

**LAUNCH CONTROL SYSTEM  
CONSOLE ENCLOSURE ACQUISITION  
REQUEST FOR INFORMATION**

**Kennedy Space Center, FL 32899**

**October 28, 2008**

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## ABBREVIATIONS AND ACRONYMS

Units of measure and some terms commonly understood within the subject disciplines have been abbreviated in the body of this document without callout but are included among the following.

ABA	Architectural Barriers Act
ADA	Americans with Disabilities Act
ANSI	American National Standards Institute
BTU	British Thermal Unit
C&C	Command and Control
CCC	Command, Control, and Communications
cm	centimeter
COMM	Communications (Subsystem)
CP	Control Panel
CxP	Constellation
dB	decibel
ECA	Electronic Components, Assemblies and Materials Association
EIA	Electronic Industries Alliance
ELV	Expendable Launch Vehicle
EMI	electromagnetic interference
FR4	Firing Room 4
GFE	Government-furnished equipment
GHz	gigahertz
GOP	Ground Operations Project
GSE	Ground Support Equipment
GS-HFRD	Ground Systems Human Factors Requirements Document
HF	Human Factors
HVAC	Heating, Ventilating, and Air Conditioning
IT	Information Technology
JSC	Johnson Space Center
KSC	Kennedy Space Center
LCS	Launch Control System
LRU	line replaceable unit

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NE	Engineering Directorate
NEMA	National Electrical Manufacturers Association
OE	Operations Engineering
OIS	Operational Intercommunication System
OTV	Operational Television
PAO	Public Affairs Office
PAWS	Paging and Area Warning System
PDC	Power Distribution Chassis
RF	radio frequency
RETMA	Radio Electronics Television Manufacturers Association
RU	rack unit
SBU	Sensitive But Unclassified
SE&I	Systems Engineering and Integration
STD	standard
TBD	to be determined
TBR	to be resolved
TC	Test Conductor
TIP	Technical Integration Panel
TM	Test Management
UN	Utility Network
V/m	volts per meter
VAC	volts alternating current
VESA	Video Electronics Standards Association

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## 1 INTRODUCTION

### 1.1 Purpose

The purpose of this document is to describe the technical design associated with the Console Enclosures of the Launch Control System (LCS).

### 1.2 Scope

This document defines the conceptual design of Console Enclosures for the LCS Control Rooms.

### 1.3 Reference Documents

The following documents contain supplemental information to guide the user in the application of this document. In addition, documents which are specifically referenced in the rationale herein will be listed in this table.

Document Number	Title	Version
ECA EIA/ECA-310-E	Cabinets, Racks, Panels, and Associated Equipment	Rev E
	Architectural Barriers Act (ABA)*	
	Americans with Disabilities Act (ADA)*	
36 CFR Part 1190 and 1191	ADA and ABA Accessibility Guidelines*	
FED-STD-595	Federal Standard Colors Used in Government Procurement	Rev C
* Codified in Title 42 and Title 29 of the United States Code.		

## 2 ENCLOSURE DESIGN

### 2.1 Description

The LCS Console Enclosures provide a modular mounting system for writing surfaces, display devices, panel-mounted equipment, computer workstations, communications equipment, cabling, and internal power distribution. The enclosures are designed specifically for mission critical operations that emphasize operator ergonomics and ease of access to equipment. They support a design that facilitates situational awareness for multiple operators.

LCS Console Enclosures include:

- Operations Engineering (OE)
- Test Management (TM)
- Operations Engineering Mini (OE-Mini)

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- Test Management Mini (TM-Mini)
- Wedges

Each of these designs carefully considers reach and equipment placement to improve operator comfort and flexibility. All enclosures recognize guidelines established by the Americans with Disabilities Act (ADA) and the Architectural Barriers Act (ABA), as well as the Human Factors Guidelines established by NASA.

The enclosures are designed to accommodate operational and technological changes and provide the capability for equipment interchangeability, assembly or replacement on-site.

The base design accommodates various equipment and system requirements including workstation towers, network patch panels, cable management, power distribution, and equipment grounding. Depending on placement in a facility, equipment is accessible from both the front and rear for servicing and upgrades. The base also provides leveling and EMI shielding.

The hood and desktop design accommodate workstation displays, keyboards and mice, desktop speakers, IT Security card readers, network and power connectivity for laptop computers, panel-mounted equipment, and telephones. In addition, the hood provides a sound barrier.

Console enclosures are constructed so that desktops do not move independently when two or more enclosures are connected together. Enclosures accept Wedges that allow series mounted enclosures to be connected together and Extended Wedges for additional desktop work space.

## **2.2 OE/TM Enclosures**

### **2.2.1 General**

OE and TM Enclosures consist of an independent base, hood, and desktop. Modular construction allows for transport and assembly in Control Room applications throughout the LCS. OE and TM Enclosures are the same physical size with the ability to interchange panel-mounted equipment and alter the amount of rack-mount space. This allows the OE and TM Enclosures to share a common design.

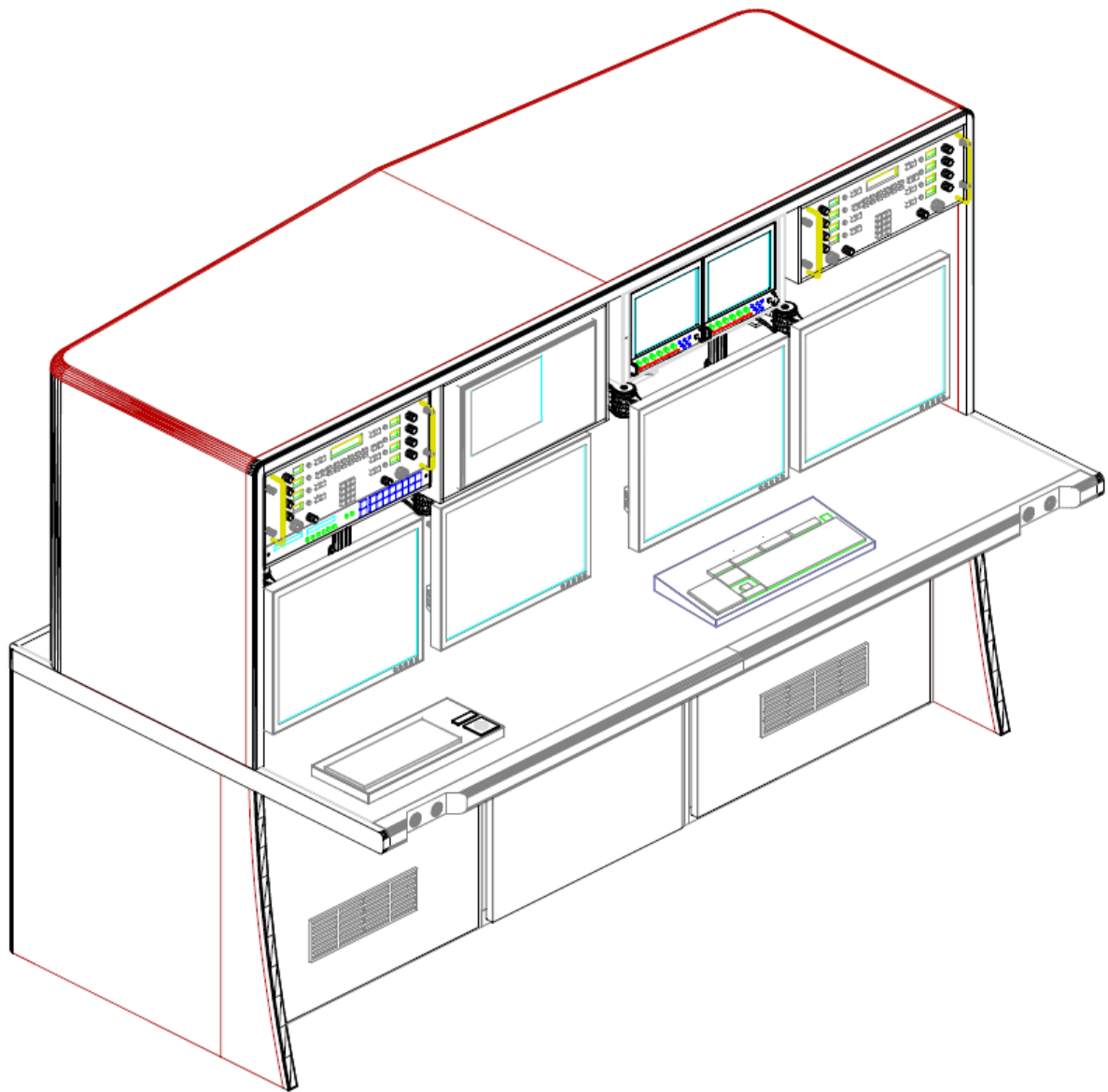
OE/TM Enclosures accommodate computer workstations, voice and video communications equipment, internal power distribution, and provide external power and network connectivity for remote computing for Systems Engineers.

