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Facility Handbook for the Vertical Processing Facility

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FACILITY HANDBOOK
FOR THE
VERTICAL PROCESSING FACILITY

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LIST OF ABBREVIATIONS AND ACRONYMS

The following abbreviations and acronyms are used in this handbook. A more comprehensive listing is contained in NASA Reference Publication 1059 Revised, Space Transportation System and Associated Payloads: Glossary, Acronyms and Abbreviations.

A	ampere
ac	alternating current
AFD	aft flight deck
BIØ	bi-phase
bps	bits per second
°C	degrees Celsius
C&W	caution and warning
CAS	CITE Augmentation System
CCAS	Cape Canaveral Air Station
CCTV	closed-circuit television
CFM	cubic feet per minute
CITE	cargo integration test equipment
CWA	clean work area
CRCF	Canister Rotation and Cleaning Facility
dc	direct current
ECS	Environmental Control System
E/E	electrical/electronic
ESA-60	Explosive Safe Area-60
EVCF	Eastern Vehicle Checkout Facility
°F	degrees Fahrenheit
f-c	foot-candle
FEP	front-end processor
FM	frequency modulation
ft ²	square foot
ft ³	cubic foot
GHe	gaseous helium
GN ₂	gaseous nitrogen
GN&C	Guidance, Navigation and Control
GOAL	Ground Operations Aerospace Language
GPC	general-purpose computer
GSE	ground support equipment

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LIST OF ABBREVIATIONS AND ACRONYMS (continued)

HEF	hypergolic exhaust fan
HEPA	high efficiency particulate air
HIM	hardware interface module
HVAC	heating, ventilation and air-conditioning
Hz	hertz
I/F TD	interface terminal distributor
in	inch
IRIG	Interrange Instrumentation Group
IUS	Inertial Upper-Stage
KSC	John F. Kennedy Space Center
kbps	kilobits per second
L	liter
lb	pound
lm	lumen
LPS	Launch Processing System
LSSM	Launch Site Support Manager
m	meter
MDM	multiplexer/demultiplexer
MHz	megahertz
MLP	mobile launch platform
mm	millimeter
MMSE	Multiuse Mission Support Equipment
MTU	master timing unit
NPF	NAVSTAR Processing Facility
NVR	Non-Volatile Residue
O&C	Operations and Checkout (Building)
OIS-D	Operational Intercommunication System-Digital
OMI	Operations and Maintenance Instruction
OSB	Operations Support Building
OTV	operational television
P	pole
PA	public address
PACAS	Personnel Access Control Accountability System
PAM	Payload Assist Module
PCMMU	Pulse Code Modulation Master Unit

LIST OF ABBREVIATIONS AND ACRONYMS (continued)

PDI	Payload Data Interleaver
PDMS	Payload Data Management System
PETS	Payload Environmental Transportation System
Ph	phase
PI	payload interrogator
PL	Payloads
PR	payload recorder
POCC	Payload Operations Control Center
POL	Petroleum, Oil and Lubricants
PPF	Payload Processing Facility
PSA	power supply assembly
psig	pounds per square inch gage
PSP	payload signal processor
PSTF	Payload Spin Test Facility (CCAS)
RPA	record and playback assembly
RSS	Rotating Service Structure
RTG	radioisotope thermoelectric generator
RTG-F	RTG-Facility
SID	Standard Interface Document
SM	System Management
SMCH	standard mixed cable harness
SSP	standard switch panel
STS	Space Transportation System
TLM	telemetry
T-0	Time Zero (lift-off)
V	volt
V&DA	video and data assembly
VPF	Vertical Processing Facility
VPHD	vertical payload handling device
Vp-p	volts peak-to-peak
VRSS	Video Routing Switcher System
W	wire
WBDI	wide-band data interleaver
WBT	wide-band terminal
WP	waterproof
Xo	X-axis of orbiter
Xp	explosion-proof

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FOREWORD

Launch site payload processing facilities are described in three levels of documentation. These levels and their purposes are:

- a. *Launch Site Accommodations Handbook for Payloads*, K-STSM-14.1, provides an overview of the John F. Kennedy Space Center (KSC) launch and landing site operations and each facility.
- b. Facility Handbooks describe a specific facility, its systems, general operating rules, regulations, and safety systems. Facility handbooks are revised approximately every three years or as required to maintain the level of usefulness necessary to support customers planning to process their payloads at KSC. The following handbooks are available:

K-STSM-14.1.1	<i>Facilities Handbook for Building AE</i>
K-STSM-14.1.7	<i>Facilities Handbook for Spacecraft Assembly and Encapsulation Facility - 2 (SAEF-2)</i>
K-STSM-14.1.8	<i>Facilities Handbook for Radioisotope Thermoelectric Generator Facility (RTG-F)</i>
K-STSM-14.1.9	<i>Facilities Handbook for Life Sciences Support Facility - Hangar L</i>
K-STSM-14.1.10	<i>*Payload Accommodations at the Rotating Service Structure (RSS)</i>
K-STSM-14.1.12	<i>Facilities Handbook for Vertical Processing Facility (VPF)</i>
K-STSM-14.1.13	<i>*Orbiter Processing Facility (OPF) Payload Processing and Support Capabilities</i>
K-STSM-14.1.14	<i>*Operations and Checkout (O&C) Building Payload Processing and Support Capabilities</i>
K-STSM-14.1.15	<i>Facility Handbook for Payload Hazardous Servicing Facility (PHSF)</i>
K-STSM-14.1.16	<i>Space Station Processing Facility (SSPF) Processing and Support Capabilities</i>
K-STSM-14.1.17	<i>Facilities Handbook for Multi-Payload Processing Facility (MPPF)</i>

- * These handbooks are titled differently as the facilities serve functions other than payload support. Only the payload accommodations are described in these documents.

- c. Standard Interface Documents (SIDs) - SIDs provide the most detailed information on facility interfaces for KSC launch site payload processing facilities. When SIDs are not available for a payload processing facility, facility handbooks should be used for design interface information and customers should ask for verification

of any areas of concern. The Payload Strongback and the Payload Environmental Transportation System (PETS) Multiuse Container do not have facility handbooks, and in these cases, only the SIDs will be used. Customers may obtain copies of any of the following SIDs from their respective Launch Site Support Manager (LSSM):

SID 79K12170	<i>Payload Ground Transportation Canister</i>
SID 79K16210	<i>Vertical Processing Facility</i>
SID 79K16211	<i>Horizontal Processing Facility (O&C Building)</i>
SID 79K17644	<i>Payload Strongback</i>
SID 79K18218	<i>Launch Pad 39A</i>
SID 79K28802	<i>Launch Pad 39B</i>
SID 79K18745	<i>Orbiter Processing Facility</i>
SID 82K00463	<i>Payload Environmental Transportation System Multiuse Container</i>
SID 82K00760	<i>Space Station Processing Facility</i>
SID 82K03223	<i>Multi-Payload Processing Facility</i>

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SECTION I

INTRODUCTION

1.1 PURPOSE

The purpose of this handbook is to provide basic information on the payload processing and support capabilities available in the Vertical Processing Facility (VPF) at John F. Kennedy Space Center (KSC). The VPF is primarily used to integrate vertically-processed payloads into specific mission configurations and download many of the payloads. Integration activities typically include installing a payload into a test cell in its relative flight position, simulating orbiter-to-payload interface verification tests and performing preorbiter tasks such as category B ordnance installation and connection. The VPF floor space can also be used as a payload processing facility (PPF) to accommodate the overflow from other facilities.

Before integrated payload operations begin at the VPF, most payloads undergo build-up and test or other off-line processing functions on the VPF floor or in PPFs located at the Cape Canaveral Air Station (CCAS) and/or KSC (see figure 1-1). The PPFs are selected by the KSC Launch Site Support Manager (LSSM), the Launch Site Support Team and the payload owner based on specific payload requirements and the overall KSC and CCAS schedules. The handbooks listed in the Foreword assist in making this determination.

1.2 SCOPE

This handbook describes the capabilities of and standardized interfaces within the VPF. It is intended to be used by the payload organization as a guide for planning payload activities in the VPF.

1.3 CUSTOMER CHARGE

Use of the VPF as a payload integration facility is considered a standard service. Support for payload stand-alone testing (i.e., use as a Payload Processing Facility) or unique services could result in additional charges.

1.4 FACILITY ACCOMMODATIONS

The facility accommodations available to the customer support a variety of NASA and NASA customer payloads and may be required to accommodate payload elements being processed simultaneously. The customer must be aware during the design development phase that there is the potential of sharing facilities with other payload elements. Individual payload customer requirements should be coordinated closely with the LSSM to ensure that support is available when needed.

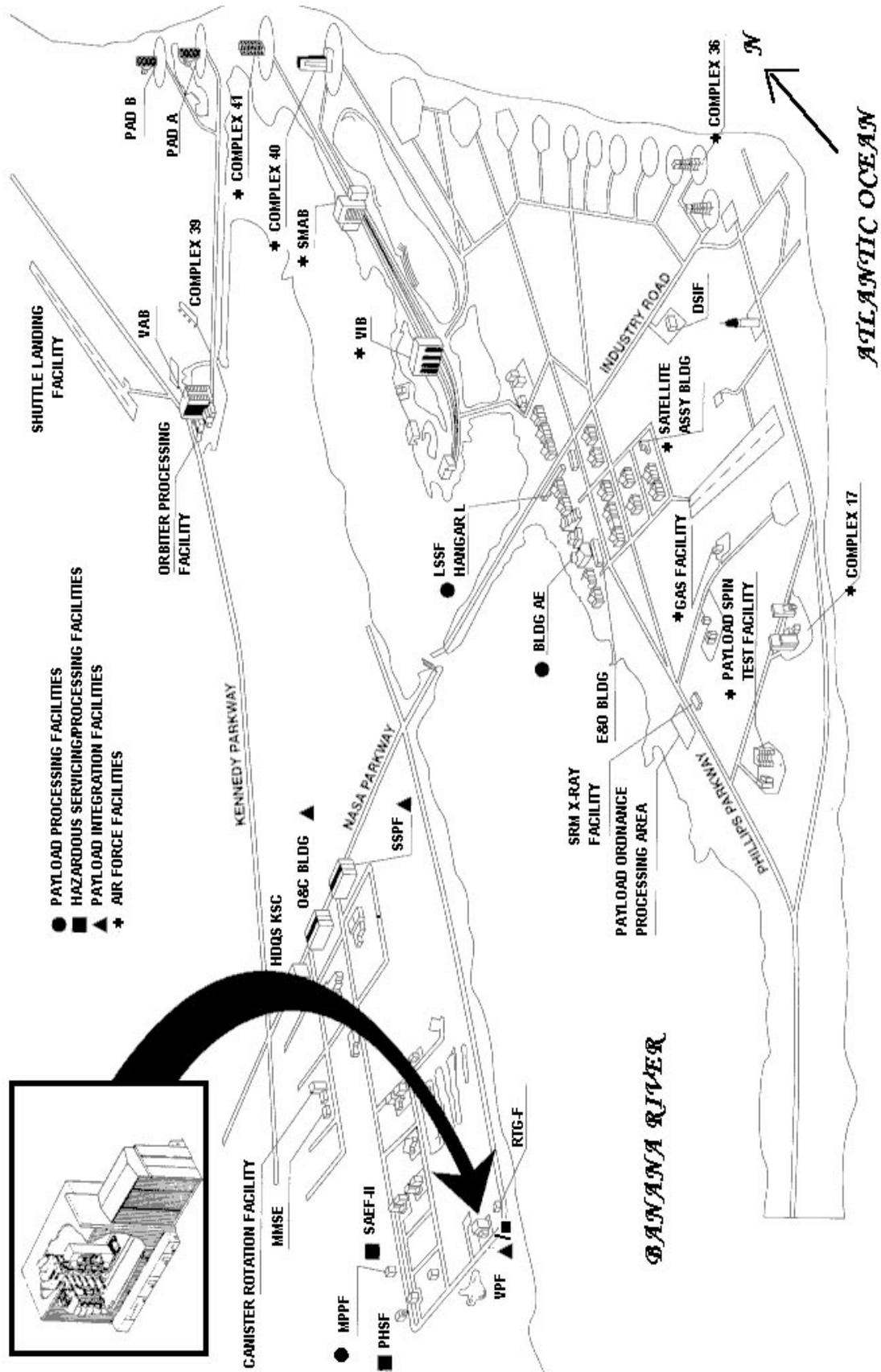


Figure 1-1. KSC/CCAS Payload Processing Facilities

Most vertical payload elements -- both deployable and non-deployable -- assigned to a particular mission will be integrated/processed in the VPF. Testing requirements include payload safety and the interface between the payload and the orbiter. Payload elements are combined with other elements to form a total payload complement for a single mission. The customer will participate throughout the entire payload processing flow.

Payload processing within the VPF will vary depending on the type of payload involved. A spacecraft that is already mated with an upper stage (e.g., a deployable payload), is installed into one of two test cells where it will be supported by the Vertical Payload Handling Device (VPHD). Spacecraft using an Inertial Upper-Stage (IUS) will be mated to the IUS previously installed in one of the two test cells. The entire payload complement for a mission will be stacked in a single VPF test cell. Individual payload elements will undergo any necessary stand-alone testing before any combined payload testing or simulated orbiter-to-payload testing is performed. VPF testing will include simulated orbiter/payload T-0 umbilical functions with GSE interfaces provided in the VPF similar to those in the Mobile Launch Platform (MLP) room 10-A. These interfaces are described in KSC-DL-522, *Payload/GSE/Data System Interface User's Guide for the Vertical Processing Facility*.

After all testing has been completed, the payload canister -- supported vertically on the transporter -- will be moved to the test cell. The canister is positioned so that the VPHD can transfer the entire payload complement into the canister. This is then moved to the Rotating Service Structure (RSS) at Pads A or B. A payload complement returning from the OPF to the VPF highbay in the payload canister, arrives in a horizontal mode. The payload elements are removed individually and installed into their shipping containers/transporters for transport from the VPF. Customers should be familiar with the *Emergency Preparedness Plan*, MDC Y1009.

1.5 EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW

The Emergency Planning and Community Right-to-Know Act, Title III of the Superfund Amendments and Reauthorization Act of 1986, requires persons to report the amount and location of hazardous chemicals produced, stored, used, or released to the environment each year. Customers are required to complete KSC form 28-185, *Environmental Health Protection Program Toxic Substance Registry System (TSRS) Inventory* and provide Material Safety Data Sheets (MSDS) for each chemical brought onto KSC. All forms must be sent to the LSSM 90 days prior to customer arrival.

1.6 HAZARDOUS AND CONTROLLED WASTE

All waste generated at KSC must be managed in accordance with the requirements of Kennedy Handbook (KHB) 8800.7, *Hazardous Waste Management*. Before arrival, customers will complete KSC Form 26-551, *Process Waste Questionnaire (PWQ)*

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which will identify any potential hazardous and/or controlled waste the customer expects to generate during processing.

A satellite accumulation area (SAA) will be established in facility areas which have been identified as waste generation sites. SAAs will comply with the intent of the Resource Conservation and Recovery Act of 1976 (RCRA), which established a nationwide program to regulate the generation, storage, transportation, treatment, and disposal of hazardous and controlled waste. Regulations for the generation, control and disposal of waste at the launch site are strictly enforced, and customers will be required to coordinate any waste operations or problems with their assigned LSSM.

