

Systems Integrator for the Commonwealth of Virginia Statewide Agencies Radio System (STARS) Project

Executive Summary

The Virginia State Police began installation of the existing statewide land mobile radio system in 1977. Many of the radios still in use today are of that vintage. Radios have been reinstalled in approximately six generations (each patrol car is driven in excess of 100,000 miles in a generation) patrol vehicles. This network supports only a single conventional voice channel in any given area. Therefore, severe radio congestion is routine and interoperability cannot be supported on existing channels without further increasing the wait times for the users. In addition, the technology used is not advanced enough to support critically needed law enforcement mobile data.

The Statewide Agencies Radio System (STARS) is built on the foundation of the recognized needs for a shared statewide public safety grade radio system that facilitates law enforcement mobile data and interoperability with the localities. The current State Police land mobile radio (LMR) network will be upgraded with state-of-the-art, industry standard, TIA/EIA 102 technology (also known as APCO Project 25). This equipment standard has been specified collaboratively by multiple user disciplines throughout the country, and by radio manufacturers throughout the world. In addition, the capacity of the network will be increased for a public safety grade of service. The microwave radio network's technology and capacity will be upgraded and disaster recovery alternate paths will be added.

Expenses and resources will be shared by the various participating agencies identified in Executive Order 28 for greater benefit and economy of scale. STARS will provide multi-channel trunked digital voice and data wireless communications that is specifically designed for public safety requirements. The tangible benefit of STARS is to provide essential public safety grade communications that can operate seamlessly throughout the Commonwealth for the 20 state agencies and facilitate interoperability with local governments and federal agencies. The interoperability solutions within STARS allow each locality, at the county and city level, to communicate with users independent of their technology or radio frequency band used. Direct interoperability can also be employed with compatible radios (STARS mobile and portable radios being used on a locality or federal radio network), based upon the situation and the needed on-scene command and control being available. STARS can also interconnect localities with each other if required.

The STARS design is a culmination of partnering with the Commonwealth, the project's engineering consultant HSMM / CTA Communications, and Motorola. Meeting needs, utilizing existing resources, and minimizing risk were heavily weighted design

parameters in developing STARS. Capitalizing on existing infrastructure and resources, whenever possible assists the Commonwealth in the ability to implement STARS in a cost effective manner. Finally, minimizing design risk through the use of Motorola, a proven system integrator and communications manufacturer, along with the use of a redundant, fault-tolerant, hierarchal design that allows for re-routing in case of single point failure. The wireless communications system for the Commonwealth of Virginia contains today's latest technology and will continue to provide updated technology at no additional cost throughout the STARS implementation. STARS allows the Commonwealth to retain a high level of service and security, plus flexibility to add additional users when additional radio frequencies are available. In all applicable design components, STARS has addressed safeguards to system security, including controlled system access, Advanced Encryption Standard (AES) encryption, and multiple security layers. The system infrastructure will serve the Commonwealth for years to come.

In accordance with the Governor's Executive Orders 28, STARS is designed around the premise that the operational needs of each participating agency can be substantially met within practical confines of system cost and radio spectrum limitations. Motorola's ASTRO 25 communication system, which integrates both voice and data, will greatly enhance the current ability for the Commonwealth's agencies to successfully communicate and experience the benefits and efficiencies of a shared wireless communication system.

The STARS Project Management Team, established by Executive Order 28, will oversee the installation, testing, and migration. They will be assisted by the State Police's Bureau of Administrative and Support Services Divisions and two consultants. The State Police Communications Division will provide systems engineering and technical support. Their technical staff that will be performing the infrastructure maintenance and first responder subscriber repair support after the warranty period. The Training Division will provide all first responder user training and coordinate the remainder of the training. The Property and Finance Division will provide civil engineering support and be responsible for the project's property. The Data Processing and Criminal Justice Information Systems Divisions will provide connectivity with state and federal data networks. The participating agencies will provide input and support during the implementation phases, as needed.