OE/TM Enclosures accommodate up to four workstations and four flat panel displays. Nineteen inch (19") RETMA standard rack-mount space as defined by EIA ANSI/EIA-310 is available in two rack unit (2RU) to fourteen rack unit (14RU) configurations in up to four locations along the hood. The primary difference between enclosure configurations is the size of the RETMA chassis installed and the quantity of monitors supported. Modular construction allows multiple RETMA and monitor configurations. The space between the hood and desktop constrains configurations. A large rack-mount space will limit the number of displays that can be installed.

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OE/TM Enclosures are designed to be freestanding using removable supports and do not require physical securing to the floor or under floor substructure. OE/TM Enclosures are designed to stand alone, be attached directly together in a straight line, or be attached together using Wedges. Wedges are available as straight or angled to form a curve. In addition, Extended Wedges add another foot of desktop space to the front of the enclosure. All enclosures are accessible from both front and rear and designed for placement as close as two inches (5.08 cm) from the wall.

**Figure 2.2-1** depicts an OE/TM Enclosure configured for Operations Engineering.

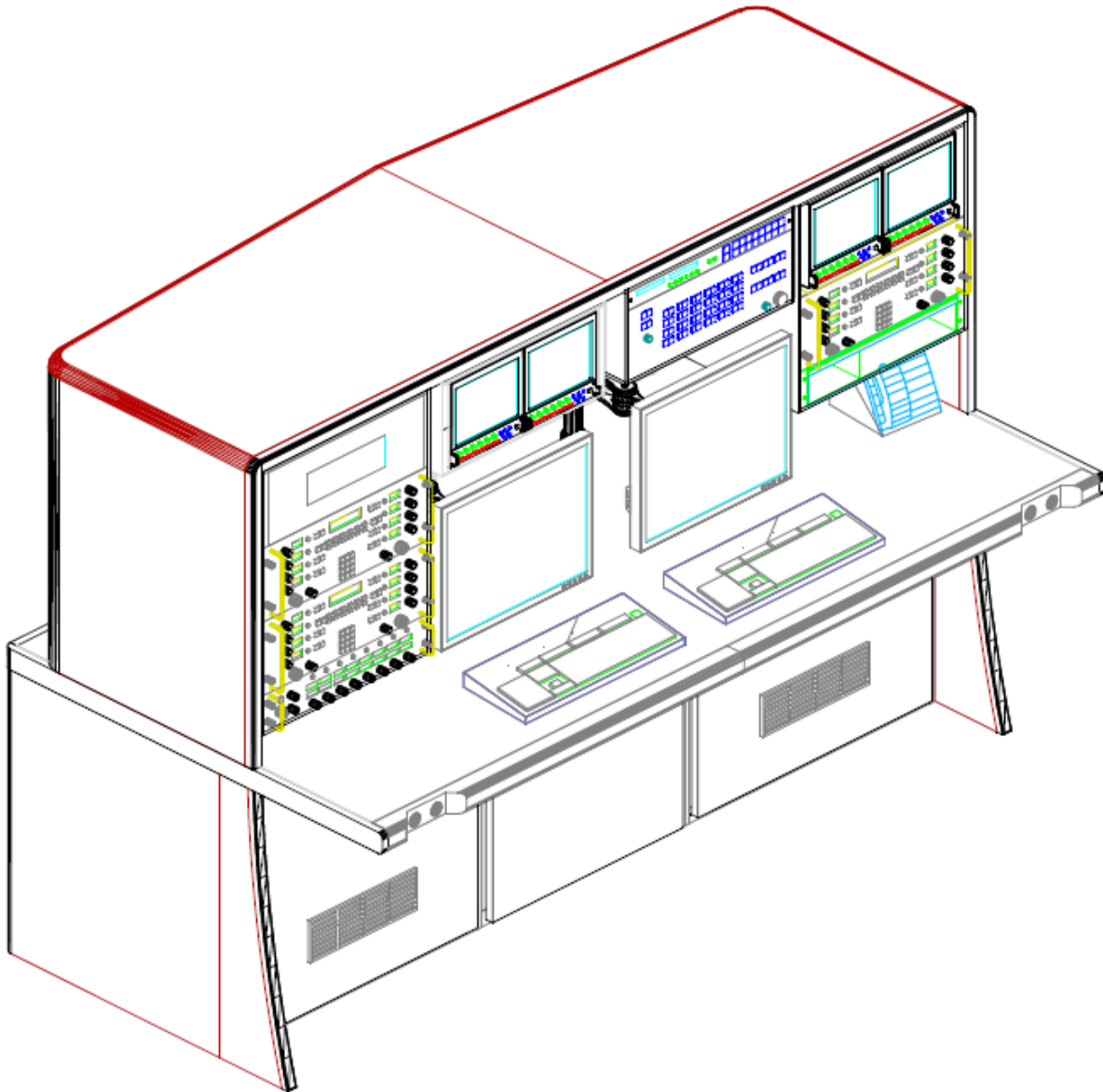


**Figure 2.2-1 OE/TM Enclosure Configured for Operations Engineering**



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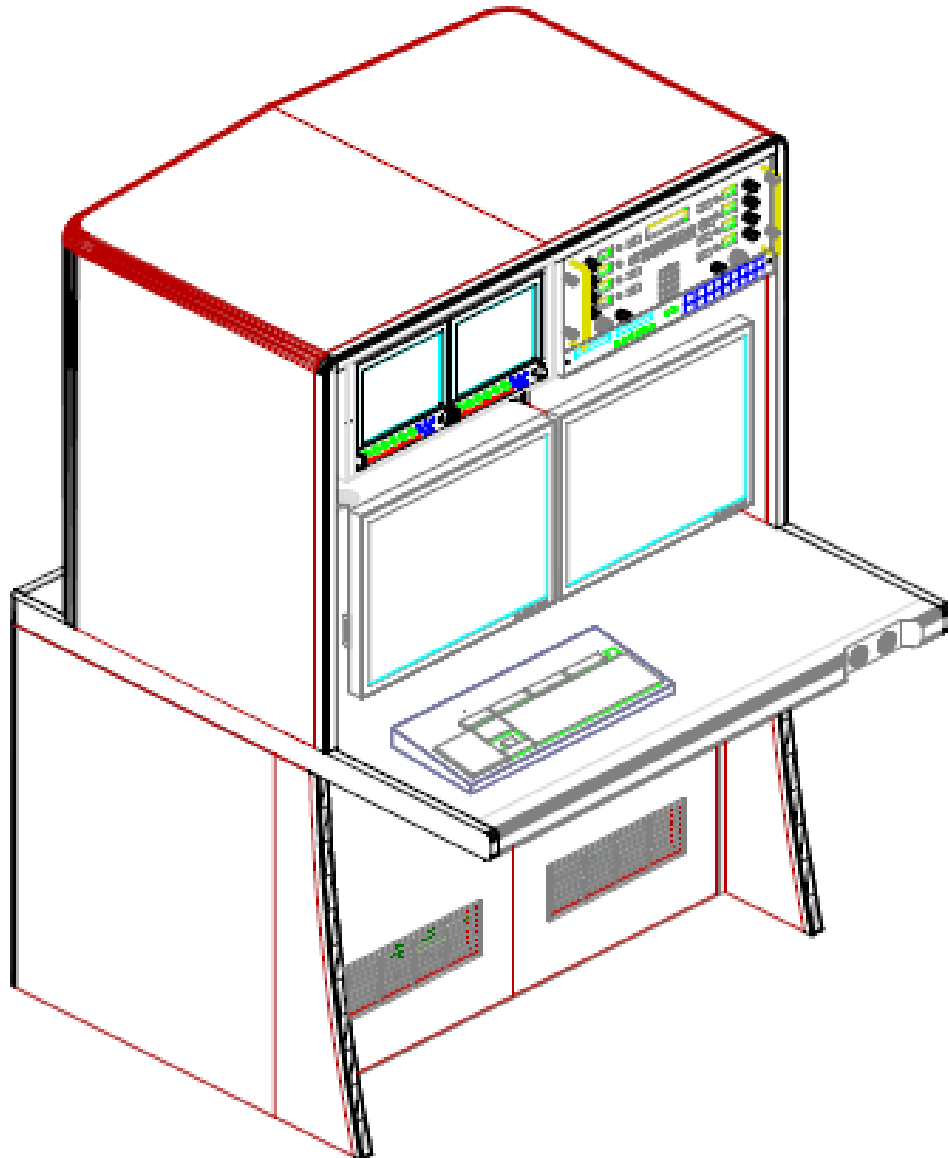
**Figure 2.2-2** depicts and OE/TM Enclosure configured for a Test Director. **Figure 2.2-3** depicts an OE/TM-Mini Enclosure configured for the Chief Engineer.



