Alaska Land Mobile Radio Communications System
Total Cost of Ownership Study
Executive Summary

The Alaska Land Mobile Radio (ALMR) Communications System, hereinafter referred to as the System, is a digital trunked, wide–area network, shared communication system that has been implemented and is being operated under a Cooperative Agreement between the principal stakeholders: the U.S. Department of Defense (DOD), the State of Alaska (SOA), and the Federal Executive Association (FEA) of Alaska. The ALMR stakeholders are executing an interoperability communication strategy that ensures ALMR is operated in compliance with the U.S. Department of Homeland Security (DHS) guidelines. The principal objective of ALMR is to provide reliable, on-demand and in real time, secure interoperable communications for emergency responders in Alaska across federal, state, and local government agencies. ALMR supports multi-agency/multi-jurisdictional public safety responses to mutual aid, emergency and medical response situations, while also meeting day-to-day land mobile radio communications needs. ALMR was implemented and is operated in accordance with standards established and endorsed by the Association of Public Safety Communications Officers (APCO) for first responder communications interoperability.

The primary objective of this document is to identify and quantify future ALMR operations and maintenance (O&M) costs. These future costs are then further classified into those that are candidates to be shared by all System users and those that will be paid solely by the agency that incurs them. All future ALMR O&M costs are driven by the level of service defined in the ALMR Service Level Agreement (SLA)[1] and have been quantified through competitive contracts with third party service providers.

The second objective of this document is to put future O&M costs into context with those for similar systems. This was accomplished via a limited benchmarking analysis of five other statewide systems. Information regarding construction costs, numbers of sites, annual operating costs, and staffing levels were examined. This was not an effort designed to define detailed metrics. Rather, it established ranges of values against which those like values for ALMR can be compared.

The final objective is to document the historical cost of the System from the time construction began through June 30, 2008. All stakeholders were involved in the acquisition and installation of the ALMR infrastructure and the associated handheld and mobile radios, to some extent. This document details these cooperative contributions.

[1] The Service Level Agreement (SLA) was developed by the operational users of the System. The SLA defines the system components as shared maintained assets or agency owned/maintained assets. The SLA also defines the level and quality of service at which the System must be maintained to meet operational needs. Draft Service Level Agreement, Version 1, dated February 26, 2008.

To assist the stakeholders in achieving these three objectives, Wostmann & Associates, Inc. (WAI), in conjunction with Homeland Security Consulting (dba 5 Star Team) and MGT of America, Inc., were commissioned to conduct this Total Cost of Ownership (TCO)[2] study of ALMR shared infrastructure under the governance of the Executive Council. The scope of the TCO does not include the determination of the amount of costs to be shared or funded by each stakeholder, or the method for determining each stakeholder's share of ALMR O&M costs. This is a governance responsibility of the ALMR Executive Council, and will be reflected in a Cost Share Agreement executed among the stakeholders.

Study Process and Approach

The TCO was conducted through a series of meetings with ALMR stakeholders, the review of existing information on ALMR, the provision of information, and the completion of surveys by ALMR stakeholders. Meetings were held with ALMR stakeholders initially, during data gathering and analysis tasks, and also during the review of draft reports. Prior reports, audits, minutes of Executive Council and User Council meetings, draft and final versions of the Cooperative Agreement and the SLA, and other documents were obtained and reviewed. Cost information was obtained from each stakeholder and projected for the seventeen-year lifecycle[3] of the System infrastructure beginning July 1, 2008. The validation or audit of the data provided by the stakeholders was not within the scope of the TCO, or the responsibility of WAI and the other firms participating in the development of the TCO. Study results are based on the cost information available at the time the TCO was developed.

Costs associated with the management and O&M of the ALMR shared infrastructure have been and are to be, shared by the principal stakeholders as defined in the SLA. Costs associated with user communications components[4] are to be borne by each user also in accordance with the SLA. To date, DOD and the SOA have shared in the implementation costs of the ALMR shared infrastructure[5]. It is not anticipated that costs incurred by the DOD and the SOA in the implementation of their agreed upon responsibilities for deployment of ALMR shared

[2] This is the second TCO conducted for the ALMR Executive Council. The first TCO was conducted in March 2005 by Marketing Strategy Group. It captured the costs of operating the legacy LMR systems of the stakeholders and provided an in-depth analysis of the projected costs of implementing the shared system infrastructure. It did not examine the cost of operating and maintaining the shared System.