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SECTION II

FACILITY DESCRIPTION

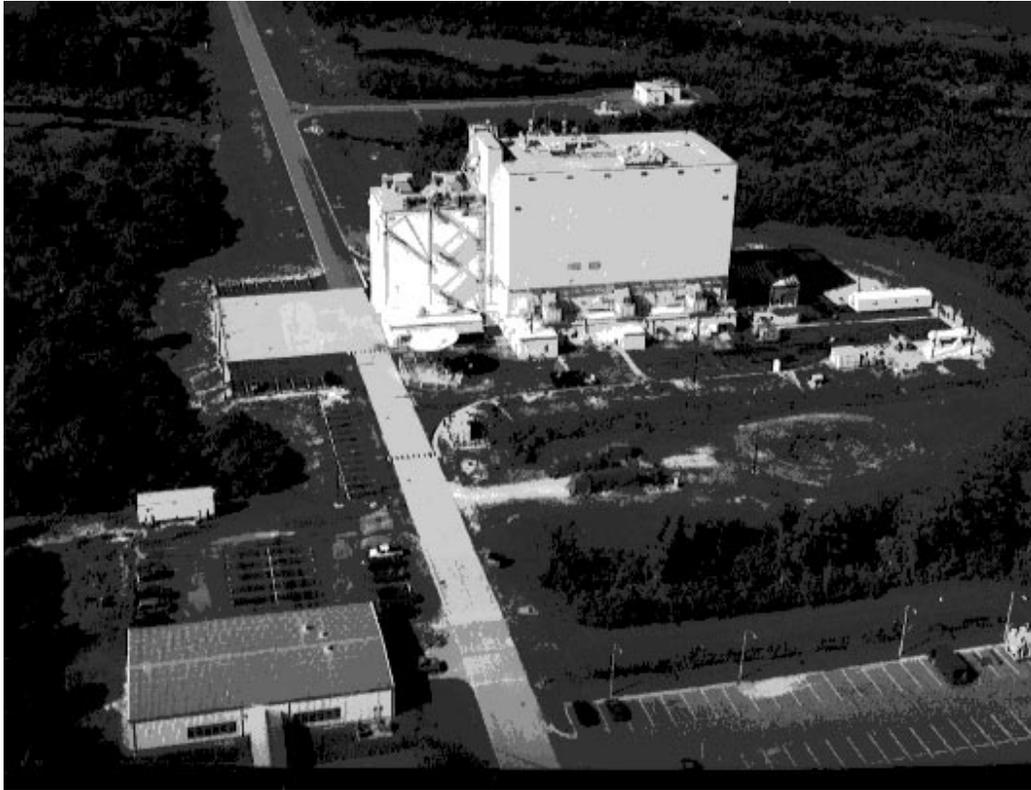


Figure 2-1. Aerial Photograph of the VPF Complex

2.1 LOCATION AND DESCRIPTION

The VPF complex is located in the Hypergol/Payload Test Area on 10th Street S.E. The complex has three main structures: 1) the VPF located on the north side of 10th Street; 2) the Operations Support Building (OSB) and Annex located on the south side of the street; and 3) the Radioisotope Thermoelectric Generator Facility (RTG-F) located on the north side of the street and east of the VPF. The complex also has a Petroleum, Oil and Lubricants (POL) shed (M7-1469C), a storage shed (M7-1469D) and an ozonator building (M7-1469E). The aerial shot of the VPF site (figure 2-1) was photographed from the east and shows the VPF at the top of the picture and the OSB in the foreground. Not included are the Annex and RTG-F. Figure 2-2 depicts the site plan for the VPF complex.

The VPF (M7-1469) contains an environmentally-controlled highbay and air lock, both of which are enclosed in steel-frame structures with aluminum siding. Single-story

support structures are attached directly to the sides of the highbay. The VPF has approximately 1208 m² (13,000 ft²) of useable floor space. The East and West Test cells occupy an additional 348 m² (3,750 ft²), but only the 0.0 m (0-ft) level is available for temporary storage of support equipment. The highbay is 32 m (105 ft) high and the air lock is 22.56 m (74 ft) high.

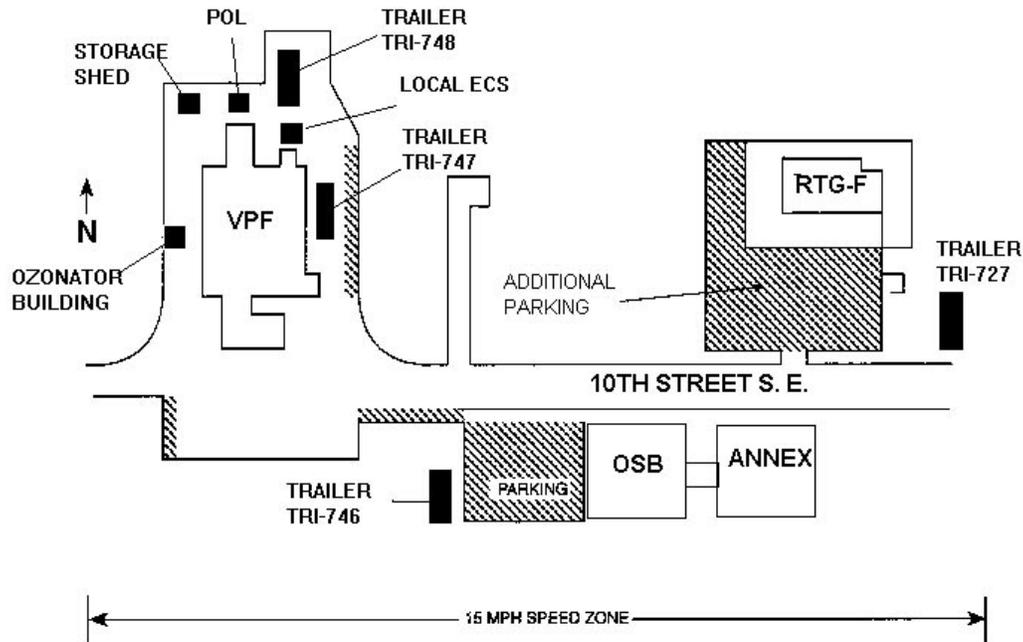


Figure 2-2. VPF Complex Site Plan

The OSB (M7-1521) and Annex (M7-1522) are located on the east side of the southeast parking lot. The OSB and Annex provide a total of 929 m² (10,000 ft²) of floor space for payload customer personnel, Quality and Engineering personnel, Quality records, minor electrical or mechanical staging work, and the Facility Manager's office. Both the OSB and Annex have conference rooms equipped with closed-circuit television (CCTV) monitors and Operational Intercommunication System-Digital (OIS-D) units for viewing payload operations in the VPF air locks and highbay during hazardous operations. See figure 2-3 for the floor plan of the OSB and Annex.

The RTG-F (M7-1472) is located on the eastern edge of the site and is surrounded by a 2.4 m (8-ft) high chain-link fence topped with barbed obstacle tape. The south and west sides of the building are guarded with reinforced, concrete barriers (Jersey Bouncers) located immediately outside the security fence. The RTG-F is divided into five rooms -- four of which can be used by the customer for storing, testing and monitoring RTGs used in payload processing activities. The total usable floor space is 276 m² (2,967 ft²). The RTG-F may also be used by the customer for storing ordnance devices or processing small payloads when no RTGs are present.

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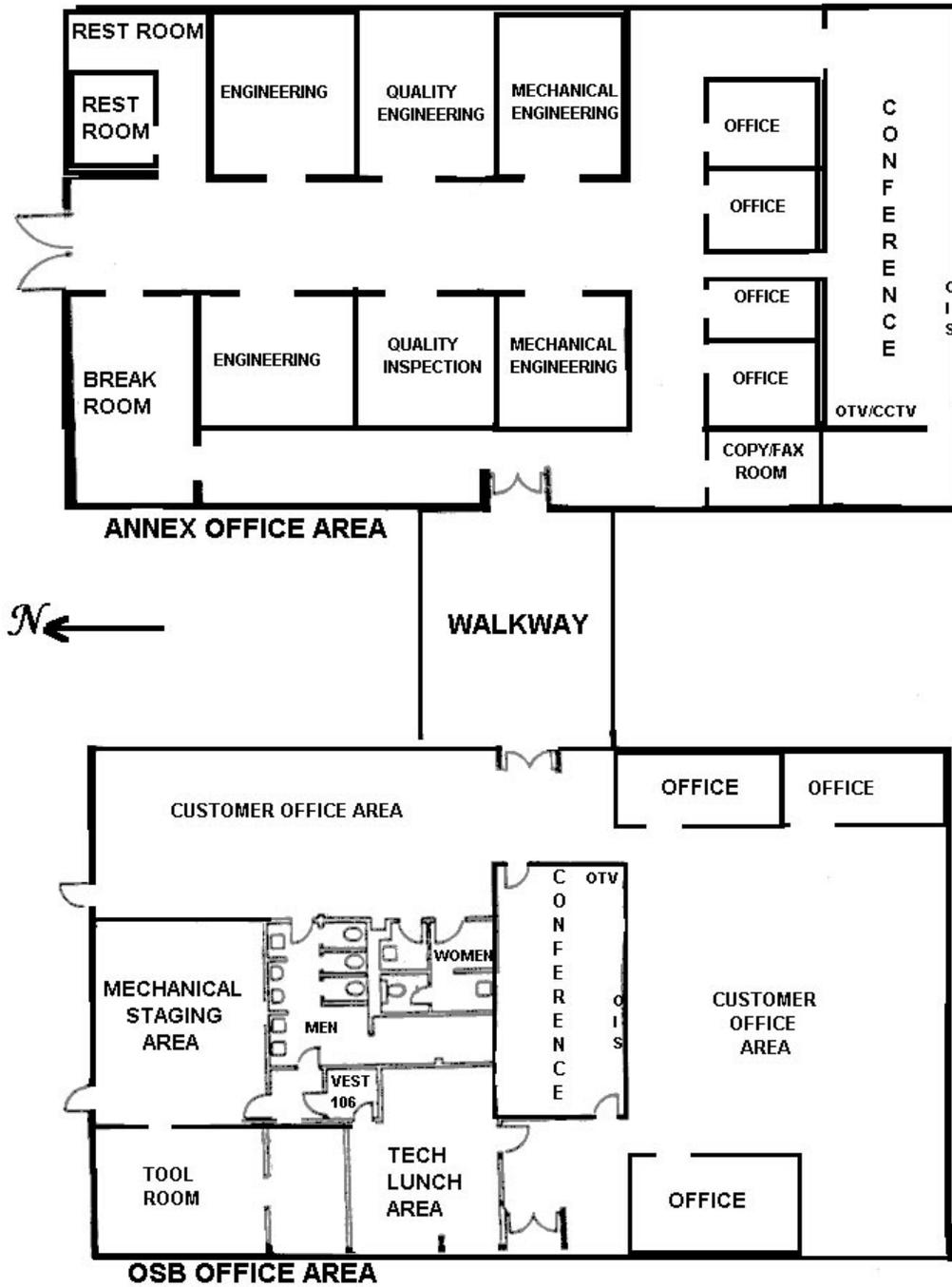


Figure 2-3. OSB and Annex Floor Plan

2.2 VPF FUNCTIONAL AREAS

The VPF facility is divided into three functional areas: clean work areas (CWAs) such as the air lock and highbay; mechanical and electrical support areas such as the cargo

integration test equipment (CITE) T-0 ground support equipment (GSE) interface room and the mechanical equipment and electrical rooms; and operations support. The floor plan of the VPF is shown in figure 2-4.

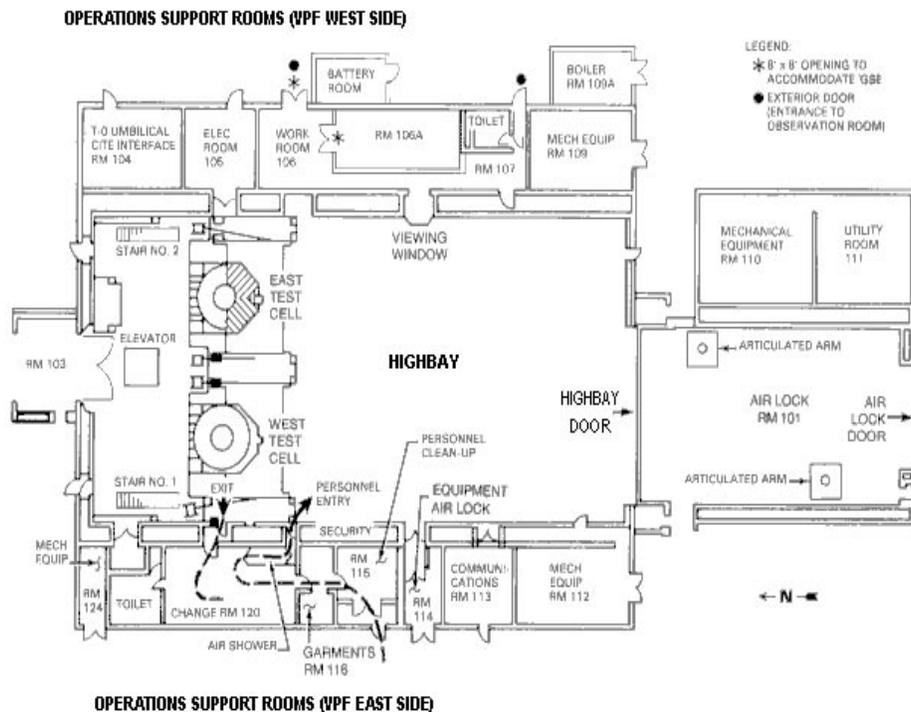


Figure 2-4. VPF Floor Plan

2.2.1 CWAs. The VPF highbay and air lock meet the CWA requirements identified in K-STSM-14.2.1, *KSC Payload Facility Contamination Control/Requirements Plan*. The highbay is classified as a level 4, class 100,000 CWA and the airlock is classified as a level 5, class 300,000 CWA. All equipment, shipping containers and transporters must be cleaned before they can enter the VPF highbay. Steam cleaning is available at the Canister Rotation and Cleaning Facility (CRCF). On the apron outside the VPF, further cleaning can take place including wiping and air blowdown, and final cleanings are performed in the air lock. Environmental cover removal, hazardous gas checks and preparations for entry into the highbay may also be performed in the air lock.

2.2.1.1 Air Lock. The air lock is located at the south end of the facility. It is approximately 12.8 m (42 ft) wide by 22.88 m (75 ft) long and provides a usable floor area of 292.64 m² (3,150 ft²). The interior walls are gypsum wallboard, the floor is concrete and coated with white, water-base epoxy paint and the ceiling surface is plastic-faced acoustic tile. The air lock has a clear ceiling height of 22.73 m (74 ft 7 in). Outside access to the air lock is by a rolling equipment door which is 7.55 m (24 ft 9 in) wide and 21.66 m (71 ft) high. A vertical leaf door, 11.6 m (38 ft) wide by 21.8 m (71 ft) high, provides access between the air lock and the highbay.

The air lock is equipped with service connections for electrical power, static grounding, compressed air, vacuum, and gaseous nitrogen (GN₂). Vacuum and compressed air service connections are also located outside the airlock so the canister transporter, GSE, GSE transporter, payload transporters, etc., can be cleaned before entering the air lock.

2.2.1.2 Highbay. The highbay is 22.88 m (75 ft) wide by 45.75 m (150 ft) long and has 1045.13 m² (11,250 ft²) of floor space. The interior walls are gypsum wallboard, the floor is concrete and coated with white, water-base epoxy paint and the ceiling surface is plastic-faced acoustic tile. The highbay has a ceiling height of 32 m (105 ft). The ceiling height is restricted by the lower surface of the bridge crane rail which is at the 29.6 m (97 ft) level. Personnel and small equipment must enter the highbay through the air showers.

2.2.1.3 Highbay Test Cells. The test cells are located at the north end of the highbay. These multiple-platform test cells occupy a floor area of approximately 22.86 m (75 ft) by 15 m (50 ft) and are about 22.86 m (75 ft) high. The test cells are designed to accommodate Space Shuttle payloads within the design parameters of the orbiter payload bay or a 4.57 m (15 ft) diameter by 18.29 m (60 ft) length and 29,484 kilogram (kg) (65,000 lb) maximum weight. Storage space is available on the 0.0 m (0-ft) level for temporary storage of support equipment. The allocation of space for customer GSE will be evaluated on a mission-by-mission basis. Figure 2-5 depicts the east and west test cells located in the north end of the highbay.

The highbay test cells may be used to process a variety of payload elements that require an environmentally clean, temperature and humidity-controlled atmosphere. Current planning includes payload element integration and checkout, total payload integration, orbiter interface verification, installation into the payload canister, and final preparations prior to transportation to the launch complex.

2.2.2 MECHANICAL AND ELECTRICAL SUPPORT AREAS. Mechanical and Electrical support rooms are located on both the east and west sides of the highbay. The east side has a T-0 umbilical CITE interface room, mechanical and electrical equipment rooms and a test equipment room with a raised floor for cable routing. The west side has two mechanical equipment rooms and a communications room, and these rooms can only be accessed from outside the VPF. For more details on these integration and interface areas, refer to KSC-DL-522, *Payload/GSE/Data System Interface User's Guide for the Vertical Processing Facility*.