**Figure 2.2-2 OE/TM Enclosure Configured for a Test Director**

OE/TM-Mini Enclosures share the same physical characteristics and architectural features as OE/TM Enclosures but are only half as wide, accommodate up to two workstations, two displays, and two 19" RETMA standard rack-mount spaces in two rack unit (2RU) to fourteen rack unit (14RU) configurations.

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**Figure 2.2-3 OE/TM-Mini Enclosure Configured for the Chief Engineer**

### **2.2.1.1 General Dimensions and Ergonomic Characteristics**

OE/TM Enclosure dimensions and architectural features were established based on support equipment requirements, launch vehicle system quantities, the ability for console users to see over the enclosure, and available floor space in KSC Control Rooms. Dimensions were validated through mock-up evaluations, design team analysis, and user reviews. OE/TM Enclosure general dimensions are as follows.

#### **OE/TM Enclosure**

- Maximum Height: 59 inches (149.86 cm)

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- Preferred Height: 58 inches (147.32 cm)
- Maximum Width: 84 inches (213.36 cm)
- Maximum Depth: 44 inches (111.76 cm)
- Maximum Desktop Height: 29.5 inches (74.93 cm)
- Desktop Leading Edge to Hood: 15 inches (38.10 cm)

### **OE/TM-Mini Enclosure**

- Maximum Height: 59 inches (149.86 cm)
- Preferred Height: 58 inches (147.32 cm)
- Maximum Width: 42 inches (106.68 cm)
- Maximum Depth: 44 inches (111.76 cm)
- Maximum Desktop Height: 29.5 inches (74.93 cm)
- Desktop Leading Edge to Hood: 15 inches (38.10 cm)

All enclosures recognize guidelines established by the Americans with Disabilities Act (ADA) and the Architectural Barriers Act (ABA), as well as the Human Factors Guidelines established by NASA. Key ADA/ABA guidelines reflected in the OE/TM Enclosure design are as follows and depicted in **Figure 2.2-4**.

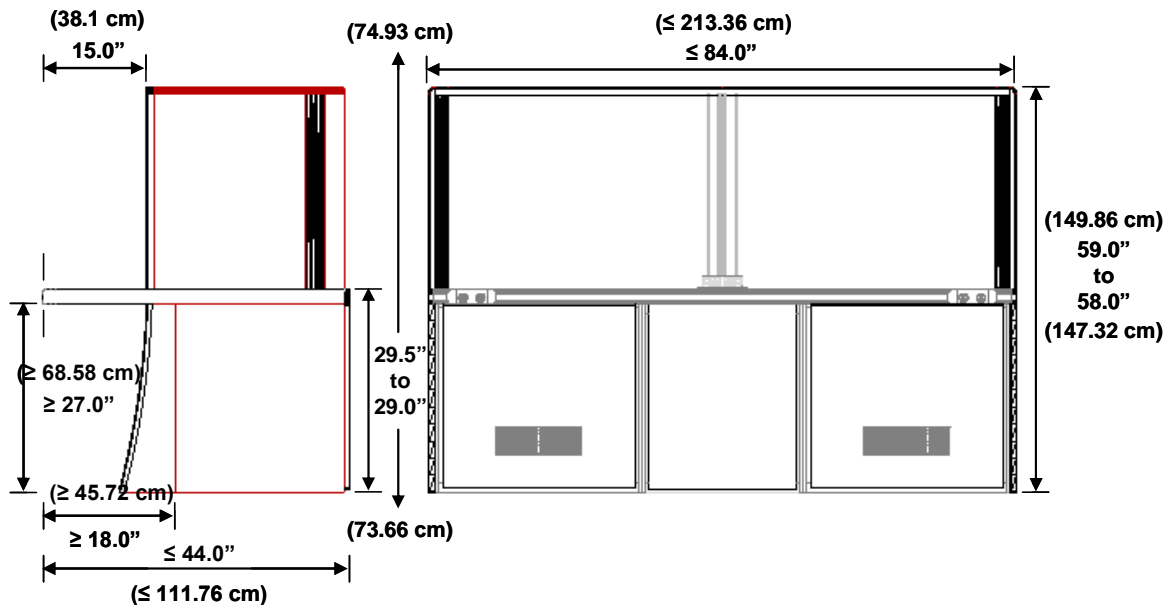
- Knee Space (floor to bottom of desktop):  $\geq 27$  inches (68.58 cm)
- Knee Space (desktop leading edge to base):  $\geq 18$  inches (45.72 cm)

While not specifically addressed in ADA/ABA, other factors considered in the design include distance to displays, visibility when standing, and equipment reach. There are no protrusions or obstructions below the desktop that would interfere with or injure the seated user.

#### **2.2.1.2 Materials and Finishes**

OE/TM Enclosures are finished metal and high quality laminates with no exposed, unfinished wood on any enclosure interior or exterior surface. Metals used in construction of the enclosures are non-corrosive or treated to resist corrosion. External surfaces are washable, resistant to mild abrasion, and not subject to damage by common liquid spills or common cleaning agents. Enclosures match the color scheme for Firing Rooms as selected by NASA and convey an “executive” appearance.

Laminates used in the construction of the enclosures are high pressure. Painted metal surfaces are powder coat or baked enamel, flat sheen.



**Figure 2.2-4 OE/TM Enclosure General Dimensions**

### 2.2.1.3 Colors

- Laminates are Wilsonart “Wild Cherry” #7054-60 or similar.
- Work surfaces are Wilsonart “Cloud Zephyr” #4856-60 or similar.
- Metal solid surfaces are Black FED-STD-595 #17038 or similar.
- End caps, trim, and grill surfaces are Black FED-STD-595 #17038 or similar.

**Figure 2.2-5** depicts an OE/TM Enclosure in applicable color scheme. The colors and textures shown are an example and do not represent a specific requirement.

### 2.2.1.4 Displays

OE/TM Enclosures accommodate up to four workstations and four flat panel displays. The quantity of displays is based on console functionality. A typical OE Enclosure has two workstations and four flat panel displays. A typical TM Enclosure has two workstations, two flat panel displays, and additional RETMA mounting area above the desktop.

Workstation displays have Video Electronics Standards Association (VESA) mounting capability. All displays are mounted to the enclosure using fixed height, non-rotating (landscape only) monitor arms. The monitor arms provide user adjustable tilt, swivel, and horizontal articulation. To preserve space for documentation and keyboards, installed displays are approximately 3 inches (7.62 cm) above the desktop at 90 degrees and no less than 2 inches (5.08 cm) above the desktop when fully tilted. Monitor arm mounting may be by pole, slat board, or other mounting scheme as proposed by the enclosure manufacturer.

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**Figure 2.2-5 OE/TM Enclosure Color Scheme**

With panel-mounted equipment above the displays and keyboards below, workstation display external dimensions are limited to 14"H X 19"W X 3.5"D (35.56 cm H X 48.26 cm W X 8.89 cm D) without stand. The maximum display weight is 18 pounds (8.16 kg).

Monitor arm design criteria are as follows:

- Mounting Location (from desktop leading edge to monitor mount leading edge):  $\geq 29$  inches (73.66 cm)
- Display Articulating Motion:  $\leq 14$  inches (35.56 cm) from desktop leading edge to  $\geq 26$  inches (66.04 cm) from the desktop leading edge.
- Display Height Range: 7 inches (17.78 cm) to 12 inches (30.48 cm) from the desktop measured from desktop to the center of monitor plate, adjustable in  $\leq 0.125$  inch (0.3175 cm) increments.
- Monitor Arm Deflection:  $\leq 0.5$  inch (1.27 cm) w/21 pound (9.5 kg) load.

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- Cable Management – Monitor arms provide cable management so cables are hidden from view and can move undamaged with the display.
- Knurled Display Mounting Knobs – Allow displays to be easily removed from the front.

Figure 2.2-6 depicts the Monitor arm design criteria.