[3] The manufacturer of the equipment defines the lifecycle as the time in which replacement parts and software upgrades will be made available and after which infrastructure may not be repairable. The system, if properly maintained, will still function for many years after the end of its lifecycle.

[4] User communications components include subscriber equipment, which is defined as the instruments that the user directly operates and interfaces with to execute communication over the System. Examples are hand held radio units, mobile vehicle units, consoles, consolettes, key management equipment, radio programming devices etc. User communications equipment also includes in-building repeaters, the deployable system and other equipment and services that do not benefit all System users.

[5] This pertains to the initial system design and infrastructure build out, to date. The Municipality of Anchorage (MOA) is solely funding the infrastructure build out of the Anchorage Wide Area Radio Network (AWARN), which will function as a part of ALMR in a zone configuration.

infrastructure will be recaptured through any future cost share approach. However, it is anticipated that all ALMR users will share in the management and O&M costs of the ALMR shared infrastructure[6] over the anticipated seventeen year lifecycle of the system.

Although the TCO provides both shared infrastructure and user specific costs, only costs associated with shared infrastructure components have been verified by the stakeholders. Significant effort has been expended by the stakeholders in determining all historical and projected costs related to shared infrastructure components presented in the TCO. Cost information associated with infrastructure and communication equipment only benefiting a specific entity, or group of entities, was not provided by several municipalities and federal agencies[7]. In those cases, the information was estimated.

Costs identified in the TCO include but are not limited to costs of procurement, site preparation, construction, implementation, program management, transition, cutover, upgrades; and annual costs associated with managing, operating, and maintaining the ALMR shared infrastructure. TCO costs do not include depreciation, or an allowance for the replacement of equipment and other capital costs. Federal funding policies require the funding of equipment and implementation costs from capital appropriations and not from annual operating and maintenance funds. In the TCO equipment category, implementation, and other capital costs have been identified as one-time costs in the year they were incurred, and also in the year they may need to be replaced or upgraded.

System Components

System component information was derived from the SLA and through meetings and discussions with stakeholders. ALMR is comprised of shared infrastructure equipment and user communications components, which are further divided into shared and non-shared costs throughout this TCO.

Shared infrastructure components are components essential for the operation of the System and which benefit all System users. Shared infrastructure costs include engineering designs, site preparation, the procurement of the equipment, management of the project, and other associated costs.

[6] As of this writing, the consensus of the stakeholders is that infrastructure owners will continue to fund the cost of maintaining and servicing their owned infrastructure equipment. Services associated with circuit backhaul, system management and operations management of the shared infrastructure will be shared among all stakeholders. The final determination of cost share approach, methods and resulting stakeholder costs will be provided through the Cost Share Agreement.

[7] Information was provided by DOD, SOA, MOA, Bureau of Land Management, FAA Fairbanks, Fairbanks Fire Department, Homer Police Department, McKinley Volunteer Fire Department, Rural Deltana, Volunteer Fire Department, Soldotna Police Department and Valdez Fire Department. Costs for those not completing the surveys were estimated based on the number of radios registered on the System.

User communications components benefit only one user, or a small group of users. Included in this category is subscriber equipment (handheld radios, mobile vehicle-mounted radios, consoles, and consolettes), as well as radio gateway equipment, bi-directional amplifiers, key management consoles, and network management console equipment.

Historical Cost and Funding

The ALMR stakeholders have expended approximately $100 million dollars on the management, implementation, operation, and maintenance of ALMR shared infrastructure through June 30, 2008 (FY 2008), and approximately $95 million dollars on user communications components[8]. A total commitment has been made of over $195 million dollars in the establishment of a DHS-compliant, reliable, and secure interoperable communications system in Alaska. Approximately 72 percent of the funding of the total System cost incurred through FY 2008 has been federally funded. Table II.1 provides a summary of ALMR-related costs and funding through FY 2008, broken down by federal and state/local funding.

