Alaska Land Mobile Radio Communications System

Cooperative Agreement Appendix B

System Description

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Version 2

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Document Revision History

Name	Date	Reason for Changes	Version
Shafer, Sherry	7/7/2010	Annual review/update. Approved by the User Council - final.	2

Acronyms and Definitions

ACP: administrator control panel

AEB: ambassador electronics bank

Alaska Land Mobile Radio (ALMR) Communications System: the ALMR Communications System, which uses but is separate from the State of Alaska Telecommunications System (SATS), as established in the Cooperative Agreement. The ALMR System is a digital, trunked, wide-area network (WAN), shared system between the Department of Defense (DOD), the Federal Executive Association (FEA) of Alaska (excluding DOD), the State of Alaska (SOA), the Alaska Municipal League, and the Municipality of Anchorage.

Alaska Municipal League: a voluntary non-profit organization in Alaska that represents member local governments.

Anchorage Wide Area Network (AWARN): The 700 MHz Anchorage node of ALMR. AWARN will make up Zone 4 of the System.

BDA: bi-directional amplifiers

BIM: base interface module

CEB: central electronics bank

Department of Defense – Alaska: Alaskan Command, US Air Force and US Army component services operating under United States Pacific Command.

DS0: Digital Signal 0 – the lowest Digital Signal or Data Service level having a transmission rate of 64,000 bits per second (64 kb/s), intended to carry one voice channel (a phone call).

Federal Executive Association (FEA): federal government entities, agencies and organizations, other than the Department of Defense, that operate on the shared ALMR system infrastructure.

Key Management Facility (KMF): allows for secure re-keying of radios over the air.

Local Governments: those Alaska political subdivisions defined as municipalities in AS 29.71.800(13).

Member: a public safety agency including, but not limited to, a general government agency (local, state or federal), its authorized employees and personnel (paid or

volunteer), and its service provider, participating in and using the System under a Membership Agreement.

Municipality of Anchorage (MOA): the MOA covers 1,951 square miles with a population of approximately 278,000. The MOA stretches from Portage, at the southern border, to Knik River at the northern border, and encompasses the communities of Girdwood, Indian, Anchorage, Eagle River, Chugiak/Birchwood, and the native village of Eklutna.

NMT: network management terminals

OMC: Operations Management Center

Operations Manager: the Operations Manager represents the User Council interests and makes decisions on issues related to the day-to-day operation of the system and any urgent or emergency system operational or repair decisions. In coordination with the User Council, the Operations Manager establishes policies, procedures, contracts, organizations, and agreements that provide the service levels as defined in the ALMR Service Level Agreement.

P25 Radio: a Project 25 compliant control station, consolette, mobile or portable radio assigned to the System that has a unique identification number.

Public Switched Telephone Network (PSTN):

Radio: a Project 25 compliant control station, consolette, mobile or portable radio assigned to the System that has a unique identification number.

RGU: radio gateway unit

RF: radio frequency

Service Level Agreement: the Service Level Agreement (SLA) outlines the operations and maintenance services as required by the User Council membership for the sustainment and operations of the ALMR infrastructure. The performance metrics contained in the SLA describes the maintenance standards for the ALMR system infrastructure. ALMR cost share services are also outlined in the SLA.

SIP: session initiation protocol

State of Alaska (SOA): the primary maintainer of the SATS (the states' microwave system), and shared owner of the System.

State of Alaska Telecommunications Systems (SATS): the State of Alaska statewide telecommunications system microwave network.

System Management Office (SMO): the team of specialists responsible for management of maintenance and operations of the System.

User/Member: an agency, person, group, organization or other entity which has an existing written Membership Agreement with one of the Parties to the Cooperative Agreement. Terms are synonymous and interchangeable.

User Council: the User Council is responsible for recommending all operational and maintenance decisions affecting the System. Under the direction and supervision of the Executive Council, the User Council has the responsibility for management oversight and operations of the System. The User Council oversees the development of System operations plans, procedures and policies under the direction and guidance of the Executive Council.

WAN: wide area network

Zone: a grouping of channels within the radio

1.0 Alaska Land Mobile Radio (ALMR) Communications System Description

The Alaska Land Mobile Radio (ALMR) Communications System is a digital, trunked wide-area network (WAN), shared system between the Department of Defense (DOD), the Federal Executive Agency of Alaska (excluding DOD), the State of Alaska (SOA) the Alaska Municipal League (AML), and the Municipality of Anchorage (MOA). The communications transport network, supporting sites and site support equipment, are components of the ALMR Communications System. The fundamental objective of the ALMR Communications System is to provide reliable and secure interoperable communications for first responders especially during emergencies, critical situations, and multiple agency exercises.

