are collected every one (1) to five (5) seconds until the air flow data reaches a steady state. The raw data points are saved in a generic data file on the laptop harddrive. Each time a generic data file is collected, the file must be saved with a new file name and deleted, before the next generic data file can be collected. New file names shall be recorded in air flow data log (reference Figure B-10). Figure B-6 provides a sample of the Labview Software Data Output.

5.3 SOUND PRESSURE LEVEL TEST SUPPORT EQUIPMENT SETUP

5.3.1 Introduction/Overview

Acoustic levels of the HRF Rack are recorded using a Larson Davis Signal Analyzer or a Bruel & Kjaer PULSE System. Random incidence microphones are used for capturing Sound Pressure Levels (SPL) from each surface of the Rack. Section 5.3.2 describes the equipment, procedure, and data acquisition if using a Larson Davis Signal Analyzer. Sections 5.3.3 describes the equipment, procedure, and data acquisition when using a Bruel & Kjaer PULSE System. For HRF Rack One, the Larson Davis Signal Analyzer was used for preliminary testing and the Bruel & Kjaer PULSE System was used for certification testing. Certification testing is performed in accordance with SSP 57000, Rev. C.

5.3.2 Larson Davis Signal Analyzer

5.3.2.1 Parts List

The items below or an equivalent, are necessary to complete the acoustic test setup procedure documented in Section 5.3.2.2. Serial number, calibration number, and due date may be recorded below if applicable.

Qty	P/N	Description	S/N	Calibration #	Due Date
1	2900B	Larson Davis Signal Analyzer			
2	2560	½ inch Random Incident Microphones			
2	PRM 900C	Larson Davis Preamp			
2	EXC025	Larson Davis Cables			
1	CAL200	Larson Davis Calibrator			
1	824	Larson Davis Sound Lever Meter			

5.3.2.2 Procedure

STEP#	ACTIVITY
1.0	Setup microphone Channel 1 and 2 per Figure B-7.
2.0	Connect Larson Davis Signal Analyzer, Preamp, Cables and microphones.
3.0	Calibrate both microphone channels with Larson Davis Calibrator.

T: ____ QA: ____

5.3.2.3 Data Acquisition

The analyzer captures Octave Band Data from 63 to 8000 Hz. An overall A-wtd sound pressure level is captured at the time of testing. Figure B-8 provides a sample of the data recorded by the analyzer. At the direction of the Acoustic Test Engineer, an initial sweep may be performed with a sound level meter to determine the loudest location in front of the HRF Rack. The microphones shall be located two (2) ft from the loudest locations in front of the Rack.

5.3.3 Bruel & Kjaer PULSE System

The Bruel & Kjaer PULSE System can be used to capture SPLs. This section describes the equipment, procedure, and data acquisition for collecting SPLs.

5.3.3.1 Parts List

The items below or an equivalent, are necessary to complete the acoustic test setup procedure documented in Section 5.3.3.2. Serial number, calibration number, and due date may be recorded below if applicable.

Qty	P/N	Description	S/N	Calibration #	Due Date
1	2825	PULSE Front-end			
1		Dolch Computer			
1	AO-0370	Connection Cable			
12	2560	½ inch Random Incident Microphones			
12	PRM 900C	Larson Davis Preamp			
12	EXC025	Larson Davis Cables			
1	CAL200	Larson Davis Calibrator			

Qty	P/N	Description	S/N	Calibration #	Due Date
12		Microphone Stands			
1		Tape Measure			
1	ZB0017	Sound Intensity Probe w/Remote			

5.3.3.2 Procedure

STEP#	ACTIVITY
1.0	Setup microphone Channel 1 and 2 per Figure B-7. **NOTE:** For Sound Pressure Level (SPL) test measurements, the microphones shall be located two (2) ft from the loudest location from the surface of the rack in accordance with SSP 57000, Rev. C.
2.0	Set up microphone Channel 3 thru 12 per Figures B-15a thru B-15d.
3.0	Connect Dolch Computer and PULSE Front-end via the connection cable, AO-0370.
4.0	Connect Bruel & Kjaer PULSE System, Preamp, Cables and Microphones.
5.0	Calibrate all microphone channels with Larson Davis or Bruel & Kjaer Calibrator.

T: ____ QA: ____

5.3.3.3 Data Acquisition

The Bruel & Kjaer PULSE System captures Octave Band Data from 63 to 8000 Hz for up to sixteen (16) channels. Channels 1 and 2 shall be used to measure sound pressure levels in each of eight (8) octave bands:
63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz, at the loudest location, 0.6 meters (2 feet), from the front surface of the rack. Additionally, an overall A-weighted sound pressure noise level is captured at the time of testing. Channels 3 through 12 shall be used to measure sound pressure levels at additional location around the rack. Figure B-9 provides a sample of the data recorded by the analyzer. At the direction of the Acoustic Test Engineer, an initial sweep may be performed with an intensity probe to determine the loudest location in front of the HRF Rack.

5.4 SOUND POWER LEVEL TEST SUPPORT EQUIPMENT SETUP

5.4.1 Introduction/Overview

The SPL data collected during preliminary acoustic testing of HRF Flight Rack One indicated readings which did not meet the requirements documented in SSP 57000. A waiver or exception to this requirement maybe processed by performing a Sound Power Level Test. The Bruel & Kjaer PULSE System uses an intensity probe to capture Sound Power Levels (PWL).

5.4.2 Bruel & Kjaer PULSE System

The Bruel & Kjaer PULSE System can be used to capture both SPLs and PWLs. This section describes the equipment, procedure, and data acquisition for collecting PWLs.

5.4.2.1 Parts List

The items below or an equivalent, are necessary to complete the acoustic test setup procedure documented in Section 5.4.2.2. Serial number, calibration number, and due date may be recorded below if applicable.

Qty	P/N	Description	S/N	Calibration #	Due Date
1	2825	PULSE Front-end			
1		Dolch Computer			
1	ZB0017	Intensity Probe w/Remote			
1	WL 1306	Adapter Cable			
1		Intensity Calibrator			
1	AO-0370	Connection Cable			
1		Guide Fixture			

5.4.2.2 Procedure

STEP#	ACTIVITY
1.0	Setup guide fixture around rack.
2.0	Connect Dolch Computer and PULSE Front-end via the connection cable, AO-0370.
3.0	Connect Intensity Probe and PULSE Front-end via the adapter cable, WL 1306.
4.0	Activate PULSE icon on the Windows desktop and select customized template for acquiring Sound Intensity data.
5.0	Calibrate the Intensity Probe with the Intensity Calibrator.

5.4.2.3 Data Acquisition

The Bruel & Kjaer PULSE System captures sound intensity (dB/pW/m^2) data from each side of the rack and computes the sound power (dB/pW/m) level based on the area scanned.

5.5 RACK ACOUSTIC ABATEMENT INSTALLATION/REMOVAL

Permanent installation of Flight Rack acoustic abatement shall be installed under the work authorization of a Task Performance Sheet (TPS) in accordance with HRF Rack One drawing, SEG46117303-303. Rack acoustic abatement without Flight Classification or permanent installation, shall be installed and removed on a type A temporary TPS.

5.6 PAYLOAD ACOUSTIC ABATEMENT INSTALLATION/REMOVAL

5.6.1 Introduction/Overview

Openings between each of the rack mounted payloads and openings around the front panel handle allow sound to escape from the HRF Rack. Covering these openings reduces the noise levels produced by the HRF Rack.

Note 1:
A the time of acoustic testing on HRF Rack 1, issues involving the ISIS handles and stowage drawers were unresolved. The flight units of this hardware had not be delivered to be used in the acoustic testing. Instead 2 ea., 8PU Stowage drawers in drawer locations 7 & 8 and 11 & 12 were used instead of 4 ea., 4PU Stowage Drawer. Additionally, the handles on the rack mounted payloads were a mix of ISIS Handles and SIR Handles. Thus, high fidelity prototype hardware in section 5.6.2 is used for certification testing.

Note 2:
At the time of this revision, the configuration and final acoustic abatement has been defined and baselined is the HRF Integrated Rack 1 top assembly drawing, SEG46117298. The acoustic abatement used in Rack 1 payloads is also defined in section 5.6.2.

5.6.2 Parts List

The following table describes the different items that can be used as front panel acoustic abatement. The quantities for the prototype abatement represent the amount used for HRF Rack 1 acoustic testing as defined by the rack and payload configuration during the tests. The

quantities for the flight abatement represent the actual configuration of the HRF Rack 1 and payloads in its 5A.1 launch configuration. These items are an equivalent and are necessary to complete the procedure.

List of Front Panel Acoustic Abatement

High Fidelity Prototype Acoustic Abatement (Non-flight)			
Qty	**P/N**	**Description**	**S/N**
14	ACST1	ISIS handle closeout, Top	N/A
4	ACST2	ISIS handle closeout, Bottom	N/A
6	ACST3	Payload to Payload Closeout	N/A
10	ACST4	SIR handle closeout, Top	N/A
8	ACST5	SIR handle closeout, Bottom	N/A

Flight Acoustic Abatement			
Qty	**P/N**	**Description**	**S/N**
7	SEG46117972-301	ISIS Acoustic Closeout Assy, HRF	N/A
4	SEG46117973-301	Acoustic Closeout Assy, HRF	N/A
4	SEG46117974-301	Flight CSD Latch Seal Assy	N/A

5.6.3 Procedure

STEP #	ACTIVITY
1.0	Unlatch GASMAP Calibration Module, GASMAP Analyzer, and CSD in location 6
2.0	Install Payload to Payload closeouts across top of payloads listed in Step 1.0.
3.0	Latch GASMAP Calibration Module, GASMAP Analyzer, and CSD in drawer location 6 **NOTE:** Payload to Payload closeout on top of CSD must be removed before unlatching Ultrasound.
4.0	Install ISIS handle closeouts top on payloads in drawer locations 1, 2, 6, 9, 10, 13, and 14.
5.0	Install ISIS handle closeouts bottom on payloads in drawer locations 2 and 9.

