

Proposal for

# Countywide Radio Communications Interoperability and System Engineering Services

RFP No. 5217





AECOM 434.582.5500 tel  
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Suite 475  
Raleigh, NC 27607  
www.aecom.com

February 29, 2016

Mr. David Cannell  
Purchasing Agent  
200 S. Cameron Street  
Hillsborough, NC 27278

**Re: Countywide Radio Communications Interoperability and Systems Engineering Services – RFP  
#5217**

Dear Mr. Cannell,

AECOM Technical Services of North Carolina, Inc. (AECOM), formerly known as CTA Communications, is pleased to respond to your request for proposals seeking a qualified a Consultant to provide professional consulting, planning, and facilitation services in support of short and long-term Radio communications and interoperability needs. AECOM is uniquely qualified to support the County with a highly experienced consulting team including team members who have specific past experience assessing, understanding and supporting the implementation of similar public safety communications system projects. Our scope includes the provision of all services outlined in your RFP Scope of Work, and as described within our proposal.

Our experience in communications system analysis and design began 30 years ago. Our core services include providing radio system assessments and needs analysis, specification and RFP development and supporting vendor selection and negotiation activities. We also have extensive experience in providing services related to system implementation and testing oversight. We understand that a successful radio system upgrade or replacement project begins with a good foundation based on thorough planning, and we will ensure that the services that you are requesting will give you that solid foundation.

AECOM was very privileged to work with Orange County in 2002 assisting with an assessment for long-term recommendation of a public safety grade system. In 2004 we were asked to update the assessment for an 800 MHz trunked radio system. In 2004 we assessed the County joining the statewide VIPER system and in 2005 we performed a coverage analysis and assisted with Talk Group Structure for participation on the VIPER System. These opportunities to partner with Orange County were both successful and rewarding for our team and we look forward to renewing our relationship with the County.

AECOM is independent of and has no affiliation with any vendor, manufacturer, supplier, or dealer of equipment, software or services. Our history of recommendations in competitive procurements proves our objectivity. In the midst of a highly competitive marketplace with a proliferation of marketing hype, this objectivity provides our clients with a fully, impartial perspective.

We are familiar with, understand and appreciate the complexity involved in upgrading your public safety radio system. We have a record of successfully completing many similar efforts for other counties, cities, regional consortiums and state governments. With a local experienced team based from our offices in Raleigh, North Carolina and Lynchburg, Virginia, we bring a wealth of local knowledge and experience to your project that seem the right fit to the services requested. AECOM is willing and able to provide all the services necessary to determine the most economical, efficient, reliable and state-of-the-art method for designing and provisioning a new countywide radio communication system.

The core values of our team are a commitment to professionalism, technical excellence, efficiency, and a keen understanding and support of your needs. We see ourselves as an extension of your staff and we will strive to be your advocates helping you attain your goals and objectives in a cost effective manner.

Our passion is to design systems that protect the lives of first responders, who everyday place themselves in danger to protect the lives and property of every citizen and visitor in Orange County. I am eager for the opportunity to meet with your representatives, to review our approach, and discuss how we can work with you to support your radio communications project and be a valued member of your team. If you have any questions or require additional information, please call me at 434.582.5500 or contact me by e-mail at [Cheryl.Giggetts@aecom.com](mailto:Cheryl.Giggetts@aecom.com)

Sincerely,

A handwritten signature in blue ink that reads "Cheryl S. Giggetts". The signature is written in a cursive, flowing style.

Cheryl S. Giggetts, CHS-III, PMP  
Senior Vice President



Orange County  
Financial Services Department  
**ADDENDUM #1**  
**February 8, 2016**

RFQ 5217
Countywide Radio Communications Interoperability And Systems Engineering Services

To all Vendors:

Modifications to bid documents for the above-named Request for Proposal are made as follows and shall be included in the proposed amount.

Questions received with County's responses are on page 2 of this document

All other terms and conditions shall remain the same

By: David E. Cannell, Purchasing Agent; [dcannell@co.orange.nc.us](mailto:dcannell@co.orange.nc.us) / (919) 245-2651

**Acknowledgement of receipt of this addendum shall be included with your submittal**

Company Name: AECOM Technical Services of North Carolina, Inc.

By: Cheryl Giggetts, CHS-III, PMP Senior Vice President

Date Received: February 8, 2016

P.O. Box 8181 200 South Cameron Street Hillsborough, North Carolina 27278  
Telephones: Area Code 919-245-2651 Fax: 919-636-4913



Orange County  
Financial Services Department  
**ADDENDUM #2**  
**February 12, 2016**

RFQ 5217
Countywide Radio Communications Interoperability And Systems Engineering Services

To all Vendors:

Modifications to bid documents for the above-named Request for Proposal are made as follows and shall be included in the proposed amount.

The due date has been extended to March 1, 2016 at 5:00 pm. We anticipate issuing at least one additional addendum to address questions received

All other terms and conditions shall remain the same

By: David E. Cannell, Purchasing Agent; [dcannell@co.orange.nc.us](mailto:dcannell@co.orange.nc.us) / (919) 245-2651

**Acknowledgement of receipt of this addendum shall be included with your submittal**

Company Name: AECOM Technical Services of North Carolina, Inc.

By: Cheryl Giggetts, CHS-III, PMP Senior Vice President

Date Received: February 12, 2016

P.O. Box 8181 200 South Cameron Street Hillsborough, North Carolina 27278  
Telephones: Area Code 919-245-2651 Fax: 919-636-4913



Orange County  
Financial Services Department  
**ADDENDUM #3**  
**February 23, 2016**

RFQ 5217
Countywide Radio Communications Interoperability And Systems Engineering Services

To all Vendors:

Modifications to bid documents for the above-named Request for Proposal are made as follows and shall be included in the proposed amount.

Questions received with County's responses are on pages 2-4 of this document

All other terms and conditions shall remain the same

By: David E. Cannell, Purchasing Agent; [dcannell@co.orange.nc.us](mailto:dcannell@co.orange.nc.us) / (919) 245-2651

**Acknowledgement of receipt of this addendum shall be included with your submittal**

Company Name: AECOM Technical Services of North Carolina, Inc.

By: Cheryl Giggetts, CHS-III, PMP Senior Vice President

Date Received: February 23, 2016

P.O. Box 8181 200 South Cameron Street Hillsborough, North Carolina 27278  
Telephones: Area Code 919-245-2651 Fax: 919-636-4913



Orange County  
Financial Services Department  
**ADDENDUM #4**  
**February 24, 2016**

RFQ 5217
Countywide Radio Communications Interoperability And Systems Engineering Services

To all Vendors:

Modifications to bid documents for the above-named Request for Proposal are made as follows and shall be included in the proposed amount.

Questions received with County's responses are on page 2 of this document

All other terms and conditions shall remain the same

By: David E. Cannell, Purchasing Agent; [dcannell@co.orange.nc.us](mailto:dcannell@co.orange.nc.us) / (919) 245-2651

**Acknowledgement of receipt of this addendum shall be included with your submittal**

Company Name: AECOM Technical Services of North Carolina, Inc.

By: Cheryl Giggetts, CHS-III, PMP Senior Vice President

Date Received: February 24, 2016

P.O. Box 8181 200 South Cameron Street Hillsborough, North Carolina 27278  
Telephones: Area Code 919-245-2651 Fax: 919-636-4913

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# Introduction

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# Introduction

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AECOM Technical Services of North Carolina, Inc. (AECOM) is pleased to present our proposal to Orange County for Countywide Radio Communications Interoperability and Systems Engineering Services. As you review our proposal, please notice the important features of our services, summarized below.

The purpose of the study is to determine the most economical, efficient, reliable, and state-of-the-art method for designing and provisioning a new countywide radio communications system for use by local government entities to meet the long-term voice communications, paging, and voice interoperability needs of emergency and non-emergency agencies serving residents, workers, and visitors of Orange County, North Carolina.