Cost

| | |
|---|----------------|
| Core System | 318,091,943.00 |
| Performance Bonds | 222,000.00 |
| Mandatory Maintenance and Configuration Warranty | 11,359,756.00 |

Total System **\$ 329,673,699.00**

Core System List:

| | |
|---|---------------|
| Master Site Equipment | 11,295,279.00 |
| Console Dispatch Equipment | 7,753,078.00 |
| Remote Site Equipment | 21,250,967.00 |
| Building/Shelter Equipment | 29,218,178.00 |
| Tower Equipment | 24,745,328.00 |
| Facilities Construction/Renovation | 2,271,943.00 |
| Transportable Site | 911,170.00 |
| Training | 4,586,540.00 |
| Project Office – Includes Design and Engineering Services (up to 25 engineers), Project Management, Administrative costs, Office Space, Outside Services and Frequency Planning | 54,412,975.00 |
| Equipment Staging | 5,310,880.00 |
| Warranty and License/Subscription Agreements | 15,896,429.00 |
| Test Equipment and Program Accessories | 3,123,598.00 |
| Equipment Spares | 10,745,723.00 |
| Radio Subscribers Equipment | 24,935,701.00 |

| | |
|--------------------------------|----------------|
| Installation Discount | -1,990,319.00 |
| Auxiliary Items | 18,746,411.00 |
| Control Stations | 3,100,477.00 |
| Locality and Legacy Interfaces | 7,431,066.00 |
| Portable Radios | 14,270,803.00 |
| Data Terminals | 15,580,471.00 |
| Aircraft Radios | 208,264.00 |
| Mobile Data | 6,824,279.00 |
| Channel Banks for IV&D Network | 4,380,604.00 |
| Microwave | 33,082,098.00 |
| Core System Total | 318,091,943.00 |

Negotiations

The lead negotiator for the Motorola contract representing the Commonwealth was Mr. Steven O. Owens, Senior Assistant Attorney General, Office of the Attorney General. The draft contract was reviewed by other members of the Office of the Attorney General's staff and their proposed revisions included in the final contract document. During the cost negotiations an original offer of \$370,751,598 for the total system was received from Motorola. The STARS staff and representatives from CTA Communications analyzed the offer and prepared a counter offer for the total system. During final cost negotiations, a total system cost of **\$329,895,699** was agreed to, resulting in a cost reduction of \$41,077,899 for the total system. The cost reduction was achieved through a combination of Motorola lowering costs and the Commonwealth adjusting requirements within the contract. Two construction projects, the renovation of a warehouse at State Police Headquarters that will serve as the Network Operations Center and the construction of a new building at the Division Six Headquarters at Salem

that will serve as a master site for the western portion of the state, were removed from the contract. These construction projects will be awarded based on the results of an RFP. After the final cost figure was agreed to, a price reasonableness determination study was conducted and concluded the prices for equipment and services within the contract were reasonable.

STARS Systems Integrator Contract Overviews By Section

1. Systems Integration

The Motorola STARS project team implementation is based on a designed and detailed integration plan. The Motorola Program Director will bring together the people and resources for the STARS project, and then manage them toward meeting every project milestone.

This intensive planning, based on dozens of successful large-scale integrations, reduces risk to the Commonwealth. Important details, such as the execution of the Customer Design Review (CDR), development of the talk group plan, the development of a migration plan for each agency and end user, including the appropriate timing of end user training, are all crucial in the preparation of a successful integration strategy for STARS. A thorough Project Schedule is critical for planning, resources, costing, and risk mitigation. The next step takes the detailed plans and pre-builds the system at the Motorola staging facility, the Customer Center for System Integration, including third-party equipment. The system is then tested, measured, and optimized to ensure it meets the design considerations. Commonwealth employees will be an essential part of the testing and implementation processes.

Much of the work entails coordinating local vendors to secure antenna sites, and erect towers and buildings. The site development phase will be underway while the equipment is being manufactured and staged. The implementation process is broken down into individual tasks in a full project plan, which covers:

- Engineering and design
- Procurement
- Facility construction and upgrades
- Systems installation
- Optimization and testing by system and subsystem
- Agency migration and cutover
- Closeout and Acceptance
- Frequency Planning
- Talk Group (Fleet Map) Development

An essential component in the transition process is the Project Cutover in each Division. After acceptance testing and cutover planning is complete, Motorola will coordinate dispatch and subscribers training, distribute the subscriber equipment, and prepare the end-users for a smooth transition. STARS will be put through a rigorous quality assurance process to make sure all components are configured properly and operating up to specifications. Once the system is working, as designed, the Department of State Police (VSP) will provide the expertise to manage, monitor, and service the system. Motorola will perform the work and tasks required to design, manufacture, install, optimize, test, and integrate STARS. Motorola will provide the documentation and training to support the operation of STARS to the Commonwealth. Motorola and the Commonwealth will each provide a dedicated project leader to act as the single point of contact for all administrative, technical, and scheduling issues related to the project. The Motorola Program Manager (has not been named) has the overall responsibility for providing the Motorola deliverables required for the implementation of STARS and management of the STARS project schedule. The Commonwealth's Project Director (Captain Michael E. Bolton) has the overall responsibility for ensuring that all Commonwealth responsibilities and tasks are completed per the Contract Schedule.