2.0 System Description

The System is a Motorola© ASTRO 25™ Digital Trunking WAN SmartZone solution that consists of the System infrastructure and multiple subsystems, as follows.

2.1 System Equipment

The System is a multiple-zone design that is divided into two zones (VHF). All sites south of the Denali Highway are in Zone 1, while those sites north of the Denali Highway are in Zone 2. The Municipality of Anchorage (MOA) encompasses Zone 4 on a 700 MHz subsystem. Zone 3 is reserved for possible expansion in the Southeast Alaska.

2.1.1 Master Sites

Each zone has a Master Site and a number of radio frequency (RF) sites. The Master Site for Zone 1 is located in Anchorage at Tudor Road. The Master Site for Zone 2 is located in Fairbanks at Birch Hill on Fort Wainwright. The Master Site for Zone 4 is located at Anchorage Fire Station 12 (FS12).

The Tudor Road Master Site serves as a core network center for the entire SmartZone system. The Birch Hill SmartZone Master Site serves as a core network center for all Zone 2 sites. The FS12 Master Site serves as a core network center for Zone 4. Data packets from the various System sites are routed through and processed from this network center. Data packets from the various System sites are routed through and processed from each network center.

Equipment associated with each Master Site includes a primary and redundant Zone Controller; the main Ethernet switch; core, gateway and exit routers; zone database; and system level and network security servers. All Master Sites include a console subsystem consisting of a Motorola© Gold Elite™ Gateway (MGEG), an ambassador electronics bank (AEB), and a central electronics bank (CEB) with associated base interface module (BIM) cards.

2.1.2 Radio Frequency (RF) Site Equipment

The RF site equipment includes a quantity of Motorola© Quantar IntelliSite Repeaters, redundant site controllers, redundant Ethernet switches and routers to interface the data packets to the SmartZone™ Master Sites. The RF equipment includes the associated multi-coupler, combiner, antenna system, Motorola© System Control and Data (MOSCAD) fault alarm system and 48 VDC power supplies. This category also includes bi-directional amplifier (BDA) systems that support wide-area connectivity and the associated RF antenna systems consisting of transmit and receive antennas, coaxial cables, lightning arrestors, grounding kits and mounting brackets/other fasteners.

2.2 Subsystem Equipment

Subsystem equipment connects directly to the System equipment or enhances the System functionality. These subsystems include dispatch consoles and CEBs, Key Management Facilities (KMFs), Network Management Terminals (NMTs), telephone interconnect systems, logging recorders, data servers and BDAs.

2.2.1 Console System

Console systems are made up of remote or local dispatch console positions and the CEB. The console positions can be connected to a CEB located at the zone controller or a CEB at the agency location. It takes one T1 (24 Digital Signal 0s, i.e. DS0s) to connect a CEB to the AEB at the zone controller. It takes three DS0s per remote console position to connect to the CEB. An additional ten DS0s are required for console programming regardless of the CEB location.

Some agencies have chosen to install bulk encryption equipment to encrypt the links between the CEB and the console positions, and the CEB and AEB. This equipment does not increase the bandwidth requirement.

The BIM cards installed in the CEB allow conventional radio resources like base stations and air-to-ground radios to be used by the console dispatcher along with trunked talk groups. This capability provides System interoperability with conventional radio systems through a patch, or by communicating directly with non-System radio systems.

Tie trunks are connections between two BIM cards in different CEBs. These can be permanent or temporary patches that link different dispatch systems and their associated resources.

2.2.2 Key Management Facility (KMF)

The Motorola© ASTRO 25™ system allows two-way radio transmissions to be encrypted and secure. The KMF is a solution for centralized key management and over-the-air-rekeying (OTAR). The KMF equipment includes a KMF application server, KMF database server and KMF client.

2.2.3 Network Management Terminals (NMT)

NMTs are consoles that connect to the System. The NMT is used by user System Managers and technologists to manage their radio system fleet, units, and configurations. The System Management Office (SMO) oversees the operation of all NMTs. NMTs can be used by individual Agencies to manage their individual radio systems. In the event that interoperability between participating Agencies is required the SMO can enable interoperability between multiple agency's NMTs.

