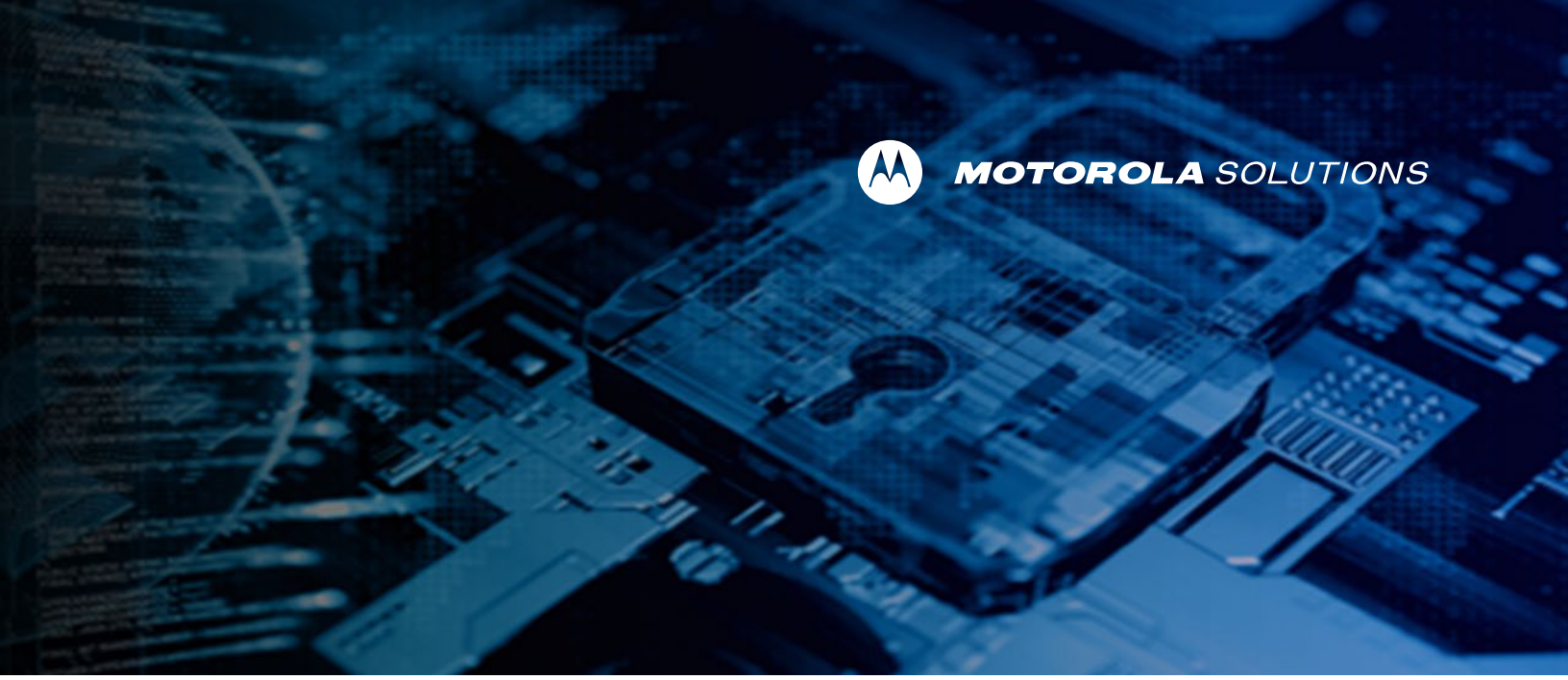


**Mira Costa College**

# New Dispatch Center

AXS Consoles

April 4, 2025

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Motorola Solutions, Inc.
500 W Monroe Street, Ste 4400
Chicago, IL 60661-3781
USA

April 4, 2025
Nicole Yax
Communications & Records Supervisor
Mira Costa College Police Department
Subject: New Dispatch Center

Dear Nicole Yax,

Motorola Solutions, Inc. (“Motorola”) is pleased to have the opportunity to provide Mira Costa College with quality communications equipment and services. The Motorola project team has taken great care to propose a solution that will meet your needs and provide unsurpassed value.

To best meet the functional and operational specifications of this solicitation, our solution includes a combination of hardware, software, and services. Specifically, this solution provides:

- (1) New AXS Console
- Backup Consolette and Antenna System
- Maintenance and Lifecycle Services
- Optional Training

The proposal includes this cover letter and is subject to the terms and conditions of the agreement between San Diego County and Motorola Solutions for San Diego County Regional Communications System (RCS) Replacement, Agreement No. 553982, dated June 27, 2016. This proposal shall remain valid for a period of 60 days from the date of this cover letter. Mira Costa College may accept the proposal by issuing a purchase order that states it is subject to this proposal and Motorola / San Diego County Contract 553982. Motorola Solutions would be pleased to address any concerns you may have regarding the proposal. Any questions can be directed to your Senior Motorola Account Executive, Ken Nordholm, at (858) 414-6647 or ken.nordholm@motorolasolutions.com.

We thank you for the opportunity to furnish Mira Costa College with “best in class” solutions and we hope to strengthen our relationship by implementing this project. Our goal is to provide you with the best products and services available in the communications industry.

Sincerely,

Denis Redzepagic
Area Sales Manager Motorola Solutions, Inc.

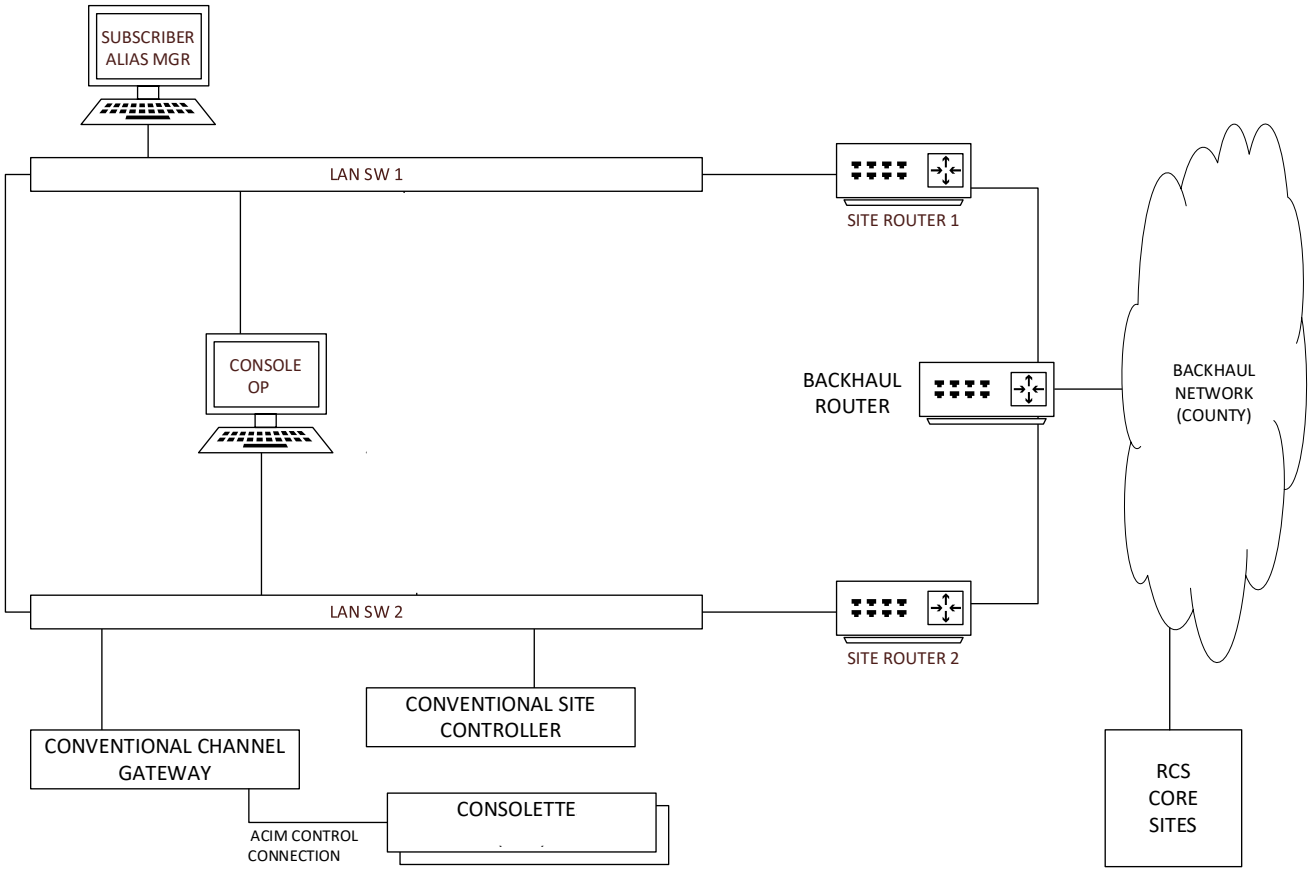
Section 1

# System Description

Motorola Solutions, Inc. (Motorola) proposes our AXS dispatch console to provide San Diego Mira Costa College with the confidence of state-of-the-art secure communications, seamless IP-based connectivity, flexible system architecture with scalable components, and centralized console management.