2. Communications within the Tunnels

Motorola is providing VHF and 800 MHz wireless communication coverage for six tunnels in the Commonwealth of Virginia (Big Walker Mountain, Hampton Roads, Elizabeth River Downtown, Elizabeth River Midtown, Monitor/Merrimack, and East River Mountain). The design allows for effective mobile radio, portable radio, and computer data communications within the tunnels. In addition to being designed for STARS, the tunnel design accommodates the existing VSP communication channels that will increase the effectiveness of the overall Commonwealth migration plan to STARS.

3. 700/800 MHz Transportable Communication Site

To provide additional capacity, interoperability, and support for disaster-recovery operations for STARS, Motorola is providing the Commonwealth a transportable site. This site is designed to be moved and placed into service where needed by the Commonwealth during special events or to handle specific emergency situations or for additional radio system capacity and interoperability. This Transportable Site provides on-site ASTRO 25 digital trunked communication in either the 700 or 800 MHz frequency band, as well interconnection with other systems via an ACU-1000 network interface. The selection of 800 or 700 MHz will follow the completion of the radio frequency channel plan. The entire site can typically be deployed within one hour of the arrival of the trailer at the site.

4. Integrated Voice and Data Network Coverage and Traffic

Through communication between the Commonwealth and Motorola, wireless radio coverage for the Commonwealth of Virginia has been defined. With the advent of integrated voice and data communications, radio coverage is described by both areas of coverage as well as data traffic or throughput. To meet the performance guarantees, Motorola will install 45 ASTRO 25 RF sites, strategically located throughout the Commonwealth.

Voice Coverage

The performance guarantees and test procedures will ensure the Commonwealth will experience clear communications as defined by a Bit Error Rate (BER) test as well as an independent Push-to-Talk Access test. Motorola will provide at least a talk-in and talk-out Delivered Audio Quality (DAQ) of 3.4 or BER of 2%.

The Voice Coverage Guarantee, expressed in percentage of a VSP Division service area, is shown below; the projected coverage is consistent with the current coverage. Note that adding the Columbia Pike site in Division 7 greatly improved coverage in key areas, but did not increase the zone's coverage by an additional percentage point.

| Service Area Description | Service Area Coverage Guarantee |
|---|---------------------------------|
| Communication Zone 1, Richmond, (Div 1) | 95% |
| Communication Zone 2, Richmond, (Div 1) | 94% |
| Communication Zone 3, Culpeper, (Div 2) | 95% |
| Communication Zone 4, Culpeper, (Div 2) | 88% |
| Communication Zone 5, Appomattox, (Div 3) | 95% |
| Communication Zone 6, Appomattox, (Div 3) | 94% |
| Communication Zone 7, Wytheville, (Div 4) | 93% |
| Communication Zone 8, Wytheville, (Div 4) | 92% |
| Communication Zone 9, Tidewater, (Div 5) | 91% |
| Communication Zone 10, Tidewater, (Div 5) | 95% |
| Communication Zone 11, Salem, (Div 6) | 94% |
| Communication Zone 12, Salem, (Div 6) | 93% |
| Communication Zone 13, Northern Virginia, (Div 7) | 91% |
| Major Waterway Communication Zone | 88% |

Data Coverage

STARS will provide successful delivery of a message/packet both from a vehicle as well as from a dispatch or 'host' location, as defined within the Contract guidelines.

Voice and Data Tunnel RF Coverage

In 95% of the bore length of the six tunnels, STARS will provide a voice DAQ of 3.4 for the VHF system or a 95% Message Success Rate for data communications. Motorola will provide a DAQ of 3.4 for the 700/800 MHz system in 95% of the bore length of the tunnel and extending 100 feet outside the tunnel entrance. In order to minimize the negative effects of too many signals around the tunnel entrances, there will be a built in 100-foot buffer zone between the in-tunnel VHF system and the outside VHF system. This zone will be covered by portable coverage via a vehicle outside of the tunnel in the event of sustained wireless radio needs.

Traffic Loading

The Traffic Grade of Service (GOS) for the VHF IV&D system are based on public safety grade needs and those parameters have been used to define the performance guarantees STARS will provide the Commonwealth. The performance testing takes into consideration the cross-functional use of voice, data and Commonwealth wide talkgroups (note that data traffic is secondary to voice). The system will be configured to support full voice priority allowing the inherent characteristics of data to efficiently fit into the unused data streams. As STARS is a public safety grade system designed to support life and death situations, the system is configured such that voice traffic is given the priority over data messages.