2.2.4 Telephone Interconnect

The telephone interconnect subsystem provides a means to connect the System with the Public Switched Telephone Network (PSTN) allowing properly programmed System subscriber radios to initiate and receive half-duplex telephone calls. Telephone interconnectivity is not considered a critical service. The telephone interconnect system is located at the Zone 2 Master Site at Birch Hill.

2.2.5 Logging Recorder

Voice logging recorders are directly associated with the console system at a particular dispatch location.

2.2.6 Data Server

Includes all equipment associated with the integrated voice and data servers which can provide data over the internet protocol (IP) network.

2.2.7 Bi-Directional Amplifier (BDA)

BDAs extend coverage into, or within, a particular facility or tunnel by repeating transmissions to and from an available donor RF site. BDAs for infrastructure sites are addressed under the RF site equipment category.

2.3 Motobridge Gateway System

The System team has installed a Motorola© Motobridge™ gateway network that has connectivity to System talk groups, but it is separate from the System network. It is on a State of Alaska local area network (LAN) with connectivity through State of Alaska Telecommunications System (SATS).

The Motobridge© system provides interoperability between various communications networks. Central management of the System is provided by dual-redundant management servers located in Fairbanks and Anchorage. Other components consist of dispatch positions with Work Station Gateway Units (WSGU) and computer consoles for linking conventional and trunked two-way radio systems together, and Radio Gateway Units (RGU) that physically tie the dissimilar radio resources to the network.

2.3.1 Operations Management Center (OMC) Server

The OMC Server is the main management server in the System and a central repository where all System users and resources (i.e., administrators, dispatchers, and radios) are registered, and where System-wide information (i.e., active patches and conferences, security parameters, etc.) is stored. The OMC Server runs on the Red Hat Linux operating system. A User-level interface to the OMC Server is provided by the Administrator Control Panel (ACP) Client PC. The primary OMC Server is located in Zone 1 at the Anchorage Emergency Operations Center (EOC) and the secondary OMC Server is located in Zone 2 at the Fairbanks EOC.

2.3.2 Administrator Control Panel (ACP)

The ACP Client PC allows an administrator, located anywhere in the System, to perform management activities for the System. The ACP Client PC runs on the Microsoft XP™ operating system. An ACP Client PC is located with each of the OMC servers.

2.3.3 Session Initiation Protocol (SIP) Proxy Server

The SIP Proxy Server is a signaling server for establishing talk paths (calls) across the system. The SIP Proxy Server complies with international standards for multimedia call routing and telephony services in the Internet. The SIP Proxy Server interacts with the gateway units in the system, which implements the SIP agent portion of the standard. The SIP Proxy Server runs on the Red Hat Linux operating system.

2.3.4 Radio Gateway Units (RGU) and WorkStation Units (WSGU)

The gateway units are based on one hardware platform which can be configured to serve as either a RGU or a WSGU. The RGU connects radio equipment to the System. The WSGU interfaces with the Dispatch Console PC to provide the Motobridge dispatch position used by the public safety interoperability dispatcher.

2.3.5 The Dispatch Console PC

The Dispatch Console PC enables a dispatcher to activate the WSGU, which allows control over a large number of connected remote radios, intercom connections, audio conferences and phone calls. The Dispatch Console PC runs on the Microsoft XP™ operating system.

2.4 Site Equipment

A major component of the System is the remote equipment sites. Without appropriate site and supporting equipment, the System will not function properly. The supporting site equipment includes shelters, towers, site/backup power, site physical area and equipment and site grounding.

2.4.1 Shelters

This category includes all stand-alone shelters, both pre-fabricated and stick-built used for housing System and associated communication equipment. For areas within existing buildings, this also includes required improvements to the rooms where the System and associated communications equipment is housed. Components in the shelters include racks, internal wiring, external ice bridges, foundations and leveling, exterior lighting, air conditioners, louvers, fans and door locks.

2.4.2 Towers

This category includes all components of the tower including the foundation, frame and ladders, painting, guys (as applicable), beacons, foundations and anchors.

2.4.3 Site/Back-Up Power

This category includes the distribution panel for external power, inverters, battery plants, battery chargers and generators. Also included are generator fuel tanks, generator enclosures and exhaust piping. This category includes backup generators and uninterrupted power source (UPS) systems associated with the zone controllers.

2.4.4 Site Physical Area

This category includes all activities for the right-of-way and the area surrounding the structure for which the System is responsible. This would include grading, plowing and graveling access roads, brushing, mowing and fencing around the area where the shelter and tower are located.