Table II.1
System Components
Costs and Funding Through June 30, 2008
(In thousands)

Components	Costs		Federal Funding		State/Local Funding	
	Total	Percent	Amount	Percent	Amount	Percent
Shared Infrastructure	$ 99,538	51.00%	$ 65,835	66.14%	$ 33,703	33.86%
User Communications Components	95,635	49.00%	74,909	78.33%	20,726	21.67%
Total	$ 195,173	100.00%	$ 140,744	72.11%	$ 54,429	27.89%

[8] The $95 million covers all subscriber equipment costs. In addition, this figure also includes the cost of the AWARN infrastructure. AWARN services the MOA agencies operating autonomously on AWARN. Technically, the connection of AWARN as a zone on the ALMR shared infrastructure extends seamless interoperable communications between users on ALMR and users on AWARN when those users are operating in areas mutually covered by both ALMR and AWARN.

Cost and Funding Summary by Stakeholder

As of the end of FY 2008, of the costs associated with ALMR shared infrastructure components approximately 66 percent has been federally funded[9]. All ALMR users have incurred costs for the acquisition and implementation of subscriber equipment, of which approximately 80 percent has been federally funded[10]. Table II.2 provides the costs incurred by each of the ALMR stakeholders and the source of funding they utilized to fund their costs.

Table II.2
System Components by Stakeholder
Costs and Funding Through June 30, 2008
(In thousands)

	Costs		Federal Funding		State/Local Funding	
Components/Stakeholders	**Total**	**Percent**	**Amount**	**Percent**	**Amount**	**Percent**
Shared Infrastructure						
U.S. Dept. of Defense	$ 47,628	47.85%	$ 47,628	100.00%	$ -	0.00%
State of Alaska	51,910	52.15%	18,207	35.07%	33,703	64.93%
Subtotal	$ 99,538	100.00%	$ 65,835	66.14%	$ 33,703	33.86%
User Components						
U.S. Dept. of Defense	46,057	48.16%	46,057	100.00%	-	0.00%
Other Federal Agencies	2,176	2.28%	2,176	100.00%	-	0.00%
State of Alaska	13,606	14.23%	-	0.00%	13,606	100.00%
Municipality of Anchorage	23,046	24.10%	16,050	69.64%	6,996	30.36%
Other Alaska Local Entities	10,750	11.24%	10,626	98.85%	124	1.15%
Subtotal	95,635	100.00%	74,909	78.33%	20,726	21.67%
Total	$ 195,173		$ 140,744		$ 54,429	

[9] 100 percent of DOD contributions have been federally funded, 35.07 percent of the SOA costs have been federally funded.

[10] This total includes both the subscriber equipment and the infrastructure costs for the MOA. AWARN infrastructure is not part of the ALMR shared infrastructure, and therefore is considered user communications components for cost determination purposes of this TCO.

Shared Infrastructure by Cost Categories

As illustrated in Table II.3, the principal shared infrastructure category through FY 2008 is site implementation[11], representing approximately $71 million dollars which is 71.7 percent of the total shared infrastructure costs. Approximately $41 million dollars (57.03 percent) of these costs were federally funded. Table II.3 also provides the costs incurred for every other shared infrastructure cost category, and the source of funding.

Table II.3
Shared Infrastructure Components
Costs and Funding Through June 30, 2008
(In thousands)

Cost Category	Costs		Federal Funding		State/Local Funding	
	Total	Percent	Amount	Percent	Amount	Percent
Project Oversight	$ 378	0.38%	$ 56	14.81%	$ 322	85.19%
Project Management Support	2,399	2.41%	1,035	43.14%	1,364	56.86%
Operations Management	2,271	2.28%	2,271	100.00%	-	0.00%
Studies and Reports	3,157	3.17%	3,157	100.00%	-	0.00%
Statewide Exercise Support	1,811	1.82%	1,811	100.00%	-	0.00%
Site Implementation	71,510	71.84%	40,704	56.92%	30,806	43.08%
System Upgrades	5,962	5.99%	5,962	100.00%	-	0.00%
System Management and Maint.	11,339	11.39%	10,839	95.59%	500	4.41%
Circuit Usage	711	0.71%	-	0.00%	711	100.00%
Total	$ 99,538	100.00%	$ 65,835	66.14%	$ 33,703	33.86%

[11] Site implementation includes the costs associated with engineering (system analysis/system design), procurement of the equipment, site preparation, training and exercises, development of standard operating procedures, operational testing and evaluation (OT&E), etc.