5. Microwave Network

The microwave network will provide the Commonwealth with the digital transport required for interconnecting Land Mobile Radio, Mobile Data, Telephone, and Alarm and Control Networks. In addition, it will be used to replace leased data lines currently connecting VSP sites. It will be highly reliable and capable of supporting government relocation, if required. For instance, the current VSP microwave network (that STARS is upgrading) was quickly reconfigured by the VSP Communications Division at the Columbia Pike Area Office to serve as a command center in response to the 9/11 terrorist attack on the Pentagon. In addition, statewide there were no outages in the VSP microwave network due to Hurricane Isabel.

This network will consist of Digital Microwave equipment of various frequencies and capacities. This microwave network, consisting of Synchronous Optical Networks (SONET) loops, parallel traffic routing and hot standby-protected microwave spurs, will connect all the Land Mobile Radio Integrated Voice and Data transmitter sites. Critical links, will utilize an OC-3 SONET controlled ring providing diverse route protection (commonly referred to as “east–west route diversity”).

Each VSP Division Headquarters, most VSP Area Offices, and microwave transmitter sites will be equipped with a phone network that will allow on-site personnel to place and receive telephone calls over the microwave network. This circuit is connected to the Commonwealth’s Private Branch Exchange (PBX) and to the Public-Switched Telephone System (PSTN).

6. Mobile Data Applications

A key component of STARS is data and a key component of data is the software applications.

The Premier MDC mobile application being provided will provide the following to the Commonwealth:

- Law Enforcement mobile data
- Intra-agency and inter-agency text messaging,
- POP3 Email Integration to access an MS Exchange Server,
- Interfaces with the VSP Computer Aided Dispatch (CAD),
- Global Positioning System (GPS) support for Automated Vehicle Location (AVL),

The mobile data system will provide mobile data functionality over the ASTRO 25 IV&D network. Motorola is including two client configurations of Premier MDC, one for VSP that offers full VSP CAD Interface capabilities, and one for other sworn officers that do not.

STARS is including an AVL subsystem to identify the location of law-enforcement mobile units with computers in the field. Location data will be sent to a display at the closest division headquarters based upon certain events or from a dispatcher initiated request. This feature is directly intended to support the commitment to maximizing a STARS subscriber users’ safety.

7. Alarm and Control

A STARS Network Fault Management (NFM) subsystem will be provided for managing transmitter site/equipment alarms and controlling various site functions. The NFM subsystem collects data automatically, processes that data, and then presents it for the decision maker. This management tool provides a single interface for monitoring equipment and systems alarms over IP (internet protocol). The data will be used to operate the network, analyze the flow of site alarm and system control data, offer system solutions and handle pre-defined alarm situations automatically. The system provides reports to the engineers and the operators that will help in administering the network. The Network Operations Center (NOC) at the State Police Headquarters (SPHQ) will house personnel on a 24/7 basis to identify, remotely correct alarm conditions or dispatch technicians.

8. Transmitter Sites

The transmitter sites in STARS support the land mobile radio voice, microwave radio, and the mobile data subsystems. Each site's communications equipment is housed in a protective building, and is monitored for technical functions and is protected with emergency power systems and sophisticated grounding systems to protect from lightning damage.

Each site will be implemented using the most efficient and cost conscience process, a methodical approach will be followed which takes into consideration many facets such as: microwave radio path surveys, necessary FAA submittals and approvals, architectural and engineering (A & E) work, and site specific improvements. The major components necessary for the completion of a communication site include, site preparation, radio towers, radio buildings, heating ventilation and air-conditioning (HVAC), backup power systems (UPS, generator and DC Power systems), as well as fencing and other work as defined in the detailed statement of work.

The STARS contract includes 14 tower loading models. This somewhat increases its initial total cost, but reduces technical risk by this measure of completeness. The cost of models or associated quantities that are not needed will be recovered through the change order process.

9. Master Sites and Dispatch Center Renovations

Motorola will provide the Commonwealth with design-build construction services to upgrade four of the seven VSP Communications Centers. They will be constructed as additions to existing VSP Division Headquarters buildings

To reduce the cost of the project, the Commonwealth has assumed the responsibility for construction services of the STARS Network Operations Center (NOC) and Master Site facilities for Motorola to install their equipment. To meet the aggressive schedule, an existing VSP warehouse will be refurbished for the NOC and one of the Master Sites. A new building at Division Six will be constructed to support VSP dispatching and the other Master Site equipment.