STEP #	ACTIVITY
6.0	Install Payload to Payload closeouts on payloads in drawer locations 1, 6, 10, 13 and 14.
7.0	Install SIR handle closeouts top on payloads in drawer locations 7, 8, 11, 12, and 15.
8.0	Install SIR handle closeouts bottom on payloads in drawer locations 7, 8, 11, and 15.
9.0	Install Payload to Payload closeout on the payload in drawer location 12.
10.0	Unlatch GASMAP Calibration Module, GASMAP Analyzer, and CSD in location 6
11.0	Remove Payload to Payload closeouts across top of payloads listed in Step 10.0.
12.0	Latch GASMAP Calibration Module, GASMAP Analyzer, and CSD in drawer location 6
13.0	Remove ISIS handle closeouts top on payloads in drawer locations 1, 2, 6, 9, 10, 13, and 14.
14.0	Remove ISIS handle closeouts bottom on payloads in drawer locations 2 and 9.
15.0	Remove ISIS handle closeouts bottom Payload to Payload closeouts on payloads in drawer locations 1, 6, 10, 13 and 14.
16.0	Remove SIR handle closeouts top on payloads in drawer locations 7, 8, 11, 12, and 15.
17.0	Remove SIR handle closeouts bottom on payloads in drawer locations 7, 8, 11, and 15.
18.0	Remove SIR handle closeout bottom Payload to Payload closeout on the payload in drawer location 12.

5.7 REMOVAL/INSTALLATION OF RACK PANELS

5.7.1 Introduction/Overview

The rack has a total of eight (8) removable panels. During the acoustic, airflow and thermal evaluation tests, the panels may be removed from the rack for installation of thermocouples, airflow probes, and acoustic abatement materials. All panels must be installed prior to any acoustic, airflow and thermal tests. Steps may be performed in any order or omitted at the direction of the Test Conductor.

5.7.2 Parts List

The items below or an equivalent, are necessary to complete the removal and installation of Rack Panels documented in Section 5.6.3. Calibration number and due date may be recorded below if applicable.

Qty	P/N	Description	Calibration #	Due Date
1		Allen Wrench (5/32)		
1		Torque Wrench		

5.7.3 Procedure

STEP#	ACTIVITY
1.0	Remove three (3) ea., Hole Plug, Pressure Relief Assy, P/N 683-46079 from the rack. N/A ____ T: ____ QA: ____
2.0	Remove four (4) ea., Panel, Access, Side Assy, P/N 683-50218 from the rack, and record serial numbers for each location: Top Right _____ Bottom Right _____ Top Left _____ Bottom Left _____ N/A ____ T: ____ QA: ____
3.0	Remove one (1) ea., Panel, Access-Rear, P/N 683-50215, from the rack. N/A ____ T: ____ QA: ____
4.0	Install three (3) ea., Hole Plug, Pressure Relief Assy, P/N 683-46079 per drawing, 683-46120. N/A ____ T: ____ QA: ____
5.0	Record torque wrench calibration and date. Calibration #: _____ Due Date: _____ NASA Tag #: _____ N/A ____ T: ____ QA: ____
6.0	Install four (4) ea., Panel, Access, Side Assy, P/N 683-50218. N/A ____ T: ____ QA: ____
7.0	Install one (1) ea., Panel, Access-Rear, P/N 683-50215. N/A ____ T: ____ QA: ____

5.8 ACTIVATION/DEACTIVATION OF AIR HANDLERS

5.8.1 Introduction/Overview

Deactivation of air handlers may reduce background noise levels in the testing facility. A ten (10)-decibel (dB) difference or greater between the background noise and the test article is required to qualify test results. Two (2) facilities are identified for acoustic testing of the rack. The procedure for activation/deactivation of the air handlers differs for the two (2) facilities, applicable instructions are provided below. Activation/Deactivation of the air handler is performed at the direction of the Acoustic Test Engineer.

5.8.2 Procedure for B241 Clean Room Facility

STEP#	ACTIVITY
1.0	**NOTE:** A maximum of two (2) people wearing clean room coveralls remain inside the clean room during air handler deactivation. One (1) additional person may remain in the changing area. Deactivate the clean room air handler by switching off the air handler power breakers switch located outside of B241 and record: Time: _____ Humidity: _____ Temperature: _____
	WARNING: **Deactivation time for the clean room air handlers should not exceed twenty (20) minutes. Relative humidity should not exceed 70% or fall below 30%. Hardware cannot be operated in the clean room if the Temperature exceeds 85° F.**
2.0	**NOTE:** If any of the specified parameters in Step 1.0 are approached, proceed to Step 3.0 and activate humidifier or dehumidifier as appropriate. Hold and evaluate while monitoring, humidity, temperature and time.
3.0	Activate the clean room air handler and record: Time: _____ Humidity: _____ Temperature: _____

T: ____ QA: ____

5.8.3 Procedure for B14 Electromagnetic Interference (EMI) Facility

STEP#	ACTIVITY
1.0	Coordinate with the B14 Facility Manager to provide date, time, and duration activation/deactivation of the air handler. **NOTE:** Deactivating the air handler for the B14 EMI chamber removes air conditioning throughout the building.

6.0 TEST PROCEDURE

This section describes the various operations performed during acoustic, airflow, and thermal testing. The HRF Rack and GSE support equipment shall be activated/deactivated per document LS-71139-2 Section 6.1, 6.2, 6.4 and 6.5. Activation/Deactivation of the Rack may be repeated as necessary at the discretion of the test conductor.

6.1 AIRFLOW/THERMAL EVALUATION

The rack is equipped with thermocouples and air velocity transducers to collect temperature and air velocity parameters. The rack and payloads are activated on during testing. Various on-orbit operational configurations may also be tested. Test support equipment is monitored until temperatures and air flow rates reach a steady state or limit requirements within the rack.

TABLE 6.1 AIRFLOW/THERMAL EVALUATION

Step	GSE Support/Test Support Equipment	HRF Rack	Payload
1.	Record on Molytek: • Initial Temperature Record on Laptop: • Initial Air Flow Data Record in Air Flow Data Log: • File Name • Date/Time		
2.		Activate power and initialize C&DH Rack per LS-71139-2 Section 6.2 or LS-71139-6 Section 6.1.1 depending upon configuration.	
3.		Send “Startup Notification” and activate EXPRESS Laptop per LS-71139-5 Section 6.1.	
4.		Configure Rack for payloads per LS-71139-5 Section 6.2.	
5.	Start Recording on Molytek: • Temperature Start Recording on Laptop: • Air Flow Data		
6.			Activate GASMAP per LS-71139-5 Section 6.3.1
7.			GASMAP Keypad Select: <4> “operate” Select: <1> “default” Verify the following: • Screen displays ambient samples
8.			Activate Cooling Stowage Drawer per LS-71139-5 Section 6.3.2
9.			Activate Ultrasound per LS-71139-5 Section 6.3.3
10.			Activate Workstation per LS-71139-5 Section 6.3.4
11.	Stop recording on Laptop: • Air Flow Data		

TABLE 6.1 AIRFLOW/THERMAL EVALUATION (CONT'D)

Step	GSE Support/Test Support Equipment	HRF Rack	Payload
12.	Record in Air Flow Data Log: • File Name • Date/Time		
13.	Approximately every twenty (20) minutes, record the following values in the Power, Temperature, and Flow Rate Logs: • EMU, PEHB, RIC, and SSPCM Power draw • Rack water temperature • Room temperature • Rack water flow rates		
14.	Monitor thermocouple output data on Molytek until HRF Rack reaches a steady state condition determined by the Test Engineer.		**NOTE:** If air inlet temperature reaches 95 degrees F for the GASMAP, Ultrasound, or Workstation, deactivate payloads and temporarily remove rack drawers to exhaust warm air.
15.	Stop recording on Molytek: • Temperature Start recording on Laptop: • Air Flow Data		
16.			Deactivate GASMAP per LS-71139-5 Section 6.4.1
17.			Deactivate Cooling Stowage Drawer per LS-71139-5 Section 6.4.2
18.			Deactivate Ultrasound per LS-71139-5 Section 6.4.3
19.			Deactivate Workstation per LS-71139-5 Section 6.4.4
20.		Deactivate EXPRESS Laptop per LS-71139-5 Section 6.6.	
21.		Deactivate Rack per LS-71139-2 Section 6.4.	
22.	Stop recording on Laptop: • Air Flow Data		
23.	Record in Air Flow Data Log: • File Name • Date/Time		

T: ____ QA: ____

6.2 ACOUSTIC/AIRFLOW/THERMAL EVALUATION

The rack is equipped with thermocouples, air velocity transducers, and acoustic abatement materials. The rack and all payloads are powered on during testing. Various on-orbit operational configurations may also be tested. The test support equipment is monitored until temperatures and airflow rates reach a steady state or limit requirements within the rack.