## Our Experience and Technical Competence in Public Safety communications is a core focus of AECOM's Technology Solutions practice.

Of our many successfully completed projects over the last 30 years, we have selected three as our main reference projects, which are most relevant to Orange County in terms of technology, geographic region, and similarity of scope.

AECOM understands the County is currently utilizing the state VIPER system, as well as a VHF voice-tone paging system that is used to page out the fire departments. We know your infrastructure is aging and much of it is beyond the end of its life expectancy. As we consider these systems, it will also be important to look at the other systems and agencies operating within your County:

- Solid Waste
- Orange County Transportation
- Town of Carrboro
- Town Chapel Hill
- Town of Hillsborough
- Orange Water and Sewer Authority (OWASA)

It will be critical that we evaluate the loading of the VIPER system (channel loading and tower loading), coverage in all areas of the county, and coverage inside buildings. Critical to the success of your moving forward, will be a detailed cost-of-ownership analysis. AECOM will provide the professional consulting, planning, and facilitation services required to meet the County's project objectives as outlined in the Request for Proposal (RFP).

AECOM understands the importance of our methods to accomplish the work while maintaining critical public safety communications. We recognize, and are very familiar with, all of the County's requested scope. Our methods and work plan describe one possible way of conducting the radio and microwave assessment. We look forward to meeting and negotiating the exact scope and work plan you need to satisfy your stakeholders. Of course, the current needs assessment is only the first step. We look forward to forging a valuable and trusted relationship, and to an invitation to continue into specifications, procurement, and implementation phases. A general outline for delivery of future steps is contained at the end of our section titled *Methods Proposed to Accomplish the Work*.

Our Project Team will provide the required consulting services as requested by the RFP to meet the County's project objectives:

- Complete an assessment of two-way radio infrastructure and equipment (base, mobile, portable, pager, fixed receiver) for all County and Town end users serving the residents, workers, and visitors in Orange County that is interoperable with the State VIPER system, your surrounding Counties, and the University of North Carolina – Chapel Hill.
- Analyze communications infrastructure backbone (microwave, fiber, or other) requirements identifying areas of improvement and system design requirements.
- Assess the need for new and/or upgrades to existing towers, supporting buildings, and backup power.
- Analyze voice paging infrastructure and Fire and EMS station alerting infrastructure to identify areas of improvement and system design requirements.
- Develop alternatives / recommendations for both short-term and long-term objectives.
- Working session with the review committee to review the alternatives and determine which alternative best fit the needs of the County.
- Develop a detailed migration plan for both short-term and long-term objectives.
- Develop a vendor-neutral request for proposal.
- Develop evaluation criteria to support an objective and protest-free vendor selection.

AECOM believes that our relevant experience and ability to perform is as much about our approach and philosophy as it is about our direct experience. In other words, how we accomplish our work is just as important, if not more important, than the fact that our team members are experienced consultants.

The summary information below reflects AECOM's sincere interest in serving Orange County and meeting each of the County's evaluation criteria.

## General Requirements

### Prior Experience and References

All of the projects we offer for comparison contain the services requested within the scope of services. All have a critical need to assure smooth interoperability with local, State, and Federal entities on their various incumbent channels. While some opt for P25 and 700/800 MHz, some have significant VHF and UHF investments and seek creative and cost effective upgrade approaches. Many, such as Spotsylvania, Loudoun, and Harrisonburg Counties, rely heavily on a comprehensive microwave network for more than just voice radio. Our recent past projects have taken us

through many of the situations we anticipate in Orange County. Most importantly, all our reference projects are successful, and our clients are satisfied with our performance. We provide three references for your review as their projects are similar in scope and size to your project. We are pleased to provide references for any of our clients as we pride ourselves on our excellent service and therefore extremely pleased clients.

AECOM was very privileged to work with Orange County in 2002 assisting with an assessment for long-term recommendation of a public safety grade system. In 2004, we were asked to update the assessment for an 800 MHz trunked radio system. In 2004, we assessed the County joining the statewide VIPER system, and in 2005, we performed a coverage analysis and assisted with Talk Group Structure for participation on the VIPER System. These opportunities to collaborate with Orange County were both successful and rewarding for our team and we look forward to renewing our relationship with the County. AECOM has retained all of this information and will begin this project with a full understanding of all work previously completed and will be able to move the project forward in a rapid manner and provide the critical inputs needed to meet the County's budgeting cycle.

### Qualifications of Firm and Staff

Our staffing plan reflects deliberate matching of skills, experience, education, and past project experience to the needs anticipated for Orange County. It is our practice to maintain the Principle-in-Charge, Project Manager, and key staff, throughout the project into future phases. We believe it is important for the core team to be present to meet the original objectives of the project. Our Principle-in-Charge, Cheryl Giggetts, maintains an active high-level role in the day-to-day efforts on each of our projects, and is required to hold at least one formal progress/financial review of each project, each month.

### Project Schedule and Workplan

We take our schedule commitments seriously and do all within our control to meet the schedule. Our proposed work plan demonstrates a cost effective and efficient approach to performing a needs assessment.

### Project Approach

As illustrated in our response to technical requirements section, the tasks the County requests are familiar to us and we are experienced in assisting similar clients needing a system upgrade or replacement. Our organization and approach delivers the immediate scope and anticipates the future project steps of specifying, procuring, and constructing the needed systems. Our client references will attest to our innovative solutions that save time, money, and satisfy stakeholders. Because we also offer a unique service of independent radio coverage testing, we are also

experts in the design and prediction of coverage, a key competency in our business.

### Cost

We have included our pricing as requested and we are pleased to negotiate any of these phases to match the County's budget. We often find, during negotiations, we have the opportunity to better refine client expectations and provide only the services required. Sometimes a change order is required to accommodate new requested scope, but barring such additional services, we take our original financial commitment seriously.

## Our Commitment to Orange County:

- ✓ Understanding the County's needs and goals
- ✓ Quality assurance – your satisfaction is our goal
- ✓ Provide recommendations for the County based upon our team's national and international experience
- ✓ Be your trusted project advisor

# Response to General Requirements

# Response to General Requirements

## Organizational Qualifications

Firm Name: **AECOM Technical Services of North Carolina, Inc.**

The below individual has primary responsibility for developing this proposal and can answer any necessary technical questions:

**Cheryl Giggetts, CHS-III, PMP**  
**701 Corporate Center Drive, Suite 475**  
**Raleigh, North Carolina 27607**  
**434-258-8427**  
**Cheryl.Giggetts@aecom.com**

## Staff Qualifications and Facilities

### Experience and demonstrated capabilities of the Firm’s proposed project team

AECOM employees belong to industry-related scientific, professional, and technical committees and associations and so we are aware of not only the new developments in these areas, but also contribute to and help drive innovation in the trade. We are familiar with federal and state regulatory requirements. Our staff continuously monitors technological changes and issues, such as the NTIA and the FCC regulatory activity and requirements, and other issues in the communications industry.

We understand that, as the communications industry evolves, we need to stay on top of the most valuable information, since this can provide short- and long-term benefits to our clients. We offer in-depth knowledge and experience in P25 digital, conventional and trunked communications systems, represented by our work with several clients, who operate, or are in the process of implementing, P25 digital radio communications systems. Our proposed Principal-in-Charge for this project currently sits on the Project 25 Technology Interest Group (PTIG) Board and each year is a presenter in a half day class on Project 25 Foundations and System Technology Updates at the International Wireless Communications Expo (IWCE).

