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**GROUND ELEMENTS
COMMAND, CONTROL & COMMUNICATIONS
PROJECT**

**RACK
PROCUREMENT SPECIFICATION**

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SPECIFICATION FOR THE LCS

RACK

1. GENERAL

1.1 Rack Description

The Rack provides the enclosure that houses Launch Control System hardware.

1.2 Purpose of This Document

This specification establishes the general characteristics, performance and design requirements of the Rack. This specification also defines the deliverable documentation requirements and delivery preparation, packaging, and shipping requirements.

1.3 Requirements Weighting Definitions for This Document

Specific meanings have been assigned to the words “shall”, “should”, and “will” as follows:

- “Shall” indicates a requirement to provide a function. “Shall” indicates that the requirement is mandatory and will be the subject of specific compliance verification for acceptance.
- “Should” indicates a desired goal for which there is no objective test. “Should” indicates that the product will attempt to achieve the desired goal to the maximum extent feasible while still remaining cost effective. This should not be at the expense of mandatory requirements. Statements using “should” may be subject to specific acceptance testing, but only to qualitatively assess the level of achievement of the goal against a specific defined set of test criteria.
- “Will” indicates a statement of fact or provides information and is not subject to any acceptance testing. Statements using “will” must not, by definition, refer to a goal or a requirement.

1.4 Vendor Assurance

- a. The Rack warranty requirements shall be as follows:
 - (1) The Vendor shall furnish factory warranties against defects in materials and/or workmanship on the Rack supplied.
 - (2) The Rack Enclosure warranty shall be for 30 years after final acceptance.

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- (3) Failed assemblies will be repaired or replaced by the vendor under the warranty. Either the vendor will provide an on-site service representative for warranty repair work, or the vendor will assume all shipping costs, to and from KSC, associated with warranty repair work.
- b. When available, provide vendor certification documentation such as ISO9001SAE, AS9100B, ISO 9001 and/or SAE AS9003, Inspection and Test Quality System for Hardware and/or CMM or CMMI Level Appraisal for Software."

1.5 Deliverable Documentation

The Vendor shall deliver all required Rack documentation to KSC concurrent with the delivery, as described below.

1.5.1 Operations and Maintenance (O&M) Manuals

- a. One (1) set of Operations & Maintenance (O&M) production documentation and data instructions shall be supplied by the Vendor.
- b. O&M production documentation and data instructions shall be supplied by the Vendor with the first shipment.
- c. All O&M production documentation and data instructions (e.g., O&M manuals, drawings, user's guides and other forms of O&M data customarily supplied by the Vendor) shall be in the English language.
- d. O&M production documentation and data instructions information shall be in the form of printed manuals and/or PDF files and customarily supplied data, consisting of the following as a minimum:
 - 1) Rack general description, including basic features, characteristics, and specifications that describe the general physical and functional makeup and operation of the Rack.
 - 2) If applicable, a complete set of instructions for administrative functions, including block diagrams and pictorial diagrams, shall be provided.
 - 3) Operating instructions that contain a full and detailed step-by-step procedure to accomplish any setup or operation the unit is required to perform, without making any assumptions (for example, about pre-existing conditions), and diagnostic processes, preventive maintenance, and troubleshooting procedures.

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- e. Any additional documentation that the vendor can make available to provide insight into the workings of the Rack, either in hard copy or soft copy format, would be desired by the Government.
- f. The vendor shall provide a written right of transfer to NASA and the rights to copy by NASA (and its designated vendor representatives) for inclusion in on-site maintenance documentation if in hardcopy form.

1.5.2 Acceptance Testing Data Package

The Vendor shall provide a certificate of compliance for this specification package.

1.6 Maintenance

The useful life of the Rack shall be 30 years with normal servicing and replacement of parts, during which time all requirements contained in the specification shall be met.

2. RACK REQUIREMENTS

2.1 Environmental Requirements

2.1.1 Non -Operating Environment

- a. The Rack shall be designed to be stored within an ambient temperatures of -17° C (0° F) to 49° C (120° F).
- b. The Rack shall be designed to be stored within a relative humidity range of 10% to 80%, non-condensing.

2.2 Design and Construction Requirements

The design and construction requirements presented in this section address the general Rack design requirements. These requirements are imposed to maximize safety, reliability, commonality, maintainability, and usability.