TABLE 6.2 ACOUSTIC/AIRFLOW/THERMAL EVALUATION

Step	GSE Support/Test Support Equipment	HRF Rack	Payload
1.	Deactivate air handlers per Section 5.8.		
2.	Record on Molytek: • Initial Temperature Record on Laptop: • Initial Air Flow Data Record in Air Flow Data Log: • File Name • Date/Time Record on Acoustic Data Acquisition System • Background Acoustic Data Record in Acoustic Data Log (See Figure B-11b): • Overall Linear CH 1 & CH 2 • Powered Equipment • Abatement Configuration		
3.	Activate Air Handlers per Section 5.8.		
4.		Activate HRF Rack per LS-71139-2 per Section 6.2 or LS-71139-6 Section 6.1.1 depending upon configuration.	
5.		Send “Startup Notification” and activate EXPRESS per LS-71139-5 Section 6.1.	
6.		Configure Rack for payloads per LS-71139-5 Section 6.2.	
7.	Start Recording on Molytek: • Temperature Data Start Recording on Laptop: • Air Flow Data		
8.			Activate GASMAP per LS-71139-5 Section 6.3.1
9.			GASMAP Keypad Select: <4> “operate” Select: <1> “default” Verify the following: • Screen displays ambient samples
10.			Activate Cooling Stowage Drawer per LS-71139-5 Section 6.3.2
11.			Activate Ultrasound per LS-71139-5 Section 6.3.3
12.			Activate Workstation per LS-71139-5 Section 6.3.4
13.	Stop recording on Laptop: • Air Flow Data Record in Air Flow Data Log: • File Name • Data/Time		
14.	Deactivate Air Handlers per Section 5.8.		
15.	Record on Acoustic Data Acquisition System • Acoustic Data Record in Acoustic Data Log: • Overall Linear CH 1 & CH 2 • Powered Equipment • Abatement Configuration		
16.	Activate Air Handlers per Section 5.8.		

TABLE 6.2 ACOUSTIC/AIRFLOW/THERMAL EVALUATION (CONT'D)

Step	GSE Support/Test Support Equipment	HRF Rack	Payload
17.	Approximately every twenty (20) minutes, record the following values in the Power, Temperature, and Flow Rate Logs: • EMU, PEHB, RIC, and SSPCM Power draw • Rack water temperature • Room temperature • Rack water flow rates		
18.	Monitor thermocouple output data on Molytek until HRF Rack reaches a steady state condition. A steady state condition will be determined by the Test Engineer.		**NOTE:** If air inlet temperature reaches 95 degrees F for the GASMAP, Ultrasound, or Workstation, deactivate payloads and temporarily remove drawers from the Rack to exhaust warm air in the Rack. Proceed to Step 24 at the direction of the test conductor.
19.			Activate and Deactivate payload hardware per LS-71139-5 Section 6.3 and 6.4, respectively to collect acoustic data for on-orbit operational configuration per Table 6.4 as directed by the test conductor.
20.	Deactivate Air Handlers per Section 5.8.		
21.	Record on Acoustic Data Acquisition System • Acoustic Data Record in Acoustic Data Log: • Overall Linear CH 1 & CH 2 • Powered Equipment • Abatement Configuration Record on Laptop: • Air Flow Data Record in Air Flow Data Log: • File Name • Date/Time		
22.	Repeat Steps 17 and 19 until on-orbit operational configuration data is collected per Table 6.4.		
23.	Activate Air Handlers per Section 5.8.		
24.	Stop recording on Molytek: • Temperature		
25.			Deactivate GASMAP per LS-71139-5 Section 6.4.1
26.			Deactivate Cooling Stowage Drawer per LS-71139-5 Section 6.4.2
27.			Deactivate Ultrasound per LS-71139-5 Section 6.4.3
28.			Deactivate Workstation per LS-711139-5 Section 6.4.4
29.		Deactivate EXPRESS Laptop per LS-71139-5 Section 6.6.	
30.		Deactivate Rack per LS-71139-2 Section 6.4.	

T: ____ QA: ____

6.3 ACOUSTIC EVALUATION

The rack and/or payloads are activated to capture acoustic data for various operational configurations. The rack may be configured with acoustic abatement materials.

TABLE 6.3 ACOUSTIC EVALUATION

Step	GSE Support/Test Support Equipment	HRF Rack	Payload
1.	Deactivate Air Handlers per Section 5.8 per Acoustic Engineers direction.		
2.	Record on Acoustic Data Acquisition System. • Background Acoustic Data Record in Acoustic Configuration (See Figure B-11a) and Data Log as appropriate per Acoustic Engineers direction: • Sound Pressure Data and Sound Power Data • Powered Equipment • Abatement Configuration		
3.	Activate Air Handlers per Section 5.8 as necessary.		
4.		Activate HRF Rack per LS-71139-2 per Section 6.2 or LS-71139-6 Section 6.1.1 depending upon configuration.	
5.		Send “Startup Notification” and activate EXPRESS per LS-71139-5 Section 6.1.	
6.		Configure Rack for payloads per LS-71139-5 Section 6.2.	
7.			Activate GASMAP per LS-71139-5 Section 6.3.1
			GASMAP Keypad Select: <4> “operate” Select: <1> “default” Verify the following: • Screen displays ambient samples
8.			Activate Cooling Stowage Drawer per LS-71139-5 Section 6.3.2
9.			Activate Ultrasound per LS-71139-5 Section 6.3.3
10.			Activate Workstation per LS-71139-5 Section 6.3.4
11.	Deactivate Air Handlers per Section 5.8 per Acoustic Engineers direction.		
12.	Record on Acoustic Data Acquisition System. • Background Acoustic Data Record in Acoustic Configuration and Datalog as appropriate per Acoustic Engineers direction: • Sound Pressure Data and Sound Power Data • Powered Equipment • Abatement Configuration		

TABLE 6.3 ACOUSTIC EVALUATION (CONT'D)

Step	GSE Support/Test Support Equipment	HRF Rack	Payload
13.			Activate and Deactivate payload hardware per LS-71139-5 Section 6.3 and 6.4, respectively to collect acoustic data for on-orbit operational configuration per Table 6.4 as directed by the test conductor.
14.	Repeat Steps 12 and 13 until operational configuration data is collected per Table 6.4.		
15.	Activate Air Handlers per Section 5.8 as necessary.		
16.			Deactivate GASMAP per LS-71139-5 Section 6.4.1
17.			Deactivate Cooling Stowage Drawer per LS-71139-5 Section 6.4.2
18.			Deactivate Ultrasound per LS-71139-5 Section 6.4.3
19.			Deactivate Workstation per LS-711139-5 Section 6.4.4
20.		Deactivate EXPRESS Laptop per LS-71139-5 Section 6.6.	
21.		Deactivate Rack per LS-71139-2 Section 6.4.	

T: ____ QA: ____

6.4 OPERATIONAL CONFIGURATIONS OF HRF

The following table illustrates payload operational configurations of HRF Flight Rack One during acoustic evaluations.

TABLE 6.4 OPERATIONAL CONFIGURATIONS OF HRF

Test #	Ultrasound	CSD #1	CSD #2	GASMAP Analyzer	Workstation	Mixing Fan
1	X					X
2	X	X				X
3		X				X
4			X			X
5				X		X
6					X	X
7			X		X	X
8						X
9	X				X	X
10	X	X	X		X	X
11				X	X	X
12			X	X	X	X
13	X					
14		X				
15			X			
16				X		
17					X	

APPENDIX A

Forms
For reference purposes only.

1. PROJECT CODE	2. JPIC CODE	**TASK PERFORMANCE SHEET** NASA - LYNDON B. JOHNSON SPACE CENTER			
3. TYPE A CONFIGURATION CHANGE ☐ PERMANENT ☐ TEMPORARY ☐		4. TPS NO.		5. PAGE OF	
B NONCONFIGURATION CHANGE ☐		6. MOD SHEET(S) NUMBER(S)	7. ORG.	8. SYSTEM	9. NEED DATE
10. PART NAME	11. PART NO./DRAWING NO.		12. SERIAL/LOT	13. TIME/CYCLE/SHELF LIFE ☐ YES ☐ NO	
14. APPLICABLE DOCUMENTS	15. CONTRACT NO./JOB NO.		16. HAZ. TASK ☐ YES ☐ NO	17. ENG. EVAL. ☐ YES ☐ NO	
18. SHORT TITLE OF TPS				19. ADP UPDATE ☐ YES ☐ NO	

20. OPER SEQ. NO.	21. OPERATIONS *(Print, Type, or Write Legibly)*	VERIFICATION 22. TECH.	23. QA/DV

24. ORIGINATOR	DATE	25. FINAL ACCEPTANCE STAMP AND DATE

APPROVALS *(Printed or Typed and Signed)*

26. PROJECT ENGINEER	DATE	27. QUALITY ENGINEER	DATE
28.		29.	
30.		31.	

JSC Form 1225 (Rev February 7, 2000) (MS Word August 1996)

Figure A-1 Task Performance Sheet

		5. Page	of
TASK PERFORMANCE SHEET CONTINUATION PAGE NASA - LYNDON B. JOHNSON SPACE CENTER		4. TPS NO.	
		6. MOD NO.	

20. OPER SEQ. NO.	21. OPERATIONS *(Print, Type, or Write Legibly)*	VERIFICATION 22. TECH.	23. QA/DV

JSC Form 1225A (Rev February 7, 2000) (MS Word August 1996)