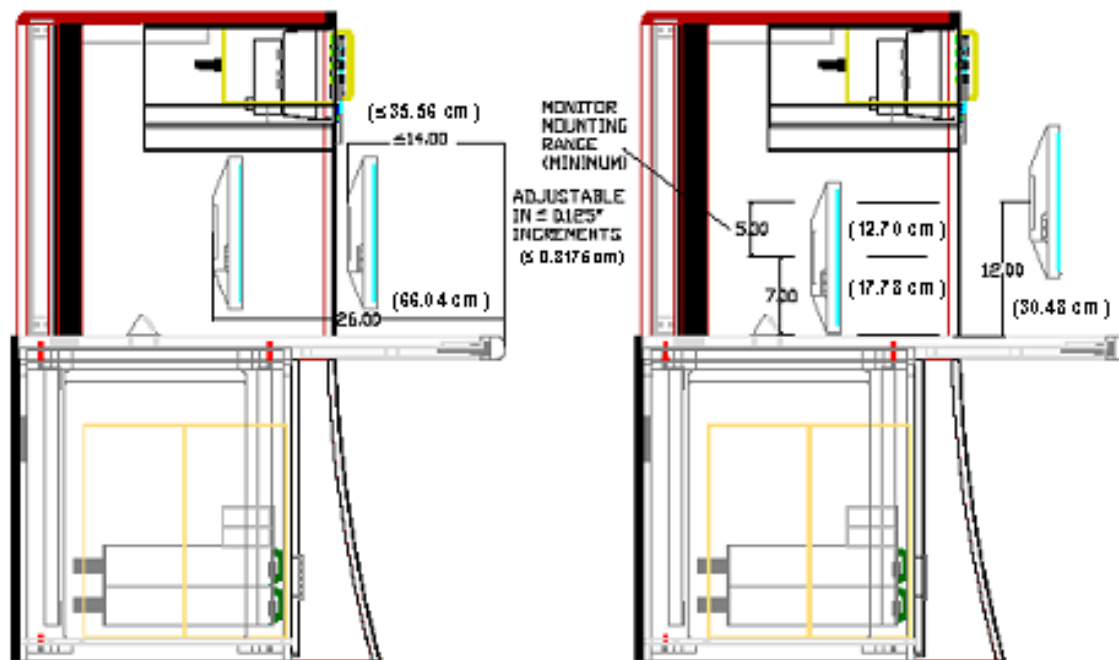


Figure 2.2-6 Monitor Arm Design Criteria

## 2.2.2 Base

### 2.2.2.1 General

All enclosures have a base. The base is designed using a “bay” concept to allow for partitioned equipment placement below the desktop and concealed from the console user. Depending on configuration, the enclosure base houses workstation towers, network and communications patch panels, satellite network switches, power distribution units, and power strips. Bases are finished metal and constructed in a manner which provides electromagnetic interference (EMI) attenuation as defined in **Table 2.2-7** with ventilation and cable penetrations. Exposed holes and penetrations not used for a particular configuration can be sealed or plugged for aesthetic purposes and to maintain EMI shielding.

Enclosure bases provide ground studs for connection to facility ground. The bases provide internal cable management, EMI shielded cable penetrations through the desktop and below

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floor, and cabinet ventilation. Low noise fans in the rear, or ducted through the hood, and ventilation grids in the front of the base provide for equipment cooling.

Frequency Range	Minimum Attenuation
2 MHz – 144 MHz	12 dB
144 MHz – 10 GHz	20 dB
10 GHz – 18 GHz	12 dB

**Table 2.2-7 EMI Attenuation Design Environment**

Equipment installed in the base is designed to operate in an air conditioned environment with ambient room temperatures between +60° F (+15.6° C) to +80° F (+26.7° C) with extremes of uncontrolled temperatures between 52° F (11.1° C) and 95° F (35.0° C) for one (1) hour. Facilities in which the enclosures reside have Heating, Ventilating, and Air Conditioning (HVAC) systems that provide an ambient temperature controllable between 72° F (22.2° C) and 89° F (31.7° C) and relative humidity between 45% and 80%. Electronic equipment installed in the base generates approximately 2,500 BTU/Hr in heat load.

Audible fan/vent noise is limited to 35dBA sound pressure as measured one meter from the console enclosure.

Enclosure bases have lockable, removable front and rear access panels/doors for equipment access and servicing. Front and rear access provides floor plan flexibility allowing enclosures to be placed back-to-back or against a wall with two inch minimum separation.

Enclosure base general dimensions are as follows.

- Minimum Height: 25.5 inches (64.77 cm)
- Maximum Depth w/Doors: 26 inches (66.04 cm)
- Minimum Inside Depth: 24 inches (60.96 cm)

Bay size is dependent on enclosure configuration.

Cable routing is provided between all bays of an enclosure without affecting the EMI shielding.

### **2.2.2.2 OE/TM Base**

At 84 inches (213.36 cm), the OE/TM Base consists of three bays. Bays 1 and 3 accommodate two each workstation towers, not to exceed 19"H X 19"W X 9"D (48.26 cm H X 48.26 cm W X 22.86 cm D) each.

Bay 2 provides a minimum of twelve rack unit (12RU) of 19" RETMA standard rack-mount capability in the front of the bay and a minimum of 12RU in the rear for patch panels, switches, and power distribution. RETMA rail depth is adjustable.

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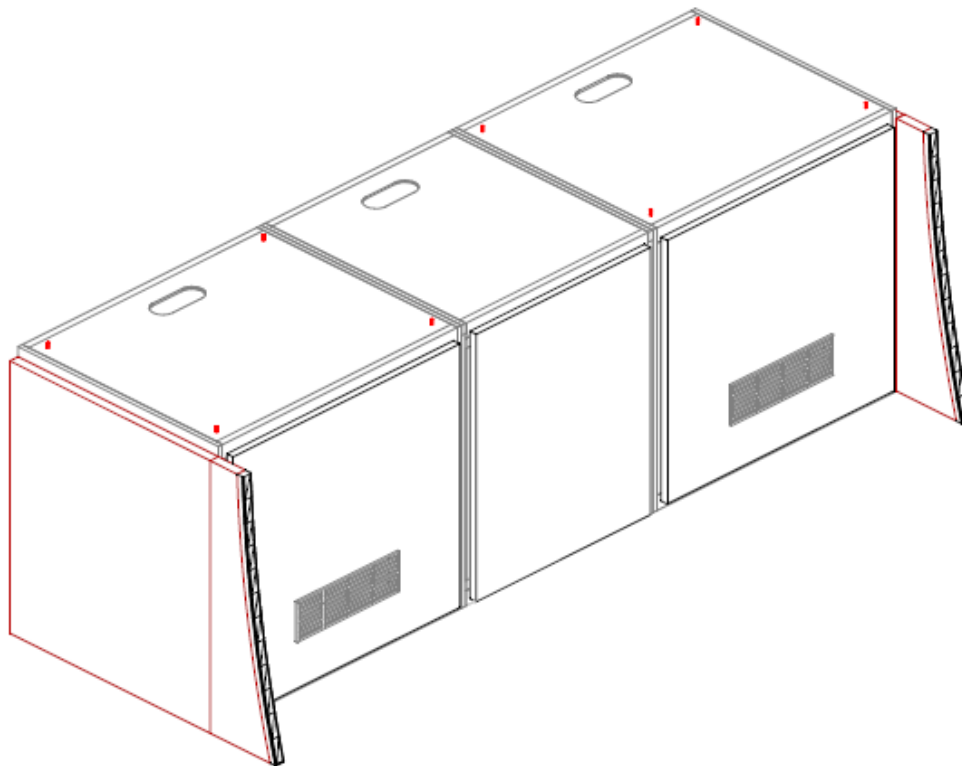
With 12RU of rack-mount space and a minimum inside depth of 23 inches (58.42 cm), Bay 2 accommodates two (2) 2RU power distribution chassis's (PDCs) weighing 25 pounds (11.35 kg) each, two (2) 1RU rack-mount power strips weighing 10 pounds (4.53 kg) each, a 1RU communication system patch panel weighing 2 pounds (0.90 kg) before cabling, and a 1RU network patch panel weighing 2 pounds (0.90 kg) before cabling.

Front and rear access panels/doors with a minimum 20 inch by 20 inch opening in each Bay facilitate equipment access, installation and removal.

OE/TM Base Bay general widths are as follows.