- Project 25 Technical Interest Group (PTIG)
- Public Safety Wireless Advisory Council (PSWAC)
- Association of Public Safety Communications Officers (APCO) International:
  - Civil Contingencies Network (CCN)
  - Commercial Advisory Committee (CAC)
  - Membership & Chapter Services Committee
- Various State Chapters of APCO
- National Emergency Number Association (NENA)
- Telecommunications Industry Association (TIA)
- Next Generation 911 Working Group
- National Society of Professional Engineers
- Institute of Electrical and Electronic Engineers (IEEE)
- American Board for Certification in Homeland Security (CHS)
- National Institute of Standards and Technology (NIST) Community Resilience Panel
- International Association of Chiefs of Police – Law Enforcement Information Management (IACP – LEIM)
- Police Executive Research Forum (PERF)
- Industry Council for Emergency Response Technologies (ICERT)

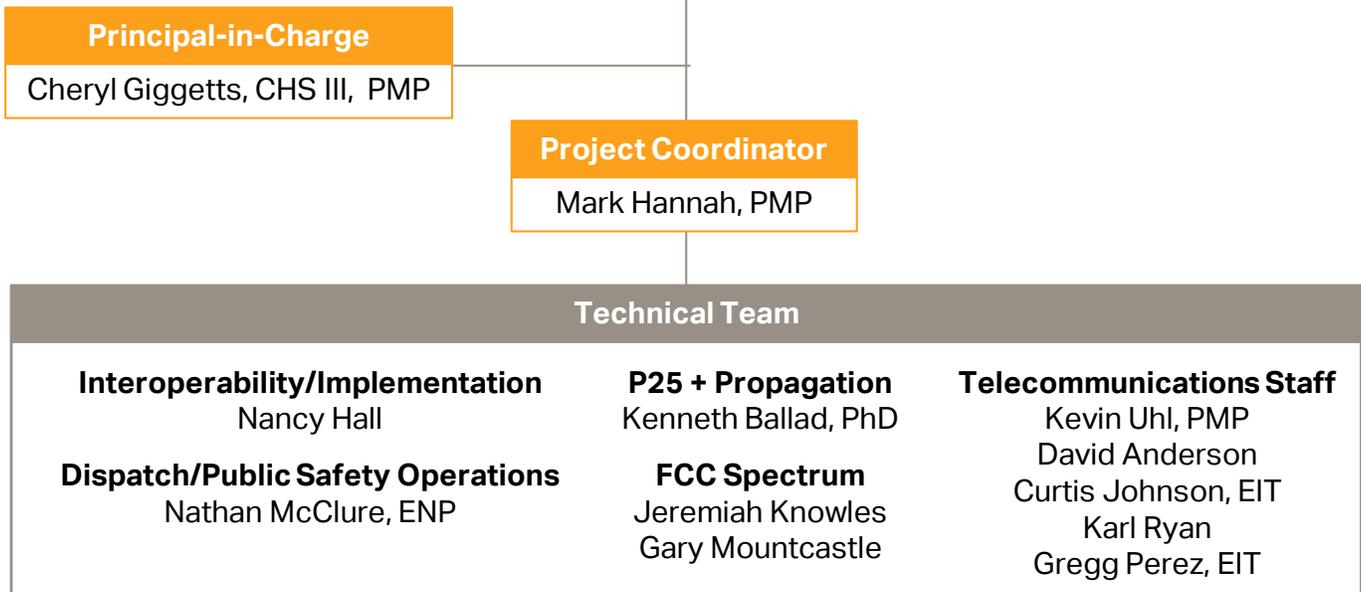
## Expert Knowledge with Public Safety Radio Technologies and Trends

**Approach to assigning a project team**

We have selected our project team based on thoughtful consideration of the County’s objectives and propose a team with strong credentials to meet desired goals. This project team has a solid understanding of what makes a project successful, gained through supporting similar radio system implementation efforts and transitions to a P25 system.

Our depth of technical resources is listed on the project organizational chart below, noting areas of primary expertise and alternate candidates if key members become unavailable.

**Organizational Chart**



AECOM’s team of consulting experts is recognized as leaders in the communications industry, with clients throughout the world. Our involvement with APCO, TIA, and NFPA is shaping the standards and applications of “what’s next in technology.” As a team of highly experienced professionals, we design and manage projects simultaneously throughout North America. We do this successfully as we bring the appropriate expertise to projects when and where needed. In the

following table, we provide the names, roles, experience summaries, and responsibilities for our proposed project team.

The project team described will be the team for the life of your project, does not include subcontractors, and is ready to move quickly to meet your critical project schedule.

**Key Personnel Qualifications and Responsibilities**

Key Personnel	Qualifications and Experience Summary	What does it mean for you?	Hourly Rate
<b>Cheryl Giggetts, CHS-III, PMP</b> Principal-in-Charge	<ul style="list-style-type: none"> <li>- Senior Vice President</li> <li>- 25 years of experience in public safety</li> <li>- Authority for legal and financial decisions</li> <li>- Ultimate responsibility for Technology Solutions</li> </ul>	Ms. Giggetts is the senior management point of contact for the County if issues cannot be resolved with the project team. More importantly, she verifies there are sufficient company resources available to complete your project successfully.	\$255.50
<b>Mark Hannah, PMP</b> Project Coordinator	<ul style="list-style-type: none"> <li>- 34 years of experience in Land Mobile Radio and Microwave networks design</li> <li>- Technology infrastructure for critical public safety facilities, including ECC and EOC</li> </ul>	Mr. Hannah has extensive experience in RF, microwave networks, coverage, and frequency analysis, and implementing large-scale land mobile radio systems. Mark is responsible for the overall performance of the project team and to verify we meet all of our responsibilities in a professional and timely manner. He will be available to the County stakeholders throughout the duration of the project.	\$169.50
<b>Nancy Hall</b> Interoperability / Implementation	<ul style="list-style-type: none"> <li>- 30 years of experience in two-way radio industry</li> <li>- Assessments, design, specification development, proposal evaluation, implementation &amp; acceptance</li> <li>- IP-based solutions for voice and data</li> </ul>	Ms. Hall has an extensive background focused on providing interoperability solutions. She works with our Oregon State client providing technical insight during procurement / implementation / acceptance phases. She is available to provide specialized expertise and analysis in interoperability.	\$169.50
<b>Nathan McClure, ENP</b> Dispatch / Public Safety Operations	<ul style="list-style-type: none"> <li>- 44 years public safety communications</li> <li>- 17 years as director of 911 dispatch center</li> <li>- 22 years as volunteer/paid on-call firefighter</li> <li>- hands-on experience in every aspect of the Public Safety field</li> </ul>	Mr. McClure is a Senior Operations Specialist specializing in Emergency Communications Center and 911 system design and operation. Mr. McClure is available to provide input as needed for Public Safety Operations / 911.	\$169.50
<b>Ken Ballard, PhD</b> P25+Propagation	<ul style="list-style-type: none"> <li>- 37 years of experience in the field of radio wave propagation</li> <li>- Project 25 radio systems</li> <li>- Various technologies related to communications systems, components, and radio waves</li> </ul>	Dr. Ballard is an expert on P25 within the public safety industry. His extensive project experience will benefit the County as you transition to a P25 system. He has engineered many communications system, and offers specialized analysis and quality review for P25 and propagation.	\$206.50

