

Integrated Voice and Data Network - Subscribers

10.0 SUBSCRIBER RADIO

10.0.1 Summary

Motorola will provide the Commonwealth of Virginia ASTRO 25 Digital Subscribers (portables, mobiles and control stations), Digital Vehicular Repeaters, and Mobile Computer Terminals for users to operate on the STARS Integrated Voice and Data (IV&D) network. The different models and tiers of ASTRO 25 digital subscribers supplied will enable the Commonwealth agencies to employ the radio types appropriate for their particular operational needs. This document describes the models and features of these subscribers. Data sheets for this equipment are located in Appendix 5. Motorola will upgrade VSP's VHF Astro Spectra radios for use in STARS with the exception of the encryption. The unit price for this upgrade is provided in the Contract price list.

10.1 ASTRO 25 DIGITAL SUBSCRIBER RADIOS

All mobile and portable radios meet MIL-STD-810C, D or E standards as detailed in the specification sheets. All radios will be programmed with Motorola's Customer Programming Software (CPS) to enable the use of specific talkgroup templates, conventional channels, properly coordinated locality trunked channels, and trunked system features.

All mobile and portable subscriber radios are FLASHport™ capable. This feature will allow Commonwealth agencies to purchase new system features to their radios as features become available. Many features and enhancements may be added by loading new software. These software enhancements and options provide the capability to add new functionality that can immediately be "flashed" into the radios.

10.2 MOBILE RADIOS

10.2.1 XTL 5000 Digital Mobile Radio



Figure 10-1 – The XTL 5000 Mobile Radio

Motorola will provide the Commonwealth of Virginia VHF ASTRO 25 digital mobile radios, which incorporate microprocessor-driven advanced digital technology based on the APCO Project 25 standard. These will be XTL 5000 model W3, W7 and W9 radios capable of operating on trunked and conventional channels. Please see Figure 10-1 above for illustration.

10.2.1.1 XTL 5000 Specifications/Features

- 110 Watts variable output power
- VHF band frequency range of 136-174 MHz
- Manufactured and assembled in the USA
- 8 megabytes of memory
- RS-232 and USB 2.0 accessory connectors
- Uni-board design gives improved access to all components on board, allowing for reduced time in assembly/disassembly and serviceability.
- Weather resistant per Mil Standard 810 blowing rain specification
- Accessibility of RF, DC power, and accessory connectors simplifies installation
- Lead free design (Green Radio)
- Automatic Gain Control for interference protection without degrading range
- AES encryption capability (when equipped)
- Alphanumeric display
- Programmable calling lists (stored in radio)
- Compatible with Direct Entry Keyboard (DEK)
- Programmable soft keys
- Dash and remote mount configurations
- Multiple modes of operation in a single radio: various combinations of digital/analog, Motorola trunked/conventional, narrowband/wideband, and encrypted/clear

- ASTRO 25 data capable
- Programmable RF power
- Multikey encryption capability (when equipped): 16 encryption keys, 2 encryption algorithms

10.2.1.2 XTL 5000 Control Heads

Motorola will provide the Commonwealth three different control head models for the XTL 5000 radio: W9, W7 and W3 (See Figure 10-2).



Figure 10-2 – The XTL 5000 Control Heads for the W9, W7 and W3

Model W9 includes:

- 512 Channels
- 11-Character alphanumeric display
- Dialing from prestored lists
- 3 x 4 Keypad for direct dialing
- Electronic mode and volume control
- Trunk Mount Only
- Emergency Push button

Model W7 includes:

- 512 Channels
- 8-Character alphanumeric display
- 3 x 4 Keypad for direct dialing
- Electronic mode and volume control
- Trunk Mount or Dash Mount
- Emergency Push button

Model W3 includes:

512 Channels
14-Character alphanumeric display
Dialing from prestored lists
Hand Held Control Head
Trunk Mount Only
Emergency Push button

10.2.1.3 XTL 5000 Standard Features

10.2.1.3.1 Multiple System Configurations

The XTL 5000 is compatible with a broad number of system configurations that include both conventional and trunked (SMARTNET, SmartZone) systems in both analog and digital modulation.

10.2.1.3.2 Field Programmable

The ASTRO Digital XTL 5000 is field-programmable using the Customer Programming Software (CPS) running on Microsoft Windows operating system.

10.2.1.3.3 FLASHport Capability

FLASHport provides the Commonwealth with the ability to change expand and modify the system without significant hardware obsolescence. Because the ASTRO 25 Digital XTL 5000 is FLASHport capable, the Commonwealth can select only those system features needed today and upgrade them as the needs change.

10.2.1.3.4 Digital Ready

The XTL 5000 is a “digital ready” radio that operates in a digital trunked, analog trunked or conventional system.

10.2.1.3.5 Repeater / Direct

The repeater/direct conventional feature allows a user to bypass a conventional repeater and talk directly to another radio. This is known as “simplex” operation or Talkaround operation. The transmit frequency is the same as the receive frequency. In Repeater operation, the user talks through the repeater, which increases the radio’s operating range. The transmit frequency is not the same as the receive frequency.

10.2.1.3.6 Multiple Squelch Operation

Conventional channels can be programmed with a Tone Private Line (PL), a Digital Private Line (DPL) code, or can be operated in carrier squelch. When in carrier squelch operation, all traffic on the channel is heard. When in PL, or DPL operation, a user’s radio responds to only those messages intended for the user. PL, DL, and carrier squelch can be programmed on a per channel basis.

10.2.1.3.7 Scan Operation

The scan feature allows the user to monitor different conventional and/or trunked modes as well as trunked system talkgroups without changing the mode-select switch. There are three different types of scan lists available: Conventional Scan, Trunking Priority Monitor, and Talkgroup Scan.

In Conventional Scan, the radio will scan for convention channels looking for voice activity. When activity is located, the user will join the conversation already in progress. Conventional Scan allows 16 members per scan list and supports Non-priority or Priority scan.