- Bay 1 Width:  $\geq 27.0$  inches (63.58 cm) and  $\leq 30.5$  (77.47 cm) inches
- Bay 2 Width:  $\geq 23.0$  inches (58.42 cm)
- Bay 3 Width:  $\geq 27.0$  inches (63.58 cm) and  $\leq 30.5$  (77.47 cm) inches

**Figure 2.2-8** depicts the OE/TM Base.



**Figure 2.2-8 OE/TM Base Concept View**

### 2.2.2.3 OE-Mini/TM-Mini Base

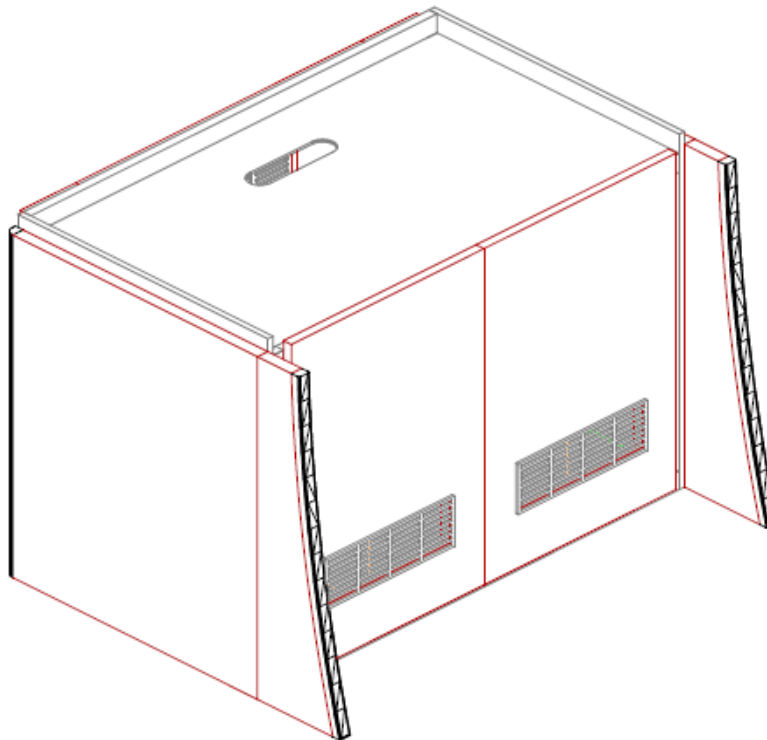
- Dimensions: 42 inches (106.68 cm) wide



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- Accessibility: Front and rear access panels/doors with a minimum 20 inch (50.8 cm) high by 36 inch (91.44 cm) wide opening to facilitate equipment access, installation and removal.
- Power: Power strip connected to adjacent enclosure power distribution.
- Equipment: Network connected to adjacent enclosure patch panel.
- Bays: The number of bays for the OE/TM-Mini Enclosure will be determined by the manufacturer.

**Figure 2.2-9** depicts the OE/TM-Mini Base.



**Figure 2.2-9 OE/TM-Mini Base Concept View**

## 2.2.3 Hood

### 2.2.3.1 General Hood

All enclosures have a hood. The hood attaches to the base and provides 19" RETMA standard rack-mount space in two rack unit (2RU) to fourteen rack unit (14RU) configurations in up to four locations using independently removable RETMA enclosures. A center mounted brace provides stability and enables the hood to support the weight of rack-mounted equipment. The hood provides a sound barrier and hidden pathways for cabling to/from the base and desktop. Cable

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pathways extend up from the desktop to approximately 3 inches (7.62 cm) below the hood to allow for cables entering the hood mounted RETMA enclosures. Cable pathways are accessible from the front to allow for cable routing when a console is placed against a wall.

The shape of the hood is an important design consideration. To convey an “executive” appearance, the hood does not have sharp edges or portray a “box” facade. The enclosure views depicted in this document represent one potential design concept utilizing large, rounded edges and an angled back.

Modular construction allows multiple RETMA configurations. Rack-mount space is allocated for various combinations of the following KSC equipment.

- 4-Channel Operational Intercom System (OIS) Unit – (2RU)
- 8-Channel OIS Unit – (4RU)
- Operational Television (OTV) Display – (5RU)
- OTV Control Panel – (1RU)
- Paging and Area Warning System (PAWS) Unit – (4RU)
- Paging Panel - (1RU)
- Emergency Camera Control – (1RU)
- Dual Time Display – (1RU)
- Safing Panel – (4RU to 6RU)

RETMA enclosures accommodate equipment mounted on slides.

To accommodate changing requirements, RETMA enclosures are independently removable without removing the hood or other RETMA enclosures. RETMA enclosures are a minimum of 16 inches (40.64 cm) and no more than 19 inches (48.26 cm) deep.

Enclosure hoods provide mounting brackets for telephones on either side.

Enclosure hoods have removable rear access panels for equipment installation, removal, and servicing. The hood-mounted RETMA space is also accessible from the front. Front and rear access provides floor plan flexibility allowing enclosures to be placed back-to-back or against a wall.

Enclosure hood general dimensions are as follows.

- Minimum Height: 28.5 inches (72.39 cm)
- Maximum Height: 30 inches (76.2 cm)
- Depth: 29 inches (73.66 cm)
- Desktop Leading Edge to Hood Leading Edge: 15 inches (38.1 cm)

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- Desktop Leading Edge to Hood Inside Wall:  $\geq 36$  inches (91.44 cm)
- Minimum Distance Desktop to Bottom of a 5RU Hood Mounted Box:  $\geq 17$  inches (43.18 cm)

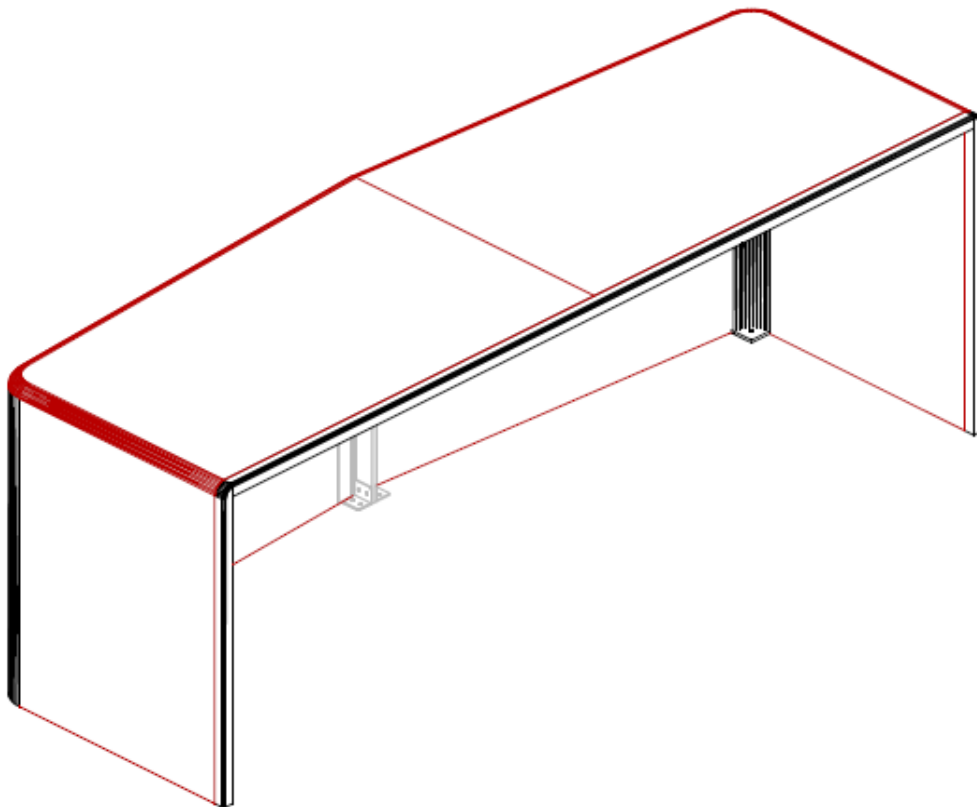
### 2.2.3.2 OE/TM Hood

The OE/TM hood is  $\leq 84$  inches (213.36 cm) wide and provides 19" RETMA standard rack-mount space in two rack unit (2RU) to fourteen rack unit (14RU) configurations in four locations. When configured with a 14RU rack mount capability on the left and right sides, and two 6RU spaces in the middle, the OE/TM Hood is capable of supporting a 160 pound (72.57 kg) distributed load.