Figure A-2 Task Performance Continuation Sheet

1. JPIC

Discrepancy Report/Material Review Record
NASA - Lyndon B. Johnson Space Center

2. Page 1 of ____

3. Ref. Doc # 4. IDR # 5. DR #

6. Name of Top Assy. 7. Drawing or P/N 8. S/N or Lot # 9. Qty.

10. Name of Sub Assy 11. Drawing or P/N 12. S/N or Lot # 13. Qty.

14. Name of Component 15. Drawing or P/N 16. S/N or Lot # 17. Qty.

18. Description of nonconformance

19. Initiator's name (print and sign) 20. Title/Stamp No. 21. Org. 22. Location 23. Date

24. Responsible Engineer/Mail Code 25. CHRP Code 26. CAGE Code 27. Time/cycles used

xx. Category
☐ Critical
☐ Major
☐ Minor

29. PRACA Reportable ☐ Yes ☐ No

30. Configuration Change? ☐ Yes ☐ No

31. Waiver? ☐ Yes ☐ No

32. Corrective Action ☐ Yes ☐ No

FIAR # _____ DCN # _____ Waiver # _____ CAS # _____

33. Final Disposition
☐ Rework ☐ Repair ☐ Change Classification ☐ Scrap
☐ Use-as-is ☐ Return to vendor/supplier ☐ Written in error

34. MRB Req'd? ☐ Yes ☐ No

35. Final Acceptance Stamp and

Material Review Board
(approvals must be typed or printed and signed)

36. Stress Engineer Date 37. Materials Engineer Date

38. Project Engineer Date 39. Quality Engineer Date

40. Other (print or type title) Date 41. QA Rep. (NASA) Date

T1 Resp. Org. T2 HW Type T3 Prev. Cond. T4 Fail. Mode T5 Defect T6 Remedial Act. T7 Cause T8 Recur. Ctrl. T9 Perf. Org. T10 Proc. Flow

JSC Form 2176 (Rev August 10, 1999) (MS Word Sep 97)

Figure A-3 Discrepancy Report/Material Review Record

1. IDR #	**Discrepancy Report/Material Review Record**	3. Page ____ of ____
2. DR #	NASA - Lyndon B. Johnson Space Center	

Continuation Sheet

4. Insp. Pts.	5. Seq. No.	6. Instructions *(Print, type, or write legibly)*	7. Verification Stamps Tech.	Qual.

8. Final Acceptance Stamp and Date

JSC Form 2176A (Sep 97) (MS Word Sep 97)

Figure A-4 Discrepancy Report/Material Review Record Continuation Sheet

1. DR #

Discrepancy Report/Material Review Record

NASA - Lyndon B. Johnson Space Center

2. Page ____ of ____

Summary Sheet

3. Configuration Change? ☐ No ☐ Yes DCN #

4. CCBD #

5. PRACA #

6. Remedial Action

7. Root Cause

8. Corrective Action (Recurrence Control)

MRB APPROVAL

9. Stress Engineer (Print and sign)	Date	10. Materials Engineer (Print and sign)	Date
11. Project Engineer (Print and sign)	Date	12. Quality Engineer (Print and sign)	Date
13. Other (Print and sign)	Date	14. QA Rep. (NASA) (Print and sign)	Date

JSC Form 2176B (Oct 97) (MS Word Sep 97)

Figure A-5 Discrepancy Report/Material Review Record Summary Sheet

1. DR #

2. Page ____ of ____

Discrepancy Report/Material Review Record

NASA - Lyndon B. Johnson Space Center

Multiple Disposition Coding Sheet

	T1 Resp. Org.	T2 HW Type	T3 Prev. Cond.	T4 Fail. Mode	T5 Defect	T6 Remedial Act.	T7 Cause	T8 Recuf. Ctrl.	T9 Perf. Org.	T10 Proc. Flow
A.										
B.										
C.										
D.										
E.										
F.										

3. Quality Engineer (Print and Sign) Date

JSC Form 2176C (Oct 97) (MS Word Oct 97)

Figure A-6 Discrepancy Report/Material Review Record Multiple Disposition Coding Sheet

LOCKHEED MARTIN

FLASH REPORT

For Safety and Product Assurance use only

NASA mishap no.	
OSHA file no.	

GENERAL INFORMATION	
1. Date (MM/DD/YY)	2. Time ☐ a.m. or ☐ p.m.
3. Building number/location	4. Specific area

5. Category of incident (check appropriate box)

☐ Injury/accident ☐ Fire

☐ Auto accident ☐ Explosion

☐ Chemical spill ☐ Other

6. Description of incident (explain what happened, including cause or description of failure)

7. SEAT involvement (name of organization)

PERSONNEL INVOLVED	
8. Name (last, first, middle initial)	9. Telephone
CONTACT PERSON	
10. Name (last, first, middle initial)	11. Telephone

FORM SEAT 094 (09/23/97)

Figure A-7 Flash Report

DISPOSAL INVENTORY
FOR MISCELLANEOUS HAZARDOUS WASTES

GENERAL NOTES:

1. Waste sources must be identified.
2. Exceptions:
   See JSCI 8837 (current issue) for disposal methods for batteries, ether, explosives, empty drums, paint and chemical containers, radioactive and biological wastes, and precious metals.
3. Containers must be waterproof.
4. Containers must be labeled; all unlabeled containers will be returned to generators for proper identification.
5. For pickup, call x32038

TO BE COMPLETED BY WASTE GENERATOR.

DATE
BUILDING NO.
ROOM NO.
NAME
PHONE EXTENSION
MAIL CODE
CARTON NO. _____ OF _____
Provide the following information at time of pickup: **PICK-UP TICKET NO.:**

INVENTORY

(Use a separate form for each carton of waste.
A copy of Inventory must be in or on each carton.)

IDENTIFICATION AND SOURCE OF WASTE	AMOUNT	IDENTIFICATION AND SOURCE OF WASTE	AMOUNT

JSC Form 1161 (Rev Aug 97) (MS Word Aug 97) COPY 1 - SHIPPING COPY 2 COPY 3 - ORIGINATOR

Figure A-8 Disposal Inventory for Miscellaneous Hazardous Wastes

Repetitive Operations Log						
Document Number : LS-71139-7 Rev ___						Page ____ of ____
Section Number	Step Number(s)	Test Conductor	Date	Tech	QA	Reason/Remarks

Figure A-9 Repetitive Operations Log

Deviation					Page ___ of ___
TPS Number:		Document Number:		Project Manager:	Test Engineer:
Dev No	Section	Step	Type (P/T)	Change	Reason
Originator:		Phone:	Date:		Quality Engineer:

Figure A-10 Deviation Sheet

Deviation Continuation Page				TPS Number:	Document Number:	Page ___ of ___
Dev No	Section	Step	Type (P/T)	Change	Reason	