In Trunking Priority Monitor, the radio will scan talkgroup modes on one system only looking for voice activity. When activity is located, the user will join the conversation already in progress. Trunking Priority Monitor is only available on Trunking systems and can scan up to 16 members per scan list, and scanning is limited to a single system.

In Talkgroup Scan, the radio will scan trunking talkgroups and conventional channels from more than one system looking for voice activity. When activity is located, the user will join the conversation already in progress. Talkgroup Scan allows 10 members per scan list and will not support priority scan. Talkgroup scan allows scanning across multiple systems.

Emergency Operation

An explanation of the Emergency button feature is based upon the perspective of an officer sitting in their driver’s seat operating a STARS mobile radio:

1. When VHF mobile is on a VHF conventional channel: emergency button is pressed and radio is programmed for conventional signaling, an emergency signal will be sent on a conventional channel. However the receiving radio console must have the capability for decoding the signal.
2. When VHF mobile is on a non-STARS VHF trunked P25 system: emergency button is pressed and radio is programmed for P25 VHF emergency signaling, an emergency signal will be sent to the non-STARS P25 VHF system. However the receiving radio console must be programmed for decoding the signal.

10.2.1.3.8 Secure Operation

Secure operation provides the Commonwealth with voice security on trunked or conventional channels. Only radios with voice encryption technology and the proper decryption key are able to decode the information. This makes it virtually impossible for unauthorized parties to monitor the transmission. The secure-capable XTL 5000 mobile radio will be equipped with AES encryption, multikey and OTAR. Specific AES encryption and multikey quantities vary per agency. Please see the equipment pricing of this contract for exact quantities. The OTAR operation is described in Section 11.

10.2.1.4 Trunking Features

10.2.1.4.1 Trunked System Busy

If all voice channels are in use, the radio emits a busy tone, similar to a telephone busy tone. The busy tone indicates that the request for a voice channel has been recognized by the system. The user is then placed in a queue until the control channel makes channel assignment.

10.2.1.4.2 Callback

When a radio in queue is assigned a voice channel, a series of three short tones indicates that a channel has been assigned and the conversation can begin. The user has two seconds to start using the channel or the radio goes back to the control channel and will have to request a channel assignment once again.

10.2.1.4.3 Talk Permit

Each time the PTT switch is activated and a voice channel assignment is granted, a series of short tones (identical to callback tones) will signal the user that a channel has been assigned and the user is free to begin the conversation. These tones may be turned off or on using the Radio Service Software programming.

10.2.1.4.4 Out of Range/Talk Prohibit

If a radio user attempts to transmit while out of range of the system, the radio generates a continuous low-pitched tone until the PTT switch is released. This tone is also generated when the radio is switched to an un-programmed mode.

10.2.1.4.5 Selective Radio Inhibit

Selective Radio Inhibit allows the NOC to selectively deny an individual radio access to the radio system over the air through commands sent via the system management terminal. Once inhibited, the radio is inoperable until the system manager restores it to operation.

10.2.1.4.6 Dynamic Regrouping

Dynamic Regrouping enables a system manager at the NOC to modify the talkgroup assignments of any individual radio from a system manager terminal. For example, a manager might use this feature to create specific groups for tactical operations, shift changes, or “storm plans”.

10.2.1.4.7 Emergency Alarm/Emergency Call

Emergency Alarm/Emergency Call is used by law-enforcement radio operators to inform dispatch personnel of a life-threatening situation. In the emergency alarm feature, data is transmitted to dispatch via the control channel. This alerts the dispatcher of the emergency condition and identifies the unit sending the emergency signal. The emergency call feature is a type of dispatch operation, which gives the radio priority access to the system. The emergency call feature is programmable through CPS and is typically set up for the top of the queue. The call is then placed in the top of the queue in order to get access to the next available channel. Other registered members of the talkgroup will also receive an indication.

10.2.1.4.8 Push to Talk ID (PTT-ID)

Push to talk ID allows the radios to generate their ID so that the dispatcher can identify the radio caller currently speaking. The ID of the transmitting radio is automatically sent when the PTT button is pressed. This ID is displayed on a properly equipped console. The ID's are displayed each time the push to talk is pressed.

10.2.1.4.9 Call Alert

The call alert function allows a caller to leave a “page” in an unattended radio. This prevents users from tying up airtime calling unattended radios. Since the page is both visual and auditory, this feature is particularly beneficial for radio users whose jobs frequently take them away from their radio, or who operate in a noisy environment. When the Call Alert is sent, the receiving radio will emit a series of tones until the user responds or resets the radio. Any button press will turn off the Call Alert indicators.

The radios can be programmed to operate Call alert in several different ways. Call Alert Encode Only enables a radio programmed with this capability to initiate a call alert. Call Alert Decode Only enables a radio to only receive call alert pages. A radio can also be programmed for both

Call Alert Encode and Decode, so the user can place and receive calls. Limited Call Alert allows the user to only place calls from the preprogrammed list. With unlimited call alert, the user may place calls to unlimited radios using the keypad.

10.2.1.4.10 Private Conversation

Private Conversation allows the user to selectively call an individual radio and hold a private conversation that other radios in the talkgroup cannot hear. Once the private conversation is established, the two units will not hear any other normal radio traffic that occurs while the private conversation is in progress. These capabilities are activated through CPS. PC encode is available in two ways, limited and unlimited. With limited PC, the user must select from a preprogrammed list. Up to 8 ID's can be programmed into the radio. This 6 digit ID is the ID of the trunked radio. With unlimited PC, the target user ID is entered via the keypad.

Private Conversation Encode enables a radio programmed with this capability to initiate a private conversation to another radio. Private Conversation Decode enables a radio to only receive phone calls. A radio can also be programmed for Private Conversation Encode and Decode, so the user can place and receive private conversation calls.