- 14RU Rack Mount Space: 50 pounds (22.68 kg) each
- 6RU Rack Mount Space: 30 pounds (13.6 kg) each

**Figure 2.2-10** depicts the OE/TM Hood with no RETMA rack mount capability installed.

**Figure 2.2-10 OE/TM Hood Concept View**



### 2.2.3.3 OE/TM-Mini Hood

The OE/TM hood is  $\leq 42$  inches (106.68 cm) wide and provides 19" RETMA standard rack-mount space in two rack unit (2RU) to fourteen rack unit (14RU) configurations in two locations.

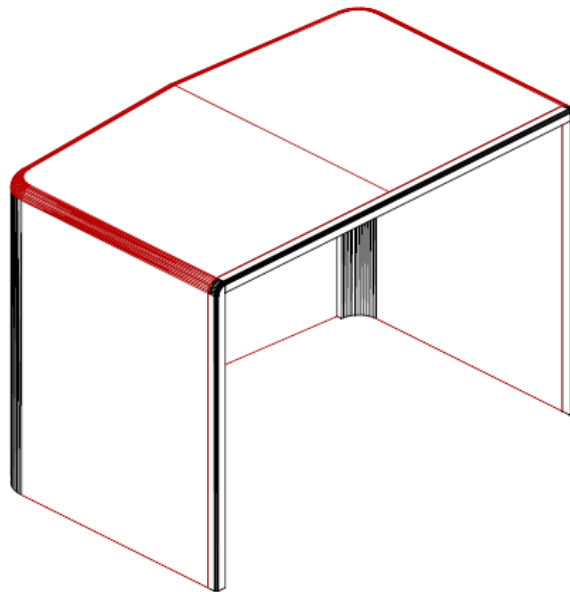
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When configured with a 6RU rack mount capability on the left and right sides, the OE/TM-Mini Hood is capable of supporting a 60 pound (27.2 kg) distributed load.

**Figure 2.2-11** depicts the OE/TM-Mini Hood with no RETMA rack mount capability installed.

**Figure 2.2-11 OE/TM-Mini Hood Concept View**

## 2.2.4 Desktop



### 2.2.4.1 General Desktop

All enclosures have a desktop. The desktop attaches to the base to accommodate workstation displays, keyboards and mice, desktop speakers, IT Security card readers, network data ports, power outlets, and laptop computers.

The desktop provides a support mechanism for pole or slat board mounted monitor arms and a pathway for cables entering the base through inset cutouts. Cable pathway cutouts are a minimum of 2 inches (5.08 cm) deep by 6 inches (15.24 cm) wide.

Desktops are constructed so that two or more enclosures can be connected together using a Wedge peripheral. A standalone enclosure desktop is capable of carrying a 200 pound (90.72 kg) load at the front edge (center of span) with a maximum deflection of 0.250 inches (0.635 cm) when cantilevered and 0.230 inches (0.5842 cm) when supported. Extra support needed to meet these standards is accomplished without changing leg space or otherwise hindering operator's leg movement.

The front edge of the desktop accommodates dual intercom system headset jacks including cabling. Headset cabling is in an enclosed pathway from the headset jacks into the rack mount space in the hood. There are no protrusions or obstructions below the desktop that would

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interfere with or injure the seated user. Desktop front edges are rounded at least 0.50 inches (1.27 cm). The desktop work surface is of seamless construction.

Enclosure desktop general dimensions are as follows.

- Overall Depth:  $\leq$  44 inches (111.76 cm)
- Desktop Leading Edge to Hood Leading Edge: 15 inches (38.1 cm)
- Desktop Leading Edge to Hood:  $\geq$  31 inches (78.74 cm)
- Thickness: 2 inches (5.08 cm) to 2.5 inches (6.35 cm)

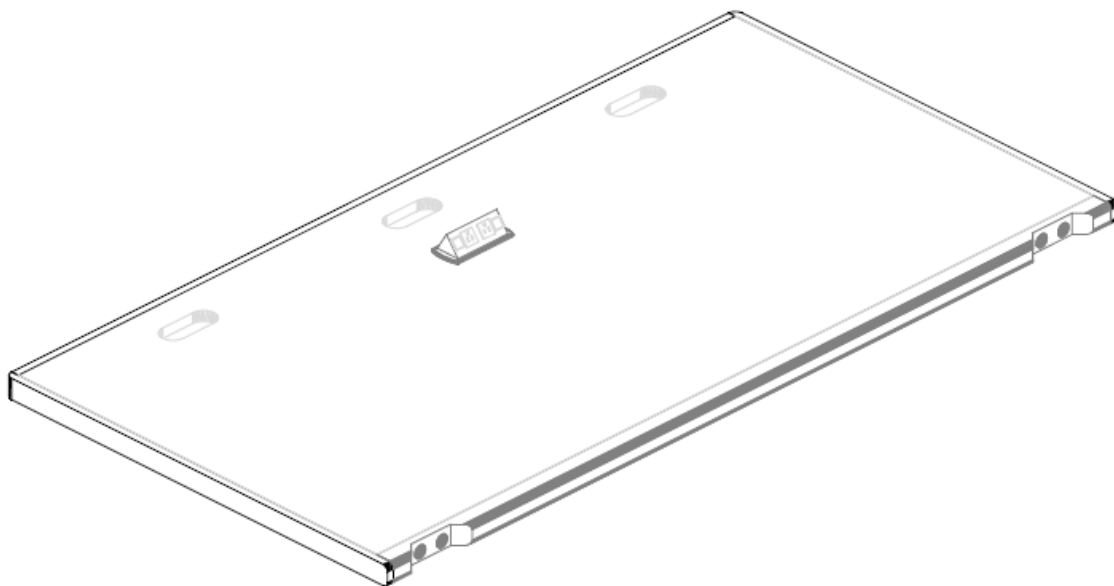
#### 2.2.4.2 OE/TM Desktop

The OE/TM Desktop is  $\leq$  84 inches (213.36 cm) wide and accommodates two dual intercom system headset jacks including cabling. Headset jacks are located on the left and right edges of the desktop with an optimum 2.75 inch (6.985 cm) offset from the end and embedded approximately 1.0 inch (2.54 cm) into the desktop.

The OE/TM Desktop provides two (2) external network jacks and two (2) 110V NEMA 15R power outlets for user provided equipment. These connections are located in the center, near the rear of the desktop but accessible by users from the front.

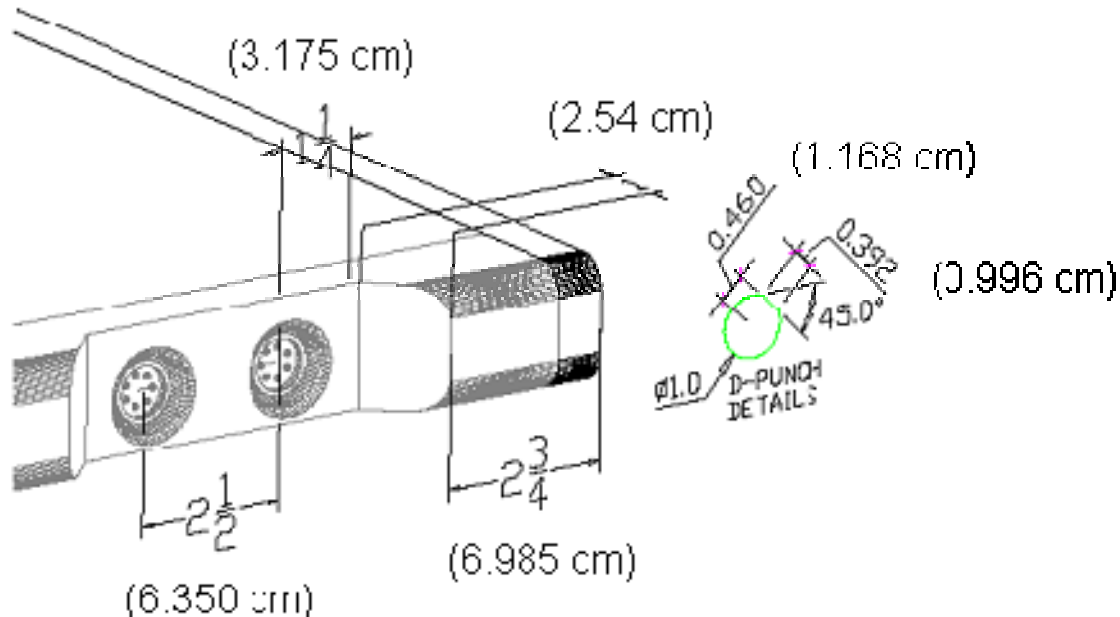
**Figure 2.2-12** depicts an OE/TM enclosure Desktop.