User Communications Components by Cost Category

The principal cost categories on which ALMR costs have been expended for user communications components have been approximately 78 percent federally funded[12] as illustrated in Table II.4.

In total, approximately 79 percent of subscriber equipment costs have been federally funded. Table II.4[13] provides, by cost category, the costs incurred for user communications components and the source of funding for these costs.

Table II.4
User Communications Components
Costs and Funding Through June 30, 2008
(In thousands)

Cost Category	Costs		Federal Funding		State/Local Funding	
	Total	Percent	Amount	Percent	Amount	Percent
Project Management Support	$ 5,105	5.34%	$ 4,927	96.51%	$ 178	3.49%
Operations Management	50	0.05%	50	100.00%	-	0.00%
Studies and Reports	1,853	1.94%	1,853	100.00%	-	0.00%
Site Implementation	16,585	17.34%	9,051	54.57%	7,534	45.43%
System Upgrades	1,950	2.04%	1,950	100.00%	-	0.00%
System Management and Maint.	1,347	1.41%	1,309	97.18%	38	2.82%
Deployable System	8,046	8.41%	8,046	100.00%	-	0.00%
Circuit Costs	50	0.05%	-	0.00%	50	100.00%
Subscriber Equipment	60,649	63.42%	47,723	78.69%	12,926	21.31%
Total	$ 95,635	100.00%	$ 74,909	78.33%	$ 20,726	21.67%

[12] For further clarification and understanding, user communications components and the associated costs include all costs of equipment not categorized as shared infrastructure that has been incurred by the owner agency and can include administration, programming, training, exercises, bi-directional amplifiers used for in-building coverage, gateway equipment, subscriber equipment, DOD Transportable Systems, etc.

[13] Note that many of these cost categories are the same as those under the shared infrastructure section. The difference is that those in Table II.3 supported the shared infrastructure, while those in Table II.4 support only one set of users.

Projected Potential Future Shared Infrastructure Cost

It is anticipated that ALMR users will share in the funding of future management and O&M costs of the ALMR shared infrastructure over the remaining seventeen years of the System lifecycle, July 1, 2008 (FY 2009) through June 30, 2025 (FY 2025). Future costs associated with user subscriber equipment and other communications components are to be borne by each user agency.

Projected, potential, future costs are those costs identified in this TCO that are candidates for the ALMR Cost Share, and are driven by the service levels defined in the SLA. As identified and quantified in this document, the ALMR stakeholders will agree on which of these costs will be shared, and which will be borne by the agency incurring them, and will delineate those costs in the final signed Cost Share Agreement.

Projected, potential, future shared infrastructure costs include annual costs associated with managing, operating, and maintaining the ALMR shared infrastructure. The costs of periodic upgrades to the System hardware and software solution are treated as capital costs and have been identified as one-time costs in the year in which they are projected to be incurred.

Future Operations and Maintenance Costs

Operations and maintenance is the primary cost category for which potential future costs are projected to be incurred in support of the ALMR shared infrastructure. These are the basic O&M costs required to support the services levels defined in the SLA. Annual O&M costs are projected to increase from approximately $5.2 million in FY 2009 to approximately $8.6 million in FY 2025. All O&M services, except for circuit usage associated with use of the State of Alaska Telecommunications System (SATS), are projected to be provided through contracts with private service providers. The majority of circuit usage associated with ALMR will be provided by SOA over SATS[14]. Table III.1 provides a summary of projected, potential, future shared infrastructure O&M costs by cost category, fiscal year, and in total. Costs for FY 2009 have been projected based on third-party contracts and SOA circuit costs. Annual costs for FY 2010 through FY 2025 have been projected by inflating the FY 2009 costs annually by 2.83 percent. The annual inflation rate of 2.83 percent is the average CPI for Anchorage[15] for the past three years for which CPI information is available (2005, 2006, and 2007). The following is a description of the four cost categories comprising ALMR shared infrastructure O&M costs:

- Operations Management Office[16] – Contracted costs of the Operations Management Office (OMO) which is responsible for overseeing the day-to-day operations of the

[14] Not all circuit costs supporting the shared infrastructure are provided by the SOA. DOD has implemented a small percentage of circuit equipment and maintains and provides bandwidth currently at no cost to the user.