10.2.1.4.11 Failsoft

Certain major failures in a trunking system cause the radio to revert to failsoft operation and automatically switch to its failsoft channel. During failsoft, the trunking repeaters will transmit a medium-pitched tone every 10 seconds. When the trunking system returns to normal operation, a user's radio will automatically leave the failsoft operation and return to trunked operation.

10.2.1.5 SmartZone Features

10.2.1.5.1 Automatic Site Registration/Deregistration

The XTL 5000 radios automatically send in their unit ID's and current mode selections upon power up, power down, site switches, talkgroup changes and on exiting emergency operation. This enables the zone controller to monitor the operation of the radio at all times, including talkgroup operation carried out by the radio.

10.2.1.5.2 Automatic Site Switching

The XTL 5000 radios use Received Signal Strength Indication (RSSI) to determine whether the radio should switch automatically to another site.

10.2.1.5.3 Busy Override

When a talkgroup call is placed in a SmartZone system and the system is not able to obtain voice channels at all necessary sites, a busy tone will be generated. If so programmed in the zone manager and through radio service software, the user may override this busy with Busy Override. The talkgroup call will be placed at all sites that have voice channels available. Other sites will be added to the call as channels become available.

10.2.1.5.4 Preferred Site

ASTRO 25 Digital XTL 5000 SmartZone radios can program certain sites to be preferred, always preferred, least preferred or no preference. This provides the user the flexibility to keep a radio on a particular site, regardless of the presence of a stronger signal from another site. Motorola will provide an analysis of actual subscriber distribution and recommend assignment of these mobiles to the appropriate preferred sites.

10.2.1.5.5 Full Spectrum Scan

The XTL 5000 Mobile radio is capable of SmartZone full spectrum scan. This feature allows the user to scan all frequencies for a control channel within the radio band range in addition to those frequencies that are pre-programmed via the CPS. This feature reduces the possibility of not being able to find all possible operating channels. Another advantage to users occurs when additional system capability (with new frequencies) is added. With full spectrum scan, radios do not have to be reprogrammed.

10.2.1.5.6 Site Lock / Site Change

This feature allows a user's radio to lock onto a specific site and not roam among wide-area talkgroup sites. This is particularly useful when operating at the fringe of a system's coverage area. The Site Search Button can be used to manually force the radio to change to a new site.

10.2.1.5.7 Control Station Accessories

A control station power supply (which includes the power cable) and tray will be ordered for control station configurations. These accessories are compatible with the W7 model.

The local controlled XTL 5000 W7 control station includes a speaker, desk microphone with monitor switch, and power supply.

10.2.1.6 Direct Entry Keyboard (DEK)

The XTL 5000 mobile radio is compatible with Direct Entry Keyboard (DEK). The DEK will control lights/siren/PA systems as well as acting as "short cut" buttons to some of the functions on the XTL 5000 radio. For example, the Commonwealth can program "Button 3" on the DEK to change the XTL 5000 mobile radio to "Channel One" instead of scrolling through the channels.

The DEK is approximately the same width as the XTL 5000, about 3 inches high and about 6 inches deep. The DEK usually sits right on top of the XTL 5000, although it can be mounted anywhere. The DEK works with a remote mount XTL 5000 radio. Specific DEK quantities vary per agency. Please see the equipment pricing of this contract for exact quantities.

10.2.2 XTL 2500 Digital Mobile Radio



Figure 10-3 – The XTL 2500 Mobile Radio

The XTL 2500 Digital VHF mobile radio is a powerful mid-tier radio for use by both the Public Safety and Public Service environment. Please see Figure 10-3 for illustration. The XTL 2500 mobile radio will utilize a new control head that is currently under development. The availability of the XTL 2500 radio with the new control head will be in the late 2004 timeframe. The XTL 2500 will share the same transceiver as the XTL 5000. The mobile specifications for the VHF transceivers will be at least those of the current ASTRO Spectra Plus VHF radios. The XTL 2500 radio will operate on one single VHF band, 136-174.

10.2.2.1 XTL 2500 Design/Technical Highlights

- 110 Watts variable output power VHF band frequency range of 136-174 MHz 8 megabytes of memory
- RS-232 and USB 2.0 accessory connectors
- Uni-board design gives improved access to all components on board, allowing for reduced time in assembly/disassembly and serviceability.
- Weather resistant per Mil Standard 810 blowing rain specification
- Accessibility of RF, DC power, and accessory connectors simplifies installation
- Lead free design (Green Radio)
- Advanced Digital Privacy (ADP) encryption capability (when equipped)
- Automatic Gain Control for interference protection without degrading range

10.2.2.1.1 XTL 2500 Control Head

The XTL 2500 mobile radio control head will feature a volume knob, mode knob, navigation key, programmable soft keys, and a front-end display.

10.2.2.1.2 Secure Operation

Secure operation provides the Commonwealth with voice security on trunked or conventional channels. Only radios with voice encryption technology and the proper decryption key are able to decode the information. The secure-capable XTL 2500 mobile radio will be equipped with ADP encryption. ADP is a low level software encryption algorithm that can be enabled via CPS. Specific ADP encryption quantities vary per agency. Please see the equipment pricing of this contract for exact quantities.

10.2.2.1.3 Direct Entry Keyboard (DEK)

The XTL 2500 mobile radio is compatible with Direct Entry Keyboard (DEK). The DEK will control lights/siren/PA systems as well as acting as “short cut” buttons to some of the functions on the XTL 2500 radio. For example, the Commonwealth can program “Button 3” on the DEK to change the XTL 2500 mobile radio to “Channel One” instead of scrolling through the channels.

The DEK is approximately the same width as the XTL 2500, about 3 inches high and about 6 inches deep. The DEK usually sits right on top of the XTL 2500, although it can be mounted anywhere. The DEK works with a remote mount XTL 2500 radio. Specific DEK quantities vary per agency. Please see the equipment pricing of this contract for exact quantities.