Motorola designs its console to help reduce the total cost of owning an IP-based, feature-rich dispatch system without compromising quality and reliability. The console provides the Mira Costa College with sophisticated network management and easy migration to future capabilities.

The system diagram below shows the proposed Mira Costa College's console site at a system level connected to the San Diego County RCS ASTRO® 25 system.



# 1.1 CommandCentral AXS Dispatch Console

Motorola Solutions, Inc.'s (Motorola) CommandCentral AXS Dispatch Console reduces the barriers between systems in Mira Costa College's dispatch center, allowing access to all the mission-critical tools and applications dispatchers need in the moments that matter. This makes operation more efficient in emergency situations. Resources are accessible with an intuitive, highly configurable browser-based GUI. Dispatchers will have an expansive feature set and a mission-critical IP network for transporting information and calls throughout the system.

CommandCentral AXS improves the efficiency and operation of dispatchers in the following ways (additional fees may apply depending upon feature and hardware additions):

- **Next Generation Dispatch Experience** – The solution responds to touch, type or click, giving dispatchers the flexibility to interact and stay connected to teams in the way that best suits them. Extensive configuration options, flexible deployment configurations and simple scalability means agencies only pay for what is needed now, with the room to adapt and grow as needs change over time.
- **Purpose-Built Dispatch Console Accessories** – Enhances the dispatch experience with accessories, such as gooseneck microphone, speakers, headset jack, and footswitch, designed and tested for industry-leading performance and reliability.

This solution also reduces operating costs and provides a smaller physical footprint in the command center without compromising on features or reliability. This combination of seamless communications, modern architecture, and advanced integration capabilities enables the CommandCentral AXS solution to scale and evolve as needs change over time.

## 1.1.1 Integration with the ASTRO® 25 Network

The proposed dispatch console seamlessly integrates into Mira Costa College's ASTRO® 25 system for an integrated, mission-critical network. This tight union between radio infrastructure and console equipment has several operational benefits to Mira Costa College. The physical space to accommodate the proposed console is comparable to that required for a personal computer.

The console can access both trunked talkgroups and conventional radio channels over the same network. This architecture reduces overall transport costs and the need for duplicate fixed network equipment.

## 1.1.2 Connection to ASTRO® 25 System

The ASTRO® 25 system's architecture is flexible and can be configured to meet Mira Costa College's unique needs.

### 1.1.1.1 Dual Site Link

The proposed console site for Mira Costa College is remote from the core site and features redundant site links to provide path diversity. The console site has two logical connections to the core site, with each connection using a different core router.

Each console site gateway provides an interface that handles the following IP traffic between the proposed console center and Mira Costa College's ASTRO® 25 core site:

- Network management traffic.
- Call control and audio traffic for all the calls being handled by the dispatch positions.
- Aux I/O traffic for the Aux I/Os being handled by the dispatch positions.

The site gateways fragment and prioritize large IP packets according to industry standards and convert Ethernet data to the desired transport medium.

#### 1.1.1.2 Advanced Conventional

This option provides the dispatcher with the ability to control ASTRO® 25 conventional channels and/or MDC 1200 channels.

### 1.1.3 Conventional Base Station Interfaces

The proposed consoles access and control Mira Costa College's analog and digital conventional base stations through the use of Conventional Channel Gateways (CCGW). The console processes audio received from the station and controls various features on the stations, such as frequency selection, private line selection, and repeater on/off.

Additionally, the CCGWs allow for recovery of MDC 1200 and digital signaling, such as unit ID and emergency alarm.

## 1.2 Making Consoles Easy to Operate

Motorola's proposed consoles are optimized for real-time audio, prioritizing emergency calls over other traffic, and minimizing voice queuing. Using robust error mitigation to maintain call quality even when the system is heavily loaded, the proposed console reduces communication errors that may force dispatchers or radio users to repeat their transmissions.

### 1.2.1 Next Generation Dispatch Experience

CommandCentral AXS features a highly configurable graphical user interface (GUI) that provides quick, single-view access to important information and functionalities. The browser-based GUI's versatile folders, tabs, and scalable resources allow users to organize and configure their dispatch experience and make engagement more familiar and intuitive from shift to shift. Folders and tabs can be relocated, exposed, or overlapped as needed, giving dispatchers more control of what information they see and how they interact with those resources. CommandCentral AXS also offers multiple options for routing audio to speakers and controlling volume levels.

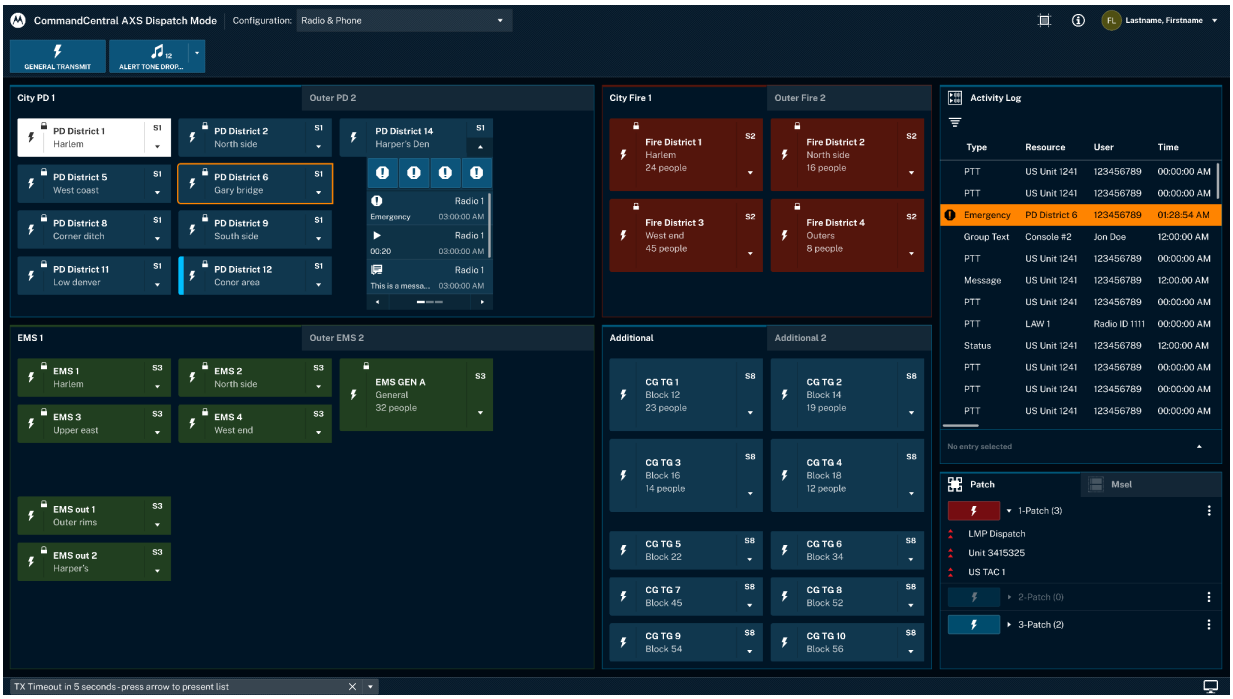



**Figure 1: Next Generation Dispatch Experience**

CommandCentral AXS features flexible window positioning and capabilities for quick and efficient access to services such as:

- **Activity Log** – Provides an efficient point of reference for all incoming calls into a dispatch console , showing dispatchers detailed, searchable call information (radio resource name and call time) to enable faster and more informed response.
- **Paging** – Allows users to send user configured pages on radio resources. This flexible paging feature is integrated with CommandCentral AXS for both conventional and trunked radio resources, while an external paging encoder port on the CommandCentral Hub enables third-party paging encoders to send pages on the selected radio resources.
- **Patch Capabilities** – Enables dispatchers to set up a communication path between two or more resources that are normally unable to communicate with each other, such as trunked resources and conventional resources.
- **Alert Tones** – Allows dispatchers to send one of fifteen user-configurable alert tones on selected radio resources. Fifteen default .wav files are provided with the dispatch console software, but any combination of these default files may be replaced with user configured.wav files to meet specific needs.
- **Channel Marker** – Enables dispatchers to send a periodically repeating piece of audio on radio resources to meet the specific needs.

## 1.2.2 Standard Radio Transmission and Reception

A typical proposed dispatch position has a headset and two speakers. One speaker is for selected audio and the second speaker is for all remaining unselected audio. Additional speakers can be added to a console allowing dispatchers to configure a specific speaker for a set of designated audio sources.

This simplifies multitasking between multiple audio sources and allows flexibility in the way the audio is presented to the dispatcher.

#### 1.1.1.3 Receiving Calls from the Field and Other Dispatchers

The proposed console provides dispatchers with greater flexibility for how to hear calls from field radio users and other dispatchers. Each dispatcher can define his or her own audio reception profile by selecting a single audio source, whether conventional or talkgroup, to be heard on a selected speaker or headset (Single Select). The dispatcher can also define groups of radio resources that can all be heard on a selected speaker or headset (Multi-Select).