2.2.3 OPERATIONS SUPPORT. The following operations support rooms are located along the west side of the highbay: a security station; a clean room garment supply room; a change room with air shower and restroom facilities; and an equipment cleaning room with access to the highbay area.

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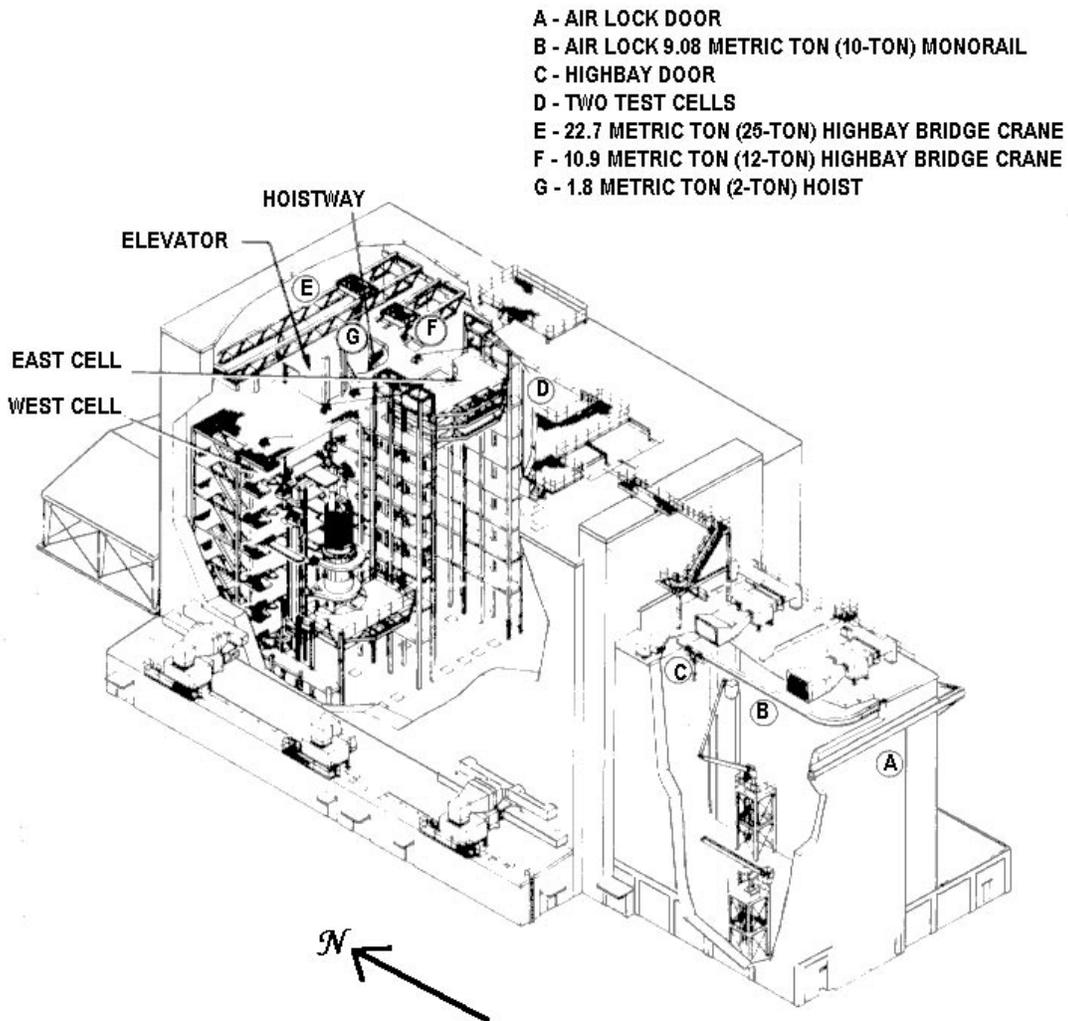


Figure 2-5. VPF Test Cells

2.3 SECURITY

A KSC Industrial Area security patrol conducts random inspections of the VPF complex on a 24-hour basis. All doors with access to the outside of the VPF are lead-sealed nightly. Each door is alarmed and monitored by an Intrusion Detection Alarm System (IDAS). If a breach of security occurs, alarms sound at KSC's Protective Services Control Center in the Launch Control Center (LCC) room 1P10. Base Operations Contractor (BOC) security personnel monitor the IDAS 24-hours a day. A graphic display indicates the exact location of the alarm, the alarm is logged and a patrol unit is dispatched. A minimum of five officers are available to respond to security events at the VPF within 10 minutes.

The NASA Site Manager controls the IDAS alarm status. During first-shift operations, the NASA Site Manager is responsible for changing the IDAS "alarm" status to

“access.” The access mode enables BOC to monitor the number of door openings at the facility and instructs console operators not to dispatch security/emergency services. The Payload Ground Operations Contractor (PGOC) maintains security within the facilities as required by the customer. Access requirements to the facility after 4:45 p.m. on weekdays, weekends or holidays must be arranged with PGOC Security at the Access Control Monitor (ACM) station located in the O&C (room 1245). The ACM station can be reached 24-hours a day at 867-7664. Additional security is a non-standard service and may be arranged by the payload organization/customer assigned to the facility.

2.4 PERSONNEL ACCESS

Personnel who require access to KSC must be issued a NASA/ESMC picture badge or machine pass. Access to the VPF is permitted only to personnel with a valid KSC-area permit or Temporary Area Authorization (TAA). Those with a “to be escorted” TAA must be escorted by a properly badged individual at all times and may only enter the VPF with an escort.

Access to the VPF is controlled by a Personnel Access Control Accountability System (PACAS) located in room 115. PACAS monitors and logs each person who enters the facility; the time of entrance and the time of exit. PACAS cards are issued through the NASA Launch Site Support Office. Access to the VPF highbay is controlled by PACAS and cipher-locked areas. All personnel entering the CWA must obtain and be responsible for the appropriate garments from room 116 and conform to the rules and regulations (table 2-1) established for VPF operations. Garments assigned to workers are not to leave the facility. Specific CWA environmental requirements and the environmental monitoring system (EMS) are discussed in detail in section 3.10.

2.5 REQUIREMENTS AND SPECIAL CONSIDERATIONS

Because much of the work performed at the VPF is hazardous, safety restrictions, strict security and personnel controls are enforced. A badge exchange board within the facility allows identification of personnel in the VPF highbay. During hazardous operations, a guard restricts vehicle access to the site complex. Amber and red beacon lights are located on the outside of the VPF at each of the four corners. Fire protection systems, sensors and warning devices are used to alert personnel in the event hazardous conditions arise.

The amount of explosives and propellants that can be housed within the VPF is limited. Therefore, the NASA Safety Office must approve the quantity of propellant used by each payload before payload processing activities begin in the VPF. Customers are advised to contact their LSSMs as early as possible to ensure the payload processing requirements can be met.

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Table 2-1. VPF Rules and Regulations

RULES	
<p>1. Badge numbers 43 & 73 required for access thru room 115.</p> <p>2. All personnel will enter the highbay via the air shower in room 118 and exit via room 119.</p> <p>3. Contact the Facility Manager or MDS&DS Operations Engineer for weekend access.</p> <p>4. No tobacco, food, beverages, or flame producing devices will be allowed beyond room 115.</p> <p>5. All tools and equipment must be “visibly clean” -- and maintained in that condition -- prior to entry into the highbay.</p> <p>6. All tools must be tethered when working alongside/above flight hardware or at heights when there is no sure way to prevent tools from falling.</p> <p>7. Tools must be stowed in non-particle generating holders (e.g., metal or plastic static-proof trays).</p> <p>8. Paper products will be limited to those necessary to perform the work.</p> <p>9. All personnel must assist in maintaining CWA conditions.</p> <p>10. Individual WADs/placards will control the use of solvents within the CWA.</p>	<p>11. Payload contractors may establish controlled work areas around their hardware. All controlled work areas must be coordinated with the Facility Manager or MDS&DS Operations Engineer.</p> <p>12. Particle generating operations such as sanding and drilling must be approved in advance by site manager or WAD.</p> <p>13. Furniture must be fire retarding and constructed from materials that minimize chipping, flaking and oxidizing.</p> <p>14. Energized electrical equipment will be manned or connected to the manned facility emergency power down system.</p> <p>15. In the event of a hypergol leak, the VPF will be powered down in accordance with <i>Emergency Preparedness Plan</i>, MDC Y1009.</p> <p>16. Approved safety harness or safety belts & lanyards must be worn whenever personnel work close to an unprotected edge of an elevated platform, stand or other structure.</p> <p>17. Any access stand or ladder that could contact a payload must have protective padding and be secured to the structure.</p> <p>18. All tours, including gold badge tours, require coordination with the site manager prior to entry into the highbay.</p>
PERSONNEL ATTIRE	
<p>1. All items must be removed from upper shirt pockets and watches and jewelry must be removed or completely taped over when above floor level when payload elements are present.</p> <p>2. The following garments are the minimum attire required for entry to the air shower/highbay at all times:</p> <p>a) Bunny suit</p> <p>b) Hood or hood with mustache/beard cover</p> <p>c) High-top booties</p> <p>3. Bunny suits must be snapped at the collar, wrists and ankles.</p> <p>4. Eyeglasses must be tethered at all times.</p> <p>5. Cleanroom garments (issued at VPF) and including special conductive shoes, are not to be removed from the facility.</p>	<p>6. Personnel clothing requirements may be revised upon concurrence of the Facility Manager.</p> <p>7. Personnel requiring access to the air lock when the highbay door is open must comply with all VPF rules and regulations.</p>
IN AN EMERGENCY DIAL 911	
QUESTIONS REGARDING THE RULES & REGULATIONS SHOULD BE DIRECTED TO THE FACILITY MANAGER AT 867-2839/2843	

SECTION III

MECHANICAL SYSTEMS

3.1 TEST CELL ELEVATING PLATFORMS

Access to the highbay test cells is provided by access platforms. Six, fixed-access levels are located on the north side of each cell at heights of 4.57 m (15 ft), 7.62 m (25 ft), 10.67 m (35 ft), 13.72 m (45 ft), 16.76 m (55 ft), and 19.81 m (65 ft) above the floor. The platform at the 22.86 m (75-ft) level is used to house the elevator motor and controls, the 1.81 metric ton (2-ton) hoist and the aft flight deck (AFD) simulator. The retractable and fixed platforms are designed to access the payload exterior (see figure 3-1).

Elevating platforms on the south side of each cell provide access to the keel side of the payload. The elevating platforms may be transferred from one cell to another and used in any combination up to the total of six on either cell. Once at the proper elevation, they are pinned to the checkout stand and the retractable platforms are positioned to the required diameter (see figure 3-2.)

The basic fixed portion of each test cell is designed to support live loads of 610.25 kg/m^2 (125 lbs/ft²). The elevating platforms are designed for live loads of 292.92 kg/m^2 (60 lbs/ft²) while the retractable are designed for live loads of 244.1 kg/m^2 (50 lbs/ft²). The steel stairs can support live loads of 488.2 kg/m^2 (100 lbs/ft²) and the ground floor live loads of 1220.5 kg/m^2 (250 lbs/ft²).

The support beams of the VPHD support payload elements using the flight trunnions in J-hooks. Payloads in the VPF cannot be supported by the keel. Three or more trunnions must be provided for handling and transportation.

Figure 3-3 shows how the VPHD permits access to the payload. The VPHD column is approximately 19.81 m (65 ft) high and allows access along the entire vertical length of each test cell. Figure 3-4 shows general access capabilities provided by the fixed and elevating platforms. Additional payload access is provided by portable, general access equipment. This equipment can be used throughout the test cell structure.

Any access limitations caused by the VPHD or access platforms should be considered when designing payload interfaces. Also, any unique access equipment must be provided by the customer. The design of any access equipment which attaches to KSC equipment must be coordinated with KSC.

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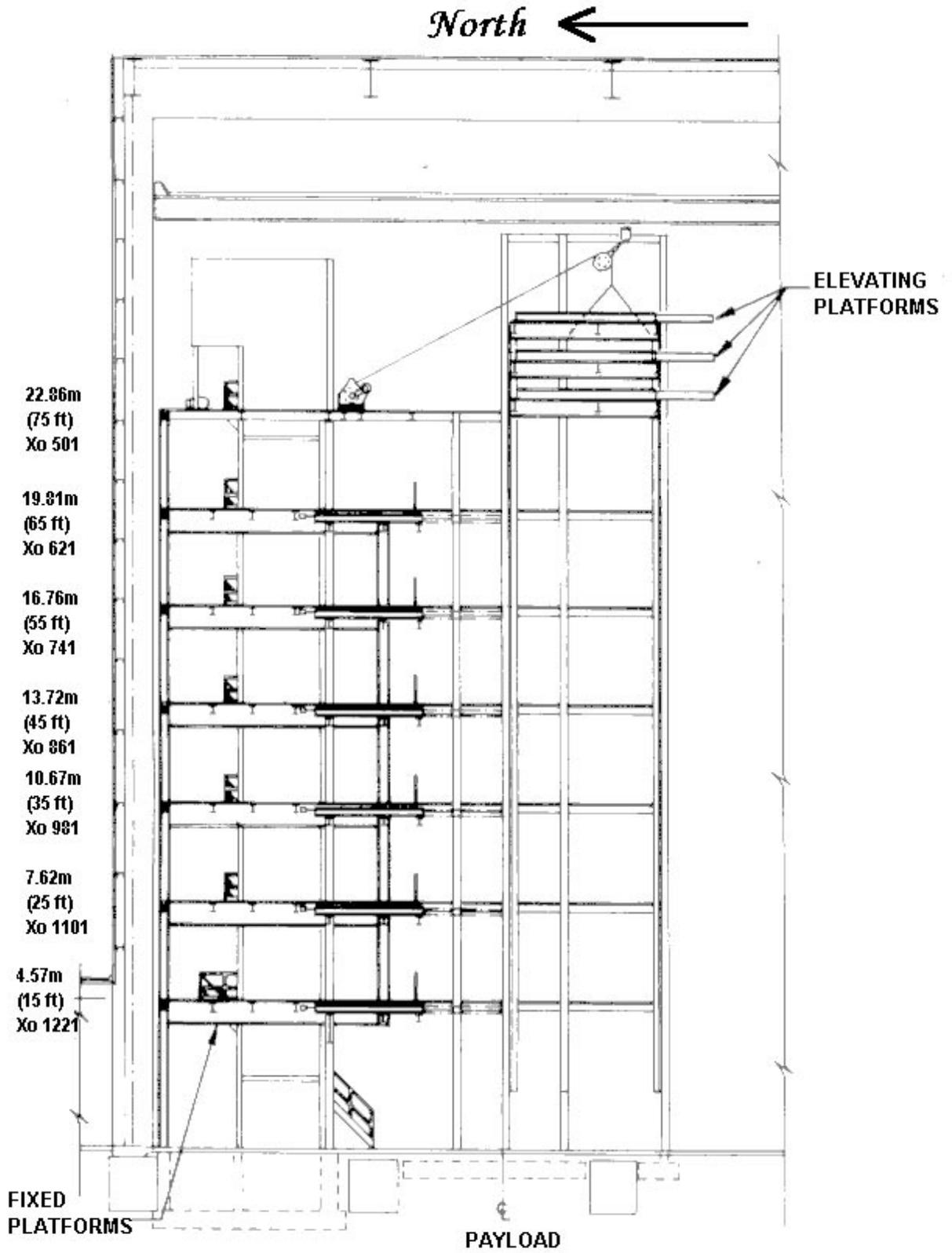