10.2.3 CDM 750 Low Band Mobile Radio

The CDM 750 low band mobile radio features include limited signaling capabilities and two customizable function buttons. Motorola's X-Pand audio enhancement and a large front-projecting speaker ensure clear sound, even in noisy environments. Refer to Appendix 5 for more detailed specifications.

10.2.3.1 Additional CDM 750 Features include the following:

- Large, easy-to-use controls
- Powerful, front-projecting speaker
- 12.5/25 kHz switchable channel spacing
- Remote mountable control head

This radio will have a noise Blanker or similar circuitry. This radio will operate on a frequency of 39.54 MHz in simplex operation.

10.3 Digital Vehicular Repeater System

Motorola will provide the Commonwealth of Virginia with a VHF/800/700 MHz crossband Digital Vehicular Repeater System (DVRS). The VHF trunked system side (mobile radio side) of the DVRS will communicate with the VHF ASTRO 25 Integrated Voice and Data system, while the 700/800 MHz conventional digital side of the DVRS will communicate with 700/800 MHz XTS 5000 portable radios.

10.3.1 DVRS Functionality

The DVRS will operate with an ASTRO 25 VHF XTL 5000 mobile radio and include the following integrated features:

- Portable to Portable or talkgroup calls through the vehicular repeater (local mode)
- Mobile to Mobile or talkgroup calls through the ASTRO 25 infrastructure (mobile mode)
- Unit-to-unit or talkgroup calls through the vehicular repeater and infrastructure (system mode)
- Talk-permit tones when operating the 700/800 MHz XTS 5000 portable radios push-to-talk (PTT) while in DVRS system mode
- Conventional Digital/trunked operation (i.e., mobile-to-infrastructure link)
- Remote activation of emergency alarm/call
- Portable ID pass-through
- End-to-end AES encryption (Portable-to-DVRS-to-system)
- All standard features/specifications of the Futurecom Mobexcom VRS as shown in the datasheet located in Appendix 5

10.3.2 Multi-VRS Operation

The DVRS will accommodate multiple units in the same area on the same talk group. DVRS units provide an automatic method of determining the presence of other DVRS in the same area on the same talk groups and provide a means of automatically arbitrating unit operation so that local traffic is handled without the need of user intervention. Moreover, the DVRS unit provides an automatic means of transferring control of local traffic (handoff) as unit(s) arrive/depart a common scene. The DVRS is capable of 64 separate talk group talk paths (limited by the number of frequencies available in the operating mode).

10.3.3 Tunnel Operation

Each tunnel will house a 700/800/VHF crossband DVRS in-rack configuration operating on a single 700 MHz or 800 MHz conventional channel. Operation is described in Section 10.3.1 and 10.3.2. See Section 2 – Tunnel System - for further detail.

10.4 MOBILE DATA TERMINALS

10.4.1 Motorola Laptop 900 (ML 900)



*The ML900 shown closed
for convenient portability*

Figure 10-4 – The ML900

Motorola's ML900 (Figures 10-4 and 10-5) is designed as a ruggedized public-safety laptop computer as specified in Appendix 5. The ML900 computing specifications include at least an Intel Pentium 4 with a 1.7 GHz Processor, 1 GB of memory and 60GB of hard drive space. The ML900 display is at least a 12.1" transfective XGA (1024 x 768 resolution) LCD panel

touchscreen. The latest version of the following programs or Commonwealth approved equivalent will be provided and installed (except where noted).

- Windows Office Professional
- Adobe Acrobat Reader
- WINSIP
- Norton Ghost
- Delorme Street Atlas
- Norton Anti Virus
- Drug ID (Commonwealth Supplied)
- VIN Assist (Commonwealth Supplied)
- Police Crimes and Punishment (Commonwealth Supplied)
- Virginia State Police Manual (Commonwealth Supplied)
- VSP Forms, MS Office Templates (Commonwealth Supplied)
- APS QuickVoice
- Mobile Flash

VSP forms and manuals will only be installed in VSP patrol vehicles.

The ML900 laptop's integrated-wireless capabilities with internal radios include:

1. Integrated 802.11g Wireless LAN (WLAN)
2. Integrated GPS receiver with externally mounted vehicular antenna

The ML900 input/output capabilities include:

- Four USB 2.0 ports
- One serial port
- An IEEE1394 digital high-speed video input (Firewire) port
- An analog (composite) video input port
- A DVI video output port which can be converted to 15pin VGA-style video signaling
- Dual stereo speakers
- Internal CD-ROM drive
- A fingerprint image reader port

The ML900 includes an on-board fingerprint reader, allowing for authentication log-in to the laptop or to user applications. The ML900 passes the radio signals from its internal GPS radio through an RF port on the bottom of the unit, allowing better signal transmission and reception when the unit is placed in the docking station.

The serviceability of the ML900 is provided through field-replaceable hard drives, memory, and swappable peripheral drives. The durability of the ML900 includes a sealed case, heat-dissipating design, and the ability to withstand vibration and impact. Finally, the ML900 complies with the MIL-810E/F standard for design and testing to handle the rugged demands of the harsh mobile environment.