[15] Anchorage CPI information was obtained from the Alaska Department of Labor & Workforce Development website. See http://almis.labor.state.ak.us

[16] An Operations Management Office Customer Support Plan has been published and is available from the User Council or the Operations Management Office that describes in detail the services provided to the customer.

ALMR shared infrastructure. Activities include coordinating and performing a range of operational and administrative activities in direct support of delivering 24/7 ALMR services, developing and administering strategic and operating plans, developing and maintaining relationships with program managers of the ALMR stakeholders and with current and prospective ALMR users, providing administrative support, reports, and recommendations to the User Council and Executive Council. The OMO also performs third party quality control of preventative maintenance inspections provided on the System to ensure that it is maintained in accordance with the SLA.

- System Management Office[17] – Contracted costs of the System Management Office (SMO) which is responsible for wide area system management, asset management, help desk, system maintenance and technical support, network operations and support, radio frequency spectrum management support, and security and information assurance.

- Equipment Maintenance[18] – Contracted costs for the maintenance of all ALMR shared infrastructure equipment. Due to the critical nature of the services supported by ALMR, the User Council has requested that ALMR be operated and maintained at the highest level of maintenance defined in the SLA. The highest level of maintenance (Level A) supports a system that is operational at least 99.999 percent of the time.

- Circuit Usage – Costs of circuits (primarily SATS) utilized by ALMR. Based on current usage information provided by the SOA, ALMR shared infrastructure costs for utilization of SATS circuits have been projected at 6.75 percent of the SOA total annual SATS operating and maintenance costs.

[17] A System Management Office Customer Support Plan has been published and is available from the User Council or the Operations Management Office that describes in detail the services provided to the customer.

[18] Equipment maintenance is not a shared cost component among all stakeholders. In accordance with the cost share approach currently being supported, equipment maintenance costs are borne by the equipment owner only. The rationale is that the equipment owner procured only equipment that they required to support independent agency needs, and not on behalf of the cooperative partnership. The agency allows access/use of the equipment for in-kind access use of other stakeholder infrastructure equipment.

Table III.1
Potential Projected Futured ALMR Shared Infrastructure Costs
For State Fiscal Years 2009 Through 2025
Operations and Maintenance Costs
(In thousands)

Fiscal Year	Operations Mgmt. Office	System Mgmt. Office	Equip. Maint.	Circuits	Total
2009	$ 629	$ 1,352	$ 2,898	$ 323	$ 5,202
2010	647	1,391	3,253	332	5,622
2011	665	1,430	3,345	342	5,782
2012	684	1,470	3,440	351	5,945
2013	703	1,512	3,537	361	6,113
2014	723	1,555	3,637	371	6,286
2015	744	1,599	3,740	382	6,464
2016	765	1,644	3,846	393	6,647
2017	786	1,691	3,955	404	6,835
2018	809	1,738	4,067	415	7,029
2019	831	1,788	4,182	427	7,228
2020	855	1,838	4,300	439	7,432
2021	879	1,890	4,422	451	7,643
2022	904	1,944	4,547	464	7,859
2023	930	1,999	4,676	477	8,081
2024	956	2,055	4,808	491	8,310
2025	983	2,113	4,944	505	8,545
Total	$ 13,493	$ 29,008	$ 67,596	$ 6,929	$ 117,026

Future Capital Outlays

Costs of future capital outlays have been projected for periodic upgrades to the System, which may include hardware and software. These capital costs have been identified as one-time costs in the year they are projected to be incurred. Table III.2 provides a summary of projected ALMR future shared infrastructure capital outlay costs for System upgrades by fiscal year, and in total.

- System Software Upgrades – The current version of the System software was acquired during FY 2007. System upgrades are expected to be released and acquired starting in 2012, and approximately every three years thereafter through FY 2024.

Table III.2
Future Projected ALMR Shared Infrastructure Costs
For State Fiscal Years 2009 Through 2025
Capital Costs
(In thousands)

Fiscal Year	System Upgrades	Total
2012	$ 3,500	$ 3,500
2015	3,806	3,806
2018	4,138	4,138
2021	4,499	4,499
2024	4,892	4,892
Total	$ 20,835	$ 20,835

Total Future Costs

Table III.3 provides a summary by year, and in total, of all projected future costs for the System. Total future costs are made up of essential O&M costs as detailed in Table III.1, capital costs as detailed in Table III.2, and two additional cost categories. The first of these cost categories is system-wide training and communications in support of cross-governmental exercises that are usually held every two to three years. These costs may be shared, or may be paid by the agency incurring the costs. The second cost category is the cost of personnel to perform oversight and coordination functions within each stakeholder agency. These costs will not be shared. They will be paid by the agencies incurring them.