Figure A-11 Deviation Continuation Sheet

APPENDIX B

Illustrations and Logs

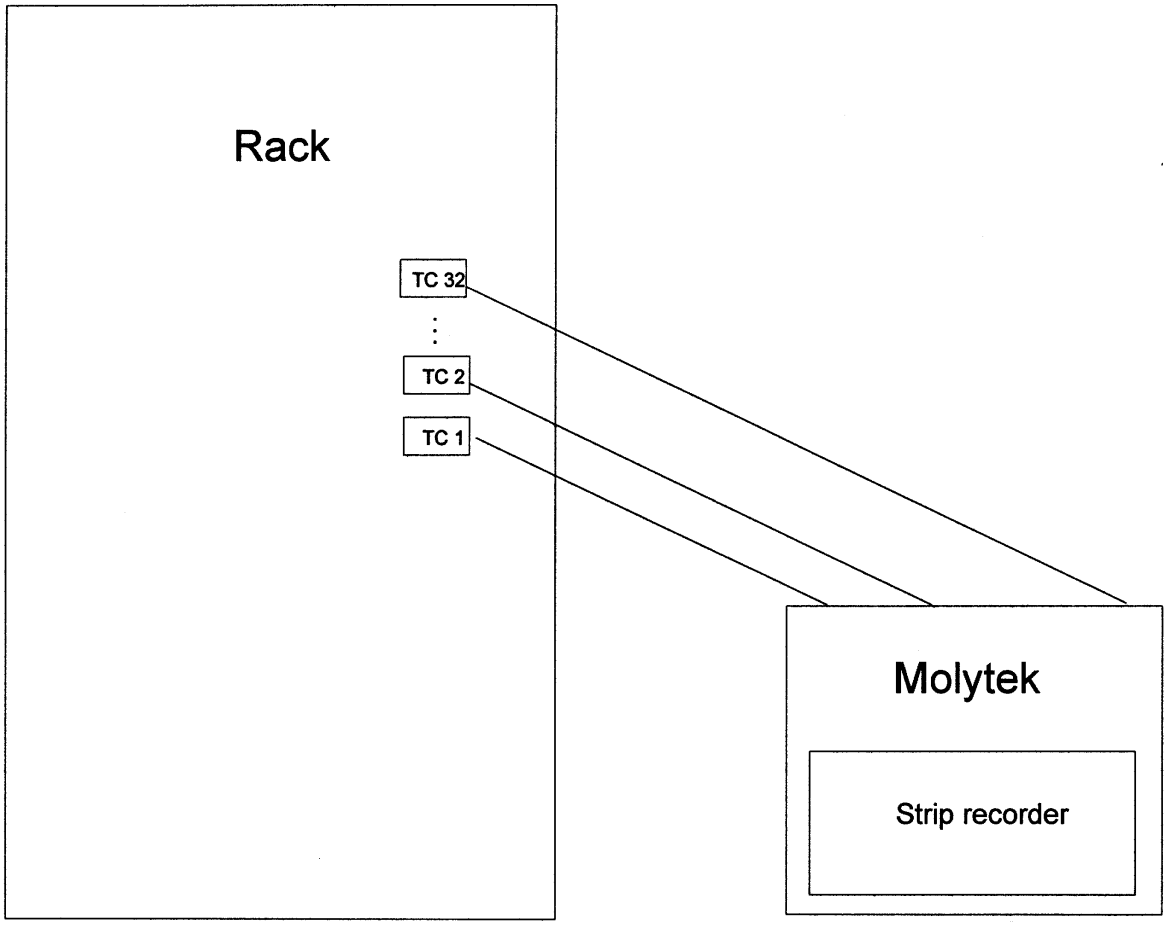


Figure B-1 Thermal Test Setup

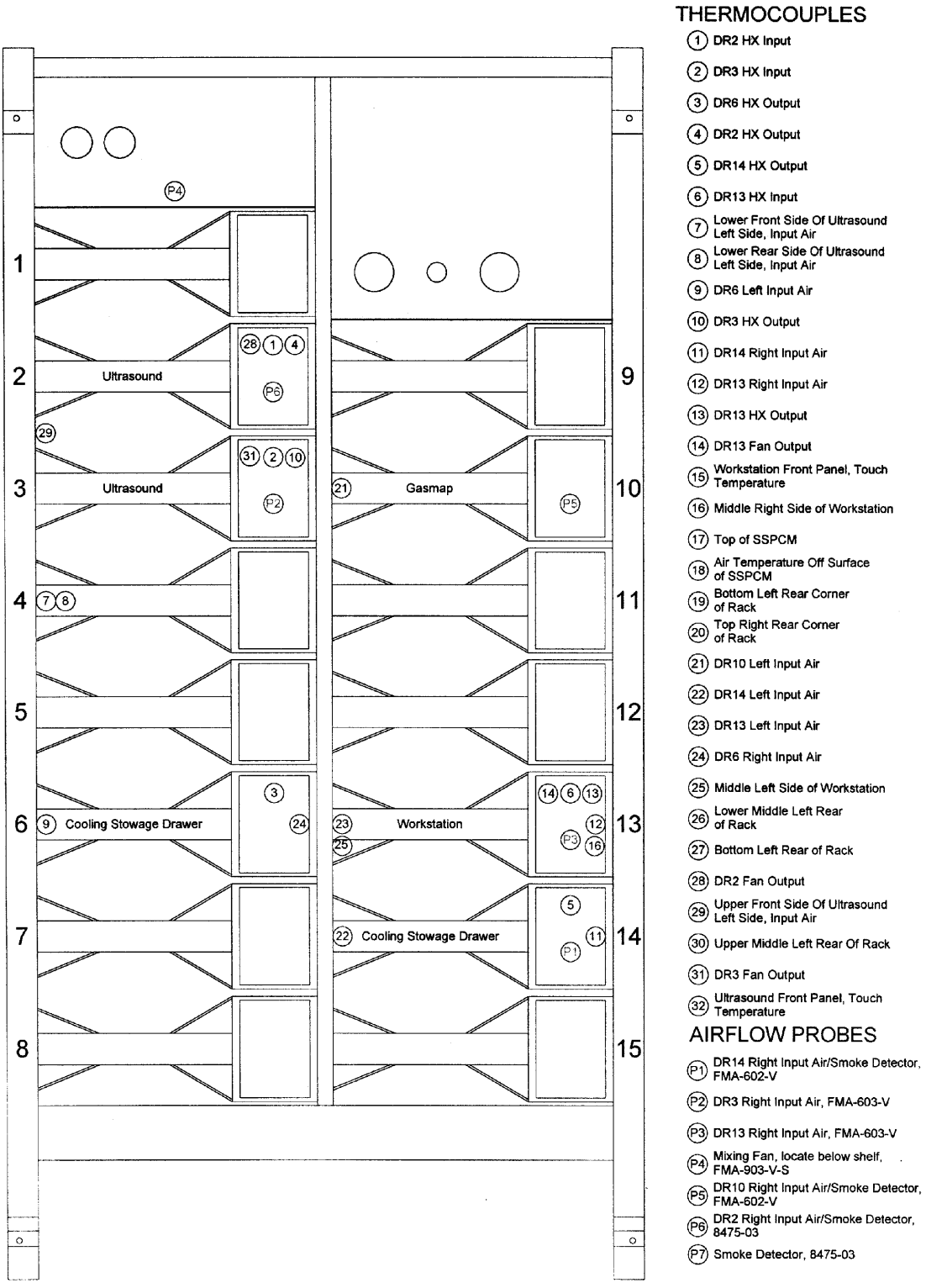


Figure B-2 HRF Rack (Front View) Thermocouple/Air Velocity Transducer Setup

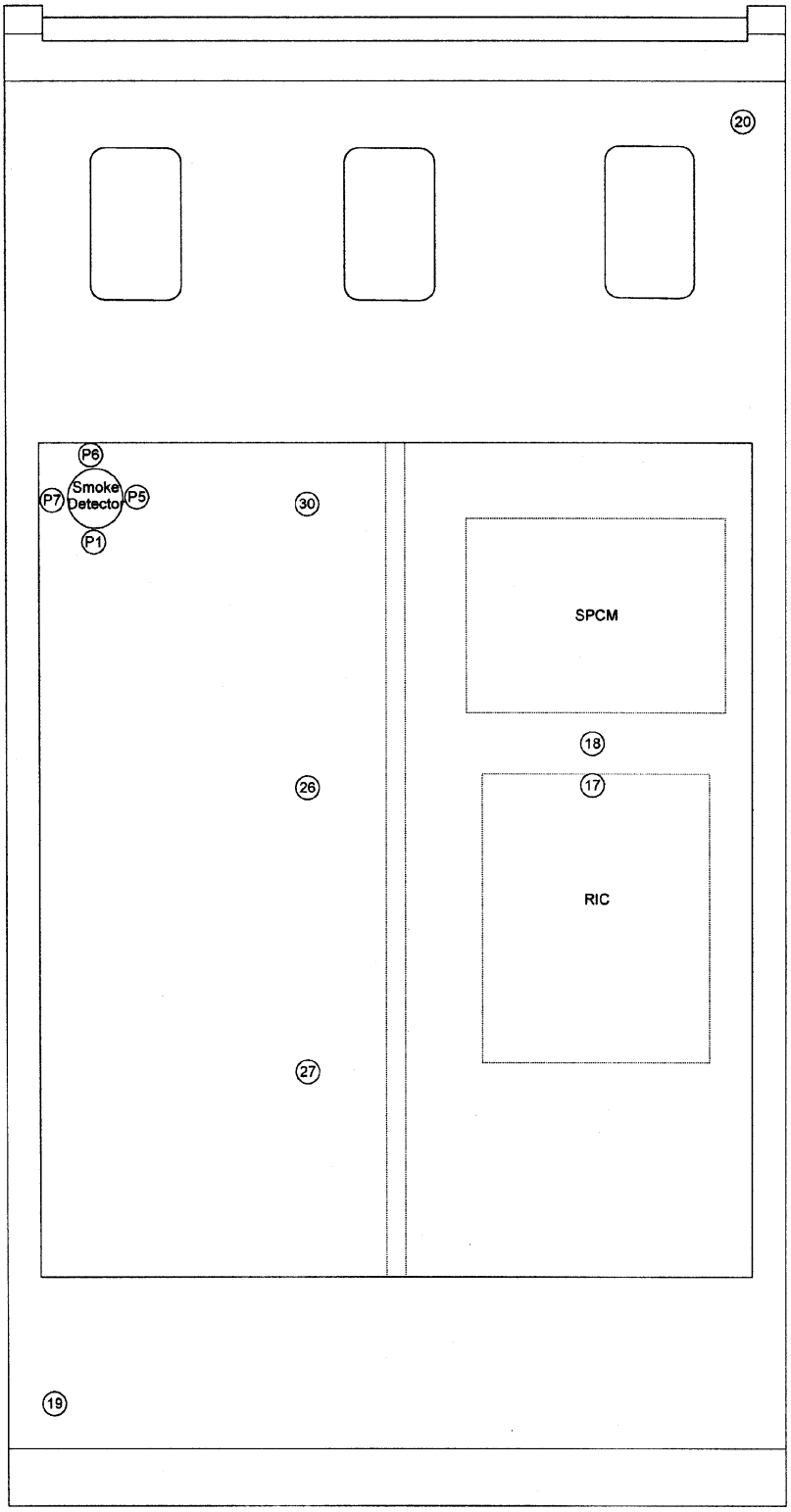


Figure B-3 HRF Rack (Rear View) Thermocouple/Air Velocity Transducer Setup

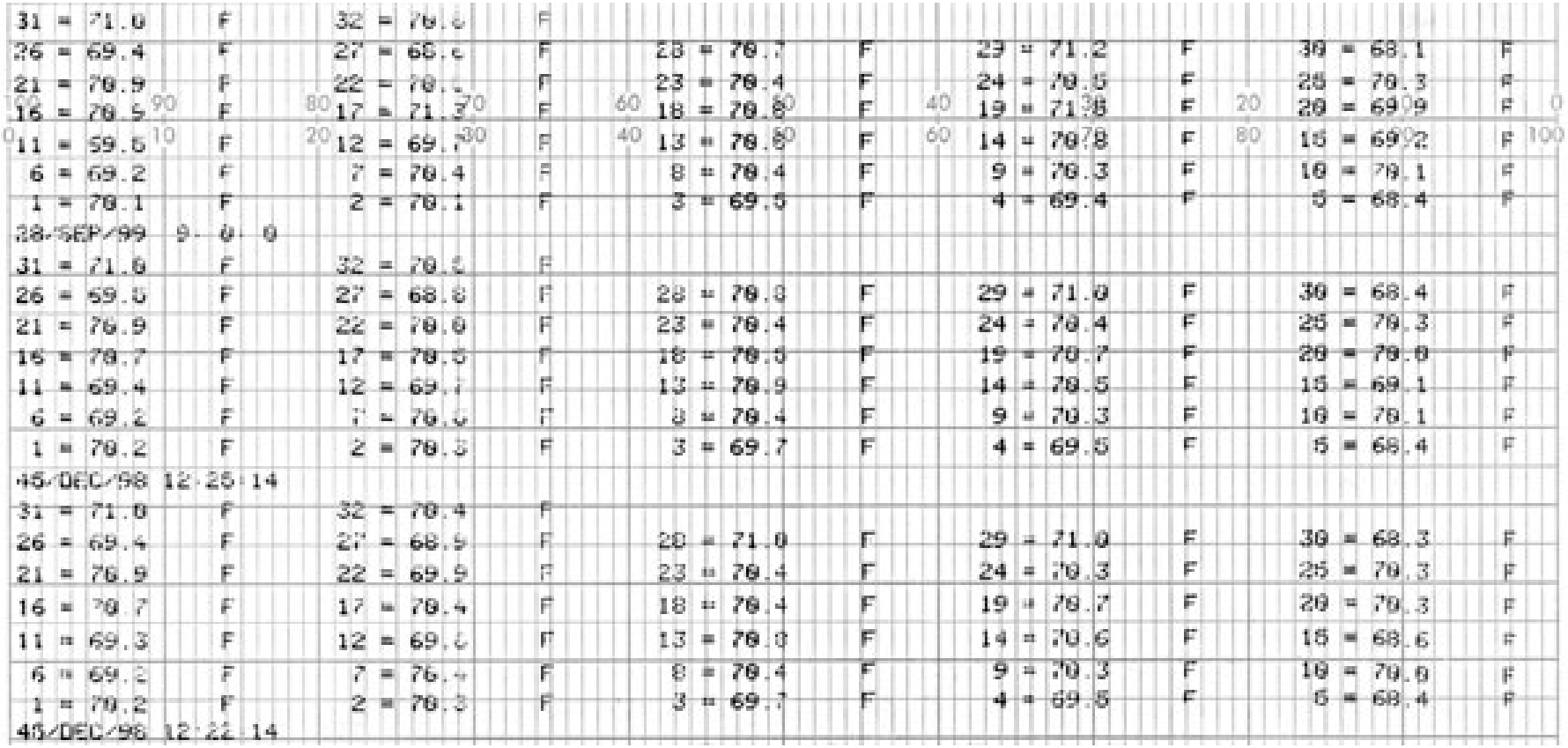


Figure B-4 Molytek Data Output

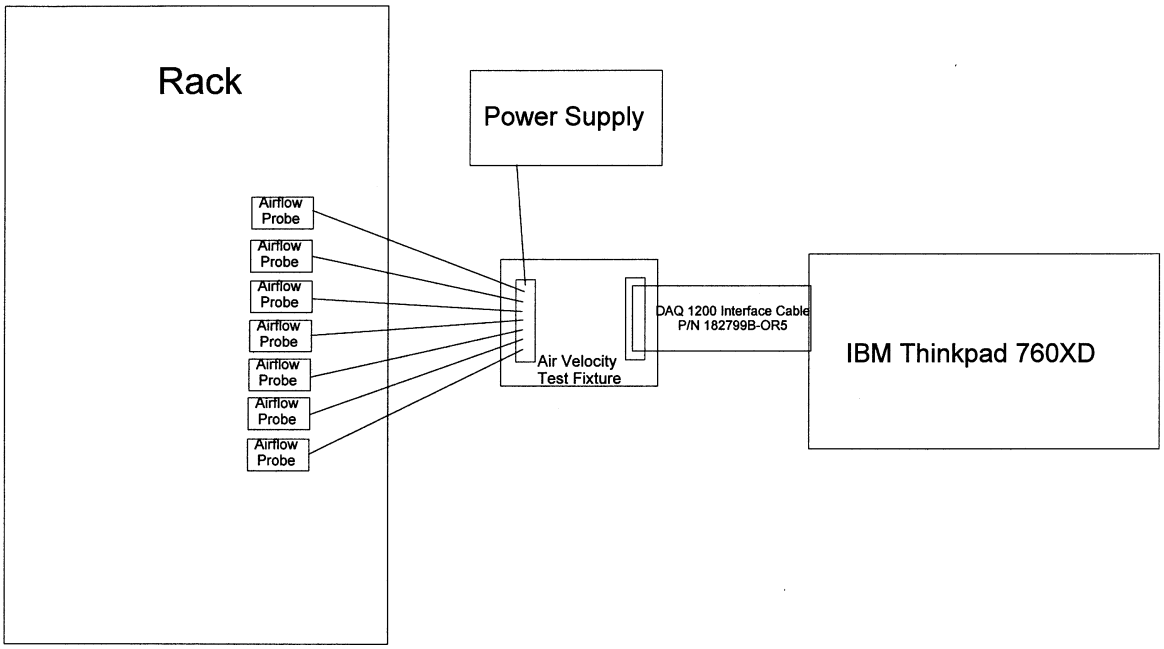


Figure B-5 Air Velocity Test Setup

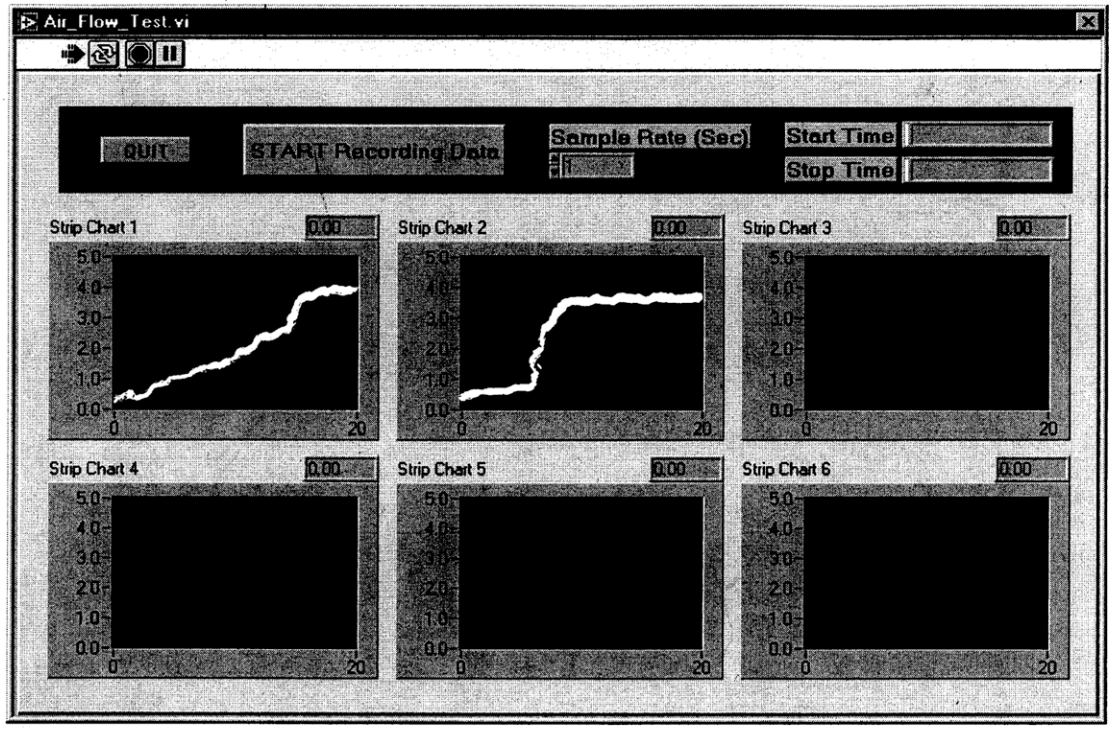


Figure B-6 Labview Software Data Output on Laptop Computer

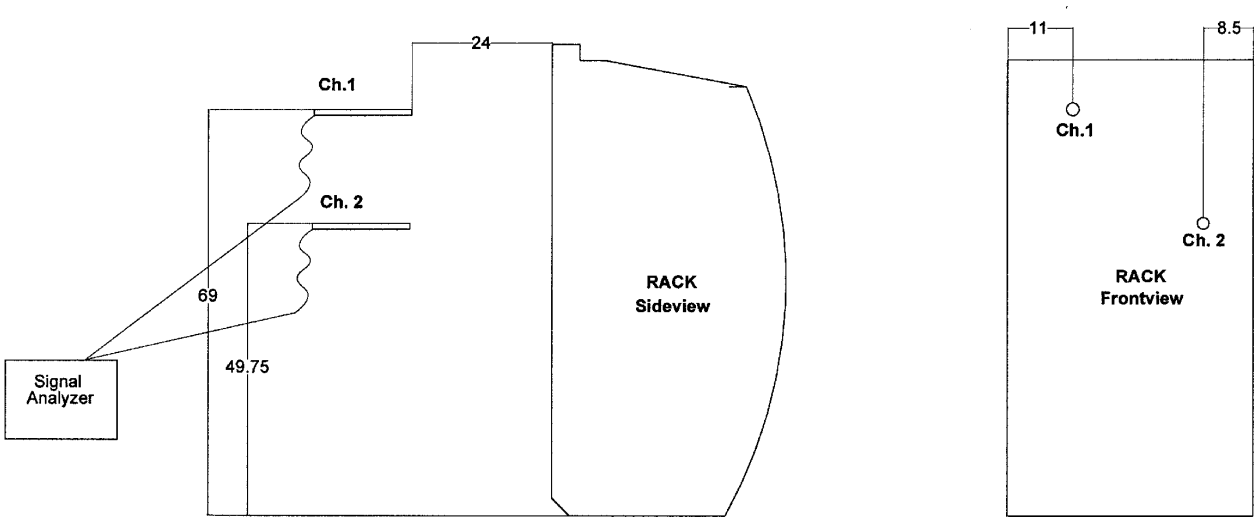


Figure B-7 Acoustic Test Support Equipment Setup

==========

Output of Normal 1

==========

15	31.5	64.5	66
18	63	52.5	54.7
21	125	54.9	56.4
24	250	51.4	48.7
27	500	44.6	43.8
30	1000	41.4	41.4
33	2000	38.5	38.5
36	4000	32.7	33.5
39	8000	27.3	28.4