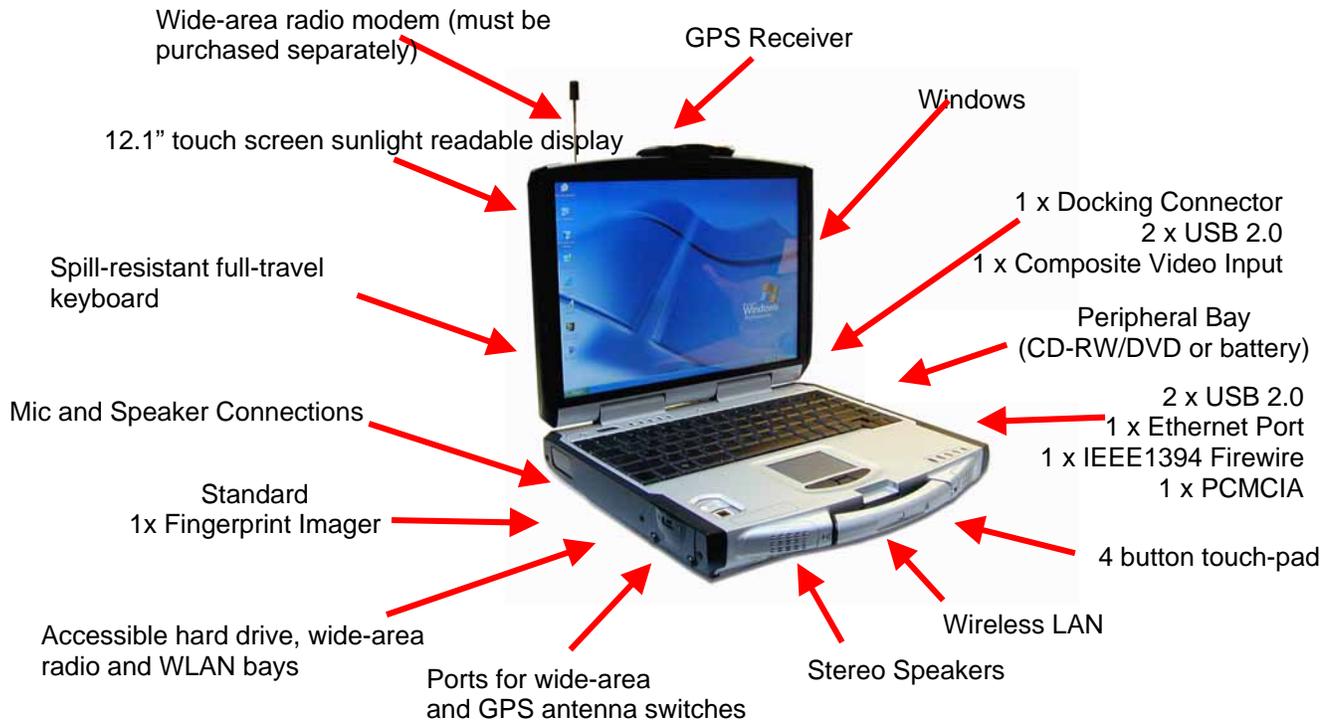


Figure 10-5 - The figure above shows some of the features of the ML900 laptop

10.4.1.1 Additional Key ML 900 Features

- Fully sealed magnesium alloy housing that meets rigorous environmental specs of MIL-STD-810F described in Appendix 5.
- Integrated DVD-RW supplied in Multiuse Peripheral Bay.
- Intel Pentium IV 1.7 GHz Processor, minimum.
- Field-replaceable 40 GB 3-D shock mounted hard drive, minimum.
- Motorola's Advanced Vehicle Dock with Hot-docking capability and automatic external antenna switching.
- Sunlight readable high-resolution XGA LCD panel. The ML 900 features a 12.1" glare-free transfective display, high resolution XGA LCD Panel that provides high quality detailed graphical images, fingerprints and mugshots.

- The ML 900 runs Windows operating systems specified herein and is compatible with Motorola's Public Safety applications such as Premier MDC™, and Airmobile™ software packages.
- ML900, consumables is defined as batteries and any peripherals that ship outside the case of the ML 900.

10.4.1.2 ML900 Peripherals

10.4.1.2.1 External GPS Antenna

Each vehicle equipped with a ML900 Mobile Data Computer and in-vehicle mapping capability will be supplied with an external GPS antenna connected to the docking station's RF port.

10.5 Portable Radios

10.5.1 XTS 5000 DIGITAL PORTABLE RADIO

Motorola is providing the Commonwealth of Virginia 700/800 MHz and VHF portable radios to operate on the STARS Integrated Voice and Data system. These will be the Model II and Model III ASTRO 25 XTS 5000 digital portable radios.



Figure 10-6 - The XTS 5000, displayed from left to right are Models II & III

10.5.1.1 Technical Features

- Multiple modes of operation (ASTRO clear and encrypted, Analog, Digital)
- Project 25 compliant on Conventional and Trunking Type II systems
- Project 25 compliant interoperable voice signaling features
- Narrow and wide bandwidth digital receiver (12.5/20/25/30 kHz)
- High quality, error corrected digital voice
- High speed and embedded digital signaling (ASTRO)
- CPS FLASHport capable via Windows
- 8MB of memory
- Multikey Encryption: up to 16 Encryption keys
- AES encryption capability (when equipped)
- Meets Mil Specs 810 C, D, E, and F as specified in Appendix 5
- Fully Integrated Voice & Data Capability
- Programmable switches/buttons
- Orange Emergency top button
- Two-position Concentric Switch
- Three-position Toggle Switch
- Top side Monitor button
- Two side buttons
- Large PTT button
- Angled On/Off Volume Knob
- Illuminated 16-Position top mounted rotary knob
- Transmit LED Indicator

XTS 5000 Model II & III include:

- Up to 512 Channels
- Large Alphanumeric Bitmap Display:
- 6 lines of Alphanumeric display (2 icon lines), 12 characters per line
- Battery fuel gauge indicator
- Time and Date Stamp
- Backlit Keypad
- Four-way Navigation Key and three softkeys for easy access to radio functions
- Full alphanumeric keypad on the Model III
- Dial from pre-stored lists

10.5.1.1.2 Standard Features of the XTS 5000

10.5.1.1.2.1 Multiple System Configurations

The ASTRO Digital XTS 5000 portable radios are designed for maximum interoperability. These versatile radios provide the Commonwealth with the ability to operate on trunked and conventional channels. In addition, the ASTRO Digital XTS 5000 radio operates in a digital mode according to the APCO Project 25 CAI standard, as well as in analog mode. This feature will give radio users full interoperability with other APCO Project 25 CAI compliant systems as well as Motorola APCO 16 users.