Figure 3-1. VPF Test Cell Elevation

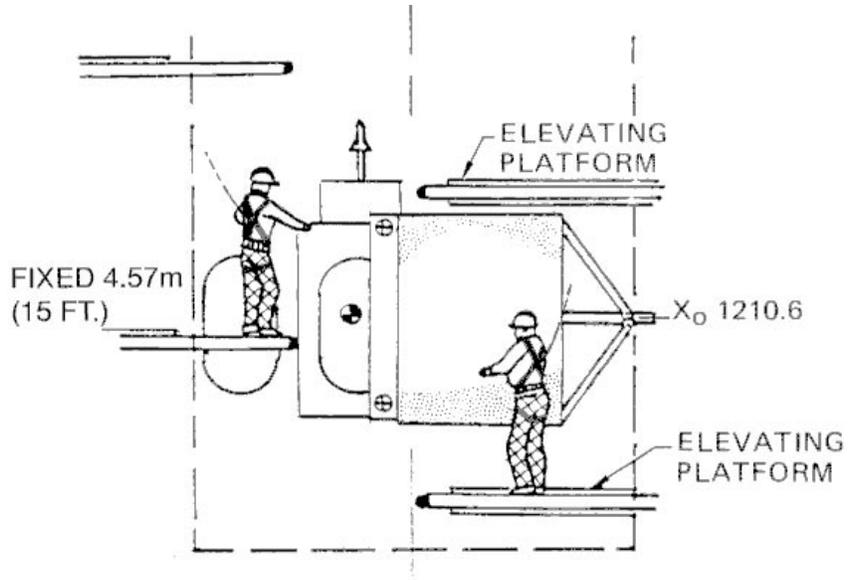


Figure 3-2. VPF Platform Access

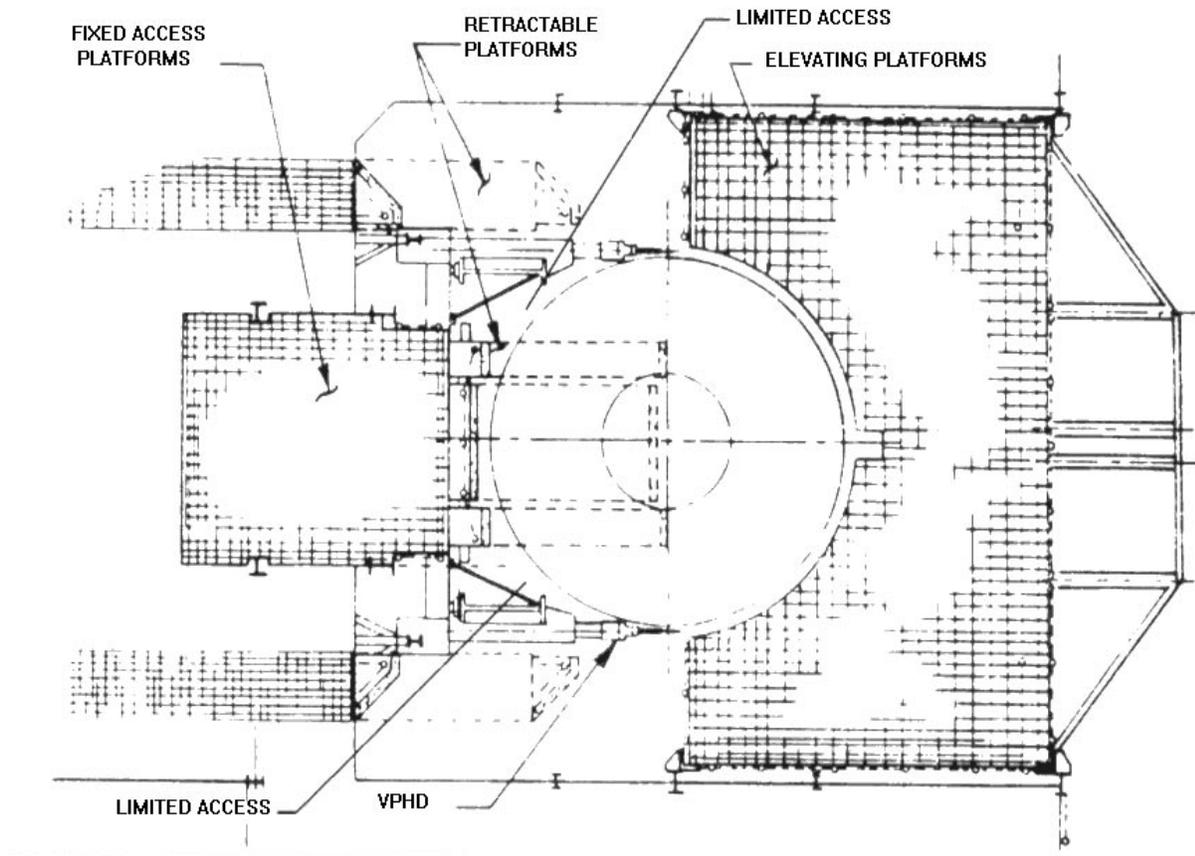


Figure 3-3. VPF Access Platforms

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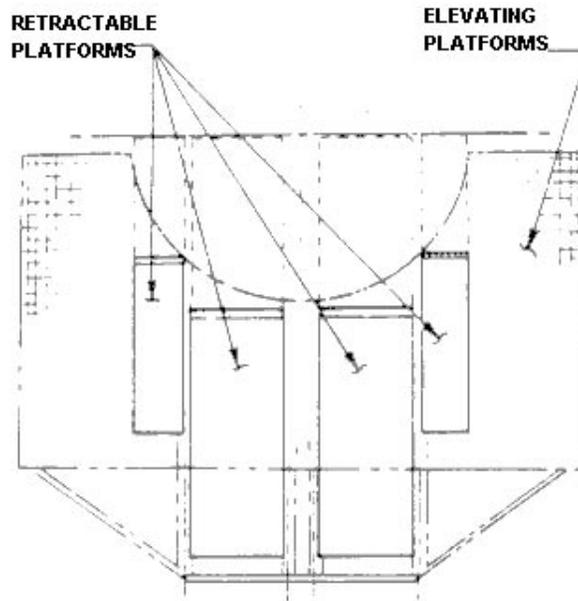


Figure 3-4. VPF Elevating Platforms

3.2 MATERIAL HANDLING EQUIPMENT

3.2.1 CRANES. A monorail track for a 9.08 metric ton (10-ton) capacity hoist is mounted in the ceiling of the air lock. The beam is constructed so that the hoist can be positioned in a remote corner when not in use. The hoist travels north/south in the centerline with no lateral movement and has a maximum hook height of 20.02 m (65 ft 8 in) and a minimum of 0.97 m (3 ft 2 in) from the floor. The crane services the center of the air lock to a point 7.01 m (23 ft) from the outside door where the monorail curves to the east, giving service up to 1.52 m (5 ft) from the air lock east wall. See figure 3-5 for hoist hook dimensions.

Two bridge cranes are located in the VPF highbay. One crane has a 22.68 metric ton (25-ton) capacity and a 10.89 metric ton (12-ton) crane was added south of the 25-ton crane to increase the hoist capacity to a total of 42.66 metric tons (37 tons). In addition to these two bridge cranes, a 1.8 metric ton (2-ton) hoist is located on the workstand at the 22.86 m (75 ft) level. The hook height for the 22.68 metric ton (25-ton) crane is 28.65 m (94 ft) and the hook height for the 10.89 metric ton (12-ton) crane is 28.35 m (93 ft). The travel of the crane from the east and west walls is 2.4 m (7 ft 10 in) for the 22.68 metric ton (25-ton) crane and 1.63 m (5 ft 4 in) for the 10.89 metric ton (12-ton) crane. Travel from the south wall (not rail stop) is 10.44 m (34 ft 3 in) for the 22.68 metric ton (25-ton) crane and 4.17 m (13 ft 8 in) for the 10.89 metric ton (12-ton) crane. Hook travel from the edge of the test cell from the north wall is 2.59 m (8 ft 6 in) for both cranes. Hoist hook interface dimensions for both cranes are shown in figure 3-5. **Note: when the 42.66 metric ton (37-ton) lifting capacity is effected, the equalizing hoist beam limits the highbay maximum hook height to 26.56 m (87 ft 3 in).**

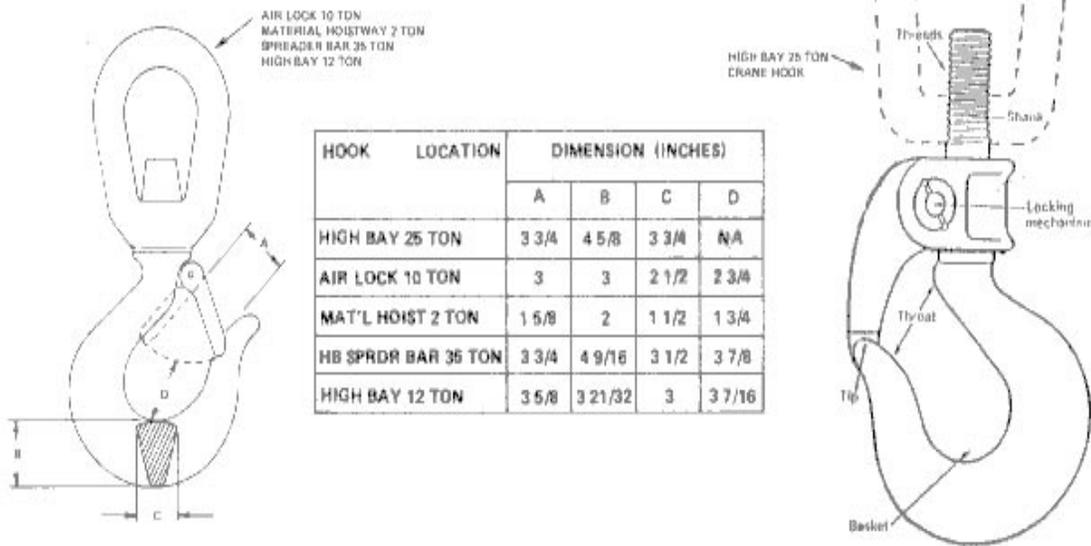


Figure 3-5. VPF Cranes - Hook Interface Dimensions

Two articulated arms with personnel work buckets (service booms) are located in the air lock. One is located at the east side approximately 17.37 m (57 ft) north of the south wall. The second boom is on the west side approximately 7.32 m (24 ft) from the south wall. The boom extensions provide sufficient length to service the entire surface of the Multiuse Mission Support Equipment (MMSE) payload canister. Refer to figure 3-6 for the articulated arm reach capability.

3.2.2 TEST CELLS HOIST. A 1.81 metric ton (2-ton) hoist is located at the 22.86 m (75-ft) level. A material hoistway approximately 1.52 by 2.44 m (5 x 8 ft) is located in the east test cell. The hoistway is located on the north side along the north-south centerline of the cell. The hoist and hoistway are available for raising and/or lowering equipment to or from the fixed test cells platforms at the 19.81 m (65-ft) level or below. Maximum hook height is 22.38 m (73 ft 5-3/8 in).

3.2.3 HYDRASETS. Two hydrasets, 22.70 metric ton (25-ton) and 9.08 metric ton (10-ton) are available for use with highbay and air lock cranes. The 9.08 metric ton (10-ton) hydraset is compatible with both highbay and air lock cranes. Other hydraset capacities can be provided.

3.2.4 ELEVATOR. The highbay test cells have one elevator that rises to the 19.81 m (65-ft) level. The elevator interior has a 1.52 m by 2.13 m (5 ft x 7 ft) floor area and a height of 2.13 m (7 ft). It has a hoisting capacity of 1587.60 kg (3500 lbs) or 488.20 kg/m² (100 lbs/ft²).

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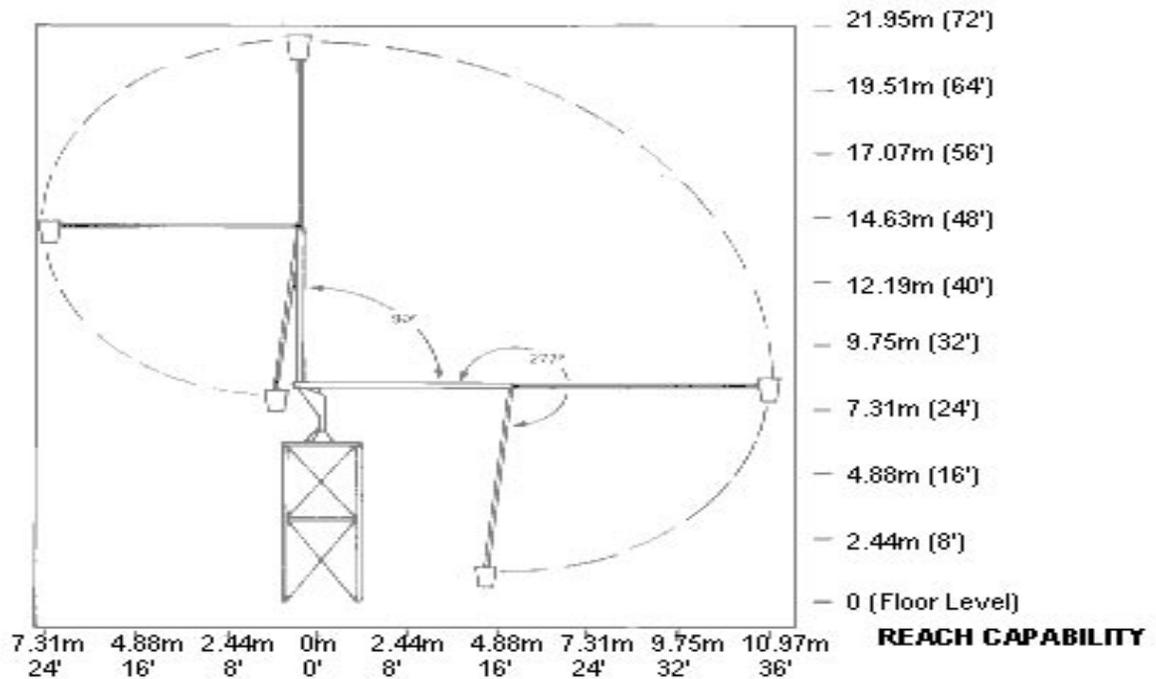


Figure 3-6. Articulated Arm Reach Capability

3.2.5 ELECTRIC TOWING. An electric tug with a towing weight capacity of approximately 15,876 kg (35,000 lbs) is available. This tug is used to move payloads in and out of the highbay and air lock.

3.2.6 AIR-BEARING PALLET. An air-bearing pallet -- using compressed shop air and capable of moving 13,608 kg (30,000 lbs) -- is used to move equipment including the elevating platforms between the east and west cells.

3.3 COMPRESSED AIR AND GASES

3.3.1 GASEOUS NITROGEN (GN₂). GN₂ is supplied through pressure-regulating panels to outlets located outside the VPF near the hypergolic scrubber system at the northwest corner of the VPF. A 3.45 bars (50 psig) GN₂ system supplies purge and valve operating pressures to the hypergolic.

GN₂ is also supplied through pressure-regulating panels to outlets located inside the VPF air lock, highbay and test cells. GN₂ is distributed to the workstand by separate riser systems which provide pressure of 413.72/206.86 bars (6000/3000 pounds per square inch gage [psig]), 51.71 bars (750 psig) and 3.45 bars (50 psig). The 413.72/206.86 bars (6000/3000 psig) and 51.71 bars (750 psig) systems supply identical pressure panels (S70-1242-3, -4 and -5) on the 4.57 m (15-ft), 10.67 m (35-ft) and 16.76 m (55-ft) levels. Each outlet is equipped with a manual vent valve and dual manual outlet valves. The outlet port fittings for the 413.72/206.86 bars (6000/3000

psig) is 6.35 mm (1/4 in), KC 124C4, bulkhead union. The outlet port fittings for the 51.71 bars (750 psig) system is 12.7 mm (1/2 in), KC 124C8, bulkhead union. The 413.72/206.86 bars (6000/3000 psig) system also supplies other pressure panels which provide purge pressures for the waveguide systems and intercom panels. It supplies two pressure panels (S70-1242-7 and -8) on the west wall of the air lock. Outlet connections on these panels are 6.35 mm (1/4 in), KC 124C4, bulkhead unions.

The 3.45 bars (50 psig) and the 0.34 bars (5 psig) systems provide the GN₂ purge for the OIS-D and RF antenna waveguide components. Refer to figure 3-7 for approximate locations of GN₂ outlets.

3.3.2 GASEOUS HELIUM (GHe). GHe is supplied through pressure-regulating panels to outlets located throughout the test cells levels. The GHe is distributed to the test cells by separate riser systems providing pressures of 413.72/206.86 bars (6000/3000 psig). GHe to the 14.57m (15-ft), 10.67 m (35-ft) and 16.76m (55-ft) levels (3 levels) is supplied through a pressure panel similar to the GN₂ system. Refer to figure 3-7 for approximate locations of GHe outlets.

3.3.3 BREATHING AIR. Breathing air (instrument purge) is supplied through pressure-regulating panel S70-1242-1 to the 14.57 m (15-ft), 10.67 m (35-ft) and 16.76 m (55-ft) test cell levels at 2400 psig. Outlet connections on these panels are 12.70 mm (1/2 in), KC 124C8, bulkhead unions. Refer to figure 3-7 for approximate locations of breathing air outlets.