2.2.1 Shielding Requirements

The rack shall provide shielding from 2 MHz to 18 GHz by 20 dB or greater to reduce the susceptibility of the equipment in the rack to electromagnetic interference (EMI) emissions. The rack shall be tested in accordance with MIL-STD-461F for radiated susceptibility (RS103).

2.2.2 Operating Supply Voltage

Exhaust fans shall operate normally within the ranges of 200 VAC to 240 VAC and 57HZ to 63Hz

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2.2.3 Design Requirements

- a. The Rack shall be compliant with either Underwriters Laboratory specifications or the International Equipment Consortium (IEC) specifications for product safety.
- b. The Rack shall use protective coatings and finishes in accordance with the supplier's standard commercial practices.
- c. The Rack, at maximum loaded weight of 2,000 pounds, shall be of sufficient structural rigidity to avoid separation of seams and joints during normal transportation and installation.
- d. Rack fastening hardware (bolts, screws, washers, nuts, Unistrut nuts, etc.) shall be Stainless Steel conforming to applicable Military standards for the types and sizes. The vendor may recommend hardware items, providing the items are cost effective, proven to have equal strength, and better resistance to both electrolytic and environmental corrosion.
- e. Rack metallic parts making up the total cabinet shall provide continuous metal-to-metal contact, bare metal, or conductive finish, at all joints and mating surfaces.
- f. Rack rails shall be non-painted and provide continuous metal-to-metal contact to equipment mounted on rails.
- g. The Rack's DC resistance across the bond of the cabinet shall not exceed 10.0 milliohms as measured directly across the mating surfaces.
- h. When the Rack is cleaned/wiped with standard industrial cleaners (i.e. isopropyl alcohol), no paint shall be removed.
- i. When standard industrial tape has been adhered to/removed from the Rack, no paint shall be removed.
- j. Rack materials shall be fungus resistant or shall be treated to resist fungus.
- k. Rack metal parts shall be treated to resist corrosion. Dissimilar metals shall not be used in direct contact unless treated for protection against electrolytic corrosion without degradation of shielding effectiveness.
- l. Use of items, with a limited life, in the Rack shall be avoided whenever possible. Items (rubber bushings, gaskets, etc.) with limited life (less than the useful life of 30 years) shall be identified in the parts list.

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- m. The Rack design shall minimize the need for special tools required for rack assembly and equipment installation at the customer's location.
- n. The Rack shall be designed, fabricated, and tested in accordance with best commercial practices. Vendors should indicate areas where significant cost avoidance could be achieved with a slight deviation in requirements.
- o. Rack screws, nuts, and bolts shall show no evidence of cross threading, mutilation, or detrimental or hazardous burrs.
- p. Rack parts, such as hinges, catches, handles, or knobs shall be assembled in such a manner as to avoid damaging the hardware or mounting surface.
- q. Rack part numbers shall be metal stamped or stamped/silkscreened per best commercial practices.

2.3 Rack Specifications

This section defines the specifications for the Rack. These definitions describe the specific requirements for the Rack.

2.3.1 Rack Physical Requirements

- a. The Rack shall accommodate 48.26 cm (19") wide rack-mountable equipment.
- b. The Rack shall have a maximum external width of 60.96 cm (24").
- c. The Rack shall have a minimum internal depth of 106.7 cm (42").
- d. The Rack shall have a maximum external depth of 121.9 cm (48"), including doors.
- e. The Rack shall provide 44RU (77") of vertical RETMA space.
- f. The Rack shall have a minimum load capacity of 907.17 kg (2,000 lb).
- g. The Rack shall have square-punched rails.
- h. The Rack shall have rails that use 10-32 snap-in cage nuts.
- i. The Rack front rails shall be adjustable.
- j. The Rack rear rails shall be adjustable.
- k. The Rack finish shall be powder-coated.