#### 1.1.1.4 Initiating Calls to the Field and Other Dispatchers

The dispatcher has several different ways of initiating a call. In most circumstances, a General Transmit is appropriate. With the General Transmit, the dispatcher selects a resource on the console and activates the transmission through a footswitch, headset transmit button, or a microphone transmit button. If the dispatcher needs to quickly transmit on a resource that is not selected, the dispatcher uses the Instant Transmit function.

A safety switch is available, which prevents accidental activation of functions that may cause negative consequences. The safety switch can be used with Aux I/Os and preprogrammed pages, as well as Instant Transmit switches.

#### 1.1.1.5 Audio Communication to the Field and Other Dispatchers

The dispatcher can transmit audio in different ways. They can make calls to all users listening to a specific conventional radio resource or a specific trunking talkgroup. When multiple resources are required, the dispatcher can select additional talkgroups and/or conventional channels, as needed using the Multi-Select feature.

The proposed console also enables dispatchers to make private calls to individual field radio users or dispatchers. Once a private call is established, it can be patched in with another resource at the dispatcher’s discretion.

#### 1.1.1.6 Controlling Console Audio

The proposed console offers dispatchers several different ways of controlling or muting the audio on their consoles, such as the following:

- Audio volume can be changed for any specific resource.
- All non-selected resources on the console can be muted for 30 seconds (All Mute) or unmuted, if already muted.
- A dispatcher can transmit on a resource while receiving audio from the same resource or other resources.
- A dispatch position can be configured to automatically mute the other dispatch audio on a shared resource to prevent acoustic feedback when a co-located dispatch position transmits.
- RF Cross Mute automatically mutes the receive audio from a specified channel when the dispatcher transmits on another specified channel to prevent acoustic feedback.

#### 1.1.1.7 Controlling Network Audio

Dispatchers can control audio on the ASTRO® 25 network. The dispatcher can enable or disable radio users to compartmentalize traffic, reduce interruptions, and maintain communications between dispatch and the field. When this function is enabled or disabled, all dispatch consoles with this resource assigned are updated with the current status of the feature. This feature can be controlled from any dispatch position.

### 1.2.3 Emergency Radio Transmission and Reception

As part of a mission-critical communications network, the proposed dispatch console facilitates immediate prioritization and resolution of emergency communications between Mira Costa College's dispatch and first responders in the field. This enables dispatchers and first responders to focus on their mission and not their equipment, especially during critical situations.

#### 1.1.1.8 Receiving an Emergency Call

When a user in the field or another dispatcher initiates an emergency call, the console emits both visual and audible indications (Emergency Alarm). The audible indication alerts the dispatcher that an emergency is underway; the visual indication directs the dispatcher's attention to the specific resource making the emergency call. The dispatcher can immediately reserve a voice channel for the duration of the emergency.

#### 1.1.1.9 Responding to an Emergency Call

A dispatcher can bypass the standard console interface to auto-open a quick list, which contains specific controls for recognizing an emergency call, initiating an emergency call, and ending an emergency call (Auto-Open of Quick List). The dispatcher can then recognize the emergency call, which ends the audible emergency indication and notifies all dispatchers that the emergency is being addressed (Emergency Recognize).

The audible emergency indication may also be muted by a dispatcher without recognizing the emergency alarm (Mute Tones at a Single Op). This can be used in a situation where one agency is monitoring a channel that belongs to another agency. That channel can be configured to not generate audible and/or visual emergency indications.

#### 1.1.1.10 Ending an Emergency Call

When an emergency is over, the dispatcher can end the Emergency Alarm. The visual indication on the dispatch position GUI is removed, and the console informs the other dispatch positions that the emergency is over (Emergency End/ Knockdown). The emergency mode remains active on the initiating radio unit until it is ended (reset) by the radio user.

### 1.2.4 Radio Patch Control

The dispatcher can patch communication between trunked and/or conventional radios that are normally unable to communicate with each other due to different features, programming, or even different

frequency bands. A patch group is a group of linked resources that can both receive messages from a console and transmit to all other members of the patch group.

#### 1.1.1.11 Setting up a Standard Patch

Patches are supported between trunked resources and/or conventional resources. After the patch is created, the dispatch position transmits all audio on one resource to all other resources in the patch group. In a patch between trunked resources, patched radio users with displays see the ID or alias of the other patched radio(s), as opposed to that of the console. This minimizes confusion and the need for the dispatcher to intervene in the call. Patches are automatically reestablished, if interrupted, so the dispatcher can concentrate on continuing operations.

#### 1.1.1.12 Predefined Patches

Patches can be predefined and automatically reinitiated each time a dispatch position computer is restarted (Patch Auto-Start).

### 1.2.5 Call Management and Control

The dispatcher can use the following functionality to manage and control audio for different types of calls between the dispatch position and radio users or other dispatchers.

#### 1.1.1.13 Automatic Prioritization of Calls

Calls on the dispatch position are prioritized through a transmission hierarchy. Calls from primary supervisors take priority over those from secondary supervisors, which in turn take priority over non-supervisors. Instant Transmit or All-Points Bulletin (APB) transmissions, regardless of whether they are from a supervisor, take priority over general or patch transmissions.

Multiple dispatchers can be designated as primary supervisors on the same system, which is useful when multiple agencies share one system. With the Network Manager Client installed, supervisors can disable and enable dispatch console functionality as needed.

#### 1.1.1.14 Manual Prioritization of Calls

System Access Priority Select allows a dispatcher to prioritize trunked resources on the system as either normal or tactical. A dispatcher can change the priority of a trunked resource to tactical to give the resource a better chance of gaining communication access on a busy system. Only emergency calls have a higher priority than tactical.

When the System Access Priority Select status of a resource is changed, it is updated at all dispatch consoles in the systems that are monitoring that trunked resource.

#### 1.1.1.15 Using the Multi-Select Feature

The Multi-Select feature allows a dispatch position to define groups of selected radio resources. When a Multi-Select group is opened, all of the resources in the group are simultaneously selected. Resources can be added or removed from a Multi-Select group while the group is open. The dispatcher

can transmit on several resources simultaneously or can listen to multiple resources simultaneously in their headset or select speakers.

#### 1.1.1.16 Standard Call Indications

The dispatch position indicates the availability of any given resource, regardless of whether the resource is involved in a transmission. An inbound call indication provides the dispatcher with a visual cue of audio activity on a radio resource and allows a dispatcher to see at a glance what the status of a resource is at any moment.

#### 1.1.1.17 Call Alerting

A dispatcher can use Call Alert to page an unattended radio or dispatch position through a series of beeps and an indication of the sender's ID. When available, the radio user or dispatcher sees the unit ID of the calling dispatch console or radio ID and is able to return the call.

Additionally, a Call Alert can trigger an activity. For instance, a Call Alert may cause a vehicle's horn to sound and its lights to flash. The dispatcher can even send a Call Alert to a user who is involved in voice and data communications over the network.

### 1.2.6 Enhanced Integrated Instant Recall Recorder (IRR)

The Enhanced IRR is seamlessly integrated with the dispatch position's software, allowing audio and call data from any radio or telephony resource to be recorded and easily played back. Call data includes PTT IDs, name of resource, start time and date, and stop time and date. Two analog inputs are available for use with recording audio from external devices.

#### IRR Features

The below list is a summary of some of the features available with the Enhanced Instant Recall Recorder application:

- Configurable Options, including recording sources, playback location, storage location, export and save outside of IRR, and purge audio on shutdown
- Audio Source Folder Tabs
- Save Calls as Wav File
- Stay Top Option
- Compact Mode
- Expand and Collapse Sections of IRR
- Manage Detail Columns in IRR Call List
- Filter Calls in IRR
- Sort Calls in IRR
- Rewind and Fast Forward Calls in IRR
- Change Playback Speed
- Adjust or Mute Playback Volume

- Improve Playback Audio Quality
- Automatic Gain Control
- Sound visualization (Waveform)

### 1.2.7 MKM 7000 Console Alias Manager (CAM)

The MKM 7000 Console Alias Manager (CAM) manages the radio unit ID aliases displayed on dispatch positions. It enables agencies that share a radio system to change aliases displayed on their dispatch positions and logging recorders without affecting the aliases displayed at the other agencies on the system.

A typical console uses many types of aliases to provide meaningful, descriptive names instead of numeric ID numbers for different resources on the console, such as:

- Trunking talkgroups and conventional channels
- Aux I/Os
- Secure keys used for voice encryption
- Frequencies on multi-frequency conventional channels
- Private Line (PL) codes on conventional channels
- Predefined pages
- Radio unit IDs (also called radio PTT IDs)

The CAM supports aliases for radio unit IDs on ASTRO® 25 trunking systems, ASTRO® 25 conventional systems, MDC 1200 conventional systems, and Advanced SECURENET conventional systems. When SmartX site converters are used with SmartZone or SMARTNET systems, the CAM supports aliases for those types of radio unit IDs as well.