3.3.4 COMPRESSED AIR. Compressed air, filtered to 1.0 micron is available on all levels of the test cells except the 22.86 m (75-ft) level. Each outlet is equipped with a shut-off valve, a filter strainer and a manually-operable pressure reducing regulator with internal relief to atmosphere. The pressure reducing regulator is equipped with a pressure gage indicating meter 0-20.69 bars (0-300 psig). Any pressure from 0 to 8.62 bars (0 to 125 psig) is available. Outlets on the 7.62 m (25-ft), 13.72 m (45-ft) and 19.81 m (65-ft) levels (3 levels) have quick-disconnect fittings (Hanson 4500). Outlets have capped fittings on the remaining levels. All outlets on the test cells are located 0.305 m (1 ft) above the grating. Compressed air hose reels are located 0.83 m (2 ft 9 in) above the grating and are dedicated to air wrenches to extend/retract extendable platforms.

Compressed air 8.62 or 6.21 bars (125 psig or 90 psig) is available at other strategic locations in the highbay and air lock. Three outlets are provided on each level --one at the end of the center finger and one located in each of the two cells on the north wall -- which are supplied with oil to operate wrenches. A closed vent system must be used with these outlets to prevent environmental contamination. Refer to figure 3-7 for approximate locations of compressed air outlets.

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3.4 VACUUM SYSTEM

The VPF vacuum system consists of 59 vacuum inlet ports, three shoe scrubbers and three mechanical mats. Vacuum fittings are flush-mounted, wall-valve types for a 38.10 mm (1.5 in) hose (Spencer 8705A Type DA). Forty-three of the vacuum inlet ports are located throughout the VPF -- the approximate locations are shown in figure 3-7. The east and west test cells have 16 vacuum inlet ports; two ports at each level beginning at the 0.305 m (1 ft) level above the grating and continuing upward in 15-foot increments to the 22.86 m (75-ft) level. The shoe scrubbers and mechanical mats are activated/deactivated by a push button station located adjacent to the light switches in the personnel entrance (room 117) and locker rooms. The vacuum pump produces a vacuum of 0.25 bar (7 in) of mercury and is located in mechanical equipment room 110.

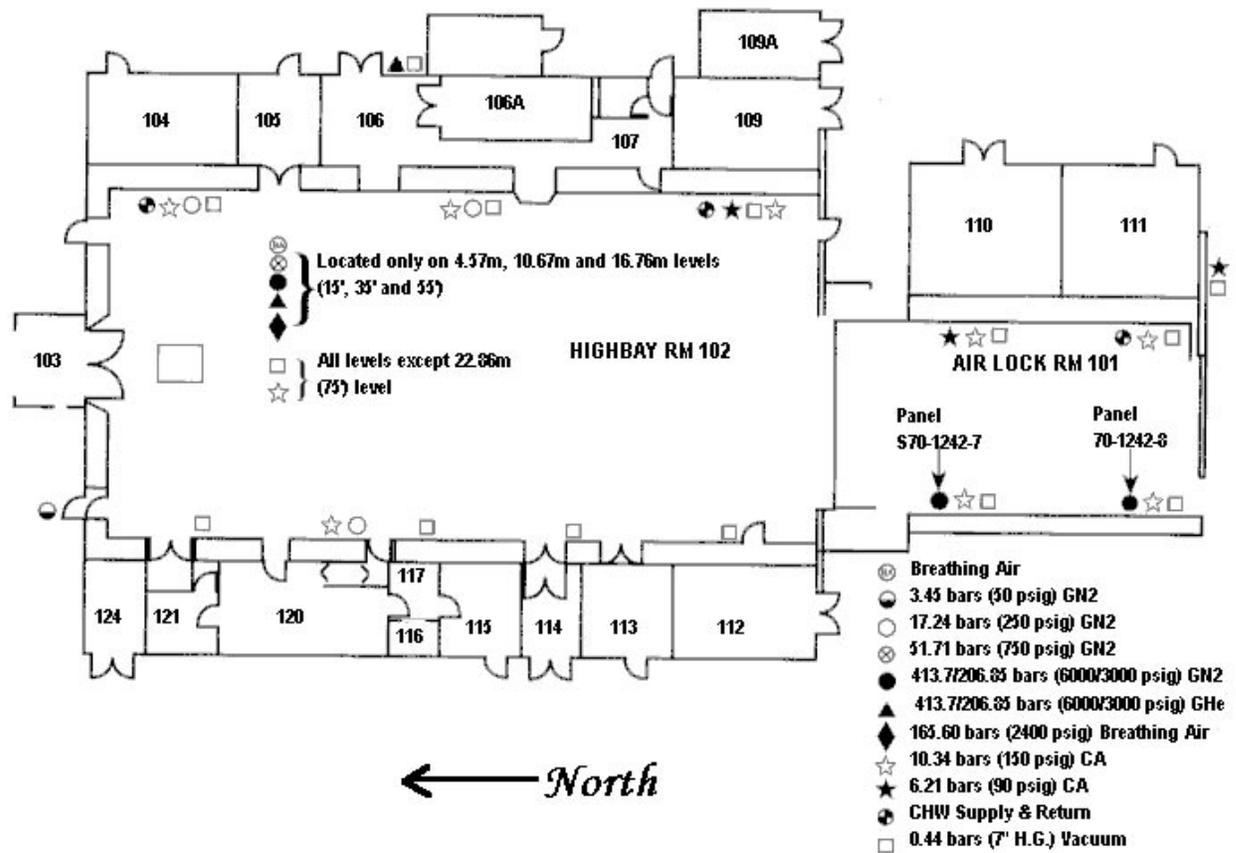


Figure 3-7. Compressed Air and Gases in VPF

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3.5 HEATING, VENTILATION AND AIR-CONDITIONING (HVAC)

Air enters the VPF through High-Efficiency Particulate Air (HEPA) filters mounted in the ceiling of the highbay and the west wall of the air lock. Air is nominally class 100,000 guaranteed class 5,000 air at the filter discharge. Temperature is 21.7 +/- 3.3 degrees Celsius (°C) (71 degrees Fahrenheit (°F) +/- 6°F) with maximum relative humidity of 55 percent and 15 parts per million or less hydrocarbons. Air is exchanged at approximately eight changes per hour and positive pressure is maintained at all times.

Table 3-1. Cleanliness Requirements [1]

CWAs		LEVEL #4	LEVEL #5
Parameter	Air Flow	Non-Laminar	Non-Laminar
Maximum Airborn Particulate Counts (Per cubic foot)	Req >= 0.5µm Req >= 5.0µm Monitoring	100,000 700 Continuous	300,000 1,000 Monthly
Temperature (°F) [3]	Requirement Monitoring	71 ± 6 Continuous	71 ± 6 Continuous
Relative Humidity (Percent) [3]	Requirement Monitoring	55 Max Continuous	55 Max Monthly
Maximum Particle Fallout [2]	Goal Monitoring	Level 750 Continuous	Level 1000 Every 6 months
Maximum NVR (mg/0.1m ² /month)	Requirement Monitoring	1.0 Continuous	2.0 Annually
Maximum Volatile Hydrocarbons (PPM) (v/v)	Requirement Monitoring	15 Every 2 weeks	N/A N/A
Maximum Positive Pressure	Requirement Monitoring	0.02 in H ₂ O Daily	N/A N/A
Minimum Air Changes	Requirement	4/Hour	2/Hour
[1] During periods of operation [2] Levels per MIL-STD-1246B for a 24-hour period [3] Program OMRSD may supersede these requirements			

RELEASED

3.6 CONTAMINATION CONTROL AND MONITORING SYSTEMS

The VPF is a non-laminar flow CWA, and the Environmental Monitoring System (EMS) provides real-time and historical data on the parameters required to maintain a CWA. The EMS is supplemented by physical measuring techniques. Environmental conditions are continuously monitored, stored and recorded for temperature, relative humidity and airborne particle matter. Surface particulate matter, non-volatile residue and volatile hydrocarbon monitoring is performed by conventional methods (i.e., witness plates). See table 3-1 for cleanliness requirements.

The Continuous Monitor/Analyzer is the heart of the EMS. The mainframe is located opposite the observation window in room 106 and remote from the sensors. The system receives data from multiple sensor outputs connected by coaxial cable, archives it in time-correlated channels of data and provides an output to the host computer system. The system provides real-time data and printed records of environmental conditions and sets off an alarm when it detects an out-of-spec condition.

Sensor sets are installed in specific areas within the VPF. The highbay has sensors at the 7.62 m (25-ft), 10.67 m (35-ft), 13.72 m (45-ft), and 16.76 m (55-ft) levels and one located in the air lock. Each sensor set detects particle count (i.e., 0.5 and 5 microns), temperature and relative humidity. When an out-of-spec condition occurs in any one of the monitored areas, the system sounds an alarm at the MDS&DS facility console. This console is monitored 24-hours a day by an Andover Controls monitoring and control system which is located in building M7-458.

3.6.1 CRYOGENIC VENT. A general cryogenic vent interface is located on the north wall of the east test cell at the 10.67-m (35-ft) level. Gases are passively vented to the outside through a 9.8 centimeter (4-in) pipe.

3.6.2 HYPERGOLIC PROPELLANT VAPOR EXHAUST SYSTEM. The hypergol exhaust fan (HEF) system can be turned on manually through a HEF control panel located in room 115. The HEF system consists of four in-line, vane axial exhaust fans with pneumatically-operated dampers and air grills. The fans have a total capacity of 4,811,144 l/sec (102,000 cubic feet per minute (cfm)) or an equivalent of 5.6 air changes per hour. The exhaust fans are interlocked with the air handling units which shut down when the fans are energized. Makeup air for the exhaust system is introduced through four supply air registers with pneumatically-operated dampers 10620 L/sec (22,500 cfm total) located above the low roof levels on the east and west side of the highbay. Use of this system will contaminate the CWA with unfiltered outside air, and it may be activated by authorized personnel only.

3.6.3 PROPELLANT WASTE DRAIN SYSTEM. The propellant waste drain system is a non-storage system that is used in the event of a spill during hypergolic operations. Drains are located on the floor beneath each workstand to collect hypergolic propellant

waste which is carried by buried 101.6 mm (4-in) double-wall stainless steel drain pipes to a buried double-wall stainless steel waste tank. The waste containment system can accommodate a maximum of 18,925 L (5,000 gal) of hypergolic propellant mixed with water. All leaks and spills must be flushed immediately with water to achieve a dilution ratio of at least one and one-half parts water to one part hypergol.

In the event of an emergency, a scrubber drain and separator tank are provided to collect -- through a closed drain/vent system -- approximately 246 L (65 gal) of undiluted hypergolic propellant. On each test cell at the 4.57 m (15-ft), 7.62 m (25-ft), 13.72 m (45-ft), and 19.81 m (65-ft) levels (4 levels) a capped outlet and a hand-operated ball valve are provided. The system is equipped with 51.72 bars (750 psig) GN₂ for aspiration operation and a fuel scrubber (S70-1094) for vapor disposal.

3.7 FIRE PROTECTION SYSTEMS

Fire protection within the VPF consists of a fire detection system, a general alarm, non-coded zone-annunciation fire alarm system, fire control equipment, and a water deluge system. Fire hydrants are located at the exterior southwest and southeast corners of the air lock. A manually-activated water spray fire suppression system protects the fuel scrubber installation. During hazardous operations, KCA-013 *Firewatch Procedure*, will be in effect. Figure 3-8 shows the locations of the various emergency warning systems within the highbay.

3.7.1 FIRE DETECTION SYSTEM. Heat activated detectors are installed in the ceilings of each room. In addition, 52 ultra-violet and infrared detectors are installed on the walls and cell areas in the highbay.

3.7.2 FIRE ALARM SYSTEM. Hand-operated, pull-type fire alarm stations are located at emergency exits throughout the VPF, on each side of all levels of the test cells and outside the building. Activation of either a fire detector or fire alarm causes a signal to be transmitted to the KSC Launch Control Center Fire Controller. At the same time that alarm bells are sounded in and around the building, the HVAC comfort air dampers close and the air handlers are shut down to contain the fire.

3.7.3 FIRE CONTROL EQUIPMENT. Carbon Dioxide (CO₂) type BC and multipurpose dry chemical type ABC fire extinguishers are located throughout the facility.

3.7.4 WATER DELUGE SYSTEM. A water deluge fire suppression system is fed from a one million gallon storage tank located at the HMF Pump Station (M7-1362) and is divided into two independent zones (east and west cells). Push-button station controls -- capable of arming and activating the system -- are located in each test cell on the 4.47 m through 19.81 m (15- through 65-ft) levels. There is also a master control panel on the west wall of the highbay and a remote-control panel in room 115 -- both of which have the capability of arming, activating, disarming, and deactivating both the east and west zones. This system may only be activated by authorized personnel.

NOTE: To prevent the water deluge system from being turned on inadvertently, three distinct actions must be taken to activate the system: authorized technicians must manually open the main control valve (A800152) located outside of the VPF in the northeast corner of the VPF site; second 2) the system must be armed; and 3) the system must be activated from the control panel(s) located within the VPF. Push-button station covers are also available to prevent accidental push-button depression.

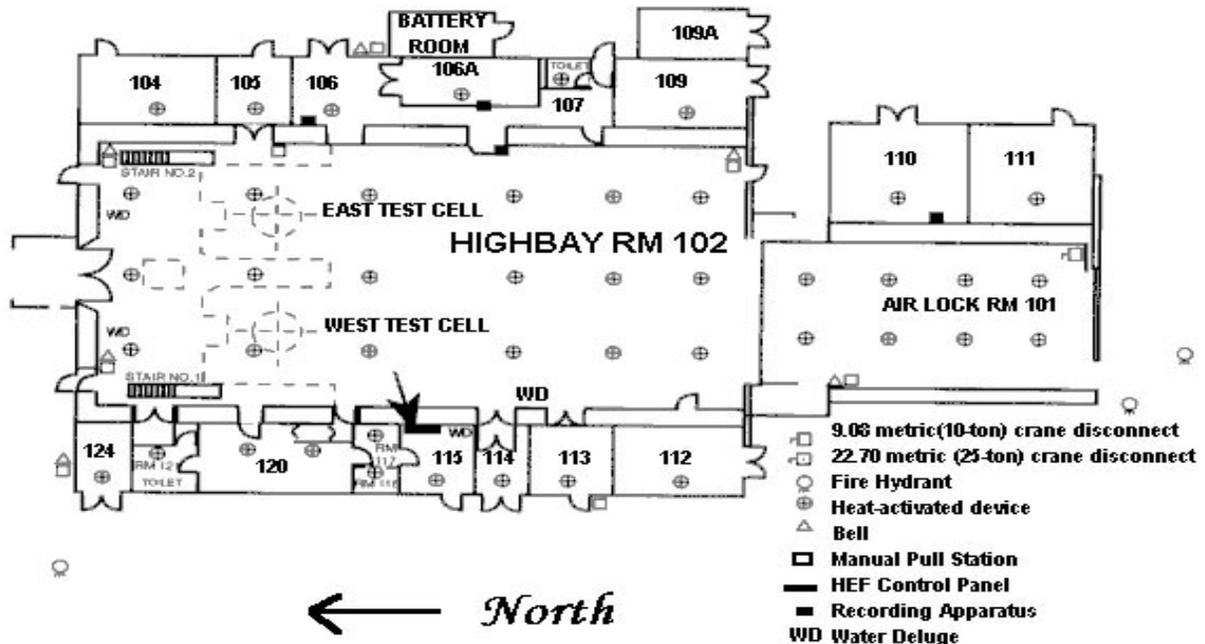


Figure 3-8. VPF Emergency Warning/Fire Protection (Highbay)

3.7.5 AUTOMATIC SPRINKLER SYSTEM. A fusible link sprinkler system protects the boiler room.

3.8 LOCAL ENVIRONMENTAL CONTROL SYSTEM (ECS)

The ECS provides local cooling air with the following characteristics:

- Temperature range of 10° to 24° C (50° to 75° F).
- Flow rate of 68.04 kg/min (150 pounds per minute) maximum per checkout cell with a flow of 45.36 kg/min (100 pounds per minute) maximum per level.
- Maximum specific humidity, 34 grains.