Table III.3
Projected Potential Future ALMR Total Costs
For State Fiscal Years 2009 Through 2025
(In thousands)

Fiscal Year	Operations & Maint.	System Upgrades	Oversight & Coord.	Exercise Support & Training	Total
2009	$ 5,202		$ 263	$ -	$ 5,465
2010	5,622		270	343	6,236
2011	5,782		278	-	6,060
2012	5,945	3,500	286	362	10,093
2013	6,113		294	-	6,408
2014	6,286		302	383	6,972
2015	6,464	3,806	311	-	10,581
2016	6,647		320	405	7,372
2017	6,835		329	-	7,164
2018	7,029	4,138	338	428	11,933
2019	7,228		348	-	7,575
2020	7,432		357	453	8,243
2021	7,643	4,499	368	-	12,509
2022	7,859		378	479	8,716
2023	8,081		389	-	8,470
2024	8,310	4,892	400	506	14,108
2025	8,545		411	-	8,956
Total	$ 117,026	$ 20,835	$ 5,642	$ 3,359	$ 146,861

Benchmarking

As part of the TCO process, a questionnaire was developed and transmitted to eight states that either have, or are in the process of implementing, a similar system to ALMR. The eight states selected represented a cross section of operational maturity, comparable technology, and similar geography out of a population of approximately 20 states that have, or are planning to implement, statewide shared systems. The primary focus of the questionnaire was the acquisition of information on other similar systems that would provide a context against which several statistics from the ALMR System can be gauged, rather than a finite set of metrics to evaluate cost reasonableness. The state communications entities from the following five states responded: Colorado, Indiana, Michigan, Pennsylvania, and South Carolina. The information provided varied significantly between the states due to the population size and density variances, the size of the area covered, the number of entities in the state, their topographical characteristics, and the equipment they are responsible for operating and maintaining.

System Configuration

All of the states are using the same, or very similar, interoperable system software and connectivity technology, and all have the goal of achieving the highest level of interoperability on the SAFECOM Continuum[19]. Four of the five responding states are using Motorola ASTRO 25™ trunking system software technology and equipment for their infrastructure (Pennsylvania is using M/A-COM Open Sky™). Indiana and South Carolina are using the same, or earlier, version of the Motorola SmartZone™ technology utilized by ALMR.

Although the responding states are using very similar interoperable system software and connectivity technology, the number of system sites utilized by each state, and the number of subscribers, varies significantly. Table IV.1 provides the number of sites for each state.

Table IV.1
Number of Sites

State	Current	Planned Additional	Total
Alaska	82	8	90*
Colorado	153	37	190
Indiana	134	16	150
Michigan	220	0	220
Pennsylvania	550	300	850
South Carolina	158	0	158

*See footnote[20]

[19]SAFECOM Continuum: See www.safecomprogram.gov. SAFECOM is a communications program of the Department of Homeland Security. SAFECOM provides research, development, testing and evaluation, guidance, tools, and templates on interoperable communications-related issues to local, tribal, state, and Federal emergency response agencies.

[20] Total of 90 sites is based on original System design without AWARN; with the addition of AWARN, the total number is 105 sites.

Table IV.2 provides the number of subscribers for each state. In Alaska, the number of federal government users on ALMR is almost 50 percent. The highest percentage of federal users on any of the other statewide systems is Michigan, where they represent less than 10 percent of the user base.

Table IV.2
Users and Numbers of Subscriber Units

State	Current	Planned Additional*	Total	Users **
Alaska	11,000	4,000	15,000	All
Colorado	27,000	3,000	30,000	All
Indiana	34,000	21,000	55,000	All
Michigan	44,000	26,000	70,000	All
Pennsylvania	15,000	10,000	25,000	State Only
South Carolina	23,000	7,000	30,000	All

* As of November 2007.