The CAM does not support aliases for systems connected through an ISSI link or non-Motorola consoles connected through a CSSI link.

## 1.3 Protecting Consoles and Communications

The console enables end-to-end encryption from the dispatcher to the ASTRO® 25 network, so that Mira Costa College’s communications will not be undermined by unencrypted transmissions. Each dispatcher is able to fully participate in secure communications while being confident that sensitive, vital information is not heard by unauthorized individuals.

### 1.3.1 Secure Access to the Console

To use the dispatch position, a dispatcher must enter a valid radio system user account name and password. The dispatch position validates that information with the radio system’s network manager and allows the dispatcher to access only the resources for which the user has access rights. This also applies to third-party applications that use the dispatch console's API.

### 1.3.2 Secure Communications at the Console

The console encrypts and decrypts radio voice messages. Thus, radio voice messages are encrypted from end-to- end between the radio user to the dispatch position. The dispatcher can choose whether to encrypt their transmissions on a particular trunked resource. Dispatchers can interface with agencies that have different encryption configurations without any manual intervention or delay.

The AXS Console supports multiple encryption algorithms (AES, DES-OFB, and/or ADP) and multiple secure keys.

The dispatchers may talk and listen on radio resources which have different encryption algorithms without any manual intervention or delay.

The key material for performing audio encryption and decryption is stored locally on the console. This key material is also associated with a Common Key Reference (CKR), so that the appropriate key can be selected for a given talkgroup or a special call type.

### 1.3.3 Key Management via Over-the-Ethernet Keying (OTEK)

Key management through OTEK provides the ability to manage the keys for a dispatch console or AIS using only a Key Management Facility (KMF). In OTEK, the management and distribution aspects of key management are all performed by the KMF. Distribution of the key management information is done across the radio system's IP network from the KMF to the dispatch console and AIS.

## 1.4 Incorporating Console Configuration and Management

The proposed console system is configured and managed by the same configuration manager, fault manager, and performance reporting applications as the radio system. The user can define exactly which resources are available and how they are presented to the dispatcher. This provides Mira Costa College with a single point for configuring and managing the entire ASTRO® 25 system. Changes are automatically distributed throughout the system.

This centralized approach saves valuable time and effort for system administrators and technicians and reduces the errors that can occur when radio IDs and other data are entered at multiple locations. In addition, call traffic and performance reports for each dispatch position can be generated from the system's network manager, enabling administrators to quickly and easily ensure optimal effectiveness and efficiency.

## 1.5 Dispatch Console Solution Components

The proposed components are connected together and to the rest of the ASTRO® 25 system on an IP network through console site routers and switches. The console functions as an integrated component of the total radio system and fully participates in system-level features, such as end-to-end encryption.

The console connects directly to the radio system's IP transport network. Audio processing, encryption, and switching intelligence for dispatch are performed within each software- based dispatch position without additional centralized electronics.

Since the network is IP-based, the system interfaces and components can be distributed physically throughout the network. Some of the available console components are identified below.

## 1.5.1 CommandCentral AXS Dispatch Console Operator Position

The dispatch position supports multiple peripheral accessories, including a USB microphone, USB headset, and USB footswitch. The following list describes the components included in the proposed configuration.

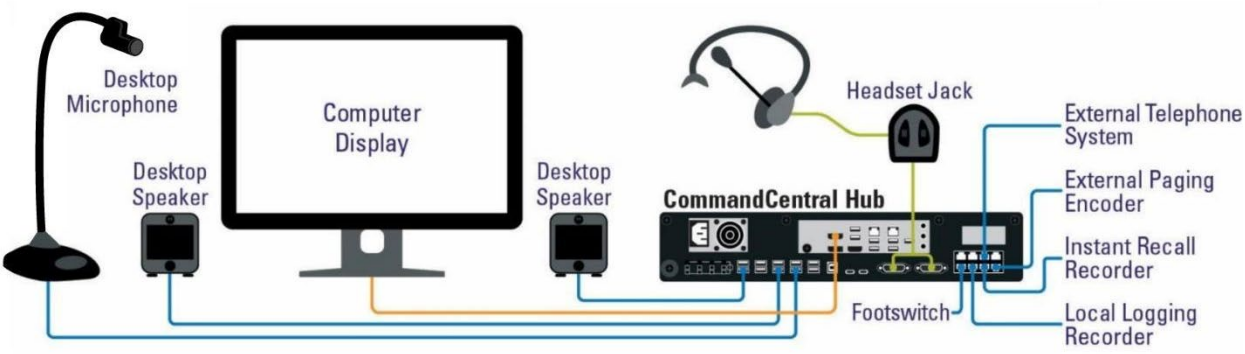



**Figure 3: CommandCentral AXS Dispatch Console Accessories Example**

### Computer Display

The dispatch position will use a 19-Inch non-touchscreen Computer Display.

### CommandCentral Hub (CC Hub)

The CommandCentral Hub (CC Hub) is the platform on which the CommandCentral AXS Dispatch Console operates. The CC Hub contains a number of analog inputs and outputs for connecting various peripheral devices as well as a workstation class computer motherboard.

The PC that is internal to the CC Hub will be programmed with a Microsoft Windows based operating system (OS) image developed for the dispatch application.

### Desktop Speakers

Two audio speakers have been included with each dispatch position and can be configured to transmit audio from a specific talkgroup or set of talkgroups. Each speaker is a self-contained unit, with individual volume controls, and can be placed on a desktop or mounted on a rack or computer display.

### Headset Jack

The dispatch position supports up to two headset jacks, both push-to-talk (PTT) and non-PTT-enabled, for simultaneous use by the dispatcher and a supervisor. The headset jack contains two volume controls for the separate adjustment of received radio and telephone audio.

### Headset

The proposed headset consists of two elements. The headset base includes an audio amplifier, a Push-to-Talk switch, and a long cord that connects to the dispatch position. The headset top consists of the earpiece and microphone as well as a short cable that connects to the headset base.

### Gooseneck Microphone

The microphone controls the dispatch position's general transmit and monitor features through two buttons on its base. The microphone can be fastened down or left loose. It can be used alone or in conjunction with a headset.

### Footswitch

Each dispatch position includes a dual pedal footswitch that controls general transmit and monitor functions.

### Telephone/Headset Interface Port

The telephone/headset port provides a connection for an external telephone to the dispatch position. This allows the operator to use a single headset to communicate on both the radio system and an external telephone system.

### Redundant Ethernet Connection

The optional redundant Ethernet connections increase console availability by protecting against the loss of multiple dispatch positions. In the event of a LAN switch failure, the system will automatically detect and switchover with no manual intervention required. Dispatching operations will not be interrupted.

## 1.6 APX All-Band Consolette

The APX All-Band Consolette provides a low-cost, mid-power wireless dispatch solution as an ideal complement to a modern P25 dispatch center. Equipped with leading edge P25 Phase 2 TDMA technology and multi-band interoperability, the APX All-Band Consolette can also be used as an emergency backup station when infrastructure is offline, or for wireless access to different system types for increased interoperability between agencies.

**APX All-Band Consolette**

The APX All-Band Consolette’s P25 operation and compatibility with legacy systems ensures that communications are clear, continuous, and coordinated across multiple users, agencies, and systems. The durable robust metal housing provides durability and allows for easy servicing, while the integrated

front panel numeric keypad allows fast access to radio controls. In addition, optional features and benefits of the APX All-Band Consolette include:

- **Optional Multi-Band Operation in One Radio** – The APX All-Band Consolette delivers the convenience of three radios in one while maintaining APCO TIA receiver specifications. With the APX All-Band, personnel can use one consolette to communicate and provide dispatch operations across multiple digital and analog networks that operate in any three of the following frequency bands: 700 MHz, 800 MHz, VHF, and UHF (R1/R2).
- **Meets Radio Users' Needs** – The APX All-Band Consolette is compatible with the following optional advanced features and data applications: Programming over Project 25 (POP25), Text Messaging, Over the Air Rekeying (OTAR), and Enhanced Encryption Software Options. It is also capable of Extended Dispatch Operation including: Emergency Alarm ACK Encode, Radio Inhibit/ Uninhibit Encode, Radio Monitor Encode, Radio Check Encode, Status Query Encode, Status Query Response Decode, Status Update Decode, and Message Update Decode.