- d. Nominal cleanliness level of class 100 guaranteed class 5,000 carbon and HEPA filtered with 15 ppm or less hydrocarbons.
- e. A maximum pressure at each level of 0.1 bar (40.68 in) of water.

ECS outlets are located 2.13 m (7 ft) above grating for the 4.57 m through 19.81 m (15-ft through 65-ft) levels. An ECS duct at ground level is routed beneath the southern end of the 4.57 m (15-ft) center fixed platform and provides an interface outlet for cooling. Customers will provide ducting from facilities interface to the payload. Figure 3-9 indicates typical ECS outlets on all levels except the 22.86 m (75-ft) level.

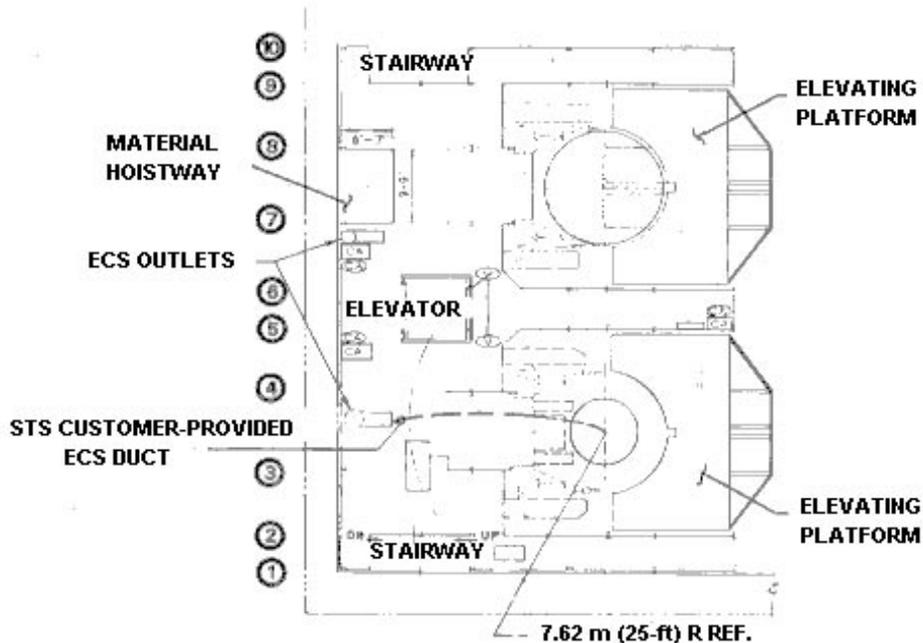


Figure 3-9. ECS Outlets, Typical All Levels Except 22.86 m (75-ft) Level

3.9 SAFETY EQUIPMENT

The VPF is equipped with several types of emergency equipment. Outside the VPF -- on the east and west sides -- are two illuminated wind socks which assist personnel to choose the most suitable marshalling location in the event an emergency egress is required. Amber and red flashing, omnidirectional lights are mounted on the outside of the building above the roof line. Amber lights are used to indicate that hazardous operations are in progress and red lights indicate that an emergency situation exists. The ON/OFF switches for these omnidirectional lights are located in room 105. A second switch for the red omnidirectional lights is located outside room 115 on the building's exterior west wall, north side of room 115 entry door. These switches may only be operated by safety personnel.

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Inside the VPF, all emergency exits have crash bar alarms installed. Use of any one of these exits will transmit a signal to the KSC Launch Control Center Electronics Security System monitor. In the VPF highbay, Breathing Escape Units are located on each test cell level in boxes marked with green and white stripes. When fuels are present, toxic vapor checks are conducted at the beginning of every shift and at critical points throughout the processing flow to detect hydrazine/fuel leaks. Any repositioning of a fueled payload requires a toxic vapor check. Emergency showers and eyewashes are provided in the VPF hypergolic area and on the test cells at the 4.57 m (15-ft), 7.62 m (25-ft) and 10.67 m (35-ft) levels. Portable eyewash canisters are provided at the 13.72 m (45-ft), 16.76 m (55-ft) and 19.81 m (65-ft) levels.

Two emergency stop warning horn push buttons and two test cell alternating current (ac) electrical power receptacle disconnect push buttons are located on each test cell level except the 22.86 m (75-ft) and ground level. The warning horn activation alerts personnel to stop work until the nature and resolution of an emergency can be determined. In the event of a spill or other type of emergency, activating the ac power disconnects will prevent sparks or a potential fire problems with test or monitoring equipment being used in the area. An ac electrical power disconnect push button is located in room 115.

3.10 MECHANICAL PREPARATIONS FOR PAYLOAD PROCESSING

PGOC will ensure the VPF is properly configured to receive a mission payload pursuant to Operations and Maintenance Instruction (OMI) E2503, *Mechanical Preparations for Payload Processing - VPF*.

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SECTION IV

ELECTRICAL SYSTEMS

4.1 FACILITY POWER

All ac electrical power to the VPF is supported by an alternate path. This is accomplished within the KSC Power Distribution System by a dual feed-loop and reclosure system which can be manually activated if the normal power path is interrupted. Critical circuits (e.g., fire alarm and platform emergency lights) have an emergency generator (60 kilowatt (kw)) activated by an automatic transfer switch. Test cell circuits can be manually transferred to a portable generator upon request. Generator connections also exist to allow HVAC operations in the event of facility power loss. Various receptacles in the VPF are dedicated to CITE and CITE power supplies and are not available for customer use.

4.1.1 HIGHBAY POWER RECEPTACLES. The highbay east wall has two 277/480-volt (V), 200-ampere (A), 3-phase (\emptyset), 60 Hertz (Hz) explosion-proof (Xp) receptacles. These receptacles are for use by the canister transporter. The highbay west wall has one 277/480-V, 100-A, 3- \emptyset , 60-Hz, Xp receptacle. Forty-five additional Xp 208 Vac and 120 Vac receptacles are available near the ground level of the highbay.

4.1.2 AIR LOCK POWER RECEPTACLES. The air lock east wall has two 277/480-V, 200-A, 3- \emptyset , 60-Hz, Xp receptacles. These receptacles are used by the canister transporter. Additional 208 Vac and 120 Vac Xp receptacles are available near the ground level of the air lock.

4.1.3 TEST CELLS POWER RECEPTACLES. Power to both the east and west cells is distributed the same way. Power is distributed in separate risers for the east and west cells. The cells 4.57 m through 13.72 m (15- through 45-ft) levels have two 120/208-V, 60-A, 3- \emptyset , 60-Hz, Xp receptacles; seventeen 120-V, 20-A, 1- \emptyset , 60-Hz, Xp receptacles; and four 120/208-V, 30-A, 3- \emptyset , 60-Hz, Xp receptacles. There is also one 277/480-V, 100-A, 3- \emptyset , 60-Hz, Xp receptacle on the 10.67 m (35-ft) level. The 16.76 m (55-ft) level has one 120/208-V, 60-A, 3- \emptyset , 60-Hz, Xp receptacle; 14 120-V, 20-A, 1- \emptyset , 60-Hz, Xp receptacles; four 120/208-V, 30-A, 3- \emptyset , 60-Hz, Xp receptacles; one 277/480-V, 200-A, 3- \emptyset , 60-Hz, Xp; and one 480-V, 60-A, 3- \emptyset , 60-Hz, Xp (dedicated to CITE) receptacles. The 19.81 m (65-ft) level has 14 120-V, 20-A, 1- \emptyset , 60-Hz, Xp receptacles and four 120/208-V, 60-A, 3- \emptyset , 60-Hz, Xp receptacles. The 22.86 m (75-ft) level has 12 120-V, 20-A, 1- \emptyset , 60-Hz, Xp receptacles; seven 120-V, 30-A, 1- \emptyset , 60-Hz, Xp receptacles; and one 120/208-V, 30-A, 3- \emptyset , 60-Hz, Xp receptacle. Extra circuits are fed to the 19.81 m (65-ft) level for receptacles to the CITE interface terminal distributor (I/F TD) racks, hardware interface modules (HIMs), Video and Data Assembly (V&DA), and the CITE heat exchanger simulator power. Electrical receptacles are generally located between 0.61 m (2 ft) and 1.7 m (5 ft 7 in) above the platforms.

4.1.4 DIRECT CURRENT (dc) ELECTRICAL POWER. The customer will provide the dc power for GSE and payload electrical systems and components. CITE dc power will simulate the orbiter dc busses in the aft flight deck and payload bay interfaces.

4.1.5 ELECTRICAL CHECK-OUT ACCESSORY KITS. The customer will provide adapter cables, jumpers and any special test equipment required to connect to the commercial test equipment.

4.1.6 ILLUMINATION. The highbay area is illuminated by ceiling-mounted metal halide lamps which are distributed to provide a minimum of 645 lm/m² (60 ft-candles) of illumination. The air lock is illuminated by hazard-proof metal halide lamps mounted in the ceiling. Each level of the test cells is illuminated by hazard-proof fluorescent lamps that are serviced by normal power and fluorescent lamps that are serviced by emergency power. Three receptacles support lighting for each moveable platform. For cleanliness inspections on each level, metal halide lamps provide a minimum of 1075 lm/m² (100 ft-candles) of illumination.

4.1.7 GROUNDING. All structural metal and other metallic components and equipment are connected to the facility grounding system (see figure 4-1). The instrumentation system is a second grounding system that is single-point grounded and electrically isolated from the facility. Customers should avoid inadvertent connection of the two grounding systems. Instrumentation ground and facility ground connections are available on each test cell level and facility ground connections are available in the floor of the highbay on a 6.10 m (20-ft) square grid network. The test cells have 12 equipment and 12 instrumentation ground terminal stations on each level from 4.57 m through 19.81 m (15-ft through 65-ft). The 22.86 m (75-ft) level has four equipment and four instrumentation ground terminal stations. Mounting holes for compression clamps are provided. Grounding attachments are located approximately .25 m (10 in) above the platform.

4.1.8 LIGHTNING PROTECTION. Lightning protection is provided by an interconnected system of roof-mounted air terminals, down conductors and ground rod field connected to the building counterpoise.

4.2 ELECTRONIC SYSTEM

The CITE, figure 4-2, is the simulated orbiter system used to validate most of the interfaces between a payload and orbiter prior to mating the payload with the orbiter. If interface anomalies exist between a payload and the simulated orbiter, the CITE hardware will support troubleshooting and fault isolation. By validating interfaces between payload and orbiter in an off-line mode, the CITE effectively minimizes the probability of impacting the space shuttle on-line flow.

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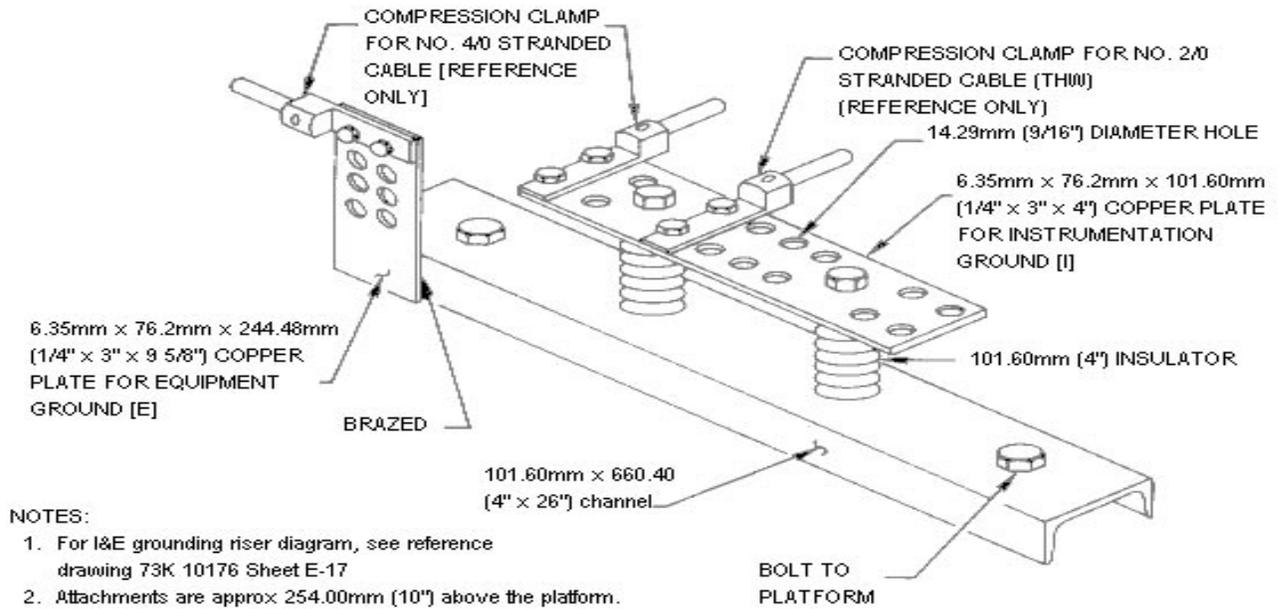


Figure 4-1. Instrumentation and Equipment Grounding Station

4.2.1 CITE/LPS. The CITE system is comprised of the same LPS assemblies used on-line. Payload interface verification is performed in the same way as the on-line shuttle integration testing using many common LPS customer interface capabilities. All Ground Operations Aerospace Language (GOAL) programs and procedural steps will be performed first in the CITE system before being used on-line.

4.2.2 INTERFACE TERMINAL DISTRIBUTOR. The I/F TD houses the CITE/orbiter avionics. All critical interface signals can be monitored with test equipment. At the I/F TD, selected signals can be patched for recording in the Control Room (room 2397) and certain signal paths can be broken and reestablished in a different configuration. The I/F TD provides monitor/patch capability for payload mission-unique signals and payload data signals. The I/F TD receives master timing unit (MTU) subassembly signals from the V&DA and the KSC wideband terminal interface. These timing signals are provided with monitor points and routed to the payload interfaces and the CITE avionics as required.

4.2.3 RECORD AND PLAYBACK ASSEMBLY (RPA). The RPA equipment located in Control Room (2397) of the SSPF will provide the capability to handle and record test data. The RPA provides recording and reproduction of voice and timing signals used in conjunction with the CITE testing. The RPA has five subassemblies: Input/Output; Raw Data Recorder; Frequency Modulation (FM) Telemetry (TM) Demodulation; Pulse Code Modulation TM Demodulation; and Display.