10.5.1.1.2.2 Field Programmable

Programming of the ASTRO Digital XTS 5000 is accomplished using Customer Programming Software (CPS). CPS allows programming with unique code plug information in a friendly Windows environment. It conveniently provides radio-cloning capability in a familiar setting. That is, the Commonwealth can program a single radio, and then program all other like radios by copying the programming information from the original radio to other radios.

10.5.1.1.2.3 CPS FLASHport Capability

FLASHport provides system owners/operators with the ability to change, expand and modify their systems without significant hardware obsolescence. Because the XTS5000 is FLASHport capable, the user can select only those system features needed today and upgrade them as the users' needs change.

10.5.1.1.2.4 Talkaround

Conventional Repeater Talkaround provides the user with the ability to communicate with other units without using the ASTRO Digital Trunked Simulcast System infrastructure. Users maintain communication between radios via an available conventional channel. Users possess talk-around capability while in digital mode or analog mode. Even when not encrypted, using Talkaround in digital mode provides a measure of privacy for radio users.

10.5.1.1.2.5 Low Battery Indicator

If the battery voltage of the radio falls below the low-voltage level, a short, high-pitched chirping tone (low battery chirp) will sound (Programmable via CPS.)

10.5.1.1.2.6 Selectable Power Levels

This feature allows the user to select the power level at which the radio will transmit. The "high power" setting can transmit longer distances but lessens the battery life. The "low power" setting may transmit shorter distances but conserves battery life. The radio will always turn on to the default setting as determined through the Customer Programming Software.

10.5.1.1.2.7 Repeater/Direct

Also known as “Simplex operation” Direct allows the user to bypass the conventional repeater and connect directly to another radio. The transmit frequency is the same as the receive frequency.

In repeater operation, the user talks through the repeater, which increases the radio’s operating range. The transmit and receive frequencies are different.

10.5.1.1.2.8 Scan Operation

The scan feature allows the user to monitor activity on different channels by scanning a preprogrammed list of channels. Each radio can have up to 32 different scan lists. The channels to be scanned are programmed using the Customer Programming Software.

Types of Scan Lists:

		#Of Channels
Trunking Priority Monitor	Comprises channels that are all from the same trunking system	10
Conventional	Comprises only conventional channels.	15
Talkgroup	Comprises trunked talkgroups from one trunking system. Priority operation is not available in this type of list.	10

Types of Scanning:

Priority-One	One member of the scan list is the chosen priority-one member. Any activity on this talkgroup will be heard on the speaker even if another talkgroup in the scan list has activity on it.
Priority-Two Non-Priority	In addition to the priority-one talkgroup, a second talkgroup can be assigned as a priority-two talkgroup. The remaining members in the scan list can be programmed as non-priority members of the scan list.
Automatic (Autoscan)	Allows radio to begin scanning whenever the user selects a talkgroup to which a scan list is assigned or strapped. The radio continues to scan until the talkgroup is changed to one that does not have autoscan.
Operator-Selectable	Can be programmed to be selected by a softkey related button or a Scan On/Off Switch.

10.5.1.1.2.9 Secure Operation

Secure operation provides the Commonwealth with voice security on trunked or conventional channels. Only radios with voice encryption technology and the proper decryption key are able to decode the information. This makes it virtually impossible for unauthorized parties to monitor the transmission. The secure-capable XTS 5000 mobile radio will be equipped with AES encryption and multikey. Specific AES encryption and multikey quantities vary per agency. Please see the equipment pricing of this contract for exact quantities. The Commonwealth is purchasing secure operation for a number of subscriber radios. Please see the equipment pricing section of this contract for more detailed information.

10.5.1.1.2.10 Multiple Squelch Operation (analog)

Conventional analog channels can be programmed with a Tone Private Line (PL), a Digital Private Line (DPL) code, network ID, or can be operated in carrier squelch. All can be programmed on a per channel basis.

Carrier Squelch	All traffic on the channel is heard.
PL, DPL, or Network ID	Radio responds to only those intended for the user.

10.5.1.1.2.11 Multiple Squelch Operation (digital)

Conventional digital channels can be programmed with one or more of the following options:

Digital Carrier-Operated Squelch (COS)	All digital traffic on the channel is heard.
Normal Squelch	Any digital traffic having the correct network access code.
Selective Switch	Any digital traffic having the correct network access code and correct talkgroup.

10.5.1.1.2.12 PL Defeat

The PL defeat feature allows the user to override any coded squelch (DPL, PL, or Network ID) that might be programmed to a channel. The user will then be able to hear any activity on the channel; if no activity is present, the radio is muted.

10.5.1.1.2.13 Smart PTT (Push-To-Talk) Button

Smart PTT is a per-channel, programmable feature used in conventional radio systems to keep radio users from talking over other radio conversations. When smart PTT is enabled in the radio, the user will not be able to transmit on an active channel. If a user tries to transmit on an active smart PTT channel, an alert tone will be generated and the transmission will be inhibited. The LED will also blink red to indicate that the channel is busy.

10.5.1.1.2.14 APCO Conventional Features

- Call Lists
- Radio Check
- Remote Monitor/Radio Trace
- Status/Message
- Telephone Interconnect (Decode/Encode)
- Voice Selective Call (*6.05 Release*)

10.5.1.1.3 Trunking Features

10.5.1.1.3.1 Trunking Features

- Dispatcher Interrupt
- DTMF
- Message
- Remote Monitor/Radio Trace
- RF Modem
- System Wide Transmit
- Voice on Control
- Audible Status Tones

10.5.1.1.3.2 Out of Range

If a radio user attempts to transmit while out of range of the system, the radio will display the currently selected zone/channel combination as OUT OF RANGE and/or generate a low-pitched tone and/or generate a tone. It will remain in this out-of-range condition until it locks onto a control channel, or it locks onto a failsoft channel, or it is turned off.