Section 2

# Statement of Work

Motorola Solutions will install and configure the proposed equipment. The following table describes the tasks involved with installation and configuration.

| Tasks | Motorola Solutions | Mira Costa College |
|---|---|---|
| **PROJECT INITIATION** | | |
| **Contract Finalization and Team Creation** | | |
| Execute contract and distribute contract documents. | X | X |
| Assign a Project Manager as a single point of contact. | X | X |
| Assign resources. | X | X |
| Schedule project kickoff meeting. | X | X |
| Deliverable: Signed contract, defined project team, and scheduled project kickoff meeting. | | |
| **Project Administration** | | |
| Ensure that project team members attend all meetings relevant to their role on the project. | X | X |
| Set up the project in the Motorola Solutions information system. | X | |
| Record and distribute project status meeting minutes. | X | |
| Maintain responsibility for third-party services contracted by Motorola Solutions. | X | |
| Complete assigned project tasks according to the project schedule. | X | X |
| Submit project milestone completion documents. | X | |
| Upon completion of tasks, approve project milestone completion documents. | | X |
| Conduct all project work Monday thru Friday, 7:30 a.m. to 5:00 p.m.). | X | |
| Deliverable: Completed and approved project milestones throughout the project. | | |
| **Project Kickoff** | | |
| Introduce team, review roles, and decision authority. | X | X |

| Tasks | Motorola Solutions | Mira Costa College |
|---|---|---|
| Present project scope and objectives. | X | |
| Review SOW responsibilities and project schedule. | X | X |
| Schedule Design Review. | X | X |
| Deliverable: Completed project kickoff and scheduled Design Review. | | |
| **Design Review** | | |
| Review the Customer's operational requirements. | X | X |
| Present the system design and operational requirements for the solution. | X | |
| Present installation plan. | X | |
| Present preliminary cutover plan and methods to document final cutover process. | X | |
| Present configuration and details of sites required by system design. | X | |
| Validate that Customer sites can accommodate proposed equipment. | X | X |
| Provide approvals required to add equipment to proposed existing sites. | | X |
| Review safety, security, and site access procedures. | X | |
| Present equipment layout plans and system design drawings. | X | |
| Provide information on existing system interfaces. | | X |
| Review and update design documents, including System Description, Statement of Work, Project Schedule, and Acceptance Test Plan, based on Design Review agreements. | X | |
| Provide minimum acceptable performance specifications for customer provided hardware, software, LAN, WAN and internet connectivity. | X | |
| Execute Change Order in accordance with all material changes to the Contract resulting from the Design Review. | X | |
| Deliverable: The default views based on workflow requirements will be defined, presented, and approved. | | |
| Deliverable: Finalized design documentation based upon "frozen" design, along with any relevant Change Order documentation. | | |
| **SITE PREPARATION AND DEVELOPMENT** | | |
| **Site Access** | | |

| Tasks | Motorola Solutions | Mira Costa College |
|---|---|---|
| Provide site owners/managers with written notice to provide entry to sites identified in the project design documentation. | | X |
| Obtain site licensing and permitting, including site lease/ownership, zoning, permits, regulatory approvals, easements, power, and telco connections. | | X |
| Deliverable: Access, permitting, and licensing necessary to install system equipment at each site. | | |
| **Site Planning** | | |
| Provide necessary buildings, equipment shelters, and towers for installation of system equipment. | | X |
| Provide the R56 requirements for space, power, grounding, HVAC, and connectivity requirements at each site. | X | |
| Provide adequate electrical power in proper phase and voltage at sites. | | X |
| Conduct site walks to collect pertinent information (e.g. location of telco, power, structures, etc.) | X | |
| Ensure that each site meets the R56 standards for space, grounding, power, HVAC, and connectivity requirements. | | X |
| Ensure that required rack space is available for installation of the new equipment. | | |
| Deliverable: Information and permitting requirements completed at each site. | | |
| **General Facility Improvements** | | |
| Provide adequate HVAC, grounding, lighting, cable routing, and surge protection based upon Motorola Solutions' Standards and Guidelines for Communication Sites (R56) | | X |
| Ensure that electrical service will accommodate installation of system equipment, including isolation transformers, circuit breakers, surge protectors, and cabling. | | X |
| Provide obstruction-free area for the cable run between the demarcation point and system equipment. | | X |
| Provide backup power for the proposed equipment at all sites. | | X |
| Supply interior building cable trays, raceways, conduits, and wire supports. | | X |
| Deliverable: Sites meet physical requirements for equipment installation. | | |
| **SYSTEM INSTALLATION** | | |
| **Equipment Order and Manufacturing** | | |
| Create equipment order and reconcile to contract. | X | |

| Tasks | Motorola Solutions | Mira Costa College |
|---|---|---|
| Manufacture Motorola Solutions-provided equipment necessary for system based on equipment order. | X | |
| Deliverable: Equipment procured and ready for shipment. | | |
| **Equipment Shipment and Storage** | | |
| Provide secure location for solution equipment. | | X |
| Pack and ship solution equipment to the identified, or site locations. | X | |
| Receive solution equipment. | | X |
| Inventory solution equipment. | X | |
| Deliverable: Solution equipment received and ready for installation | | |
| **General Installation** | | |
| Deliver solution equipment to installation location. | X | |
| Coordinate receipt of and inventory solution equipment with designated contact. | X | |
| Install all proposed fixed equipment as outlined in the System Description based upon the agreed-upon floor plans, connecting audio, control, and radio transmission cables to connect equipment to the power panels or receptacles, and audio/control line connection points. Installation performed in accordance with R56 standards and state/local codes. | X | |
| Provide system interconnections that are not specifically outlined in the system design, including dedicated phone circuits, microwave links, or other types of connectivity. | | X |
| Connect installed equipment to the provided ground system. | X | |
| Label equipment, racks, and cables. | X | |
| Perform preliminary audit of installed equipment to ensure compliance with requirements and R56 standards. | X | |
| Note any required changes to the installation for inclusion in the “as-built” system documentation. | X | |
| Remove, transport, and dispose of old equipment. | | X |
| Deliverable: Equipment installed. | | |
| **Console Installation and Configuration** | | |
| Identify circuits for connection to console and a demarcation point located within 25 feet of the console interface. | | X |

| Tasks | Motorola Solutions | Mira Costa College |
|---|---|---|
| Connect console to circuit demarcation points. | X | |
| Install PC workstation w/ keyboard and mouse, and monitor. | X | |
| Install console equipment in accordance with R56 standards and state/local codes. | X | |
| Perform console programming and configuration. | X | |
| Deliverable: Console equipment installation completed. | | |
| **Control Station Installation and Configuration** | | |
| Provide the locations of control station at each site. | | X |
| Survey mounting locations and develop control station installation plan. | X | |
| Provide adequate space, grounding, and power for the control station installation. | | X |
| Properly ground the cabling, which will be run to the outdoor antenna location using the least obtrusive method. | X | |
| Provide an elevated antenna mounting location, and adequate feed-line routing and support. | | X |
| Provide and install standard antenna mounts. | X | |
| Properly install antenna system. | X | |
| Install line (not greater than 100 feet in length) and antenna system (connectors, coax grounding kit, antenna, and surge protection). | X | |
| Install RF local control station identified in the equipment list. | X | |
| Provide existing control station codeplugs or provide a list of channels (and associated parameters) to program the proposed control station. | | X |
| Perform control station programming. | X | |
| Deliverable: Control station equipment installation completed. | | |
| **Functional Acceptance Testing** | | |
| Verify the operational functionality and features of the solution supplied by Motorola Solutions, as contracted. | X | |
| Witness the functional testing. | | X |
| Document all issues that arise during the acceptance tests. | X | |

| | | |
|---|---|---|
| If any major task for the system as contractually described fails during the Customer acceptance testing or beneficial use, repeat that particular task after Motorola Solutions determines that corrective action has been taken. | X | |
| Resolve any minor task failures before Final System Acceptance. | X | |
| Document the results of the acceptance tests and present for review. | X | |
| Review and approve final acceptance test results. | | X |
| Evaluate wear-ability of Si device. Provide Feedback to customer on options | X | |
| If any major task as contractually described fails, repeat that particular task after Motorola Solutions determines that corrective action has been taken. | X | |
| Document all issues that arise during the acceptance tests. | X | |
| Document the results of the acceptance tests and present to the Customer for review. | X | |
| Resolve any minor task failures before Final System Acceptance. | X | |
| Deliverable: Completion of functional testing and approval by Customer. | | |
| **PROJECT TRANSITION** | | |
| **Cutover** | | |
| Finalize Cutover Plan. | X | X |
| Conduct cutover meeting with relevant personnel to address both how to mitigate technical and communication problem impacts to the users during cutover and during the general operation of the system. | X | |
| Notify the personnel affected by the cutover of the date and time planned for cutover. | | X |
| Provide ongoing communication with users regarding the project and schedule. | X | X |
| Cut over and ensure that user are operating on system. | X | X |
| Resolve punchlist items, documented during the Acceptance Testing phase, in order to meet all the criteria for final system acceptance. | X | |
| Assist Motorola Solutions with resolution of identified punchlist items by providing support, such as access to the sites, equipment and system, and approval of the resolved punchlist items. | | X |

| | | |
|---|---|---|
| Deliverable: Migration to new system completed, and punchlist items resolved. | | |
| **Transition to Warranty** | | |
| Review the items necessary for transitioning the project to warranty support and service. | X | |
| Motorola Solutions to provide services during year 1 warranty which align with the proposed services. | X | |
| Provide a Customer Support Plan detailing the warranty support associated with the contract equipment. | X | |
| Participate in the Transition Service/Project Transition Certificate (PTC) process. | | X |
| Deliverable: Service information delivered and approved by Customer | | |
| **Finalize Documentation and System Acceptance** | | |
| Provide manufacturer's installation material, part list and other related material to Customer upon project completion. | X | |
| The Overall System Manual will be updated with the following:<br>- Site Block Diagrams.<br>- Site Floor Plans.<br>- Site Equipment Rack Configurations.<br>- Antenna Network Drawings for RF Sites (where applicable).<br>- ATP Test Checklists.<br>- Functional Acceptance Test Plan Test Sheets and Results.<br>- Equipment Inventory List.<br>- Console Programming Template (where applicable).<br>- Maintenance Manuals (where applicable).<br>- Technical Service Manuals (where applicable). | X | |
| Receive and approve documentation. | | X |
| Execute Final Project Acceptance. | X | X |
| Deliverable: All required documents are provided and approved. Final Project Acceptance. | | |

# 2.1 Assumptions

Motorola has made several assumptions in preparing this proposal, which are noted below. In order to provide a firm quote, Motorola will need to verify all assumptions or seek alternate solutions in the case of invalid assumptions.