10. Voice and Data Subscribers

Motorola will provide the Commonwealth of Virginia Digital Subscribers (portable, mobile, and control station radios), mobile 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.

11. Integrated Voice and Data Communications

Motorola is providing a VHF Integrated Voice and Data (IV&D) Trunking network that is designed to meet the wireless voice and law enforcement data communications needs of the Commonwealth. This is a significant cost savings as compared with two separate networks.

The communications solution will provide mobile coverage throughout the Commonwealth, including the six major tunnels. It will also interface with designated conventional (non-trunked) and trunked radio systems located in the Commonwealth. Finally, the system will use an integrated infrastructure for voice and data subscribers.

Microwave Telecommunications Subsystem (MTS)

- Leveraging the existing VSP Microwave Network that uses Tadiran equipment to accommodate higher-traffic areas
- Automatic rerouting as needed to avoid delays, congestion and disaster recovery

Land Mobile Radio Subsystem (LMR)

- Standards-based technology for narrowband, VHF, high capacity, trunked system
- Meets the Federal Communications Commission's mandate for improved spectrum efficiency
- Compatible with both analog and other APCO P25 systems (VHF, 700MHz or 800 MHz) used throughout the Commonwealth for direct radio-to-radio interoperability when appropriate

- To reduce the cost of the project, the Commonwealth will assume the responsibility of installing the antenna mounting structures for control stations when a building cannot be used.

Mobile Data Subsystem (MDS)

- Provides remote access to state and federal law enforcement data bases
- Includes interagency messaging system, both car-to-car and to/from fixed computers
- Provides guaranteed message delivery and coverage throughout the Commonwealth (which is not available from commercial wireless services)

Alarm and Control Subsystem (ACS)

- All communications systems and sites are remotely monitored, 24 hours a day and 7 days per week by the STARS Network Operations Center (NOC) (located at State Police Headquarters) and by the Motorola System Support Center during the warranty period, resulting in fewer and shorter outages at remote sites

12. Acceptance Test Procedures

12a. STARS Integrated Voice and Data Acceptance Test Plan

12b. Microwave Network Field Acceptance Test Plan

12c. Automated Vehicle Location Test Plan

12d. Integrated Voice and Data Network Coverage Acceptance Test Plan

The Contract includes detailed acceptance test plans for both functionality and performance. This reduces the Commonwealth's technical risk because of their specificity.

13. Schedule

The contract includes a detailed document that includes the tasks, milestones and contract deliverables.

All member agencies will have their STARS equipment installed along with the State Police field division in which they have operations. The seven State Police field divisions will be operational on STARS by:

Richmond (Division One)
Tidewater (Division Five)

December 2005
May 2008

| | |
|------------------------------------|----------------|
| Culpeper (Division Two) | July 2008 |
| Northern Virginia (Division Seven) | October 2008 |
| Salem (Division Six) | April 2009 |
| Appomattox (Division Three) | May 2009 |
| Wytheville (Division Four) | September 2009 |

Note: This implementation could be adjusted should Division Seven move into a new facility as is being proposed.

14. Training

Motorola is providing a full suite of both operator and maintenance. Operator train the trainer is being provided for the State Police instructors to train the law enforcement users. Motorola will directly handle the remaining users. The State Police Communications Division engineers and technicians are being trained on the maintenance of all major subsystems so that they can continue to self-maintain the infrastructure and mobile equipment.

15. Warranty and Support

Motorola is providing a one-year warranty on the functionality of the infrastructure and individual items of equipment (three years on the mobile computers). The master site equipment will be maintained by Motorola for the duration of the implementation. Configuration and asset management will also be provided by Motorola. The Commonwealth will assume the inventory control, asset and configuration management functions through the change order process after a suitable internal process is developed. The Commonwealth will purchase most of the test equipment through separate procurements.

The STARS Network Operations Center (NOC) located at SPHQ will be the primary point of contact for all warranty and maintenance issues. The NOC will receive landline calls for maintenance issues and all status alarms from the infrastructure equipment. During warranty, the NOC will notify Motorola who will dispatch service. The NOC will also receive a maintenance call or an alarm on infrastructure that is post warranty, the Commonwealth will have the primary maintenance responsibility and will dispatch Commonwealth technicians accordingly.

The Warranty and Support Plan for STARS combines the services of the Commonwealth's technical staff, local Motorola Service Subcontractors, central Motorola Support Centers, and other specialized technical subcontractors. This approach will enable STARS to maximize the utilization of resources while providing responsive service and maximum system operation and reliability.