Key Personnel	Qualifications and Experience Summary	What does it mean for you?	Hourly Rate
<b>Jeremiah Knowles</b> FCC Spectrum	<ul style="list-style-type: none"> <li>- 18 years of experience in two-way radio systems, point-to-multipoint technology, microwave networks, and RF propagation</li> <li>- Radio spectrum search and FCC licensing and FAA permitting expertise</li> </ul>	Mr. Knowles has experience in radio spectrum and will participate as needed in frequency searches and alternatives analysis. He also has experience in tower and microwave site support systems and can provide input as needed.	\$99.50
<b>Gary Mountcastle</b> FCC Spectrum	<ul style="list-style-type: none"> <li>- 38 years of experience in two-way radio systems, point-to-multipoint technology, microwave networks, and RF propagation</li> <li>- Radio spectrum search and FCC licensing and FAA permitting expertise</li> </ul>	Mr. Mountcastle has experience in radio spectrum and will participate as needed in frequency searches and alternatives analysis. He also has experience in Tower and microwave site support systems and can provide input as needed.	\$129.00
<b>Kevin Uhl, PMP</b> Telecommunications	<ul style="list-style-type: none"> <li>- 17 years of Project Management and Systems Engineering Management in Land Mobile Radio (LMR) Systems implementation</li> </ul>	Mr. Uhl has extensive experience in radio system implementation and microwave networks. He will assist with the radio design, propagation, specifications, procurement, and implementation.	\$184.50
<b>David Anderson</b> Telecommunications	<ul style="list-style-type: none"> <li>- 35 years of experience in engineering, R&amp;D, radio and broadband communications systems</li> </ul>	Mr. Anderson has extensive experience in radio system implementation and microwave networks. He will assist with the radio design, propagation, specifications, procurement, and implementation.	\$194.00
<b>Gregg Perez, EIT</b> Telecommunications	<ul style="list-style-type: none"> <li>- 11 years of experience of various Public Safety communications systems</li> <li>- Analysis, technical designs, cost estimates, integration, deployment and testing</li> <li>- RFP development, assessments, field surveys and system / site acceptance testing</li> </ul>	Mr. Perez is experienced and available to assist the technical team with interoperability and project implementation as necessary.	\$184.50

**Provide detailed resumes for the members of the project team and staff that are anticipated to be utilized during the course of the project, highlighting their similar or relevant experience to this project.**

The following pages provide detailed resumes for each of our team members, highlighting their project-specific expertise, as well as their experience on projects similar or relevant to the County's scope of work.



# Cheryl Giggetts, CHS-III, PMP

## Principal-in-Charge

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### EDUCATION:

MS, Business Administration, Lynchburg College  
BA, Psychology, Randolph-Macon Women's College

### CERTIFICATIONS/ACCREDITATIONS:

Homeland Security Level III Certification  
Project Management Professional

### PROFESSIONAL AFFILIATIONS:

Project Management Institute  
American College of Forensic Examiners International  
Certified Homeland Security  
Preparation and Response Team  
Telecommunications Industry Association (TIA)

APCO International:

- Civil Contingencies Network (CCN)
- Commercial Advisory Committee
- Membership + Chapter Services Committee

APCO Virginia

NENA Virginia

Commonwealth of VA Interoperability Advisory Team

Emergency Interoperability Consortium

Project 25 Technical Interest Group

Region 2000 Technology Council:

- Board of Directors
- Executive Committee

### AREAS OF EXPERTISE:

APCO P25 Phase 1&2

Public Safety Radio Systems Needs Analysis

Radio System Design + Implementation

Project Management Cost/Schedule Management

Customer Interface

Team Coordination

## Summary

Ms. Giggetts is a senior vice president and director of AECOM's Technology Solutions group. She has over 30 years of experience in management, and over 25 years in the public safety and utilities industries. She has extensive knowledge of emergency communications centers, 911 technology, land mobile radio systems, including analog, digital, UHF, 800 MHz, 700 MHz, 900 MHz, APCO P25, conventional, VHF, and trunked systems. She ensures the proper technical and management resources are available for each project.

## Relevant Project Experience

**County Emergency Management, Orange County, NC.** Project involved an independent, comprehensive study of the existing communications system and the future communications needs of Orange County Emergency Management. The Phase 1 report included a long-term recommendation for procurement, installation, and implementation of a wide-area, integrated, public-safety-grade trunked radio system. The Phase 2A report updated survey information, identified system alternatives, evaluated several

alternatives, performed coverage analysis and provided a preliminary system design with an opinion of probable cost for purchasing a county-owned 800 MHz Trunked Radio system. During Phase 2A, Ms. Giggetts coordinated RaCE<sup>SM</sup> coverage testing. The Phase 2B report addressed the County forming a partnership with the NC State Highway Patrol on the VIPER (Voice Interoperability Project for Emergency Responders) system in lieu of purchasing a county-owned radio system.

### Davidson County, Countywide P25 Trunked Radio System, Davidson County, NC.

Provided assistance in the evaluation and negotiation of an unsolicited proposal submitted by a vendor and determined the County needs were not fully addressed. Provided straightforward explanations and recommendation of all alternatives considered to Davidson County management, the Davidson County Board of Commissioners, and the Emergency communications staff. Ultimately, the team was able to secure a significant discount over the initial proposal.

### Pima County Wireless Integrated Network, AZ.

Project manager responsible for establishing a regional network that will allow 31 public safety and governmental agencies in the county located along the US-Mexican border to communicate within their own jurisdictions, and with other agencies in emergencies. PCWIN also includes co-location of four major dispatch centers and the EOC.

### Arlington County 800 MHz Trunked Radio System and ECC Relocation and Mobile Data, VA.

Project Manager to implement an 800 MHz P25 radio system upgrade and ECC relocation for conversion of the current radio system from an analog 800 MHz simulcast system to a modern digital 800 MHz simulcast system. Client wanted to achieve regional interoperability and correct poor radio coverage, aging equipment, and lack of modern features. The new system has enhanced operating capabilities and allows for growth.

### Virginia Statewide Agencies Radio System (STARS) Land Mobile Radio and Microwave Network Systems Upgrade, VA.

Project Manager for quality assurance and oversight of this 60-site, VHF trunked, P25 system and upgrade to state police land mobile radio and microwave networks. Developed detailed budget/schedule, specifications, site surveys, and interviews with 23 state agencies. Assessed the radio needs of participating agencies, evaluated/ documented current infrastructure, and researched viable technologies. Involved in independent verification/validation of the radio, data, microwave, and facilities.

# Mark A. Hannah, PMP

## Project Coordinator

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### EDUCATION:

MBA Lynchburg College  
BSEE, Bradley University

### CERTIFICATIONS/ACCREDITATIONS:

Project Management Professional (PMP) Certification

### PROFESSIONAL AFFILIATIONS:

Project Management Institute  
North Carolina Chapter, Project Management Institute  
APCO

### AREAS OF EXPERTISE:

Areas of Expertise:  
Trunked Radio Systems  
Interoperability  
Policies and Procedures  
Project Management  
Microwave Communications design and implementation  
Communication System design and implementation

### TECHNOLOGIES:

APCO P25 Phase 1 & 2  
Conventional Radio  
Propriety Trunked Radio Systems  
Standards-Based Trunked Radio Systems  
Single & Multi-Site Systems  
Multicast & Simulcast  
Wide area systems  
Microwave Systems  
HF, Low Band, VHF, UHF, T-Band, 700/800 MHz, 900 MHz  
Console systems  
IP Networks

## Summary

Mr. Hannah brings to AECOM over 30 years of experience in telecommunication system design and implementation management, including microwave networks. He has over 25 years of experience in project management in the Public Safety and Utilities industry. At AECOM he leads technology teams in the development, design, and implementation of complex public safety systems for Land Mobile Radio, microwave networks, and technology infrastructure for critical public safety facilities, including Emergency Communications Centers and Emergency Operations Centers. Mr. Hannah's experience also includes subcontractor evaluation, bid analysis, project cost management, and contract negotiations for multi-million dollars projects. His career has included design of complex analog and digital LMR systems. At Harris Microwave Communications (now Aviat Networks) as a Program Manager, he led the design and implementation of point to point microwave networks for Public Safety and Federal projects.