** All - Includes local, state, and federal entities.

Entity Responsibilities and Composition

All of the states used in the comparison have designated a single state government entity responsible for the management, operation, and maintenance of their system, and none of them use the consortium approach adopted by ALMR, which incorporates all levels of government. Although all of the state entities have the same general responsibilities, the composition and size of each entity varies significantly. The size of the entities are primarily affected by the number of subscriber units, their maintenance responsibilities, and whether they contract for maintenance or provide it with state staff. Table IV.3 provides the composition of the responding state organizations by major activity.

Table IV.3
Composition of Entity

State	Mgmt. & Admin	Finance & Billing	Help Desk	Operations	Maint.	Total
Alaska	2	0	1	4	2	9
Colorado	2	2	4	6	35	49 *
Indiana	2	3	2	3	0	10
Michigan	2	3	9	6	50	70
Pennsylvania	4	1	13	12	0	30
South Carolina	3	0	0	0	0	3

* See footnote [21]

The quantities represented in Table IV.3 represent various mixes of contracted-versus-state employee operations and maintenance strategies. In Alaska, Indiana, Colorado, Michigan, and Pennsylvania, the central entity is only responsible for maintaining the system's shared infrastructure. South Carolina has completely outsourced all O&M activities and the three positions noted in the chart are for state oversight only. In Colorado and Michigan, maintenance is provided by state employees, which accounts for their large staffing size. As in Alaska, the other states contract for maintenance services.

[21] The 49 personnel identified for the Colorado system operate and maintain both the radio system and the microwave system. A breakout of only the radio system personnel was not provided.

Build-out Cost and Funding

None of the states that responded to the questionnaire had completed a TCO study, or maintained any detailed records on the total cost to complete and implement (build-out) their system. Further, none of the states indicated that their implementation addressed in-building coverage, communications with disparate radios systems, or a transportable solution which the total cost of ALMR includes.[22] As a result, it was not clear whether all costs beyond the physical build-out of fixed sites and procurement of subscriber equipment were included[23]. However, based on non-audited records and non-official records, all the responding states provided build-out cost estimates. The system components included in the cost estimates varied significantly in that some only include infrastructure components, while others include transport backbone costs.

Table IV.4 provides the build-out cost estimate provided by each of the states, and the cost components included in each cost estimate.

[22] ALMR executed a standards based communications technology solution that addressed the need to interoperate in a secure, on-demand and in-real-time basis. The solution examined the; who, when, where, what and how of interoperable communications to meet public safety and homeland security roles and missions. This examination led to engineering and system designs and implementation of fixed sites, critical infrastructure/in-building coverage solutions, an ALMR gateway network for interoperability with disparate radio systems and a transportable solution. ALMR also completely incorporated the SAFECOM five success elements. The incorporation of the SAFECOM elements aside from a standards based technology and single shared systems approach, required execution of training and exercises, deliberative planning and development of plans, development of standard operating tactics, techniques and procedures, development of governance and extensive outreach efforts.

[23] Based on the lack of an even benchmark, the reader should not conduct an exact cost comparison between ALMR total costs and those of the other states presented here.

Table IV.4
Buildout/Implementation Costs

State	Costs	Components
Alaska	$195,173,000	Includes infrastructure, subscriber units, project management, design and engineering. Does not include microwave backbone that was already in place.
Colorado	146,600,000	Includes infrastructure and subscriber units. Does not include the majority of the microwave backbone or about 85 sites that were already in place.
Indiana	80,000,000	Includes the cost of infrastructure and site construction work, excluding towers. No subscriber equipment is included as that is the responsibility of each participating agency.
Michigan	230,000,000	Includes the cost of the infrastructure and approximately 3,000 subscriber units.
Pennsylvania	500,000,000	Includes all state owned infrastructure and subscriber units.
South Carolina	80,000,000	Only includes the cost of the infrastructure equipment.

Only in Alaska has the primary funding source for the statewide system been federal funds. Although Colorado (33.4 percent) and Indiana (14.5 percent) did utilize federal funding, the five responding states primarily funded their systems through general fund appropriations and special levies. The older systems in Michigan, Pennsylvania, and South Carolina were funded entirely through state general fund appropriations. Indiana funded approximately 77 percent of their costs through a special levy created by the Indiana General Assembly. The Assembly dedicated $1.25 of certain fees collected by the State's Bureau of Motor Vehicles to fund costs associated with the construction, operation, and maintenance of the system infrastructure.