2.4.5 Equipment and Site Grounding

All site equipment shall be bonded together to form a single common earth ground electrode system as outlined in the Motorola© "R56 - Standards and Guidelines for Communication Systems." All internal and external grounding must be in working order and maintained through the life of System usage.

2.5 Transportable/Deployable Systems

The System includes two transportable/deployable systems. The transportable systems are designed so that each system integrates into the existing ALMR fixed infrastructure. One system is designed to operate in the southern zone, and the other in the northern zone. Both systems can be deployed independently, or combined in areas where there is no fixed ALMR infrastructure. The transportable system is the property of Joint Task Force Alaska, and is available to the services to meet their mission needs.

The transportables are designed to function as stand-alone systems or to connect with, and be an integral part of, the System. The transportable system is designed to provide three critical functions in support of sustained emergency communications. First the transportable is designed to "plug" into the existing system to provide emergency replacement, or fill in for site infrastructure that is damaged or down for repair. Second, the design allows for the transportable system to be added to the wide-area system, as needed, to expand the loading capacity at a location where emergency response has overwhelmed the existing capacity. Thirdly, the transportable is designed to provide a stand-alone capability with reach back to the fixed infrastructure and other critical communications capabilities where there is not fixed ALMR infrastructure present to support emergency operations.

Each transportable/deployable consists of multiple modules that can be transported via tractor-trailer, C-130/similar-sized cargo plane, or Chinook/similar-sized helicopter. Transportable 1 encompasses all four modules, while Transportable 2 does not have Module 4 (the 4.5 Meter C-Band Satellite Earth Station Antenna Skid). Only the modules required for the mission will be transported for set up.

Bandwidth Capacity of the Transportable System The transportable system has a total bandwidth capacity of 15 T1s. This capacity is provided through various components of the System. The following is a breakdown of the bandwidth capacity provided by each component: the satellite earth-station (2 T1s); high-bit-rate digital subscriber line (1 T1); tactical fiber gigabyte Ethernet (2 T1s); spread spectrum microwave (4 T1s); and digital-to-analog converter (DAC)/ Premisys mux (6 T1s).

2.5.1 Communication Shelter

The communications shelter module is approximately 9 feet wide, by 16 feet long, by 9 feet high. It contains a five-channel RF site, satellite control interface, an unlicensed 5.8 GHz microwave radio, a CEB and a 48 VDC battery plant for 8 hours run time. It is air and ground transport ready.

2.5.2 Dispatch Shelter

The dispatch shelter is approximately 9 feet wide by 16 feet long by 9 feet high. It contains one Motorola© Gold Elite console position and a conventional UHF and VHF radios, marine band and air-to-ground radios, a Motobridge™ RGU, OMC, ACP, SIP server, WSGU and dispatch position. It is air and ground transport ready.

2.5.3 Tower/Power Skid

The tower/power skid is approximately 9 feet wide by 20 feet long and contains a 35KW self-contained diesel generator and integral fuel tank designed for three continuous days of operation at half load. It also contains a 50-foot, powered crank-up tower. It has permanently mounted antennas for the RF site and two conventional frequencies. It is air and ground transport ready.

2.5.4 C-Band Satellite Earth Station Antenna Skid

A C-Band transportable earth station is provided with an Andrew 4.5 Meter Tri-Fold antenna mounted on a trailer/skid approximately 9 feet wide by 20 feet long. It is air and ground transport ready.

2.5.5 Logistics Skid

The logistics skid is utilized to store ancillary equipment that supports the transportable system for and during deployment. It also serves as a facility for maintenance operations while in the deployed state. Contained within the Logistics Skid is the Mesh Network. Mesh network technology was originally developed for the military battlefield to provide instant, ad-hoc communication networks where fixed infrastructure was not available or deployable. As a result, users receive a robust mobile broadband communications network that is self-forming and self-healing. The technology is capable of delivering seamless broadband data connections and real-time video transfers to vehicles moving at highway speeds. The logistics skid measures 9 feet wide, by 20 feet long, by 9 feet high. It is air and ground transport ready.

2.5.6 Unclassified Deployable Mesh (UDM) Network Skid

The Mesh Network Skid houses the Mesh™ Network components and is approximately 9 feet wide, by 20 feet long, by 8 feet high. It provides a robust wireless communications solution operating in the unlicensed 2.4GHz and the newly licensed 4.9GHz public safety spectrum at the employed site via microwave, fiber or satellite connection, which supports up to four networks in a single access point with a two-mile radius coverage capacity. It also provides WiFi access, license-free mobile broadband, a dedicated licensed network connectivity and security, and real-time video.