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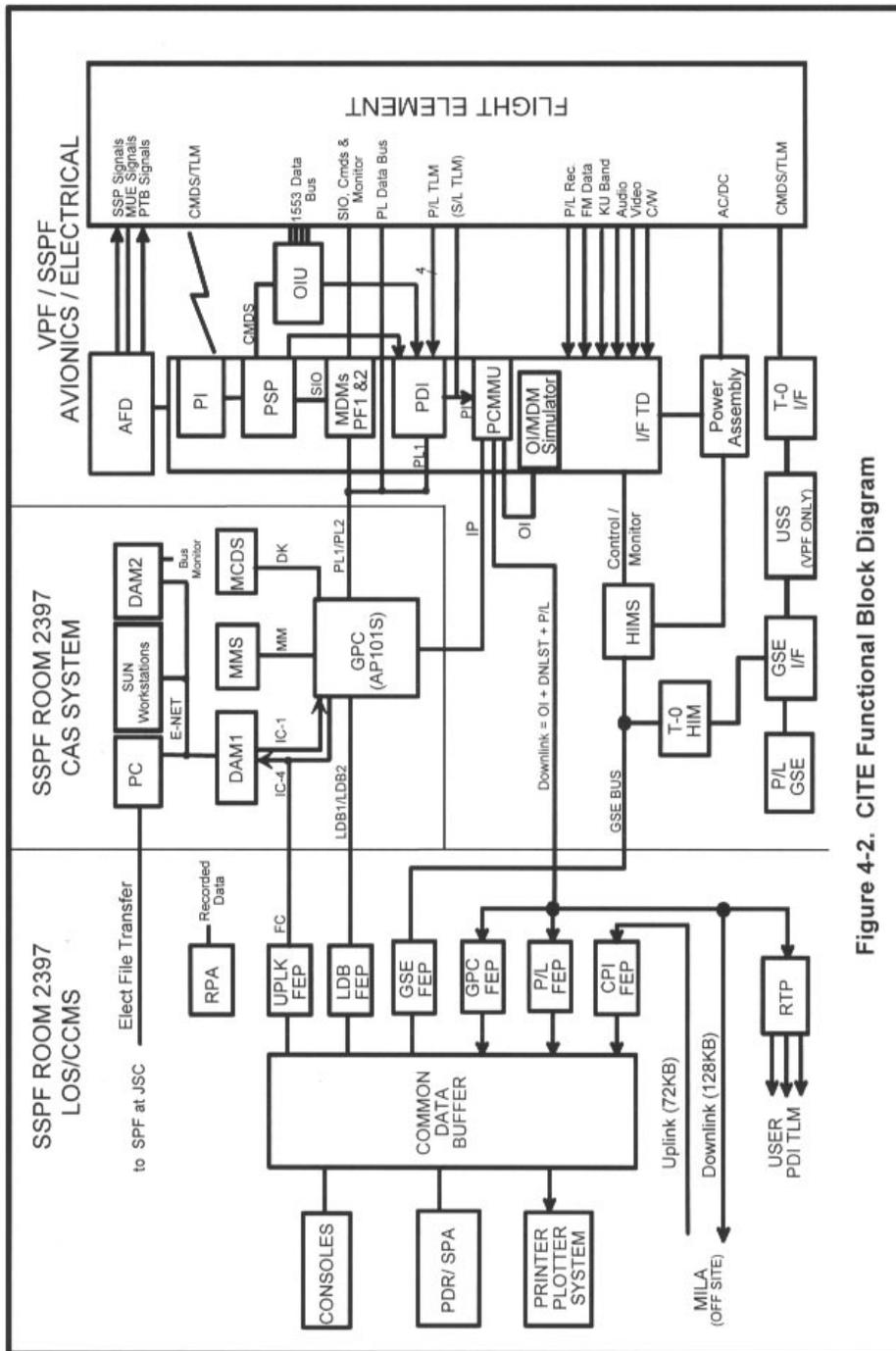


Figure 4-2. CITE Functional Block Diagram

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4.2.4 PAYLOAD/ORBITER INTERFACES. The payload-to-orbiter interfaces provided by CITE are:

- a. Power Supply Assembly (PSA) which simulates orbiter electrical power to the CITE payload interfaces and to orbiter avionics located in CITE. Both 400 Hz and 28V dc power are available.
- b. Multiplexer/Demultiplexer (MDM) which interfaces between the orbiter payload MDMs and the bus terminal units connected to the payload.
- c. Caution and Warning (C&W) is used to test the payload C&W inputs and alarms but not the orbiter C&W signals.
- d. Master Timing Unit (MTU) is used to test orbiter timing signals.
- e. Payload Timing Buffer (PTB) is used to test orbiter timing signals.
- f. Pulse Code Modulation Master Unit (PCMMU). The PCMMU provides downlink and downlist formats using the same software load as the orbiter PCMMU.
- g. Payload Data Interleaver (PDI). The PDI provides payload downlink data using the same PDI decom loads as the orbiter.
- h. Payload Signal Processor (PSP). The PSP is used to command and monitor payloads via pre-deployment/attached phase and the PSP/PI in simulated post-deployment phase.
- i. General Purpose Computer (GPC) which provides the capability to execute the flight software in the GPC -- System Management (SM), Guidance, Navigation and Control (GN&C) and Payloads (PL) modes -- to verify orbiter-to-payload interfaces and compatibility.
- j. Standard Switch Panel (SSP) which is used to verify the payload-to-aft flight deck SSP interfaces.
- k. Payload Recorder (PR). CITE simulates the payload recorder input impedance using a 14-track analog recorder to record payload data.
- l. GSE Interface Distributor which supports the T-0 interface through the GSE I/F Distributor. T-0 signals are routed through the distributor to the MLP-10A simulation racks located in room 104. These racks provide the GSE interface to the payload in CITE or the T-0 signals may be routed to GSE or PPF.

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- m. Special CITE Functions. CITE provides special monitoring and support functions such as breakout distributors, patch panels, test points, and signal recording capability for:
 - 1) Mission-unique monitor panel
 - 2) Scientific data panel
 - 3) GSE monitor panel
- n. Payload Interrogator (PI). CITE provides a PI to command and monitor the payload in a simulated post-deployment phase.

4.2.5 AFT FLIGHT DECK (AFD) SIMULATOR. The AFD simulator provides a working platform and support for the payload specialist, on-orbit specialist and mission specialist consoles and electrical interface panels. See figure 4-3.

4.2.6 T-0 UMBILICAL SUPPORT. Figure 4-4 shows the support equipment which is available to checkout payload functions that are routed through the T-0 umbilical. A CITE payload interface distributor interfaces with the T-0 umbilical Xo1307. From room 104, T-0 umbilical signals along with payload antenna signals or payload-unique signals can be distributed through proper switching and impedance matching networks to customer GSE or to the wideband terminal in room 113 for distribution by landlines to other facilities.

4.2.7 CITE EQUIPMENT PHYSICAL LAYOUT. The CITE Electrical/Electronic (E/E) IF/TD, HIMs and V&DA are on the 19.81 m (65-ft) level and the PSA is located on the 16.76 m (55-ft) level (refer to figure 4-5). The AFD MCDS Simulator -- including the SSP and the timing buffer -- are located on the 22.86 m (75-ft) level. A single set of CITE E/E and AFD equipment supports VPF operations (see figure 4-6.) The set is located in the west cell, but cabling can be configured to support testing in either cell, however, dual-cell avionics checkout capability cannot be supported. To physically support the standard mixed cable harnesses (SMCH), each test cell has an east and west harness support fixture which can be extended or retracted (by rotary actuator arm) in a vertical plane through 99 degrees and can be stopped in any position. Each harness support extends from the 4.57 m to the 19.81 m (15-ft to the 65-ft) levels. The harness support contains covered cable trays (four-channeled) and interface panels. The support has mechanical interface panels at Xo576, Xo603, Xo645, (power), Xo688 (data bus), and Xo1203. A ski-slope harness support is used to support the SMCH cables which interface between the AFD and the cradle.

Support equipment may be lifted to work platforms by either the 1.82 metric ton (2-ton) hoist through the material hoistway or by the elevator. Roller plates may be required to move support equipment to service positions.

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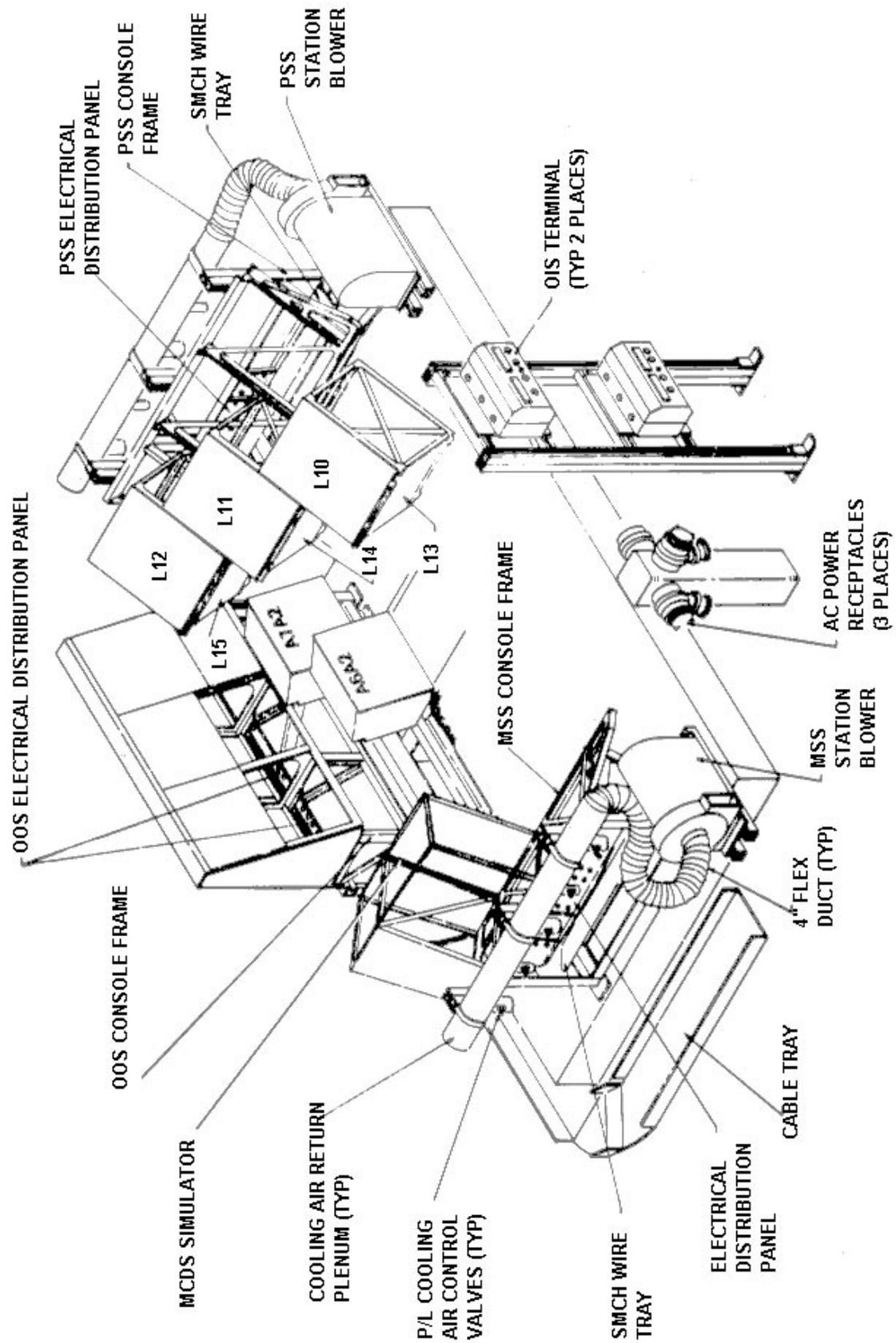


Figure 4-3. Aft Flight Deck Outfitting 22.86 m (75-ft) Level

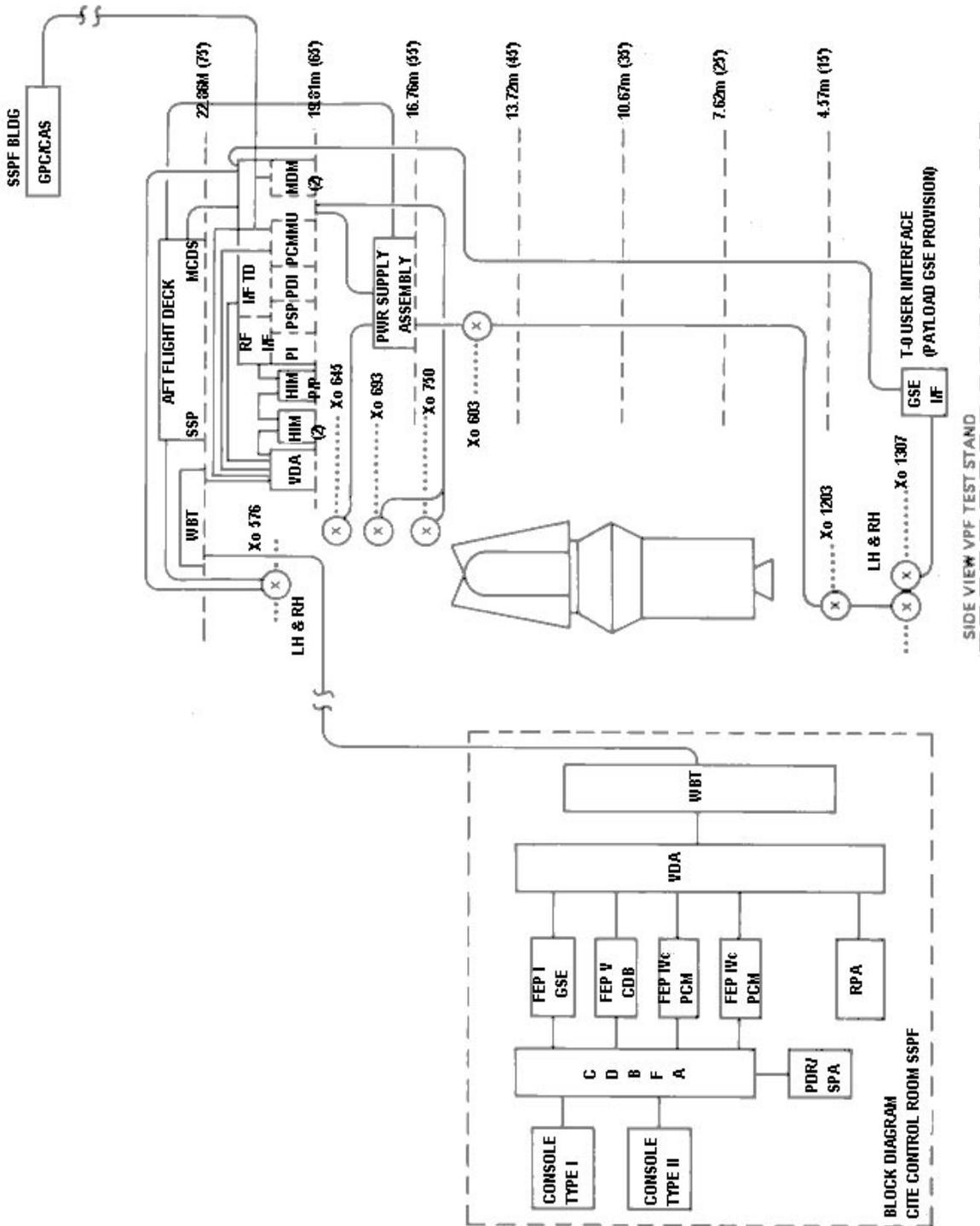


Figure 4-5. CITE Equipment Physical Layouts

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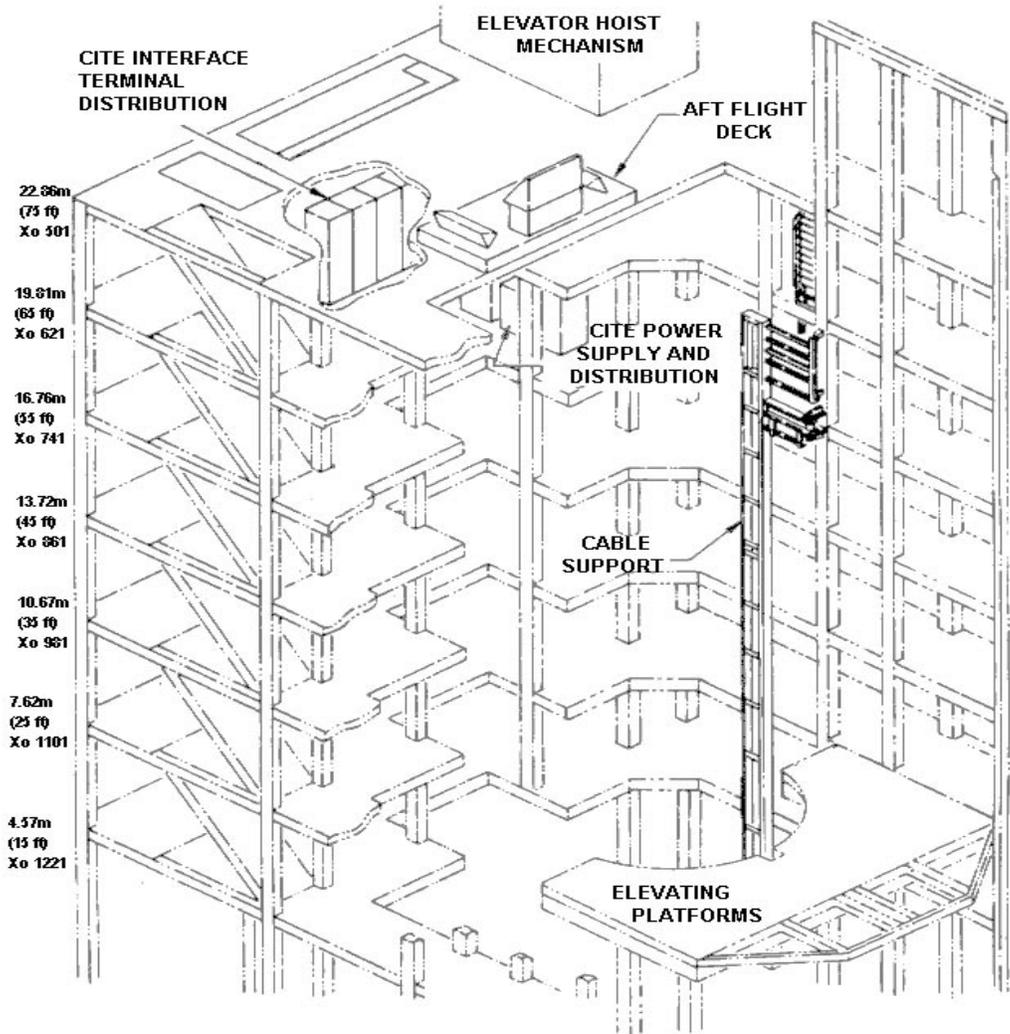


Figure 4-6. VPF CITE Equipment Location

4.2.8 INTERFACE TEST PROCEDURES. Before connecting CITE to a payload, the CITE system is validated to ensure proper, safe and compatible operation with payloads. After the payload is mechanically installed and electrically connected to CITE, a payload interface verification test is performed to validate the interfaces between CITE (the simulated orbiter) and the payload. The payload and carrier owners participate in this test. CITE software is provided to test and monitor CITE hardware prior to and during payload interface testing at CITE.