At the conclusion of the subscriber warranty period, the VSP Communications Division will be responsible for all law enforcement agencies' equipment and Motorola will be contracted to continue supporting the remainder of the equipment. The VSP Property and Finance Division will continue equipping vehicles for the State Police and Motorola will be contracted for the remaining agencies.

STARS Performance Issues

Available funding and radio frequencies are two resources that are limiting factors for the performance of any radio system. The Commonwealth and Motorola have thoroughly explored the effects of the limitations of these resources to implement a reasonable statewide communications system. The following are some of the issues that were a result.

Coverage: The system is being designed to serve radios mounted in vehicles (mobiles) and not hand-held radios (portables) because they require more transmitter sites. A vehicular repeater is being used so that on-scene portable radio coverage will be available (when within range of the vehicle mounted repeater). This may be a limitation for agencies that do not always have close proximity to a vehicle.

Mobile Data: Secondary status is being imposed on law enforcement mobile data transmissions when the network is serving voice users. The system is being designed so that only two of the transmitters at a given site can service mobile data communications. The file size of attachments has been limited to 15 kilobytes. In addition, the routine passage of mug shots and fingerprints has not been accommodated in the traffic-loading model. The 15 kilobyte file size meets all current needs. Mug shots and fingerprints are not currently sent over Mobile Data Terminals; however, future enhancements will add this requirement. Within two years Motorola anticipates a software upgrade that will increase the file size of attachments to approximately 150 kilobytes that will accommodate mug shots and fingerprints.

Voice Communications: The features facilitated by the ASTRO25 technology being provided will be limited to a less functional message profile in order to maintain an appropriate grade of service (the amount of time a user potentially could wait to communicate). These features can be implemented as required under the management of the STARS Program Director. The locality interoperability subsystem will likewise be managed (locally in this case) because its traffic-loading is also not part of the Contract's performance guaranty.

Migration: Each of the 20 participating agencies uses different operational service areas. The VSP divisional boundaries are being used because STARS is an upgrade to the

existing VSP radio networks. Therefore, some agencies could be delayed access to STARS until their operational service area is completely covered by one or more VSP divisional boundaries.

Project Risk / Risk Mitigation

Insufficient funding by the General Assembly for the entire Systems Integrator Project may result due to economic situations or other priorities.

Impact: Scale back Microwave Network's alternate paths; reduce Voice and Data Network's coverage or features; or reduce the number of users. Failure to appropriate sufficient funds could result in spending substantial sums and only receiving a partially operational radio system.

Mitigation Approach: Provide sufficient validation to the Management Group and Legislature to substantiate funding and the necessity of the project.

The Systems Integrator Contract includes generalizations / approximations from published literature concerning electrical conditions. The radio coverage is dependent on interference due to other transmitters and / or localized electrical noise.

Impact: Lower the coverage guarantees in one or more communications zones or increase the number of land mobile radio transmitter sites. Additional sites may significantly increase the project's total cost-to-complete or may not be feasible if frequencies are not available.

Mitigation Approach: Have funds available to implement additional transmitter sites. If a simulcast solution is not possible due to the distance from the closest operational site, then additional radio spectrum will be needed for the new site or coverage will necessarily be reduced. The procurement of VHF frequencies from Motorola guarantees sufficient radio spectrum to operate the STARS system.

The delivered system does not provide radio coverage in a specific limited area that is necessary / vital for one or more agencies' operations.

Impact: Increase the number of land mobile radio transmitter sites. Additional sites may significantly increase the project's total cost-to-complete.

Mitigation Approach: Have funds available to implement additional transmitter sites. If a simulcast solution is not possible due to the distance from the closest operational site, then additional radio spectrum will be needed for the new site or additional coverage may not be achievable. Prior to implementing a communications zone, the STARS Project

Management Team will review the coverage projections with the User Agency Requirements Committee (UARC) to identify potential coverage issues and attempt to resolve them prior to construction. However, the Contractor is not able to guarantee radio coverage in a specific area in the design phase, only a service area percentage within a communications zone. The coverage maps in the contract or those revised during the design review are for reference only. Motorola has been provided a list of coverage areas that are currently poor so they can work to improve coverage in those areas.

The Systems Integrator's initial design includes assumptions concerning physical conditions. With the exception of 25% of the transmitter sites, best-case conditions (such as 2% onsite grade, 14 foot wide mountain top access roads, rock free soil) have been assumed.