42	16000	34.5	33.9

==========

Output of Normal 2

==========

15	31.5	62.3	63.9
18	63	57.1	59.5
21	125	60.5	61
24	250	63.3	62.8
27	500	60	61.5
30	1000	56.8	56.5
33	2000	51.4	50.9
36	4000	47.8	47.7
39	8000	36.3	39.1
42	16000	36.5	34.9
		61.88167	62.20489

Output of Normal 3

==========

15	31.5	63.8	65.3
18	63	56.1	58.5
21	125	59.8	59.9
24	250	62.9	62.2
27	500	60.1	61.6
30	1000	55.5	55.6
33	2000	49.3	49.9
36	4000	45.3	45.6
39	8000	34	38.2
42	16000	36	34.9

Figure B-8 Larson Davis Signal Analyzer Data Output

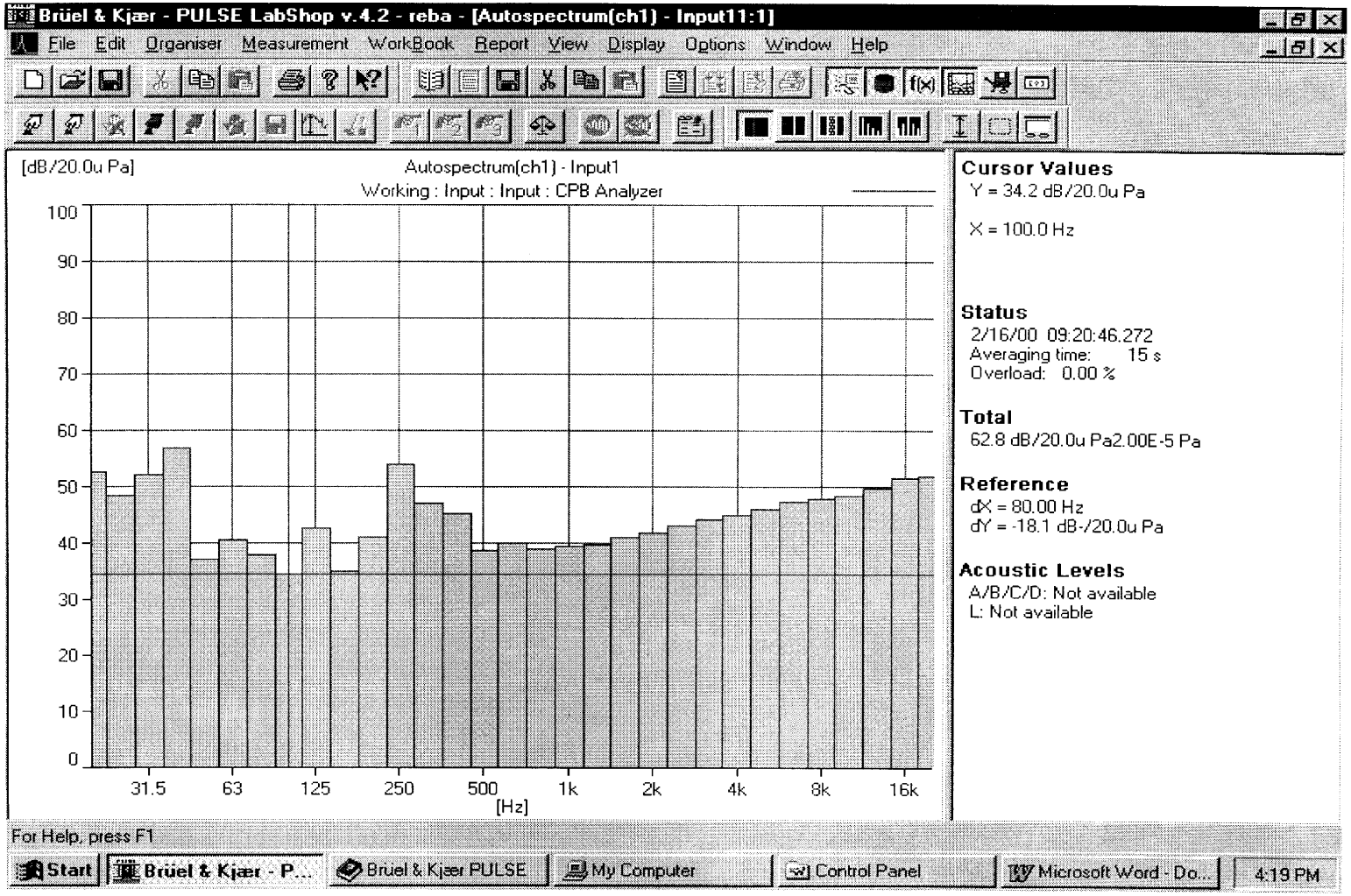


Figure B-9 Bruel & Kjaer PULSE System Data Output

File Name	Date/Time

Figure B-10 Airflow Data Log

Date: _____ Start Time: _____ TPS Step #: _____

TEST #/ File Name	Ultrasound	CSD #1	CSD #2	GASMAP Analyzer	Workstation	Mixing Fan	Acoustic Abatement			
							Handle Closeouts	P/L Closeouts	Pouches	Gasket

Figure B-11a Acoustic Configuration Log

Date: _____ Start Time: _____ TPS Step #: _____

TEST #/ File Name	CH1	CH2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9	Ch10	Ch11	Ch12

Figure B-11b Acoustic Data Log

Date/Time	Case/Total	Laptop Readings				PRCU Readings	
	Flow Set Pt.	F1/Avionics	F2/PL 8	F3/PL 7	F4/PL Deployed	Flow Out-RFCA	Delta P-RFCA

Figure B-12 Flow Rate Log via EXPRESS Laptop and PRCU

Date/Time	Case/Total	Laptop Readings															
	Flow Set Pt.	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16

Figure B-13a Temperature Log via EXPRESS Laptop

Date/Time	Case/Total	PRCU Readings		
	Flow Set Pt.	Temp Out-RFCA	Temp Out-Chiller	Room Temp

Figure B-13b Temperature Log via PRCU

Date/Time	Case/Total	Laptop Readings													
	Flow Set Pt.	Ch 0	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7	Ch 8	Ch 9	Ch 10	Ch11	Ch 12	Ch 13

Figure B-14a Power Log via EXPRESS Laptop

Date/Time	Case/Total	Laptop Readings						PRCU Reading	
	Flow Set Pt.	PL 2	PL 3	PL 6	PL 10	PL 13	PL 14	PEPSIE-Main	WORD 98