4.3 AUXILIARY FACILITY INTERFACE POINTS

The north end of the VPF area contains ac power 120/208-V, 100-A, 60-Hz receptacles along with portable instrument grade ac power. An interface panel -- located on the east wall of room 104 -- contains an ac power supply along with an instrument grade power supply.

4.4 FUELING/DEFUELING SAFEGUARDS

PGOC will perform power off/on sequences for VPF Highbay hazardous and non-hazardous classified electrical equipment prior to and after payload fueling or defueling activities in the VPF East Cell. PGOC will safe all electrical systems in accordance with the procedures outlined in OMI 2561, *60 Hz Electrical Systems Shutdown Procedure - VPF*.

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SECTION V

COMMUNICATIONS AND DATA HANDLING

5.1 COMMUNICATIONS

The VPF is serviced by the following administrative and operational communications systems: the Operational Intercommunication System-Digital (OIS-D); closed-circuit television (CCTV); administrative telephones; range timing signal and count-down indicators; and a public address (PA) system.

5.1.1 OIS-D. OIS-D is a multi-channel voice communication network which interconnects payload processing operational areas at KSC and CCAS (see figure 5-1). OIS-D type 53-D cabinets are located in all work areas, and OIS-D headsets can be requested through the LSSM.

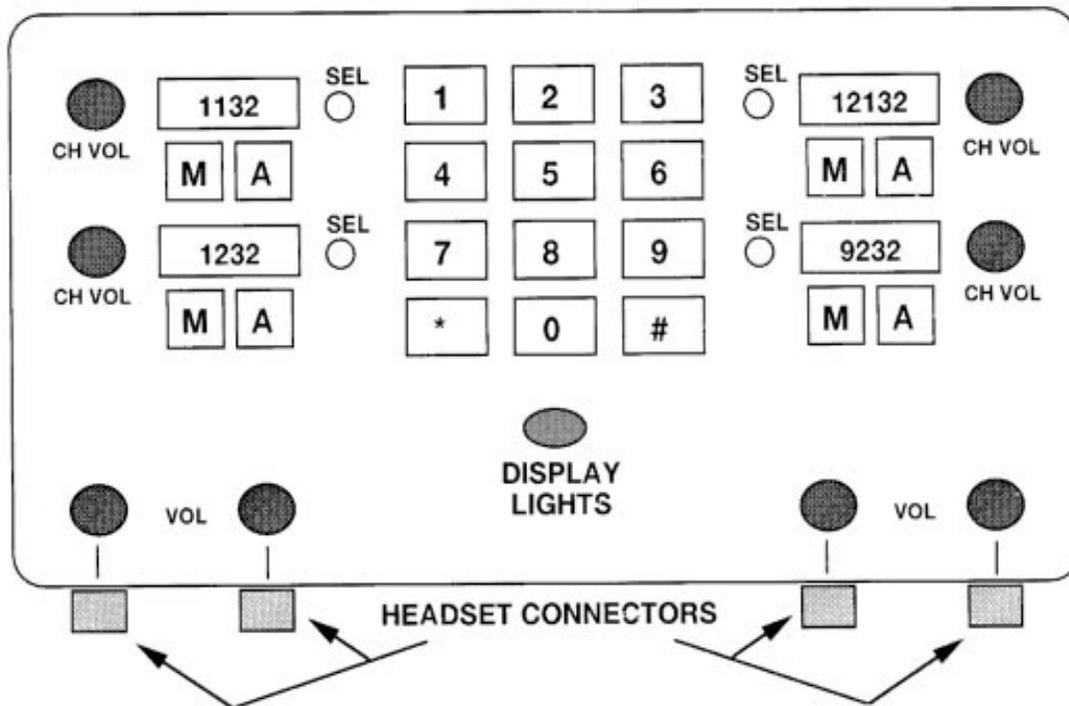


Figure 5-1. OIS-D Type 53-D End Instrument

5.1.2 CLOSED-CIRCUIT TELEVISION. The VPF has five hazard-proof CCTV cameras with zoom, pan and tilt capabilities: two in the highbay -- one on the west wall and one on the east wall; one in the air lock on the west wall; and two portable cameras with the capability to be used on the 4.57 m through 13.72 m (15-ft through 45-ft) levels

of the test cells. Operations can be monitored at viewer discretion in the OSB conference room as well as other areas with access to the CCTV switching system.

CCTV provides closed-circuit video surveillance and recording of payload processing operations in the air lock and highbays. CCTV can be monitored and controlled in areas of the OSB, the CITE control room (SSPF room 2397) and the Video Routing Switcher Systems (VRSS). A monitor capability also exists in both payload control rooms in the SAEF-2 Control Facility (M7-1061).

5.1.3 OTHER COMMUNICATIONS. Other forms of communication located in the VPF include explosion-proof telephones located in the highbay and air lock. The internal PA system is common to both the VPF and OSB. Paging may be inhibited during hazardous or critical operations. Countdown clocks (displaying Greenwich Mean Time and range timing) are installed on the east wall of the highbay and on the 19.81 m and 22.86 m (65-ft and 75-ft) levels of the test cells.

5.2 DATA HANDLING

Wideband and reradiating antenna systems are available in the VPF to support payload element processing requirements. The payload LSSM should be contacted for current data handling capabilities.

5.2.1 WIDEBAND CABLE TRANSMISSION SYSTEM. A wideband terminal distributor is located on the 22.86 m (75-ft) level. CITE signals and payload signals interface at this distributor and continue to the wideband terminal (WBT) in room 113 and to landlines to other facilities.

A hardline communications capability is provided to link the payloads in the VPF with remote GSE located at the PPFs. The hardline communications system consists of data line drivers and receivers which provide the necessary cable compensation for digital data transmission of up to 128 KBPS (BiØ-L) or 256 KBPS (NRZ-L) to and from the PPFs. These data lines meet the RS-422 standards. The WBT is designed to present the same signal characteristics as those found at the VPF and pad. The signal characteristics for a wideband circuit at KSC references an analog or digital signal between 30 Hz and 4.5 MHz at 1.0 Vp-p +/- 0.2 terminated into a 124 ohms balanced load. Twisted pair copper unequipped lines are also available to support customer modems.

Inter-range instrumentation group (IRIG-B), IRIG-E and IRIG-H timing is available on all levels of the test cells and floor. Cabling is routed from the communications room to the test cells and travels up a riser to each cell. A timing distributor box is available on all levels. Timing signals terminate in a connecting block.

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A fiber optics circuit references an analog signal between 30 Hz and 10 MHz or a digital signal between 30 bps and 4 Mbps at 1.0 Vp-p +/- 0.2 terminated into a 124 ohms balanced load or a 75 ohms unbalanced load.

5.2.2 RERADIATING ANTENNA SYSTEM. There are 10 vertically-polarized antennas on the roof of the highbay: four S-band (1.7 to 2.3 GHz); two X-band (7.1 to 8.4 GHz); one low C-band (3.7 to 4.2 GHz); one high C-band (5.9 to 6.4 GHz); one low Ku-band (11.7 to 12.2 GHz); and one high Ku-band (14.0 to 14.5 GHz). The antennas are not fixed in azimuth but manually aligned to support unique customer/mission requirements. Table 5-1 summarizes for RF capability of the VPF.

Table 5-1. RF Capability of VPF

Band	Number of Links	Interface
C	2	AE, Astrotech, PHSF, MOSB, SAEF-2, and SAEF-2 Control Facility
Ku	2	AE, Astrotech, GMIL, PHSF, MOSB, SAEF-2, SAEF-2 Control Facility
S	4	AE, Astrotech, EVCF, GMIL, OPF, PHSF, MOSB, SAEF-2, SAEF-2 Control Facility, and VIB
X	2	GMIL, PHSF, MOSB, SAEF-2, and SAEF-2 Control Facility

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SECTION VI
FACILITY DESCRIPTION SUMMARY

6.1 SAFETY

a.	Automatic fire detection system	Heat-activated devices located in ceilings, infrared and ultra-violet installed on walls and test cells
b.	Manually-operated fire alarms	Pullboxes located in air lock (101), highbay (102), oven (103), and outside
c.	Fire protection system	Water deluge system and manual extinguishers (CO ₂)
d.	Hypergol exhaust system	Highbay
e.	Hypergol drain system	Below test cells in highbay
f.	Scrubber system	4.7 m thru 19.81 m (15-ft through 65-ft) levels with aspirators
g.	Safety equipment	Safety showers, eyewash fountains, audio-visual warning signals, hazard-proof exit lights, emergency breathing air apparatus

6.2 FLOOR SPACE

	VPF	1207.7 m ² (13,000 ft ²) of usable floor space
a.	Air lock	12.8 m x 22.88 m (42 ft wide x 75 ft) long
b.	Highbay	22.88 m x 45.75 m (75 ft wide x 150 ft) long

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- c. Operations Support Building and Annex 929 m² (10,000 ft²)
- d. RTG-F 276 m² (2,967 ft²)

6.3 CEILING HEIGHT

- a. Air lock 22.73 m (74 ft 7 in)
- b. Highbay 32.00 m (105 ft)

6.4 EQUIPMENT ENTRY (CLEAR)

- a. Air lock Rolling equipment door
7.55 m x 21.66 m (24 ft 9 in wide x 71 ft 1/8 in) high
- b. Highbay Vertical leaf door 11.58 m x 21.77 m (38 ft wide x 71 ft 4-1/2 in) high

6.5 CRANES

- a. Air lock One 9.08 metric ton (10-ton) monorail
- b. Highbay One 22.68 metric ton (25-ton) bridge crane

One 10.89 metric ton (12-ton) bridge crane
- c. 22.86 m (75 ft) level test cell 1.8 metric ton (2 ton) hoist

6.6 HOOK HEIGHTS

- a. Air lock 20.02 m (65 ft 8 in)
- b. Highbay 28.34 m (93 ft) 12 ton

28.65 m (94 ft) 25 ton

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6.7 SYSTEMS AND EQUIPMENT

- | | | |
|----|--------------------|--|
| a. | Pneumatics | Compressed air at 0-9.24 bars (0-135 psig) on all levels of test cells except 22.86 m (75-ft) level; 9.24 and 5.52 bars (135 psig and 80 psig) in highbay and air lock |
| b. | C/A exhaust system | Air tools used to retract platforms are serviced by a hose reel connected to an oil supply. The exhaust is contained and routed through an outside vent system |
| c. | Vacuum system | Air lock, highbay, all test cell levels, personnel entry room, locker room, and equipment air lock |
| d. | Gaseous Nitrogen | 413.72/206.86 bars (6000/3000 psig), 51.72 bars (750 psig), 3.45 bars (50 psig) to the test cell |
| e. | Gaseous Helium | 51.72 bars (750 psig) to the test cell |
| f. | Breathing air | 2400 psig at 14.57 m (15 ft), 10.67 m (35 ft), and 16.76 m (55 ft) test cell levels |

6.8 TEMPERATURE/HUMIDITY

- | | |
|-----------------------|--|
| All operational areas | 21.7° +/- 3.3°C (71° +/- 6°F)/55 percent relative humidity |
|-----------------------|--|

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6.9 CLEANLINESS SPECIFICATIONS

- | | | |
|----|----------|---------------------------|
| a. | Highbay | Class 100,000 CWA |
| b. | Air lock | Class 100,000/300,000 CWA |

6.10 ENVIRONMENTAL MONITORING

Test cells in highbay (4 levels); one station in airlock

6.11 ELECTRICAL POWER

- | | | |
|----|------------|---|
| a. | Air lock | 277/480-V/200-A/3-Ø/60 Hz
120/208-V/100-A/3-Ø/60 Hz
120-V/20-A/1-Ø/60-Hz
120-V/30-A/1-Ø/60 Hz |
| b. | Highbay | 277/480-V/60-A/3-Ø/60-Hz
277/480-V/200-A/3-Ø/60-Hz
277/480-V/100-A/3-Ø/60-Hz
120-V/30-A/1-Ø/60-Hz |
| c. | Workstands | 120/208-V/60-A/3-Ø/60-Hz
120-V/20-A/1-Ø/60-Hz
120/208-V/30-A/3-Ø/60-Hz
277/480-V/200-A/3-Ø/60-Hz
120-V/30-A/1-Ø/60-Hz |

6.12 ILLUMINATION

- | | | |
|----|-----------|----------------------------------|
| a. | Highbay | 645 lm/m ² (60 f-c) |
| b. | Platforms | 1075 lm/m ² (100 f-c) |

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6.13 COMMUNICATIONS

- | | | |
|----|-----------------------|---|
| a. | CCTV | |
| | 1) Surveillance areas | Air lock and highbay |
| | 2) Monitor area | OSB conference room
CITE Control Room
(SSPF 2397) and VRSS
Payload control rooms in
SAEF-2 Control Facility
(M7-1061). |
| b. | Telephones | Commercial telephone
service with FTS capability |
| c. | OIS-D | Transmit and receive from
KSC and CCAS |
| d. | Public address | All areas and exterior |
| e. | Other | Range timing signal and
countdown indicators |

6.14 DATA HANDLING

- | | | |
|----|------------------------------|---|
| a. | Wideband transmission system | |
| | 1) Frequency | 30 Hz to 4.5 MHz |
| | 2) Capability | TV video, telemetry, data
display, OIS-D, automated
payload checkout and
surveillance monitoring
information, timing
distribution (IRIG-B, IRIG-
E, and IRIG-H) |
| b. | Radiating System | C-band to AE, Astrotech,
PHSF, SAEF-2, MOSB

Ku-band to AE, Astrotech,
GMIL, PHSF, SAEF-2,
MOSB |

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S-band to AE, Astrotech,
EVCF, GMIL, OPF, PHSF,
SAEF-2, VIB, MOSB

X-band to GMIL, PHSF,
SAEF-2, MOSB

c. Digital data transmission

1) Data rate

256 KB (NRZ-L), 128 KB
(BIØ-L)

2) Capability

RS-422

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BB-D	C. BEGGS
BE	M. CARDONE
BE-B	J. BOURNE
BE-E	J. LACKOVICH
BE-F	D. WEBB
BE-F2	D. STIGBERG
BL-C2	C. MCEACHERN
BQ-C	J. STRAITON
BR	R. HEUSER
BR-C	W. FLETCHER
BR-C	S. GREEN
BR-C	K. MEASE
JPL-AO/CCAS	S. BERGSTROM
MDS&DS-KSC-F200	J. SCHOFIELD
MDS&DS-KSC-F206	M. HUTCHINS
MDS&DS-KSC-F364	K. PAGE
MDS&DS-KSC-F562	D. THOMAS
MDS&DS-KSC-F602	D. CROOKER
MDS&DS-KSC-F626	P. SECCURO
MDS&DS-KSC-F674	D. DAILEY

TOTAL**20**

For distribution changes contact your Validation Representative:

KSC/BB--P. Davis:[BR-B3,7-7755]

KSC/DE/DF/DL--E. Rhodes:[DF-FSO,7-4112]

KSC/EC--M. Page:[EC-E-D,7-2020]

KSC/IM--H. Brown:[IM-SST-K,7-4540]

KSC/PH--H. Johnson:[PH-E,7-3898]

ALL OTHERS [PAYLOAD]--P. Davis, BR-B3, (407)867-7755

ALL OTHERS [SHUTTLE]--H. Johnson, PH-E, (407)867-3898

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