- All existing sites or equipment locations will have sufficient space available for the system described as required/specified by R56.

- Mira Costa College will provide adequate space in the officer locker room for proposed equipment.
- All existing sites or equipment locations will have adequate electrical power in the proper phase and voltage, and site grounding to support the requirements of the system described.
- Any site/location upgrades or modifications are the responsibility of Mira Costa College.
- Approved local, State, or Federal permits as may be required for the installation and operation of the proposed equipment are the responsibility of Mira Costa College.
- Any required system interconnections not specifically outlined here will be provided by Mira Costa College. These may include dedicated phone circuits, microwave links, or other types of connectivity.
- No coverage guarantee is included in this proposal.
- A dedicated Radio Logger solution is not required and therefore, not included in this proposal.
- No spares are provided in this proposal.
- No backup power is included in this proposal.
- No CAD interface is provided.
- The call counts coming into the site will not exceed the capacity that a single logical dispatch site can handle.
- Interfacing to 3rd party equipment or applications is not a part of this proposal.
- Mira Costa College is responsible for providing connectivity from Customer to San Diego County core.
- Backhaul testing and meeting minimum connectivity requirements as outlined in this proposal will be the responsibility of Mira Costa College. If backhaul link testing fails, a change order to the project may be required.
- Mira Costa College has approval of the County of San Diego to join the RCS system.
- No subscriber work is included in this proposal.

Section 3

# Acceptance Test Plan

System Acceptance of the proposed solution will occur upon successful completion of a Functional Acceptance Test Plan (FATP), which will test the features and functions for the installed new equipment in order to verify that the solution operates according to its design. The Acceptance Test Plan will be determined during the design review.

Section 4

# Project Schedule

Motorola estimates the project implementation to be approximately 4-6 months from Contract Execution to Final Acceptance. As part of the Design Review and Implementation Planning, the implementation project schedule will be fine-tuned by Motorola's Project Manager with the Mira Costa College project team.

Section 5

# Service/Warranty

Motorola will provide warranty services per our standard warranty terms and conditions as outlined within the warranty provisions of the existing contract #553982 between the San Diego County and Motorola, dated June 27th, 2016.

## 5.1 Maintenance and Lifecycle Services

### Essential Services Package

Motorola Solutions' ASTRO® 25 Essential Services (Essential Services) provide an integrated and comprehensive sustainment program for fixed end network infrastructure equipment located at the network core, RF sites, and dispatch sites. Essential Services do not include maintenance for mobile devices, portable devices, or network backhaul equipment.

Essential Services consist of the following elements:

- Remote Technical Support
- Network Hardware Repair
- Security Update Service

### System Upgrade Agreement (SUA II)

The SUA II service provides public safety radio system release updates on a consistent, budgeted plan. These updates maintain reliable network operations and cybersecurity protection. In addition, SUA II will keep the Mira Costa College ASTRO 25 network compatible with expansion elements, as well as new products or features. With SUA II, the Mira Costa College network will remain on a release that qualifies for support services.

Motorola Solutions delivers SUA II in two-year periods, with up to one update in each period. The SUA II service includes the following:

- Software Release Updates - Motorola Solutions-certified software that improves network functions over previous releases. This also includes commercial operating system and application software updates.
- Hardware Update – When needed to support a software release update, Motorola Solutions provides new hardware. New hardware will both support the new software update, as well as maintain existing functions and features.
- Professional Implementation Services – Motorola Solutions will plan and implement updates at the Mira Costa College sites. This includes factory integration, testing, and supply chain management for new software and hardware.
- With these services, Mira Costa College will have access to the technology, support, and planning expertise needed for an effective upgrade.

**Table 1-1: Eligible System Upgrade Window**

| First Eligible Upgrade Window | Second Eligible Upgrade Window | Third Eligible Upgrade Window | Fourth Eligible Upgrade Window |
|---|---|---|---|
| 2026-2027 | 2028-2029 | 2030-2031 | 2032-2033 |

Section 6

# Equipment List

The following equipment will be provided to the Mira Costa College.

| GROUP | QTY | NOMENCLATURE | DESCRIPTION |
|---|---|---|---|
| CORE LICENSE | 1 | UA00156AA | ADD: 5 CONSOLE OPS: AXS, MCC7500/E AND AIS |
| CORE LICENSE | 1 | CA01316AA | ADD:UNC ADDTL DEVICE LIC (QTY 10) |
| CONSOLE POSITION | 1 | HKVN4729A | AXS DISPATCH CONSOLE LICENSE |
| CONSOLE POSITION | 1 | HKVN4730A | LICENSE,AXS TRUNKING SERVICES LICENSE |
| CONSOLE POSITION | 1 | HKVN4731A | LICENSE,AXS ADVANCED CONVENTIONAL SERVICES LICENSE |
| CONSOLE POSITION | 1 | HKVN4732A | LICENSE,AXS SECURE VOICE SERVICES LICENSE |
| CONSOLE POSITION | 1 | HKVN4733A | LICENSE,AXS INTEGRATED IRR |
| CONSOLE POSITION | 1 | HKVN4736A | LICENSE,AXS AMBE+2 VOCODER ROYALTY AND LICENSE |
| CONSOLE POSITION | 1 | HKVN4739A | LICENSE,AXS SECURE OTEK SERVICES LICENSE |
| CONSOLE POSITION | 1 | HKVN4737A | LICENSE,AXS STANDARD LEVEL RADIO RESOURCE CAPACITY LICENSE |
| CONSOLE POSITION | 1 | B1957A | AXS SOFTWARE DVD |
| CONSOLE POSITION | 1 | B1956A | COMMANDCENTRAL HUB, W/CLIENT PC |
| CONSOLE POSITION | 1 | CA03850AA | ADD: WINDOWS OS FOR MCC7500E CONSOLE |
| CONSOLE POSITION | 1 | CA03553AA | ADD: AC LINE CORD, NORTH AMERICA |
| CONSOLE POSITION | 1 | B1951B | MICROPHONE, DESKTOP, USB |
| CONSOLE POSITION | 1 | CA03413AA | ADD: USB CABLE, TYPE A TO TYPE C, 4.5M |
| CONSOLE POSITION | 2 | B1952B | SPEAKER, DESKTOP, USB |
| CONSOLE POSITION | 2 | CA03413AA | ADD: USB CABLE, TYPE A TO TYPE C, 4.5M |
| CONSOLE POSITION | 2 | CA03405AA | ADD: POWER SUPPLY WITH DC CORD |
| CONSOLE POSITION | 2 | CA03406AA | ADD: AC LINE CORD, NORTH AMERICA |
| CONSOLE POSITION | 2 | B1913A | MCC SERIES HEADSET JACK |
| CONSOLE POSITION | 1 | L3226A | CERTIFIED OPTICAL WHEEL MOUSE FOR RSD SERVERS AND WORKSTATIONS |
| CONSOLE POSITION | 1 | L3225A | CERTIFIED KEYBOARD FOR RSD SERVERS AND WORKSTATIONS |