Annual Operating and Maintenance Costs

The annual costs to operate and maintain the systems vary significantly. The primary factor affecting costs is the number of system sites. Table IV.5 provides the annual operating and maintenance cost estimate for FY 2009 provided by each of the states.

Table IV.5
FY2009 Annual Operating and Maintenance Costs

State	Costs	Components
Alaska	$5,202,000	Includes operations and maintenance for shared system components.
Colorado	3,900,000	Includes operations and maintenance for state-owned portion of the infrastructure.
Indiana	12,000,000	Includes operations and maintenance for state owned infrastructure.
Michigan	16,000,000	Includes operations and maintenance for state owned infrastructure. Costs are expected to rise to $20 million as equipment begins reaching the end of its life cycle.
Pennsylvania	28,000,000	Includes operations and maintenance for state owned infrastructure.
South Carolina	11,000,000	Includes operations and maintenance of the RF and backbone infrastructure and 24 hour system monitoring. Not included are costs by large users that are credited against their user charges.

Table IV.6 provides the average annual operating and maintenance cost per site. The average cost is calculated by dividing each system's total annual operating and maintenance costs by their current number of sites. Michigan and Pennsylvania costs include subscriber unit maintenance costs, which they were unable to segregate from the total costs. It should also be noted that a base, or minimum, level of administrative and system support costs is required regardless of the number of sites, and will usually not increase proportionately as sites are added.

Table IV.6
Average Annual Operating and Maintenance Costs Per Site

State	Number of Sites	Annual O&M Costs	Average Per site
Alaska	82	$5,202,000	$63,439
Colorado	103*	3,900,000	37,864*
Indiana	134	12,000,000	89,552
Michigan	220	16,000,000	72,727
Pennsylvania	550	28,000,000	50,909
South Carolina	158	11,000,000	69,620

* See footnote [24]

Annual Operating and Maintenance Funding

As discussed before, Alaska is the only state where the System is being operated under a consortium approach. Furthermore, as of this writing, the ALMR stakeholders have not selected a Cost Share approach and method. Only Pennsylvania is funding their annual costs entirely through state general fund appropriations. Three of the five states are funding either all, or a portion, of their annual costs through subscriber and/or usage fees. Indiana is funding their annual costs from a dedicated fee assessed on certain vehicles and boats. The following is a more detailed discussion of how each state funds the annual O&M costs for their statewide system.

- Colorado – The state charges a subscriber fee to state agencies of $265 per year for each subscriber unit. Only state agencies are charged. Federal and local agencies are not assessed any fees or costs for system usage.

- Indiana - The Indiana General Assembly dedicated $1.25 of certain fees collected by the State's Bureau of Motor Vehicles to fund costs associated with the construction, operation, and maintenance of the system's infrastructure. The $1.25 is assessed on

[24] The Colorado system consists of equipment and sites that are both state owned and owned by local government. The $3.9 million number referenced in the table above applies only to the radio equipment and 103 sites that are managed by the State of Colorado. The total cost for operating and maintaining all 153 total sites that make up the Colorado system is borne by both the State of Colorado and local communities and was not available. This information was provided by Kim Coleman of the Colorado Department of Information Technology on September 3, 2008.

transactions such as driver's licenses, and vehicle and boat registrations. Currently the fee generates approximately $13 million in revenue, which is used to fund operations, maintenance, and capital upgrades to the system.

- Michigan – The state funds their annual costs through state general fund appropriations, and federal and local subscriber fees. Basically, the state has established a subscriber fee for any non-state user, and makes up the difference through state general fund appropriations. The state waives a significant amount of local fees to encourage infrastructure integration. User fees range from $0 to $200 per year, based on level of planned system usage.

- Pennsylvania – The state funds their annual costs entirely through state general fund appropriations.

- South Carolina – The state funds all of their annual costs through monthly fees for basic dispatch services and system features, and annual fees for mutual aid and interoperability access. The monthly fees are charged to state and local users, and are based on a detailed feature-based billing process. The base fee for statewide access is $62.50 per month. The annual fees charged to federal agencies are for mutual aid and interoperability access only. Federal agencies must maintain their own separate radio communications systems for daily operations.

This concludes the Executive Summary.