Impact: Unfavorable physical site conditions could significantly increase the cost-to-complete the project or select construction be canceled.

Mitigation Approach: Ensure sufficient funds are reserved outside of the Systems Contract to complete the construction. Note that design parameters or construction alternatives may need to be altered at specific sites to reduce cost. The projected cost of tower sites should cover the cost to improve the transmitter sites and access roads.

The Richmond area implementation schedule is not met.

Impact: Richmond area operations will be delayed. Operational demonstrations that could be needed to receive the next biennium's funding may not occur during the General Assembly session. Non-implemented microwave radio frequencies throughout the state may need to be re-coordinated at additional cost. In general, any unforeseen delays, including radio frequency licensing, site acquisition, Commonwealth site upgrade responsibilities or other such issues, will extend the project's schedule.

Mitigation Approach: Provide adequate work priority and resources for the STARS Project Management Team. Both Motorola and the STARS staff are committed to ensuring the implementation schedule is met.

Suitable transmitter sites are not acquired.

Impact: Significant delays or excessive costs in obtaining land, payment of the contractors' losses due to schedule delays, or jeopardized system performance.

Mitigation Approach: Alternative sites that are less than optimal or design changes will be considered. Otherwise, management needs to be willing to use the granted eminent domain authority, including quick take authority, to allow the project to stay on schedule.

Leased VSP Area Offices will use commercial data lines instead of microwave radio connectivity. Leased data line issues make a VSP Area Office site less suitable for a remote emergency operations center or continuity of government location.

Insufficient Microwave Radio Frequencies.

Impact: Two or more microwave transmitter sites will need to be relocated.

Mitigation Approach: Coordinate all microwave paths immediately upon contract award. Negotiate with current licensees if sufficient spectrum and / or bandwidth is not available. Commercial services can be used as an alternative but monthly cost will be incurred and reliability will be decreased.

Insufficient VHF Land Mobile Radio Frequencies.

Impact: Acquire additional frequencies, which can be expensive. Reduce the number of channels, number of users, or accept reduced performance at the affected transmitter site. Limit the number of small talk groups, which means less privacy on the network. The amount of time any given user may have to wait to communicate is directly related to the number of channels available. The grade-of-service and coverage guaranties in the contract are based upon (and can be revised because of) the number and quality of radio frequencies the Commonwealth has.

Mitigation Approach: Strict Commonwealth control of system loading and radio use after implementation. Partner with localities to share their allocated spectrum if it is underutilized. This may require the Commonwealth to fund a locality's replacement equipment. The procurement of VHF frequencies from Motorola guarantees sufficient radio spectrum to operate the STARS system.

Insufficient 700/800 MHz Land Mobile Radio Frequencies.

Impact: Reduce the number of channels in the vehicular repeaters thereby limiting the number of on-scene talk paths. Note that no channels in these bands have been identified in Northern Virginia, meaning that STARS cannot be implemented there until they are.

Mitigation Approach: Strict Commonwealth control of system loading and radio use after implementation. Partner with localities to share their allocated spectrum (not talk groups on their networks) if it is underutilized. VITA's assistance has been requested for obtaining 700 MHz channels for STARS' use. Significant coordination with the surrounding states and local broadcasters has yet to occur for STARS to have specific 700 MHz channels allocated from the Commonwealth's license (thereby reducing risk). In addition, STARS has to be added to the 700 MHz spectrum planning committees'

requirements so that spectrum can be allocated, particularly wideband spectrum for future mobile data use.

Federal Communications Commission Involvement.

Impact: The FCC must grant waivers and issue or amend numerous frequency and other licenses in connection with this project. Any delays or refusals by the FCC represent a serious risk to this project in terms of both viability and cost.

Mitigation Approach: Responsible, timely management of the spectrum actions and existing frequency resources of all participating agencies. The FCC has been cooperative and supports the implementation of the STARS public safety grade radio system.

Migration of Users onto STARS Interrupts Ongoing Activities.

Impact: Current vehicular repeaters are not compatible with the replacement units. Therefore, should Troopers be moved to support another division with different equipment, on-scene communications will be more complicated.

Mitigation Approach: Advanced statewide planning and training will be performed.

Locality Interoperability Requirements Affecting Mobile Data.

Impact: STARS performance guarantee is for a given number of voice users on a site-by-site basis with a specific use profile. The number and quality of radio frequencies at site and the amount of electrical noise present may reduce the stated guarantee for servicing voice users in the Contract. This will not be known until after detailed analysis, site surveys, and actual testing is performed. Data users will have a secondary status to voice. This means that data transmissions (such as VCIN queries or dispatching) could be delayed or curtailed for short periods of time for any system limiting voice usage, which probability of occurring will increase when STARS is further loaded with locality voice traffic. In addition, as the number of voice users increases, the system availability for the voice users in total decreases.