| | | | |
|---|---|---|---|
| CONSOLE POSITION | 1 | RLN6098A | HDST MODULE BASE W/PTT, 15 FT CBL |
| CONSOLE POSITION | 1 | DSF2B56AA | USB EXTERNAL DVD DRIVE |
| CONSOLE POSITION | 1 | RMN5150A | OVER-THE-HEAD, MONAURAL, NOISE-CANCELING HEADSET |
| CONSOLE POSITION | 1 | DSTWIN6328A | PROVIDES ONE DUAL PEDAL FOOTSWITCH |
| CONSOLE POSITION | 1 | DSTG191B | TECH GLOBAL EVOLUTION SERIES 19INCH NON TOUCH |
| CONSOLE POSITION | 1 | T8742A | MCAFEE FOR WINDOWS CLIENT, A2019.2 +PLUS |
| CONSOLE POSITION | 1 | T8806A | WINDOWS SUPP. TRANSPARENT, A2022.1 |
| CONVENTIONAL CHANNEL GATEWAY | 1 | SQM01SUM0333A | MCG 8000 CONVENTIONAL GATEWAY |
| CONVENTIONAL CHANNEL GATEWAY | 1 | CA03714AA | ADD: AC POWER |
| CONVENTIONAL CHANNEL GATEWAY | 1 | CA03717AA | ADD: ACIM INTERFACE |
| SITE CONTROLLER | 1 | T8810A | STANDALONE DSC 8000 CONTROLLER |
| SITE CONTROLLER | 1 | CA04079AA | ADD: ASTRO NEXT SYSTEM RELEASE 2024.X |
| SITE CONTROLLER | 1 | CA03801AA | ADD: DSC 8000 CONVENTIONAL SITE CONTROLLER |
| SITE CONTROLLER | 1 | UA00787AA | ADD: DSC 8000 CONVENTIONAL SITE CONTROLLER SW |
| SITE CONTROLLER | 1 | CA03832AA | ADD: NM--DISPATCH SITE |
| SWITCHES | 2 | CLN9066A | SWITCH,SWITCH,EX4100 24-PORT SWITCH NON TAA |
| SWITCHES | 1 | CLN9105A | FRU: JUNIPER 1M DAC CABLE |
| CONSOLE ALIAS MANAGER | 1 | BVN1013A | MKM 7000 CONSOLE ALIAS MANAGER SOFTWARE |
| CONSOLE ALIAS MANAGER | 1 | TT4270A | Z2 G9 MINI WORKSTATION NON RETURNABLE |
| NETWORK | 2 | T8492A | SITE ROUTER & FIREWALL- AC |
| NETWORK | 2 | CA03445AA | ADD: MISSION CRITICAL HARDENING |
| NETWORK | 2 | CA03448AA | ADD: STATEFUL FIREWALL |
| CONTROL STATION | 1 | L37TSS9PW1AN | ALL BAND CONSOLETTE (CONTROL STATION) |
| CONTROL STATION | 1 | G90AC | ADD: NO MICROPHONE NEEDED APX |
| CONTROL STATION | 1 | G851AG | ADD: AES/DES-XL/DES-OFB ENCRYP APX AND ADP |
| CONTROL STATION | 1 | G996AS | ENH: OVER THE AIR PROVISIONING |
| CONTROL STATION | 1 | GA00580AA | ADD: TDMA OPERATION |

| | | | |
|---|---|---|---|
| CONTROL STATION | 1 | CA01598AB | ADD: AC LINE CORD US |
| CONTROL STATION | 1 | G51AT | ENH:SMARTZONE |
| CONTROL STATION | 1 | GA05508AA | DEL: DELETE VHF BAND |
| CONTROL STATION | 1 | GA05509AA | DEL: DELETE UHF BAND |
| CONTROL STATION | 1 | G78AR | ADD: 3Y ESSENTIAL SERVICE |
| CONTROL STATION | 1 | L999AG | ADD: FULL FP W/E5/KEYPAD/CLOCK/VU |
| CONTROL STATION | 1 | G806BL | ENH: ASTRO DIGITAL CAI OP APX |
| CONTROL STATION | 1 | QA09113AB | ADD: BASELINE RELEASE SW |
| CONTROL STATION | 1 | W969BG | ENH: MULTIKEY OPERATION |
| CONTROL STATION | 1 | G361AH | ENH: P25 TRUNKING SOFTWARE APX |
| CONTROL STATION | 1 | HKN6233C | APX CONSOLETTE RACK MOUNT KIT |
| MICROWAVE ROUTER | 1 | DSC9300L24T4GA | CATALYST 9300L 24P DATA NTWK PERP ADVANTAGE 4X1G UPLINK |
| MICROWAVE ROUTER | 1 | DSPWRC1350WACP2 | 350W AC 80+ PLAT CONFIG 1 SECONDARY POWER SUPPLY FOR C9300 |
| MICROWAVE ROUTER | 1 | DSC9300LDNAA243Y | C9300L CISCO DNA ADVANTAGE |
| MICROWAVE ROUTER | 1 | DSGLCEXSMD | GE SFP LC CONNECTOR EX TRANSCEIVER |
| ANTENNA SYSTEM | 100 | 429150 | COAX, 1/2 FOAM HELIAX CABLE |
| ANTENNA SYSTEM | 3 | 377273 | N MALE COAX CONNECTORS |
| ANTENNA SYSTEM | 1 | 307941 | N FEMALE COAX CONNECTORS |
| ANTENNA SYSTEM | 1 | 58966 | COAX SURGE PROTECTORS |
| ANTENNA SYSTEM | 1 | 71321 | 800 MHZ OMNI ANTENNAS |
| ANTENNA SYSTEM | 1 | 69293 | MOUNTING KITS FOR ANTENNAS |

Section 7

# Pricing Summary

Motorola is pleased to provide the following equipment and services to Mira Costa College. The following pricing is inclusive of the RCS Contract Discounts.

## Equipment and Installation

| Description | Price |
|---|---|
| Equipment | $121,404 |
| Installation | $120,270 |
| Subtotal | $241,674 |
| Estimated Tax on Equipment (7.75%) | $9,409 |
| **Project Total** | **$251,083** |
| SUAII (7 Years) | $59,043 |
| **Grand Total** | **$310,126** |
| Optional Training | $11,598 |

## Lifecycle Services Yearly Breakdown

| Description | Year 1 | Year 2 | year 3 | year 4 | year 5 | year 6 | year 7 | Total |
|---|---|---|---|---|---|---|---|---|
| SUA II | $7,774 | $7,980 | $8,194 | $8,417 | $8,649 | $8,890 | $9,141 | $59,043 |

## Optional Maintenance Services Yearly Breakdown

| Description | Year 1 | Year 2 | year 3 | year 4 | year 5 | year 6 | year 7 | Total |
|---|---|---|---|---|---|---|---|---|
| Essential (Optional) | $4,137 | $4,303 | $4,475 | $4,654 | $4,840 | $5,034 | $5,235 | $32,677 |

# 7.1 Payment Terms

Contract Price. The Contract Price in U.S. dollars is $_____.

Motorola Solutions will use the following major milestones of the project for financial billing:

1. 50% of the Contract Price due upon Contract Execution (due upon effective date); and

2. 50% of the Contract Price due upon Final Acceptance.

100% of the contract price for training (if elected for purchased) will be invoiced upon completion of training.

Customer will make payments to Motorola within thirty (30) days after the date of each invoice. Customer will make payments when due in the form of a wire transfer, check, or cashier's check from a U.S. financial institution. Motorola reserves the right to make partial shipments of equipment and invoice for partial shipment. Overdue invoices will bear simple interest at the maximum allowable rate.

Motorola reserves the right to make partial shipments of equipment and to request payment upon shipment of such equipment. In addition, Motorola reserves the right to invoice for installations or civil work completed on a site-by-site basis, when applicable.

For Lifecycle Support Plan and Subscription Based Services: Motorola will invoice Customer annually in advance of each year of the plan.

Due to significant market and tariff volatility, as well as fluctuations in the cost of energy and raw materials including, but not limited to, steel, copper, finished wood, and concrete, Motorola Solutions reserves the right to equitably adjust the contract price, completion schedule, and/or contract requirements. Additionally, Motorola Solutions reserves the right to apply a fuel surcharge to quoted freight rates based on the prevailing diesel cost at the time of shipment.

Section 8

# Contractual Documentation

The proposed solution is subject to the terms and conditions of the agreement between San Diego County and Motorola Solutions for San Diego County Regional Communications System (RCS) Replacement, Agreement No. 553982, dated June 27, 2016. Both Motorola and San Diego County agree and acknowledge that, to the extent that County purchases any or all of the services described in this proposal during the term of the Motorola / San Diego County Contract 553982(Contract), purchases will be made using a Purchase Order issued against the Contract and the terms and conditions within the Contract and this proposal will apply to the procurement.

# Backhaul Requirements

Motorola Solutions backhaul requirements are on the following pages.

IP Network Practice Office

# ASTRO Services Requirements

**Version 1.4**

# Contents

# Introduction

This document specifies the current Motorola requirements for ASTRO services on an IP Ethernet network. This document's intended use is for new and existing backhaul deployments for ASTRO to convey the specific application requirements.  It covers all aspects of the service design to ensure proper requirements are presented to ensure consistent network performance regardless of implementation.

This document uses terms such as "**MUST**", "**MUST NOT**", "**SHOULD**" to define the requirement as outlined in RFC2119.

# 1. Service Definitions

All application services **MUST** be designed and configured to support a routed network architecture, a switched network architecture (Point to Multi-point) or a dedicated link (Point to Point). Load Balancing **MUST NOT** be used in support of ASTRO transport.

ASTRO will construct point-to-point tunnels (IPSEC or IPIP depending on design) across the provided infrastructure to carry application payload.