10.5.1.1.3.3 Failsoft

If a trunking system experiences a complete failure, the radio will revert to failsoft operation and automatically switch to its failsoft channel. During failsoft, the trunking repeaters will transmit a medium-pitched tone every 10 seconds. When the trunking system returns to normal operation, the radio will automatically leave the failsoft operation and return to trunked operation.

10.5.1.1.3.4 Trunked System Busy

If all voice channels are in use, the radio emits a busy tone, similar to a telephone busy tone. The busy tone indicates that the request for a voice channel has been recognized by the system. The user is then placed in a queue until the channel assignment is made by the control channel.

10.5.1.1.3.5 *Callback*

When a radio in queue is assigned a voice channel, a series of three short tones indicates that a channel has been assigned and the conversation can begin. The user has two seconds to start using the channel or the radio goes back to the control channel and will have a request a channel assignment once again.

10.5.1.1.3.6 *Talk Permit*

Each time the PTT switch is activated and a voice channel assignment is granted, a series of short tones (identical to callback tones) will signal the user that a channel has been assigned and he is free to begin the conversation. These tones may be turned off or on using the Customer Programming Software (CPS).

10.5.1.1.3.7 *Selective Radio Inhibit*

Selective Radio Inhibit allows the system manager at the NOC to selectively deny an individual radio access to the radio system over the air through commands sent via the system management terminal. Once inhibited, the radio is inoperable until the manager restores it to operation.

10.5.1.1.3.8 *Dynamic Regrouping*

Dynamic Regrouping allows the system manager at the NOC to temporarily reassign selected radios to a single special channel so they can communicate with each other. This feature is typically used during special operations and is enabled by a system manager terminal. If the user tries to access a zone or channel that has been reserved by the system manager as a dynamically regrouped mode for other users, he will hear an invalid tone.

10.5.1.1.3.9 *Emergency Alarm/Emergency Call*

Emergency Alarm/Emergency Call are used by law enforcement radio operators to inform dispatch personnel of a life-threatening situation. In the emergency alarm feature, data is transmitted to dispatch via the control channel. This alerts the dispatcher and other members of the talk group of the emergency condition and identifies the unit sending the emergency signal. The emergency call feature is a type of dispatch operation, which gives the radio priority access to the system. The emergency call feature is programmable through CPS and is typically set up for the top of the queue. The call is then placed in the top of the queue in order to get access to the next available channel.

10.5.1.1.3.10 *Push-To-Talk ID (PTT-ID)*

Push-to-talk ID allows the radio to generate its ID so that the dispatcher can identify the radio caller currently speaking. The radio's ID number is automatically sent every time the PTT button is pressed. This ID is displayed on a dispatcher's console. The ID is displayed each time the PTT button is pressed.

10.5.1.1.3.11 Call Alert

The call alert function allows a user's radio to work like a pager. It leaves a "page" in an unattended radio. This prevents users from tying up airtime calling unattended radios. Since the page is both visual and auditory, this feature is particularly beneficial for radio users whose jobs frequently take them away from their radio, or who operate in a noisy environment. When the Call Alert is sent, the receiving radio will emit a series of tones until the user responds or resets the radio. Any button press will turn off the Call Alert indicators.

The radios can be programmed to operate Call Alert in several different ways. Call Alert Encode Only enables a radio programmed with this capability to initiate a call alert. Call Alert Decode Only enables a radio to only receive call alert pages. A radio can also be programmed for both Call Alert Encode and Decode, so the user can place and receive calls. Limited Call Alert allows the user to only place calls from the preprogrammed list. With unlimited, the user may place unlimited calls.

10.5.1.1.3.12 Private Conversation

Private Conversation allows the user to selectively call an individual radio and hold a private conversation that other radios in the talkgroup cannot hear. Once the private conversation is established, the two units will not hear any other normal radio traffic that occurs while the private conversation is in progress. These capabilities are activated through CPS. To initiate a Private Conversation, the user must select a radio user ID from a preprogrammed list or enter the ID using the radio keypad. Up to eight IDs can be programmed into the radio. This six-digit ID is the ID of the trunked radio.

Private Conversation Encode enables a radio programmed with this capability to initiate a private conversation to another radio. Private Conversation Decode enables a radio to only receive phone calls. A radio can also be programmed for a Private Conversation Encode and Decode, so that the user can place and receive private conversation calls. With limited private conversation ability, the user may only place calls from the programmed list. With unlimited private conversation capability, the user may place unlimited private conversation calls to any radio using the keypad.

10.5.1.1.4 Smartzone Features

10.5.1.1.4.1 Automatic Site Registration/Deregistration

XTS 5000 radios automatically send in their unit IDs and current mode selections upon power up, power down, site switching, talkgroup changes, and on exiting emergency operation. This enables the Zone Controller to monitor the operation of the radio at all times, including talkgroup operation carried out by the radio.

10.5.1.1.4.2 Automatic Site Switching

Wide-area-enabled XTS 5000 radios use Received Signal Strength Indication (RSSI) to determine whether the radio should switch automatically to another site. This feature provides for seamless wide-area roaming across the Commonwealth, while ensuring consistent audio quality for those portable radios enabled for wide-area operation. The radio tracks and compares the receive signal strength of control modes/channels for all ASTRO 25 trunked tower sites within range of the radio.

10.5.1.1.4.3 Preferred Site

XTS 5000 radios can be programmed with a roaming parameter that causes the radio to categorize tower sites as preferred, always preferred, least preferred, or having no preference. This provides STARS participating agencies the flexibility to manage system traffic loading by controlling which users are allowed to roam to which sites throughout the Commonwealth. Motorola will provide an analysis of actual subscriber distribution and recommend assignment of these mobiles to the appropriate preferred sites.