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- l. The Rack color shall be FED-STD-595 black #37038 or equivalent.
- m. The Rack shall have a removable solid front door.
- n. The Rack shall have a removable solid rear door.
- o. The Rack shall have lockable doors that use a keyed lock.
- p. The Rack shall have removable solid side panels with internal fastening hardware.
- q. A ground point shall be provided inside the rear of the Rack.
- r. The Rack shall be made to be secured to a raised floor by Unistrut clamping method.
- s. The Rack shall be made to be secured on a solid floor by bolting method.
- t. The Rack door hinges shall be on the left side of the rack.
- u. Rack door latching mechanisms shall be installed in such a manner as not to protrude into the enclosure opening.
- v. Rack door latching mechanisms shall be installed in such a manner as not to interfere with panel-mounted hardware.
- w. The Rack shall accommodate removable lifting eyes on the top of the rack.
- x. The Rack top panel shall be perforated with exhaust fans and be removable using internal fastening hardware.
- y. Rack exhaust fan assembly shall have IEC-60320 C14 plug.
- z. The Rack rail hole pattern shall be universally spaced in accordance with EIA-310-E.
- aa. Rack Z-rails shall have holes on both flanges.
- bb. Rack L-rails shall have holes on both flanges.
- cc. Rack Z-rails shall be continuously adjustable in the horizontal direction front to back.
- dd. Rack L-rails shall be continuously adjustable in the horizontal direction front to back.
- ee. The Rack shall have the capability to allow cable access from the top of the rack.
- ff. The Rack shall have the capability to allow cable access from the bottom of the rack.

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gg. The Rack shall have an open bottom with a removable solid internal plate, held in place with internal mounting hardware.

hh. The Rack shall provide the capability to be bolted to adjacent racks with or without side panels installed.

ii. The Rack shall provide the capability to install additional mounting hardware in the internal horizontal rails.

2.4 Rack Accessories

The vendor shall be able to provide the following accessories:

- a. Perforated Door
- b. Clear Door
- c. Solid Top Panel
- d. Blowers & Fan / Fan Trays
- e. Bus Bar
- f. Cable Management
- g. Drawers

1. Sizes

- I. 5.25"
- II. 7.00"
- III. 8.25"
- IV. 10.50"

h. Blank Panels

1. Sizes

- I. 1.75"
- II. 3.50"
- III. 5.25"
- IV. 7.00"
- V. 8.75"
- VI. 10.50"
- VII. 12.25"
- VIII. 14.00"

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- IX. 15.75"
- X. 17.50"
- XI. 19.25"
- XII. 21.00"
- XIII. 22.75"
- XIV. 24.50"
- XV. 28.00"
- i. Shelves
- j. Supporting Angles

3. PREPARATION FOR DELIVERY

The Vendor shall be responsible for preservation, packaging, and packing the Rack and associated Rack and deliverable documentation, marking packages and containers, and shipping them to KSC:

- a. The rack and accessories shall not be delivered with missing, inoperative, defective, bent, broken or otherwise damaged parts.
- b. Loose burrs/metal fragments shall be vacuumed from the cabinets.
- c. Rack surfaces shall be wiped with isopropyl alcohol to remove dust and dirt prior to shipping.
- d. The rack and deliverable documentation shall be packed in shipping containers which ensure acceptance by common carrier and safe delivery at destination.
- e. Shipping containers shall comply with the Department of Transportation (DOT) common carrier rules and regulations as applicable to the mode of transportation.
- f. Containers shall be compatible with on-site normal transportation, handling, and storage methods.
- g. Packaging techniques shall be used to prevent damage from vibration, shock and weather (including solar radiation) encountered during transportation, handling, and storage.

4. ABBREVIATIONS AND ACRONYMS

Term	Definition
	- A -
	- B -

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Term	Definition
	- C -
C	Celsius
CD	Compact Disc
CoC	Certificate of Compliance
COTS	Commercial off the Shelf
	- D -
dB	Decibels
DOT	Department of Transportation
DVD	Digital Video Disc
DWS	Development Workstation
	- E -
EDL	Edit Decision List
EMI	Electromagnetic Interference
	- F -
F	Fahrenheit
FCC	Federal Communication Commission
FSB	Front Side Bus
	- G -
GB	Gigabit
GHz	Gigahertz
GUI	Graphical User Interface
	- H -
HWCI	Hardware Configurable Item
	- I -
IEC	International Equipment Consortium
	- J -
	- K -
KSC	Kennedy Space Center
	- L -
LCS	Launch Control System
	- M -
MHz	Megahertz
	- N -
NASA	National Aeronautics and Space Administration
	- O -

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Term	Definition
	- P -
	- Q -
	- R -
RAID	Redundant Arrays of Independent Disks
RETMA	Radio Electronics Television Manufactures Association
RPM	Revolutions Per Minute
	- S -
SATA	Serial Advanced Technology Attachment
	- T -
	- U -
UL	Underwriters Laboratory
	- V -
	- W -
	- X - Y - Z -