Figure B-14b Power Log via EXPRESS Laptop and PRCU

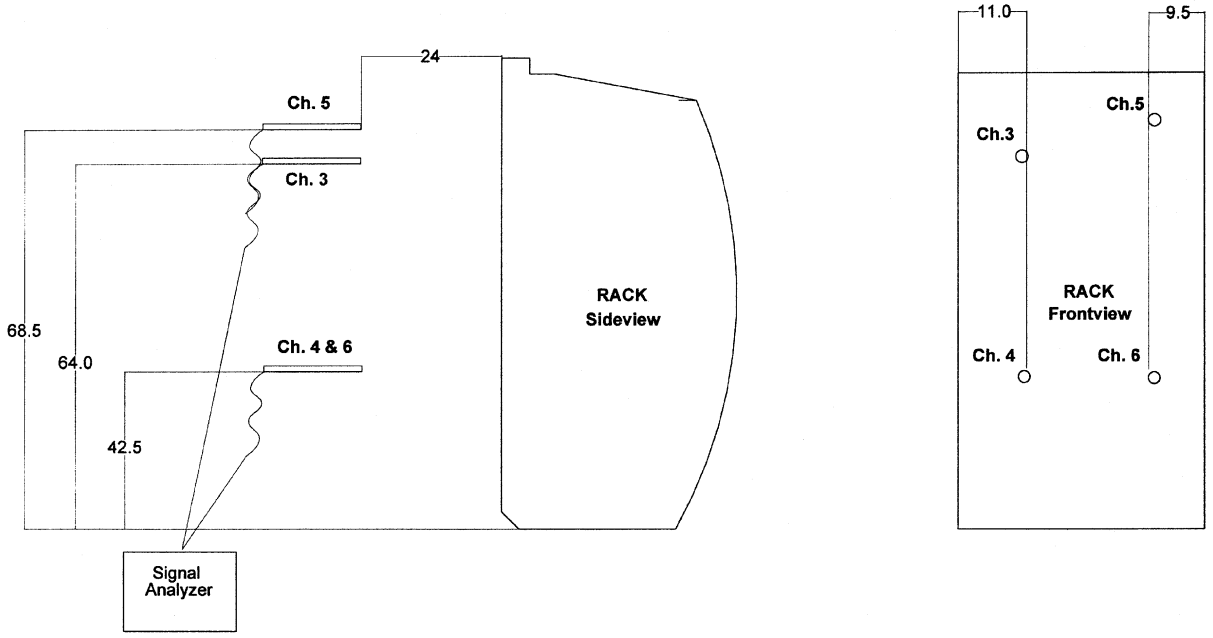


Figure B15a Front Microphone Locations for Sound Pressure Data Collection

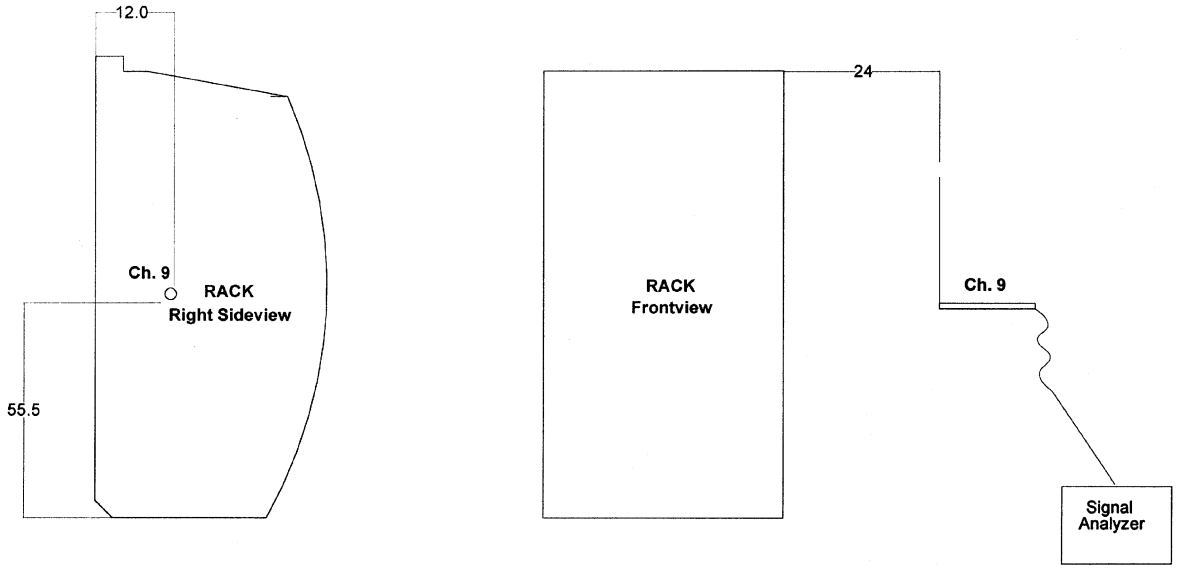


Figure B15b Right Side Microphone Locations for Sound Pressure Data Collection

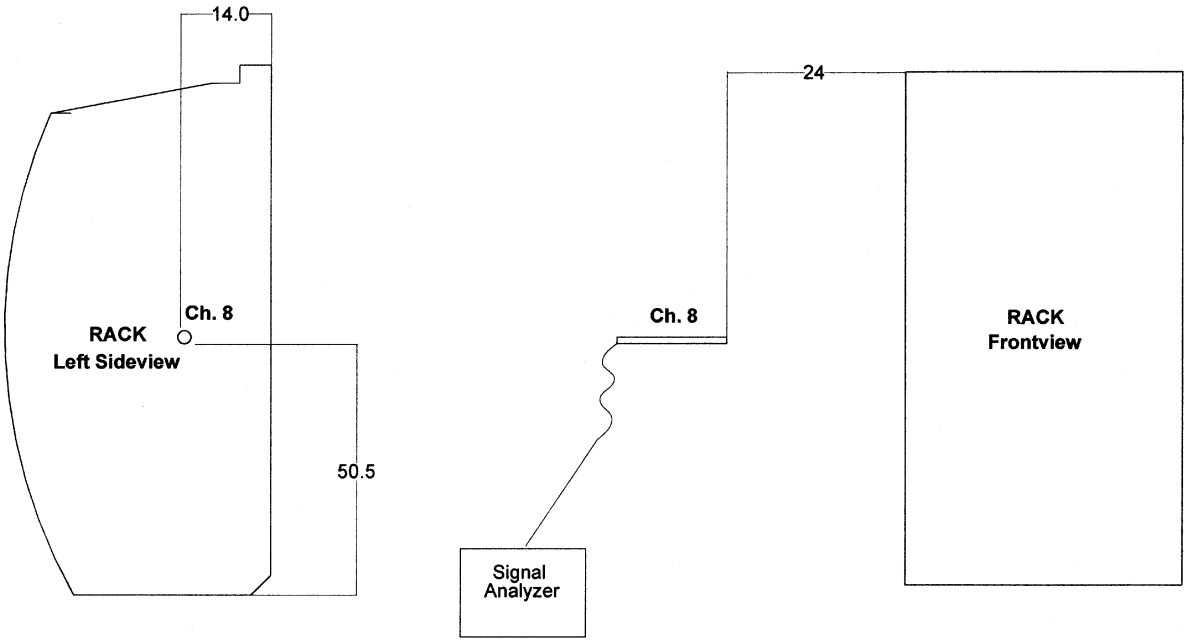


Figure B15c Left Side Microphone Locations for Sound Pressure Data Collection

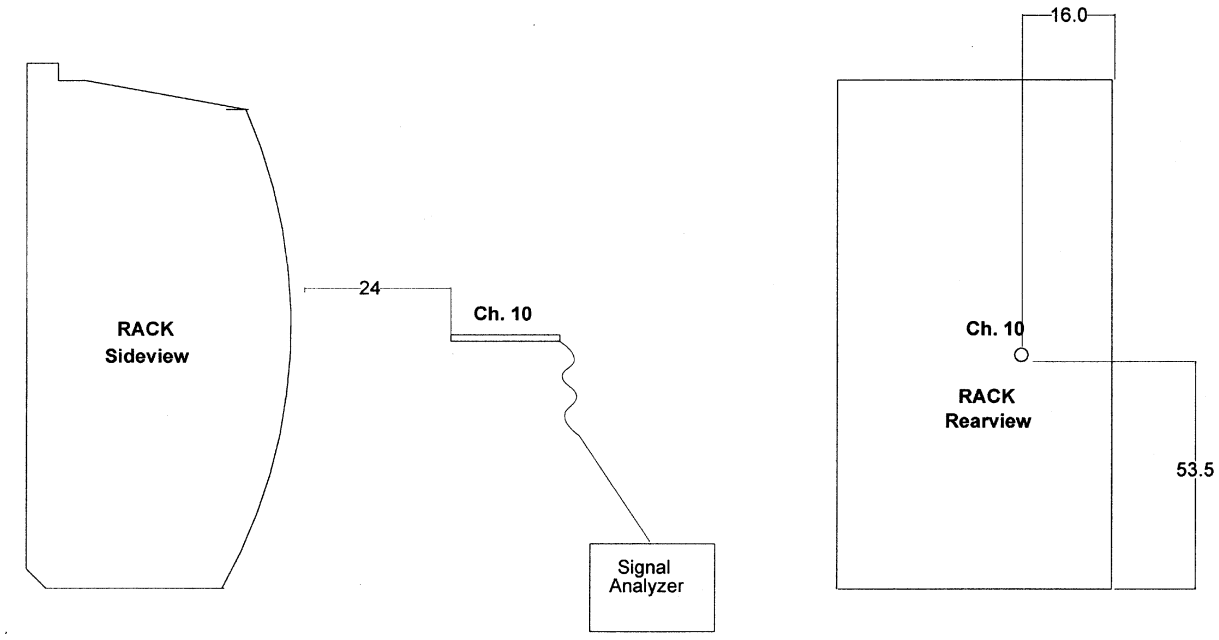


Figure B15d Back Side Microphone Locations for Sound Pressure Data Collection

DISTRIBUTION
FOR LS-71139-7B

NASA/JSC
EA5/L. Bauer
EA5/E. Strong
NT3/GFE Assurance Branch
SF/D. Grounds

LOCKHEED MARTIN
C20/G. Harvey
C64/S. Fetzer
C64/R. Henneke
C64/D. Reed
C64/R. Trittipo
C64/T. Wiggins
S03/D. Babic
S03/P. Miller
S03/J. Searcy
S03/Science Payloads Library
S18/J. Hoge
S18/M. Klee
S18/G. Salinas
S22/D. Barineau
S22/S. Bhaskaran
S22/R. Gonzales
S22/K. Lajaunie
S22/T. Leger
S22/C. McGee
S22/S. Tarver
S22/M. Trenolone (3)
S22/K. Upham
S22/E. Witt
S361/J. McDonald
S362/STI Center/Bldg. 36 (3)
S56/G. Geissen