**Figure 2.2-12 OE/TM Enclosure Desktop Concept View**



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**Figure 2.2-13** depicts a typical dual intercom system headset jack embedded in a desktop.



**Figure 2.2-13 Desktop Dual Intercom System Headset Jack Concept View**

### 2.2.4.3 OE/TM-Mini Desktop

The OE/TM-Mini Desktop is  $\leq 42$  inches (106.68 cm) wide and accommodates one dual intercom system headset jack including cabling, located on the right edge of the desktop with an optimum 2.75 inch (6.985 cm) offset from the end and embedded approximately 1.0 inch (2.54 cm) into the desktop.

The OE/TM-Mini Desktop provides two (2) external network jack and two (2) 110V NEMA 15R power outlets for user provided equipment. As in the OE/TM Enclosure, these connections are located near the rear of the desktop but accessible by users from the front. The network/power connections are located on the left or right side of the desktop, depending on enclosure configuration.

**Figure 2.2-14** depicts an OE/TM-Mini enclosure Desktop.

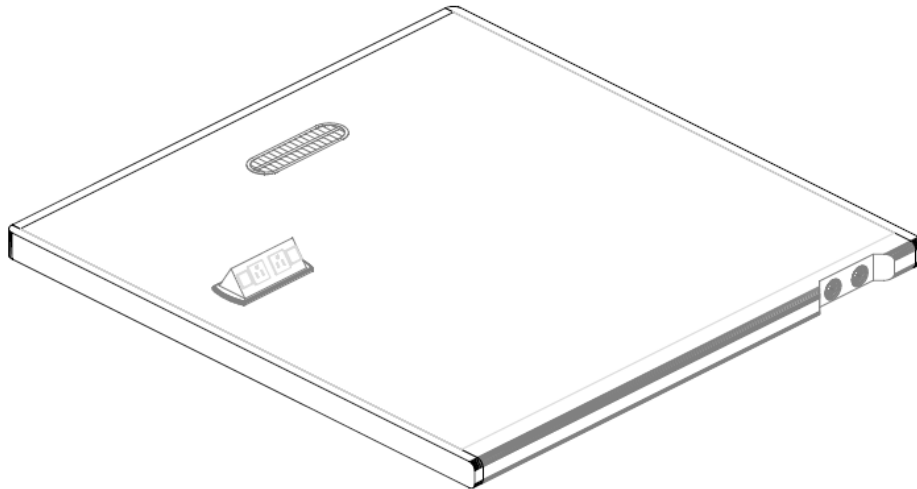
### 2.2.5 Wedges

Enclosures accept extension modules in the form of Wedges. Wedges connect two OE/TM Enclosures together to form a straight or curved configuration. Wedges maintain the same desktop profile as the enclosures they link together.

Extended Wedges connect two OE/TM Enclosures together and add another foot of desktop space in the front, between the two enclosures.

Wedges are peripheral enclosure components.

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**Figure 2.2-14 OE/TM-Mini Enclosure Desktop Concept View**

### 2.2.5.1 Angle Wedges

An Angle Wedge consists of a base, desktop, and hood. Angle Wedge bases offer no EMI attenuation and are not designed to house equipment below the desktop. Angle Wedge desktops carry the same characteristics of OE/TM Enclosure desktops but do not accommodate integrated intercom system headset jacks or cabling. Angle Wedge hoods can accommodate a standard telephone bracket with cable penetration. Angle Wedge hoods do not accommodate RETMA equipment.

Angle Wedge general dimensions are as follows.

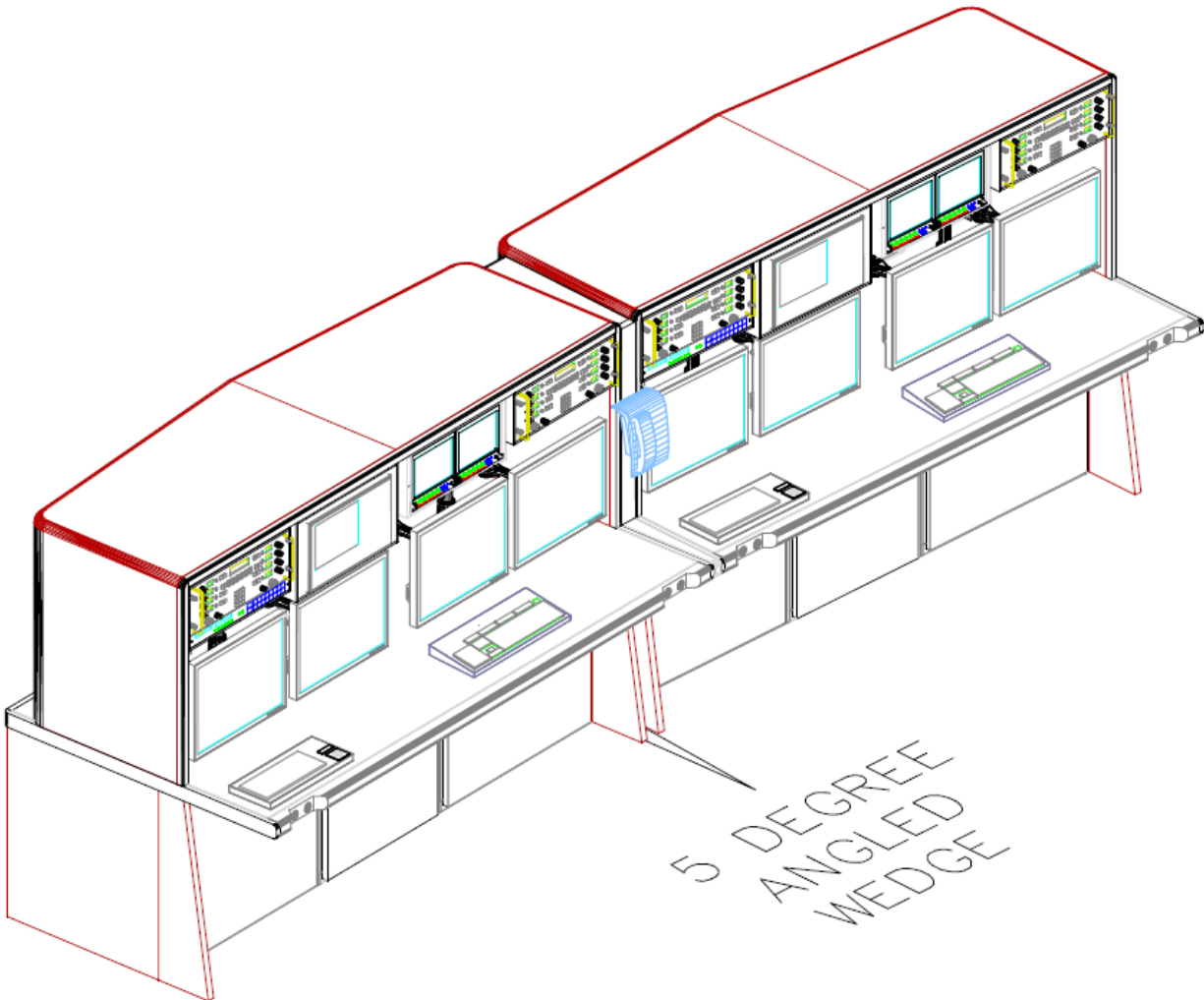
- Maximum Height: 59 inches (149.86 cm)
- Minimum Width (Desktop Front): 1 inch (2.54 cm)
- Maximum Depth: 44 inches (111.76 cm)
- Maximum Desktop Height: 29.5 inches (74.93 cm)
- Angle: 5 Degrees to 30 Degrees

**Figure 2.2-15** depicts two OE/TM Enclosures connected by a 5 degree Angled Wedge.

### 2.2.5.2 Straight and Extended Wedges

Straight and Extended Wedges consist of a base, desktop and hood. Wedge bases have the same characteristics of OE/TM Enclosure bases. Wedge desktops have the same characteristics of OE/TM Enclosure desktops without headset jacks. Straight and Extended Wedges support an adjustable bookcase shelf and up to four telephone brackets. Wedges less than 12 inches (30.48 cm) wide are limited to two phones and do not support a bookcase shelf.

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**Figure 2.2-15 Angled 5° Wedge Concept View**

Straight Wedge general dimensions are as follows.