10.5.1.1.4.4 Full Spectrum Scan

The XTS 5000 portable radio is capable of full-spectrum scan. This feature allows the user to scan all frequencies for a control channel within the radio band range in addition to those frequencies that are pre-programmed via the Customer Programming Software (CPS). This feature reduces the possibility of not being able to find all possible operating channels. Another advantage to users occurs when additional system capability (with new frequencies) is added. With full spectrum scan, radios do not have to be reprogrammed.

10.5.1.1.4.5 Site Lock/Site Change

This feature allows the user to force the radio to remain registered at a specific tower site, thus preventing roaming to an adjacent tower site. The Site Search Button can be used to manually force the radio to change to a new site.

10.5.1.1.5 XTS 5000 Accessories

The XTS 5000 portable radios include a spare NIMH 2000 MAH battery, carry case with swivel belt loop and the appropriate single unit or vehicle charger and Commander Plus remote speaker microphone.

10.5.1.1.5.1 Impres™ Smart Battery/Charger System

The Commonwealth will be able to place a smart battery in the smart charger and the system will charge it, recondition it if necessary, keep it fully charged over time while controlling damaging heat build up, and notify the user if the battery is beyond its useful life. These features will help the Commonwealth maximize battery operating time between charge cycles by virtually eliminating memory effect in nickel based battery chemistry. The charger automatically performs a recondition cycle only when required. The circuitry allows for conditioning and reconditioning of a battery in the smart charger while it is still attached to the radio. Also, smart batteries are designed to operate in extreme temperatures down to -30° C.

The system will allow the Commonwealth to simplify battery management by eliminating the need to have dedicated personnel for managing & reconditioning the batteries. Since the Impres charger reconditions the batteries as necessary, the user can be responsible for maintenance of his/her battery. Motorola will provide Impres Smart Batteries and Smart Chargers as described below and in Appendix 5.

The Impres charger is actually three units in one: a rapid charger, a conditioning charger and reconditioner. The Impres™ charger only performs the necessary number of reconditioning (usually only one cycle is needed) instead of the industry standard of 3 reconditioning cycles. This not only saves the Commonwealth time on reconditioning but it optimizes battery life by limiting the battery charge cycle.

As mentioned above, by using a low current trickle charge and a zero current maintenance mode, the battery does not build up heat during charging time. This allows the battery to be left in the charger after the charging cycle is completed without losing cycle life or having the battery slowly discharging while the battery is dormant. Since the battery does not build up heat the battery life is extended.

Other Features:

- The charger will automatically recondition any battery that has not been charged within the past 30 days when it is placed in the Impres charger.
- The Impres charger gives the Commonwealth the ability to either charge the battery by itself or while it is still attached to the unit.

- The Impres batteries and chargers are engineered to work with existing Motorola two-way portable radios utilized in the Commonwealth: Impres adaptive chargers will not overheat standard batteries left in the charger pocket for an extended period of time.
- Impres batteries store data on how they have been used and they support continuous status updates of the charge/reconditioning process. The batteries use a Microprocessor to keep track of the following information:
 - Date of the last charge/recondition cycle
 - The number of cycles the battery has received
 - The amount of charge added and remaining
 - Current performance info
 - History of the service life
 - The Projected “end of service life” – this helps determine warranty coverage.

10.5.2 XTS 2500 DIGITAL PORTABLE RADIO



10-7 - The XTS 2500 is displayed above

10.5.2.1 Features of the XTS 2500

- 3600 Baud control channel Mode Operation or 9600 Baud control channel Mode Operation
- Multiple system configuration including: Conventional, and Trunking
- Dual mode capable: Analog and Digital
- Multiple software package options
- FLASHport capable
- Limited Integrated Voice & Data (M-Core Processor)
- Durability and reliability
- Meets and exceeds military specifications 810 C, D, E, and F as specified in Appendix 5
- Polycarbonate housing
- Factory mutual approved batteries options
- Enhanced reduction software
- Superior audio gain control
- User-Friendly ergonomics
- Smaller in size and weight than XTS 5000
- Compatible with most MTS 2000 and XTS 3000 accessories
- Programmable top and side buttons

All XTS 2500 radios include the following Technical Features:

- Multiple modes of operation
- Analog, and Digital
- Project 25 capable on Conventional and Trunking Type II systems
- Project 25 compliant interoperable voice signaling features
- Narrow and wide bandwidth digital receiver (12.5/20/25/30 kHz)
- High quality, error corrected digital voice
- High speed and embedded digital signaling (ASTRO)
- CPS FLASHport capable via Windows
- Meets Mil Specs 810 C, D, E, and F as specified in Appendix 5
- Advanced Digital Privacy (ADP) encryption capability (when equipped)
- Limited Integrated Voice & Data Capability
- Programmable switches/buttons
- Orange Emergency top button
- Three-position Concentric Switch
- Top side Monitor button
- Two side buttons

- PTT button
- On/Off Volume Knob
- 16 Position Rotary Frequency Knob
- Transmit LED Indicator
- Compatible with most MTS 2000 and XTS 3000 accessories

Additional Features of the XTS 2500 include:

- Up to 160 Channels
- Large Alphanumeric Bitmap Display:
 - 4 lines and 12 characters (two additional icon lines)
- Battery fuel gauge indicator
- Time and Date Stamp
- 3 x 4 Alphanumeric DTMF Backlit Keypad
- Four-way Navigation Key
- Three softkeys for easy access to radio functions
- Dial from pre-stored lists

Secure Operation

Secure operation provides the Commonwealth with voice security on trunked or conventional channels. Only radios with voice encryption technology and the proper decryption key are able to decode the information. The secure-capable XTS 2500 mobile radio will be equipped with ADP encryption. ADP is a low level software encryption algorithm that can be enabled via CPS. Specific ADP encryption quantities vary per agency. Please see the equipment pricing of this contract for exact quantities.

10.5.2.2 XTS 2500 Accessories

XTS 2500 portable radios include a spare NIMH 1750 MAH battery, carry case with swivel belt loop and rapid rate single unit charger or multibay charger.