## Relevant Project Experience

**Davidson County, Countywide P25 Trunked Radio System, Davidson County, NC.** Provided assistance in the evaluation and negotiation of an unsolicited

proposal submitted by a vendor and determined the County needs were not fully addressed. Evaluated County needs through interviews, surveys, and discussions with stakeholders. Developed clear requirements for a county-wide P25 trunked radio system that fully addressed the County's needs. The requirements included site development, coverage requirements, and coverage acceptance testing. Provided straightforward explanations and recommendation of all alternatives considered to Davidson County management, the Davidson County Board of Commissioners, and the Emergency communications staff. Prepared detailed breakdowns of the prices during negotiations and identified many opportunities in the vendor proposal to target for cost reductions. Ultimately the team was able to secure a significant discount over the initial proposal.

**Harrisonburg + Rockingham ECC Radio Upgrade Project, VA.** Mr. Hannah in the role of Project Manager, provided oversight and technical recommendations during factory acceptance testing, coordinated the preparation of FCC form 601, ready for signature and submission, with FCC license modifications necessary to operate the new radio system with P25 Phase 2 modulation. Also he reviewed proposed microwave path studies and prepared alternative paths after identifying a partially obstructed path that would not provide the reliability needed for Public Safety communications. He continues to provide guidance on the implementation phase of the project.

**Loudoun County Radio Communication Consulting Services, 800 MHz Trunking and P25 Upgrade, VA.** As Program Manager, Mr. Hannah led a team responsible for designing, negotiating, and supplying the microwave network to support the LMR multi agency system as well as the data communications needs of the county. Delivery time of the microwave network was compressed to allow the old microwave network to be removed to make space for the new LMR system to be installed and tested before foliage loss

**City of Raleigh Critical Public Safety Facility Design, Raleigh, NC.** Mr. Hannah managed the technology team developing the technical specifications for a new Critical Public Safety Facility building to support the Raleigh-Wake Emergency Communications Center (911), a new City of Raleigh Emergency Operations Center, the City of Raleigh Data Center, and the City of Raleigh Traffic Control Center, coordinating the technology requirements across multiple technology team and engineering disciplines.

# Nancy Hall

## Interoperability/Implementation

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### EDUCATION:

BS, Electrical Engineering, University of Illinois at Chicago  
MA, Speech Pathology, University of Illinois at Urbana-Champaign  
BA, Speech Pathology, Northwestern University

### PROFESSIONAL AFFILIATIONS:

Past Section Chairperson, IEEE

### AREAS OF EXPERTISE:

APCO P25 Phase 1 & 2  
Trunked Radio Systems  
Interoperability  
Policies and Procedures  
Regional and Tactical Interoperability Plans

### Summary

Ms. Hall's responsibilities at AECOM include conducting needs assessments, system design, specification development, technical proposal analysis, and system implementation and acceptance. Interoperability assessment, two-way radio and interoperability system design and implementation, and IP-based solutions for voice and data comprise Ms. Hall's areas of expertise. Ms. Hall was involved in the development of AECOM's innovative survey instrument, Surveyor<sup>SM</sup>.

Ms. Hall has worked in the two-way radio industry as an engineer and technical trainer for major radio manufacturers. As a software engineer, she designed and developed software for trunked radio systems, site alarm and testing equipment, trunked subscriber equipment, as well as software for mobile data functionality in trunked mobiles. For her extensive work in these areas, Ms. Hall was awarded three patents.

As a technical trainer, she provided customer training on the maintenance and administration of trunked radio systems, as well as operational training for end radio users and dispatchers. Ms. Hall developed administration and management training for P25 trunked systems, and created both standard and customized training courses.

### Relevant Project Experience

**South East Texas Regional Interoperability Communications Plan (SETRPC).** AECOM updated the South East Texas Regional Interoperable Communications Plan (RICP), and identified needs and associated costs of implementing their regional interoperability plan. AECOM provided the requirements of the project on time, and a clear implementation plan was provided to transition to P25 radio technology. As the lead engineer, Ms. Hall was responsible for developing the Regional Interoperability Communications plan for the South East Texas Regional Planning Commission. She also provided a

migration plan for achieving their interoperability goals and cost estimates.

**Oregon Department of Transportation, State Radio Project, OR.** The Oregon Department of Transportation is implementing a State Radio System. Ms. Hall is the project lead engineer.

**Virginia Statewide Agencies Radio System (STARS) Land Mobile Radio and Microwave Network Systems Upgrade, VA.** AECOM was hired by the Commonwealth of Virginia to assess the radio needs of each participating State Agency, evaluate and document the State Police current infrastructure, and research and benchmark viable technologies. As a contributing engineer, Ms. Hall provided oversight during the implementation and acceptance phases of the statewide radio system.

**City of Harrisonburg and Rockingham County Radio and ECC Building Design, VA.** AECOM conducted a Two-Way Radio Needs Assessment study to assess the Harrisonburg and Rockingham public safety and general government radio-systems, and 911 Emergency Operations Centers. This project included four phases: needs-assessment, specifications, procurement, and implementation and acceptance. Ms. Hall was the lead engineer for the implementation and acceptance phases on this trunked radio system.

**Commonwealth of Virginia's Interoperability Coordinator's Office Communications Feasibility Study for Deploying Interoperability Channels, VA.** Ms. Hall was the lead engineer for this feasibility study, which identified the opportunities and costs, as well as provided recommendations on the deployment of the FCC-designated National Interoperability Channels throughout the Commonwealth.

**Commonwealth of Virginia's Interoperability Coordinator's Office Communications Interoperability Baseline Assessment.** As the Lead Engineer, Ms. Hall deployed the Virginia Interoperability Baseline Assessment Report. The information obtained provided a baseline for future performance measurements, identify gaps, and helped determine future interoperability funding in the Commonwealth of Virginia.

# Nathan McClure, ENP

## Dispatch/Public Safety Operations

### EDUCATION:

Master's in Public Administration, Western Michigan University

BS, Political Science and History, Rockford College

### CERTIFICATIONS/ACCREDITATIONS:

NENA Certified Emergency Number Professional (ENP)

APCO Institute – Master Instructor

CALEA – Certified Assessor & Certified Team Leader  
State of Michigan:

- Firefighter II and Fire Service Instructor
- CAMEO Instructor
- Hazmat Awareness & Operations Instructor

### PROFESSIONAL AFFILIATIONS:

APCO – Life Member, President (1978-1979)

Illinois Chapter – President (1973, 1974)

Michigan Chapter – President (1987)

North Central Regional Conference Chair (1988, 1998)

NENA Michigan Chapter – President (1995-1999)

Chair, Michigan 911 Conference (1996-2001)

National Fire Protection Association – Technical Committee  
on Public Emergency Service Communications – Principal  
member 2005 - Present

Radio Club of America, Fellow

Amateur Radio License N8TE

### AREAS OF EXPERTISE:

Public Safety Communications Center Operations

Public Safety Dispatch Center Consolidation

Public Safety Agency Operations

Public Safety Dispatch Center Design

911

CAD / RMS

Grant Writing

## Summary

Mr. McClure is a Senior Operations Specialist specializing in Emergency Communications Center and 911 system design and operation. He has over 44 years of public safety communications experience, including 17 years as the director of a consolidated 911 dispatch center, 8 years as an emergency services coordinator, and 9 years as a deputy sheriff. Additionally he has over 22 years of experience as both a volunteer or paid on-call firefighter and medical first responder. A former president of APCO, Mr. McClure possesses hands-on experience in every aspect of the Public Safety field.

Mr. McClure specializes in Public Safety Communications Center operations and design. He works on Public Safety Dispatch Center consolidation and design, Computer Aided Dispatch (CAD), and Records Management.