- Maximum Height: No taller than a OE\TM Enclosure
- Width: 5 inches (12.7 cm) to 24 inches (60.96 cm)
- Depth:  $\leq$  44 inches (111.76 cm)
- Desktop Profile: Conforms to OE\TM Enclosure desktop profile
- Angle: Zero degrees (straight)

Extended Wedge general dimensions are as follows.

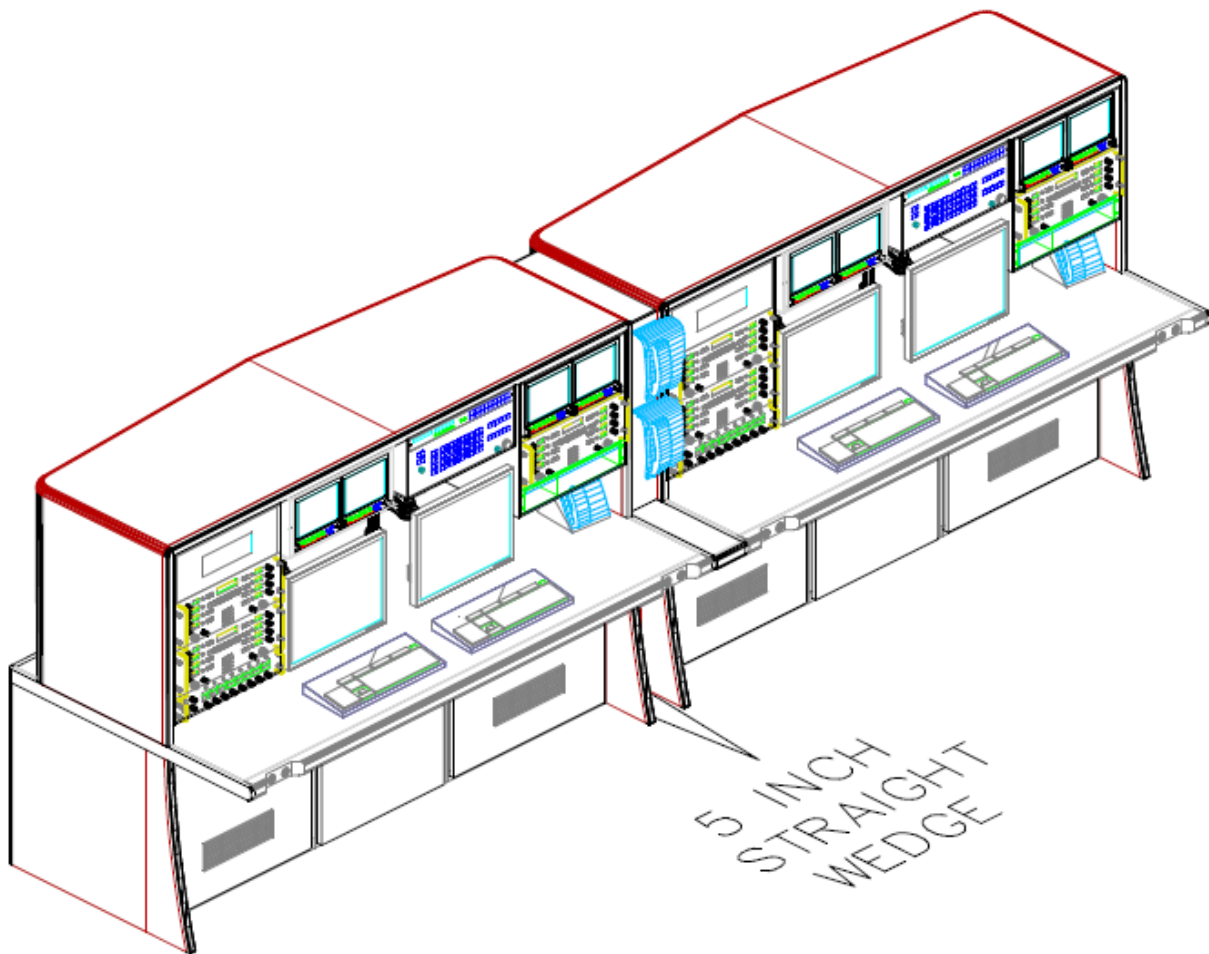
- Maximum Height: No taller than a OE\TM Enclosure



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- Width: 12 inches (30.48 cm) to 24 inches (60.96 cm)
- Depth:  $\leq$  56 inches (142.24 cm)
- Desktop Profile: Conforms to OE\TM Enclosure desktop profile
- Desktop Corner Radius:  $\geq$  2 inches (5.08 cm)
- Angle: Zero degrees (straight)

**Figure 2.2-16** depicts the 5" version of a Straight Wedge.



**Figure 2.2-16 Straight 5" Wedge Concept View**

**Figure 2.2-17** depicts the 24" version of an Extended Wedge.

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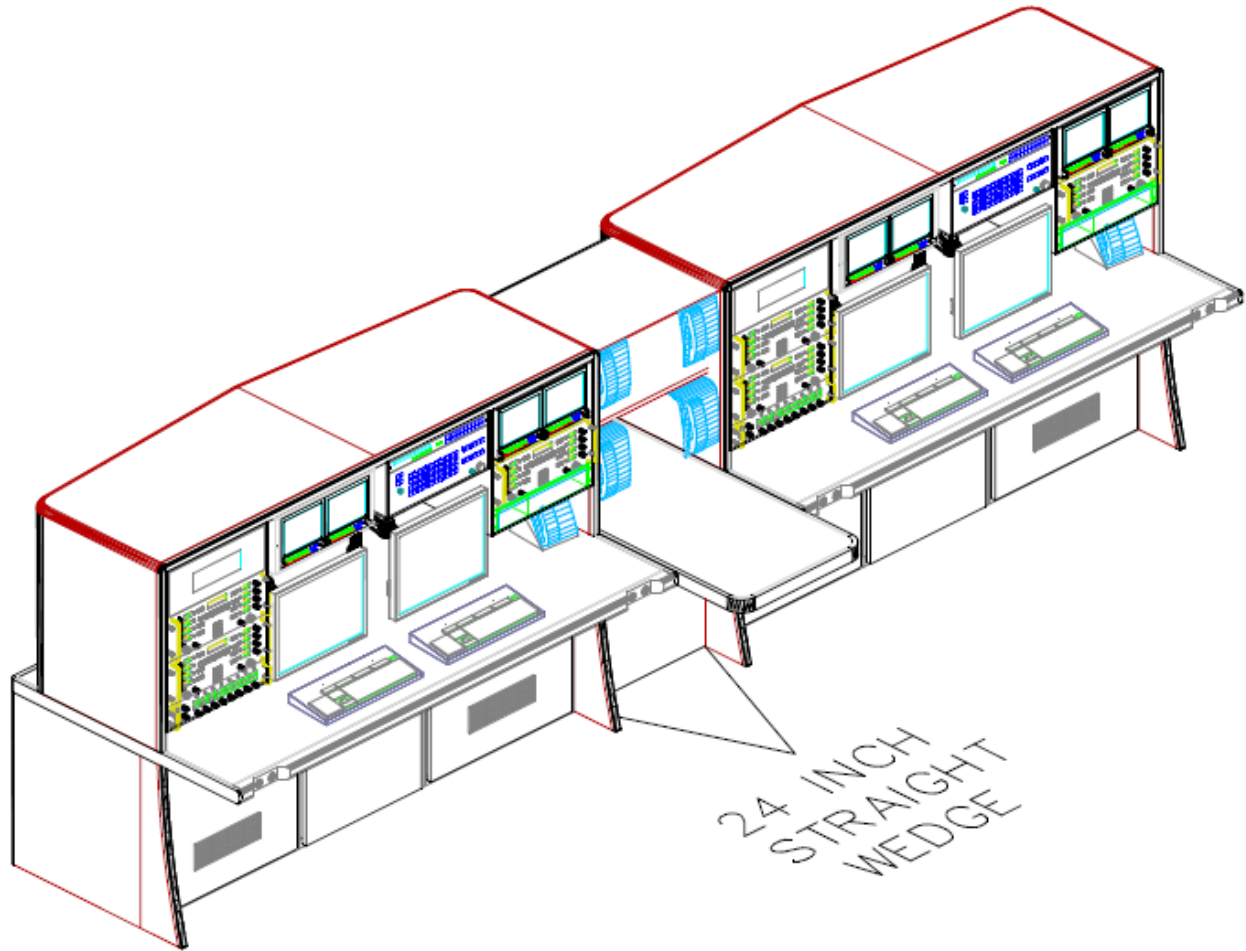


Figure 2.2-17 Extended 24" Wedge Concept View