Mitigation Approach: Highly refined talk group development, interoperability analysis, and rigid controls on connecting external network to STARS will be undertaken. Each additional technology upgrade being considered for STARS (in addition to the basis one-talk path per locality) to enhance interoperability needs be carefully studied before implementation. The too much of a good thing could cause vital failures to communicate (both voice and data) because STARS' radio frequencies are limited.

Future Projects

The STARS Program is also comprised of a series of potential future projects. These future projects are described after the statement, assuming there are sufficient resources and approved by the Administration and General Assembly.

The Statewide Agencies Radio System (STARS) Program will facilitate the communications of 20 participating state agencies by upgrading the existing Virginia State Police land mobile and microwave radio networks of 2,500 users. STARS will create an integrated, seamless, statewide, wireless voice and data communications system designed to meet the needs of these agencies, up to 7,500 users. The system will be shared by agencies engaged in public safety, protection, and service; and will facilitate interoperability with and between localities at the county and city level. To accomplish this, the program will: increase capacity, upgrade the technology, and enhance coverage of the land mobile radio network; implement statewide law enforcement mobile data; and upgrade the technology of, and create disaster recovery alternate paths for the microwave radio network. Radio communications for the Virginia components of the National Weather Service's Integrated Flood Observing and Warning System (IFLOWS) network are also being upgraded as part of this program. Future procurement phases are expected to expand portable radio coverage where required, VSP wireless access points, create a secure and highly reliable statewide Intranet with wireless access, and implement private 700 MHz radio wideband mobile data in selected areas with Intranet access. Completion for currently planned procurement phases is scheduled for 2011. The subscriber equipment (such as mobile radios, portable radios, vehicular repeater systems, and mobile computers) will be replaced periodically as necessary and the infrastructure's technology can be updated if operationally required. Localities and federal organizations can be added as full-time STARS users/partners when appropriate. The STARS Program will provide participating agencies with a cost-effective systems approach that enables interoperability between federal, local, and Commonwealth government agencies.

Expand portable radio coverage where required. There are agencies where individual radio users are not assigned vehicles or they perform their duties far from their vehicles. However, it is not cost effective to initially design a statewide radio system for portable radio coverage (STARS is designed for mobile radio coverage). Testing will document the many areas where coverage is sufficient for portable radio use, without a vehicular repeater. In specific areas where portable radio use is necessary and coverage is not sufficient, additional transmitter sites can be implemented,

Upgrade the mobile computers to replace the law enforcement in-car tape based video systems. The STARS mobile computers include an input for a video camera and a DVD-RW drive for recording the video on disks.

Create a secure and highly reliable statewide Intranet with wireless access. The STARS Microwave Network is a data transport that is highly reliable and secure that can connect

the agency data networks to each other. This data will be made available to the mobile computers via a wireless connection. This will greatly improve the Commonwealth's response to a natural disaster or terrorist attack. It can also provide reliable statewide cost effective VOIP telephone communications between agencies (subject to legal review).

Implement private 700 MHz radio wideband mobile data with intranet access. The use of this radio frequency band should clear the VHF spectrum deficiency issues so that all of the agencies can benefit from STARS mobile data service, not just law enforcement. The 700 MHz band has channels that have the bandwidth necessary to support the next generation law enforcement databases and tools. VITA will provide assistance for and acquiring the necessary spectrum.

Install VSP wireless access points. The law enforcement mobile computers need immediate wideband access to the network to send / receive large files and for maintenance. In emergency situations, law enforcement providers can receive detailed information. The anti-virus and other security software can be updated on a regular basis. These access points will be installed at VSP Division Headquarters, State Police Headquarters (SPHQ), and the VSP Area Offices served by the Microwave Network. This is approximately 60 locations evenly spread throughout the Commonwealth. The wireless access points are a cost effective measure until the 700 MHz band wireless solution can be implemented.

Recommendation

It is recommended that the Commonwealth enter into the proposed contract with Motorola. The implementation of STARS will provide the participating Commonwealth agencies with a modern, dependable, statewide voice and data radio system. In addition STARS will be available to federal and local agencies that can provide spectrum as participating agencies. This will give them a local radio system that will directly communicate with other STARS users. STARS will also provide a single talk path interoperability solution to all counties and cities that are not a participating agency.