## Relevant Project Experience

**County Emergency Management, Orange County, NC.** Project involved an independent, comprehensive study of the existing communications system and the

future communications needs of Orange County Emergency Management. The Phase 1 report included a long-term recommendation for procurement, installation, and implementation of a wide-area, integrated, public-safety-grade trunked radio system. The Phase 2A report updated survey information, identified system alternatives, evaluated several alternatives, performed coverage analysis and provided a preliminary system design with an opinion of probable cost for purchasing a county-owned 800 MHz Trunked Radio system.

### Harrisonburg and Rockingham County

#### Consolidated Dispatch Center, VA.

Mr. McClure served as the Project Lead for the design and renovation of an existing building into the new Emergency Communications Center. This project involved the consolidation of three public safety dispatch centers and the implementation of a new 800 MHz trunked radio system. It also consisted of installing a new 911 system, an upgraded computer aided dispatch system, new radio consoles and new dispatch workstations. AECOM provided cutover planning and assistance.

### City of Springfield Centralized Public Safety Dispatch Center Feasibility Analysis and

**Assessment, MA.** To enhance their public safety and general government two-way radio communications capabilities, the County, City, and municipalities undertook the design and implementation of a multi-agency 800 MHz simulcast two-radio system. They retained AECOM to assist with the design, procurement, and implementation of the system and supporting physical plant. The contracted system is a seven site, 18 channels, simulcast trunked, dual mode (analog and digital) 800 MHz radio system. Mr. McClure worked as the Project Lead.

### Bi State Metro Planning Commission, Illinois and

**IA.** AECOM was hired to conduct a feasibility study for consolidating two or more of the dispatch centers in Scott County. Recognizing that a shared center with proper implementation offers significant service improvements to all of the participants improves interagency coordination, and at the same time reduces the overall cost of providing service to the community, AECOM recommended that a shared public safety Emergency Communications Center be created. Participants in the shared center include the City of Davenport, Scott County Sheriff's Office, City of Bettendorf, and MEDIC-EMS. Mr. McClure worked as the Project lead for the Bi State Metro Planning Commission.

# Kenneth Ballard, PhD

## P25 + Propagation

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### EDUCATION:

PhD, Engineering Science, Dartmouth College  
MS, Engineering Science, Dartmouth College  
BS, Physics, University of Texas, El Paso

### PROFESSIONAL AFFILIATIONS:

Institute of Electrical and Electronic Engineers,  
Member since 2008  
Association of Public-Safety Communications Officials  
(APCO), Virginia Section  
National Society of Professional Engineers  
American Geophysical Union  
Association of Old Crows  
Dartmouth Society of Engineers  
Project 25 Technology Interest Group, Board of Directors

### AREAS OF EXPERTISE:

APCO P25 Phase 1 & 2  
Public Safety Radio System Design + Implementation  
QA/QC  
VHF Radio Systems  
System Architectures  
Radio Coverage Design  
Radio Wave + RF Propagation  
Project Management  
Scheduling

## Summary

Dr. Ballard has 36 years of engineering experience with two-way radio communications systems, RF propagation, antenna design, and aerospace electronics. Dr. Ballard has engineered a variety of applications, including wide-area trunked radio systems and the controls and networks required for integration of these systems. This experience enables him to successfully manage the implementation of complex, wide-area wireless communications systems.

He is an expert in the field of radio wave propagation, APCO P25 radio systems, and is co-inventor of the Radio Coverage Evaluator (RaCE).

## Relevant Project Experience

**County Emergency Management, Orange County, NC.** Project involved an independent, comprehensive study of the existing communications system and the future communications needs of Orange County Emergency Management. The Phase 1 report included a long-term recommendation for procurement, installation, and implementation of a wide-area, integrated, public-safety-grade trunked radio system. The Phase 2A report updated survey information, identified system alternatives, evaluated several alternatives, performed coverage analysis and provided a preliminary system design with an opinion of probable cost for purchasing a county-owned 800 MHz Trunked Radio system. During Phase 2A, Dr. Ballard managed the RaCE<sup>SM</sup> coverage testing. The Phase 2B report addressed the County forming a partnership with the

NC State Highway Patrol on the VIPER (Voice Interoperability Project for Emergency Responders) system in lieu of purchasing a county-owned radio system.

**Pima County Wireless Integrated Network (PCWIN), AZ.** Deputy Project Manager to deploy and operate a regional public safety voice and data communications network; improve public safety radio interoperability; design, construct, and operate a regional communications center. Dr. Ballard oversaw the design and participated in the procurement of the contractor.

**Nevada Statewide Communications Interoperability Engineering Project.** Project Manager. Dr. Ballard led the AECOM team in a series of design and analysis tasks for the development of an interoperable frequency plan, proposed methodologies and concept of operations, interconnect design and engineering specifications, gateway design and specifications, and a Tactical Interoperability Communications (TIC).

**Oregon Statewide Radio Project.** AECOM is overseeing the project implementation of the statewide radio system, integrate the VHF and 700/800 P25 (Phase 2 TDMA), microwave and network management system (NMS), regional communication centers (consoles), coverage, site and infrastructure physical facilities, spectra traffic analysis and licenses.

**Virginia Statewide Agencies Radio System (STARS) LMR and Microwave Network Systems, VA.** AECOM assessed the radio needs of each participating state agency, evaluated and documented the state police current infrastructure, and researched and benchmark viable technologies. Dr. Ballard acted as a technical expert. He participated at a senate hearing, and provided technical analysis.

**Loudoun County Radio Communication Consulting Services, 800 MHz Trunking and P25 Upgrade, VA.** AECOM developed specifications and requirements for a new radio system. Dr. Ballard worked on proposal evaluation and contract negotiations with Motorola for the initial 800 MHz trunked radio system. Additionally Dr. Ballard served as Project Manager to upgrade the county's radio system to **P25 Phase 2** technology.

**Fauquier + Culpeper Counties, 800 MHz Radio System, VA.** As Project Manager for both clients, Dr. Ballard suggested the two neighboring jurisdictions consider sharing critical infrastructure. By collaborating, the two counties realized considerable savings, markedly improved regional interoperability and back-up capabilities. AECOM assisted in the FCC licensing and performed the design and oversight for the physical facilities, microwave network, paging system.

# Jeremiah Knowles

## FCC Spectrum

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### EDUCATION:

Diploma in Analyst Electronics, Danville Community College

### AREAS OF EXPERTISE:

APCO P25 Phase 1 & 2  
Two-way Radio Systems  
Frequency Planning  
RF Propagation  
Radio Coverage Design  
Coverage Testing  
VHF Radio Systems  
Radio Coverage Testing  
Microwave Analysis

### Summary

Mr. Knowles is a Communications Specialist at AECOM. He has 18 years of experience with Two-Way Radio Communications Systems, Point-to-Multipoint Two-Way systems, Point-to-Point Microwave Links, and RF propagation. In recent years, he has focused on wireless communication in LMR and Point-To-Point microwave links.

Mr. Knowles responsibilities have comprised many key aspects of the communications consulting process, including radio coverage testing, radio/microwave site surveying, inspecting equipment installations, radio/microwave site acceptance, system acceptance, interviewing system users, writing test reports, microwave path analysis, measuring RF and EME levels at sites, RF and EME studies, and propagation studies. On a day to day basis, he works on propagation studies and microwave path analysis using Softwright Terrain Analysis Package (TAP), RF and EME studies using TowerCalc and RoofView, and In-Building Coverage Studies using iBwave Design.

Mr. Knowles's involvement in STARS, DOJ TETRA, and RaCE<sup>SM</sup>, displayed his strong work ethic, team-oriented mindset, and his leadership ability. For STARS, he worked on propagation, coverage testing, microwave path analysis, and site inspections. This comprehensive project required cooperation and teamwork at all levels.

### Relevant Project Experience

**Virginia Statewide Agency Radio System (STARS) Land Mobile Radio and Microwave Network Systems Upgrade, Richmond, VA.** Mr. Knowles conducted site inspections, coverage testing, assisted with conducting on site EME measurements for site located next to a 100 kW FM broadcast tower, propagation studies, coverage analysis, and microwave path analysis.