The following table defines the expected communication paths within the ASTRO application

| Link Type | Location 1 | Location 2 | Link Category |
|---|---|---|---|
| Dispatch Site Link | Dispatch Center | ASTRO Core | Site |
| RF Site Link | Repeater Site | ASTRO Core | Site |
| Prime Site Link | Simulcast Prime Site | ASTRO Core | Site |
| SubSite Link (Simulcast) | Simulcast/Tsub Subsite | Simulcast Prime Site | Subsite |
| Geo-Prime Site Link (L2) | Simulcast Prime Site | Simulcast Prime Site | Geo Prime |
| CSUB Site Link | Conduit Hub Site | ASTRO Core | Site |
| SubSite Link (CSUB ) | Base Radio / Hub Site | Hub Site | Subsite |
| SubSite Link (CSUB ) | Base Radio / Hub Site | Conduit Hub Site | Subsite |
| Geo-CSUB Site Link (L2) | Conduit Hub Site | Conduit Hub Site | Geo Prime |
| InterZone/DSR Link | ASTRO Core | ASTRO Core | InterZone |
| Geo CEN Link (L2) | ASTRO Core | ASTRO Core | Geo CEN |

Table 1: ASTRO Communication Paths

# 2. Service Demarcation

All ASTRO service demarcation points **SHOULD** be copper RJ45, configured per Table 2. All layer 3 ASTRO demarcation points **MUST** be untagged. All Layer 2 ASTRO demarcation points **MUST** be tagged.

All layer 3 ASTRO interfaces will utilize static routing on the CE for communication. There are no dynamic routing protocols (RIP, OSPF or BGP) on the CE-PE links. Reference section 5 below for additional requirements.

The following table defines the physical demarcation requirements at each location

| Site Hardware | Network Architecture | Interface Type | Speed & Duplex | Tagged | Link Type |
|---|---|---|---|---|---|
| S6000<br>GGM8000 | L2 | Copper | 100FDx | Y | Site Link/<br>SubSite Link |
| S6000<br>GGM8000 | L3 | Copper | 100FDx | N | Site Link/<br>SubSite Link/<br>InterZone |
| SRX345/1500 | L2 | Copper | Auto | Y | Site Link/<br>SubSite Link |
| SRX345/1500 | L3 | Copper | Auto | N | Site Link/<br>SubSite Link/<br>InterZone |
| HP2930<br>DSC8000 | L2 | Copper | 10/100FDx | Y | Geo Prime/<br>Geo CEN |

Table 2: Physical Demarcation

All ethernet cables provided **MUST** meet CAT5e standards or better.

# 3. Quality of Service

Quality of service **MUST** be enabled and configured on all CE-PE interfaces. The transport network **MUST** honor all forwarding classes defined on all intermediate transport nodes. The classifications used are unique to each service type being provided.

The following table outlines the recommended classification requirements for each service type

| Application | Service Type | QOS Model | Priority Level |
|---|---|---|---|
| ASTRO<br>- Site Links<br>- Subsite Links<br>- InterZone Links | Layer 3 | DSCP | EF |
| | | | AF41 |
| | | | AF11 |
| ASTRO<br>- Site Links<br>- Subsite Links | Layer 2 WAN<br>- Point to Multipoint<br>- Point to Point | 802.1p | 6 |
| | | | 4 |
| | | | 1 |

| Application | Service Type | QOS Model | Priority Level |
|---|---|---|---|
| ASTRO<br>- Geo Prime Link<br>- Geo CEN Link | Layer 2 LAN<br>- Point to Point | 802.1p | 5-7 |
| | | | 0-4 |

Table 3: Quality of Service Class Definitions

When provisioning QOS, all queues **SHOULD** be provisioned to the link required Committed Information Rate (CIR). Reference Section 6 for service performance requirements.

# 4. CE-PE Interfaces

## 4.1 Maximum Transmission Unit (MTU)

MTU is driven by the topology being deployed and **MUST** be set appropriately. For an ASTRO Layer 3 deployment, the transport **MUST** be set to a minimum MTU of 1518 bytes. For an ASTRO Layer 2 deployment, the transport **MUST** be set to a minimum MTU of 1522 bytes to account for the 802.1Q header.

When deploying Geo-Simulcast, Geo-CSUB or Geo-CEN, the Intra-Site Link **MUST** be set to a minimum MTU of 1522 bytes.

## 4.2 Routing Isolation

All ASTRO services **MUST** be separated from all other network services in its own L3VPN. On larger designs each zone core, simulcast subsystem, and Conventional Subsystem **SHOULD** have their own L3VPN to permit smaller routing tables and better network isolation.

No dynamic protocols are required on ASTRO service Interfaces. When implementing MPLS, please reference the "*MPLS Requirements Document*" for additional requirements on the provisioning of the network and the services.

## 4.3 CE-PE IP Plan

All ASTRO CE-PE IP addresses **SHOULD** use RFC 1918 addresses, **MUST NOT** conflict with internal ASTRO IPs and **SHOULD** follow the latest IPNPO recommended plan.

The following list identifies the addresses that are allocated for use inside of the ASTRO system, overlapping with any of the address listed below will cause certain features to become unavailable:

- 10.0.0.0/16 ~ 10.15.0.0./16
- 10.101.0.0/16 ~ 10.107.0.0/16

- 10.151.0.0./16 ~ 10.157.0.0/16
- 10.184.1.0/24 ~ 10.200.0.0./24
- 10.248.16.0/20 ~ 10.248.127.0/20
- 172.16.0.0./16 ~ 172.31.0.0./16
- 180.15.0.0/16
- 183.1.0.0/16 ~ 183.7.0.0/16
- 183.128.0.0/15
- 183.192.0.0/16
- 184.8.0.0/13 ~ 184.56.0.0/13

# 5. Ports and Protocols

The transport network **MUST** be able to process and pass the following ports and protocols to ensure proper application communication.

| Link Type | Encrypted | Protocol | Port Numbers |
|---|---|---|---|
| ASTRO Site Link (MNR) | N | IPIP- ID 4 | N/A |
| ASTRO Site Link (MNR) | Y | IPSEC - ID 50 & 51 | UPD Port 500 |
| ASTRO Site Link (SRX) | N | IPSEC - ID 50 & 51 | UPD Port 500 |
| ASTRO Site Link (SRX) | Y | IPSEC - ID 50 & 51 | UPD Port 500 |
| Geo-Simulcast Intra-Prime Link | N/A | ALL | ALL |

Table 4: Failure detection protocols & configuration

# 6. End-to-End Service Requirements and Testing

## 6.1 Service Performance

All ASTRO services **MUST** pass a time appropriate y.1564 test configured with the link metrics for the link being tested. The metrics to be tested **MUST** include at a minimum: IPTD, IPDV, IPLR, Bandwidth and QoS.  These tests **MUST** be completed before system acceptance.

The following table outlines the Service Level Agreement (SLA) requirements for each of the link types in the system (**Note that all values are one-way values**).

| Link Type | Latency | Jitter | Packet Loss | Availability | Bandwidth (CIR) |
|---|---|---|---|---|---|
| Site Link | < 10ms | < 10ms | < 0.01% | 99.999% | 1 to 10 Mbps |
| SubSite Link | < 10ms | < 10ms | < 0.01% | 99.999% | 1 to 10 Mbps |
| InterZone Link | < 10ms | < 10ms | < 0.01% | 99.999% | 10 Mbps Per Zone |
| Geo-Prime Link | < 5ms | < 5ms | < 0.01% | 99.999% | 10 to 100 Mbps |
| Geo-CEN Link | < 5ms | < 5ms | < 0.01% | 99.999% | 10 to 100 Mbps |

Table 5: Service Level Agreement Requirements

## 6.2 Service Failure and Recovery

To ensure continuous operation of all applications, the transport **MUST** be designed to detect and recover from failures in a given window. Network failure convergence and recovery times **SHOULD** be less than 900 ms to support the ASTRO site links.

Failure convergence and recovery times **SHOULD** also be tested before system acceptance. These times **MUST NOT** be measured via a physical link pull from the CE as this gives an unrealistic failure time.

# Contributors & Revision History

Contributors & Revision Information

| Version | Date | Contributor | Change Comments |
|---|---|---|---|
| 1.4 | 2/7/2023 | Waleed Shayib<br>Vince Patrizi | - Updated version number to match user editable template<br>- Re-organized sections to allow for better flow<br>- Removed PE-PE Requirements<br>- Moved MTU specs under the PE-CE Interface<br>- Added additional clarifications to the document<br>- This document now replaces the editable template |
| 1.0 | 1/10/2023 | Waleed Shayib<br>Vince Patrizi | - Initial Release |

# Glossary and Acronyms

| Term | Definition |
|---|---|
| P | Provider Link - The Wide Area Transport Link used to tie the Transport (MPLS) Nodes together |
| PE | Provider Edge - The physical demarcation point that will interface to the Customer Edge/Equipment (CE) |
| CE | Customer Edge - Motorola Site Router or HP Switch |
| TE | Traffic Engineering - The act of influencing the traffic flow other than the shortest calculated path |
| HA | High Availability = Fault Tolerant |
| VPRN | Virtual Private Routed Network - Isolated Routing instance inside an MPLS network |