2.5.7 Transporter.

The Transporter is a tracked or wheeled, all-terrain trailer used to transport the modules short distances, move the modules from hot storage, stage modules for deployment, and place the modules back into their original configuration upon redeployment (North and South Zone).

2.5,8 Tug

The Tug is a 2007 Ford F350, Bobtail, capable of towing 30k pounds at 25 mph and is used to pull the transporter.

2.5.9 Rapid Deployable System

The Rapid Deployable System (RDS) Shelter provides a fast, easy, durable, and versatile structure perfect for first responders, command posts, operations centers, or other remote operations.

2.6 Communications Transport Network

All voice and data signals that are carried on the System are transported to the Master Site Zone 1 controller at Tudor Road through SATS. SATS is comprised of multiple methods of network connectivity to include microwave, commercially leased T1s, and local fiber networks. In some locations, the connectivity links are encrypted utilizing bulk encryption equipment.

The System channel banks provide a connectivity gateway from the System central controllers to the remote RF sites. The channel banks provide individual Channel Service Units (CSUs) to each remote site location and link them to the prime site controller.

2.7 Administration/Management

To administer and manage the ALMR Communications System, a number of full time permanent employees are required to provide operations management, system management, system monitoring and maintenance, asset management and administrative support for the governance structure. These functions are typically cost shared between the ALMR cooperative partnership.

2.7.1 General Administration

To ensure the operational integrity of the System and to provide centralized administration and system management, which supports all users, an Operations Management Office (OMO) and a System Management Office (SMO) are cost shared between the cooperative partners. The OMO develops and recommends policies, procedures, and guidelines; identifies technology and standards; and coordinates intergovernmental resources to facilitate communications interoperability with emphasis on improving public safety and emergency response communications to the User Council for approval. The OMO is the central point of contact for all users concerning the operation of the shared System.

The OMO also provides oversight and quality assurance and control over the maintenance providers. The quality of service and service levels at which the System operates are defined in the Service Level Agreement.

The SMO, which works in coordination with the OMO, includes the System Manager, System Technologists, Help Desk, Security Manager, and other contracted maintenance functions. The SMO develops technical processes and procedures related to the shared infrastructure, and also provides technical assistance and advice to ALMR users and prospective users.

2.7.2 Support - User Council

The OMO attends monthly meetings, or more often as requested, with the User Council and designated representatives of System user groups to understand new communication needs, to communicate System information, and address questions, complaints, or provide clarification about the System and other topics, as requested.

The OMO will prepare annually, with the collaboration of user agencies, a survey to be used to determine the user satisfaction level with the coverage, features, functions, usability, management and service response for the System. The responses to the survey will be used to guide the User Council and the OMO for improvements, changes, upgrades or additions needed for the System. If the user survey indicates that user satisfaction level is inadequate, in the judgment of User Council, the OMO will initiate action to identify the areas of concern, develop a corrective action plan, and take necessary steps to resolve the unsatisfactory areas within their control.

2.7.3 Support - Technology Planning

The OMO will keep abreast of new technology developments, advancements, announcements, standards, and operational best practices in LMR-related technology. The OMO will report and meet periodically with the appropriate User Council personnel to discuss and evaluate new technology for applicability to the System. The OMO will be present during System/equipment testing or product reviews at the designated user facility and facilitate the test plan (if requested), check off procedures, and the sign off documents.

An important initial consideration in enhancing the management of an existing wireless network is the condition, design and operations of the current wireless equipment. The OMO will work closely with users to evaluate the current state of operations and equipment capabilities and recommend changes to the User Council as necessary for improved management and operations of the System.

The OMO working with the User Council will assess the goals and objectives of the System, from time to time, to identify the role radio communications play in achieving the desired System operational objectives. Some of the activities that will be involved in the strategic technology planning process include, but are not limited to:

2.7.3.1 Review currently available wireless technologies in the industry and evaluate their applicability to System functional, technical, and agency requirements.

2.7.3.2 Evaluate changing technical and applicable User Council, mission requirements to recommend how the System can be used more effectively.

2.7.3.3 Develop a plan, in cooperation with the User Council, for the necessary modification of hardware/software of the existing wireless system equipment.

2.7.4 Management Processes

Management and operational processes and procedures required for the smooth operation of the System are developed and administered by the OMO at the direction and approval of User Council on behalf of the user community.