**Radio Communication Consulting Services, 800 MHz Trunking and P25 Upgrade, Loudoun County, VA.** AECOM developed specifications and requirements for a new public safety radio communications system. Mr. Knowles assisted in the coverage testing and system cutover.

**Central Virginia Radio Communications System (CVRCS), 800 MHz Rebanding Services, Lynchburg, VA.** For this project, Mr. Knowles performed system coverage testing using AECOM's RaCE<sup>SM</sup> coverage testing tool. His responsibilities included drive testing, data processing, coverage analysis display development, equipment set up, and equipment maintenance.

**Pima County Wireless Integrated Network (PCWIN), Pima County, AZ.** Mr. Knowles served as Technical Specialist for this project, to deploy and operate a regional P25 public safety voice and data communications network; improve public safety radio interoperability; and design, construct, and operate a regional communications center. MR. Knowles assisted with physical facilities development, radio site auditing, and resolving voice radio system concerns. He was part of the team that conducted the county-wide coverage acceptance test.

**Oregon Department of Transportation, State Radio Project, Salem, OR.** AECOM was contracted to help the client through the procurement process for a statewide radio system. The project is now in the implementation and acceptance phase. AECOM is responsible for quality assurance services related to the implementation and acceptance of the State Radio System. Mr. Knowles role for this project is to provide technical support to the engineering staff by performing coverage studies, microwave path studies, and updating system displays.

**New York City RaCE<sup>SM</sup> Coverage Testing, NY.** AECOM developed and patented our automated Radio Coverage Evaluator, or RaCE<sup>SM</sup>. RaCE<sup>SM</sup> provides end-to-end, two-way evaluation of the communications system. A key advantage of RaCE<sup>SM</sup> is the fact that this technology drastically minimizes the human subjectivity that is present in most other methods of voice quality radio coverage testing. Mr. Knowles worked as the project communications specialist. He maintained test equipment, oversaw test equipment installations, and performed coverage testing.

# Gary Mountcastle

## FCC Spectrum

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### EDUCATION:

Certificate, Counter Mortar Radar Technician, US Marine Corps, 1977

### AREAS OF EXPERTISE:

APCO P25 Phase 1 & 2  
Two-way Radio Systems  
Frequency Planning  
RF Propagation  
Radio Coverage Design  
Coverage Testing  
VHF Radio Systems  
Radio Coverage Testing  
Microwave Analysis

### Summary

Mr. Mountcastle is a telecommunications specialist and has previously worked in the electronics field as a technician in both the military and civilian sectors. He has designed test systems and written code (LabView, HP Rocky Mountain Basic) for automation. Mr. Mountcastle has extensive knowledge of RaCE hardware, RaCE software, and Motorola R56 facility standards. He also participates in the onsite project initialization and onsite surveys for communication (911), radio and microwave facilities. Assists in determining facility upgrades required for the new system design, and participates in developing the report. He has the ability to draft electrical schematics and drawings, troubleshoot, and repair electronic equipment (RF, digital and analog systems). Mr. Mountcastle's responsibilities include determining the facilities requirements for the wireless communications system. He develops applications in Visual Basic for Applications.

Mr. Mountcastle was a member of the United States Marine Corps, where he worked as a counter mortar radar repairman. He repaired and maintained AN/MPQ-4 counter mortar radars, and the AN/TPQ-31 counter battery radars. He previously maintained and operated the AN/FPQ-6 precision tracking radar at the NASA tracking facility in Bermuda. Mr. Mountcastle worked as an electronic technician on passive radio frequency detection equipment. His work as a system design technician/test engineer consisted of developing test systems and fixtures for factory production tests of various products.

### Relevant Project Experience

**Orange County Emergency Management, NC.** Mr. Mountcastle assisted with the Phase 2A report updating survey information, identified system alternatives, evaluated several alternatives, performed coverage analysis and provided a preliminary system design with an opinion of probable cost for purchasing a county-owned 800 MHz Trunked Radio system.

During Phase 2A, Mr. Mountcastle conducted RaCE coverage testing. The Phase 2B report addressed the County forming a partnership with the NC-State Highway Patrol on the VIPER (Voice Interoperability Project for Emergency Responders) system in lieu of purchasing a county-owned radio system. Mr. Mountcastle produced the final report.

**High Point Public Safety 800 MHz Trunked Radio System, NC.** AECOM provided consulting services for the design, specification, procurement and implementation project management for High Point, North Carolina. Police, fire, and general government channels were crowded with no reasonable expansion possibilities, and the communications center was crowded and operating with outdated equipment as well. AECOM examined the communications situation and developed the system framework for the primary solution responding to the High Point concerns: a trunked radio system operating in the 800 MHz band. Mr. Mountcastle performed the FCC Spectrum analysis and assisted in license acquisition. He also conducted facility inspections and system acceptance testing of new 800 MHz simulcast system. Mr. Mountcastle assisted in conducting the RaCE CTA proprietary test system for voice quality testing which was used for evaluating the High Point system.

**Virginia Statewide Agency Radio System (STARS) Land Mobile Radio and Microwave Network Systems Upgrade, Richmond, VA.** Mr. Mountcastle conducted site inspections, coverage testing, assisted with conducting on site EME measurements for site located next to a 100 kW FM broadcast tower, propagation studies, coverage analysis, and microwave path analysis. He also assisted in the FCC Spectrum analysis and creation of licensing packages for both the FCC and FAA.

**Pima County Wireless Integrated Network (PCWIN), Pima County AZ..** The objectives of PCWIN were to deploy and operate a regional public safety voice and data communications network; improve public safety radio interoperability; and design, construct, and operate a regional communications center. Mr. Mountcastle conducted site surveys, microwave profiles and propagation prediction and mapping, FCC Spectrum analysis, and final acceptance testing of system with the RaCE test system.

# Kevin Uhl, PMP

## Telecommunications

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### EDUCATION:

BS, Electrical Engineering, Rensselaer Polytechnic Institute  
MEA, Engineering Administration, The George Washington University

### CERTIFICATIONS/ACCREDITATIONS:

Project Management Professional

### AREAS OF EXPERTISE:

APCO P25 Phase 1&2  
Organization and Team Leadership  
Project Management (active PMP Certification)  
Engineering Management  
Product Development  
Process & Performance Tool Development

### Summary

Mr. Uhl has over 17 years of experience in Project Management and Systems Engineering Management in Land Mobile Radio (LMR) Systems implementation. He has directed engineering teams to complete all facets of implementation for major radio system procurements, from planning and design, through to testing and final signoff. These major procurements involved integrating new systems as well as transitioning from legacy systems.

Mr. Uhl interfaced with both customer leadership and users to understand their needs to help advance the projects he worked on. His focus on process improvement led Mr. Uhl to develop project management procedures and tools, according to the PMBOK methodology, that addressed system implementation methods for a major LMR manufacturer and integrator.

### Relevant Project Experience

**Davidson County, Countywide P25 Trunked Radio System, Davidson County, NC.** Provided assistance in the evaluation and negotiation of an unsolicited proposal submitted by a vendor and determined the County needs were not fully addressed. Evaluated County needs through interviews, surveys, and discussions with stakeholders. Developed clear requirements for a county-wide P25 trunked radio system that fully addressed the County's needs. The requirements included site development, coverage requirements, and coverage acceptance testing. Provided straightforward explanations and recommendation of all alternatives considered to Davidson County management, the Davidson County Board of Commissioners, and the Emergency communications staff. Prepared detailed breakdowns of the prices during negotiations and identified many opportunities in the vendor proposal to target for cost reductions. Ultimately the team was able to secure a significant discount over the initial proposal.

**Nevada Statewide Radio System (NSRS) Project Phase 1, NV.** Mr. Uhl served as a senior engineer and analyst for the needs assessment of the NSRS Statewide Radio system. In this important effort, he researched the current needs of the consortium of major state, local and energy partners, and provided implementation recommendations for replacement of the current system with a new next generation platform.

**Washington Metropolitan Area Transit Authority (WMATA), Washington, DC.** Mr. Uhl serves as the Engineering Manager for the implementation study and specifications development effort to replace the Washington, DC transit radio system with a new 700 MHz P25 Phase 2 system. Implementation planning currently being performed for this effort includes cost analysis of leasing vs. building new sites, frequency coordination and RFP development for the large area 700 MHz system.

**San Francisco Public Utilities Commissions (SFPUC), Radio System Migration Study, San Francisco, CA.** Engineering Manager on the project team. The study included an assessment of the various SFPUC radio communications systems and recommended a migration plan for each, which considered various options and cost benefit factors.

**Alleghany County, VA.** AECOM performed a Needs Assessment and developed Conceptual Designs for a new P25 Phase 2 public safety radio system. As the Project Manager, Mr. Uhl reviewed the considerable topology and frequency constraints impacting radio communications for the County. He led the engineering team to analyze the current systems in place, evaluate the sharing of system assets from neighboring cities and counties and develop creative alternatives to recommend a cost effective solution that will meet the communication needs of the County's public safety agencies and personnel.

**US West Region Ericsson/Tyco Electronics, Private Radio Systems – Lynchburg, VA.** Led systems engineering team to implement major land mobile radio systems in the US West Region for public safety and utilities customers. Systems implemented include Washoe County, Denver, Albuquerque, Honolulu, San Antonio and Oklahoma City.

# David Anderson

## Telecommunications

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### EDUCATION:

BS, Electrical Engineering Technology, Virginia Tech  
MS, Electrical Engineering, Virginia Tech

### AREAS OF EXPERTISE:

System Architectures and Design  
Radio Traffic Analysis  
Radio Coverage Design  
Project Management  
Specifications & Procurement  
Scheduling  
Risk Evaluation  
Customer Interface  
Team Coordination  
Cost Estimation and Budgeting

### TECHNOLOGIES:

APCO P25 Phase 1&2  
Cellular & Broadband Data  
Trunked & Conventional Systems  
Public Safety Mobile Data Systems  
SCADA Systems  
Voice Encryption  
Dispatch Systems  
Paging Systems  
Industrial Control Systems

## Summary

Mr. Anderson has 35 years of engineering, R&D, and applications experience, working in radio and broadband communications systems for 28 of those years.

Responsibilities consist of project management, needs assessment, system design, specification development, proposal technical analysis, and system performance evaluation. Areas of expertise include mobile data systems operating over private, commercial, and broadband wireless networks, and IP-based solutions for voice and data. His broad experience working with public safety operations enables him to understand their needs and transform those needs into realistic and practical communications solutions. His approach to system design enables him to view the big picture including operations, training, systems, and political issues, and leads him to create innovative and useful solutions.

## Relevant Project Experience

**County Emergency Management, Orange County, NC.** Project involved an independent, comprehensive study of the existing communications system and the future communications needs of Orange County Emergency Management. The Phase 1 report included a long-term recommendation for procurement, installation, and implementation of a wide-area, integrated, public-safety-grade trunked radio system. The Phase 2A report updated survey information, identified system alternatives, evaluated several

alternatives, performed coverage analysis and provided a preliminary system design with an opinion of probable cost for purchasing a county-owned 800 MHz Trunked Radio system. The Phase 2B report addressed the County forming a partnership with the NC State Highway Patrol on the VIPER (Voice Interoperability Project for Emergency Responders) system in lieu of purchasing a county-owned radio system.

**Pima County Wireless Integrated Network (PCWIN), AZ.** AECOM provided the County with conceptual system designs, architectures, and specifications for the hardware and software necessary to implement large and small public safety communications systems, including statewide interoperable solutions. Once the 800 MHz P25 Phase 2, 29-site, countywide design was completed; Mr. Anderson assisted the County with project implementation. The major components, radio, network backbone, and tower site facilities, were procured separately as a cost-savings strategy. AECOM also provided a coverage acceptance tests using AECOM's patented RaCE, the real-voice coverage test equipment tool.

**Spotsylvania County, Virginia 800-MHz P25 Phase 2 Radio System Project, VA.** AECOM designed and is currently implementing the Spotsylvania County's 800-MHz two-way radio system project. AECOM performed a functional needs analysis and proposal review to replace the system. Mr. Anderson completed a needs assessment covering public safety and service users, conceptual design, cost estimates, and project planning. Special considerations included maintaining regional interoperability, acquisition of additional frequencies, high capacity service in urban areas, and seamless service in rural areas for firefighting. A competitive procurement resulted in reselecting Harris for the P25 Phase 2 upgrade, and the system is now under construction. Mr. Anderson is assisting with site acquisition, permitting, and licensing.

**Arlington County Public Safety Network Design Project, VA.** The County desired to achieve excellent regional interoperability and correct poor radio coverage, and following AECOM's recommendation, implemented an 800 MHz P25 Phase 2 radio system upgrade and ECC relocation for conversion from an analog 800 MHz simulcast system to a modern digital 800 MHz simulcast system. Mr. Anderson architected a three-way network; UHF private channels, Wi-Fi hotspots, and commercial broadband services, with automatic network selection. He developed the specifications, oversaw implementation, and evaluated delivered performance. The Arlington County Mobile Data design is a 2005 ISA award winner from the American Council for Technology, selected for innovative design and multi-agency collaboration.

# Curtis Johnson, EIT

## Telecommunications

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**EDUCATION:**

BS, Computer Engineering, Virginia Tech

**AREAS OF EXPERTISE:**

Public Safety Radio Systems  
Radio System Design + Implementation  
Coverage Testing

### Summary

Mr. Johnson is a communications engineer in AECOM's Technology Solutions group. His experience includes coverage prediction, network testing and maintaining existing land mobile radio (LMR) systems. He also is skilled in software and hardware interaction, leadership, and customer communications. Mr. Johnson has extensive experience in customer service and is driven by customer satisfaction. His experience working on the vendor side of radio systems give him a great understanding of all stages of the procurement process for Project 25 (P25) LMR systems.

Mr. Johnson has used his knowledge of propagation to analyze existing P25 systems, and to make changes that result in the improvement of overall coverage and reliability. His passion for electronics and networking keeps him up-to-date with current technology offerings. Mr. Johnson's work ethic and knowledge of P25 systems makes him a key player of the AECOM team.

### Relevant Project Experience

**Washington Metropolitan Area Transit Authority, Washington DC.** AECOM is assisting the Washington Metropolitan Area Transit Authority (WMATA) with narrowbanding the 10-site trunking system serving their operations in the National Capitol Region. AECOM developed the list of activities to help the client team understand the project from beginning to end. We evaluated before/after coverage predictions and helped evaluate the need for additional tower sites. We anticipate planning a two-phase project that will complete narrowbanding on a schedule to meet FCC guidelines. Further, we anticipate the ability to reduce costs by adding sites only where justified by actual coverage testing. AECOM's work includes system architecture, conceptual design, and procurement support.

**Washington Metropolitan Area Transit Authority, Narrowbanding Support for Regional Radio System, Washington, DC.** Communications Engineer providing design services to maintain reliable voice operations communications. Mr. Johnson is part of the team assisting the client with maintaining communications in the face of changing FCC regulatory rules and the need for equipment upgrades. The project involves upgrading the 10-site trunking system serving WMATA operations in the National Capitol Region. The project also involves radio traffic loading,

RF coverage studies, site and facility surveys, and developing and performing radio maintenance test procedures. AECOM's work includes system architecture, conceptual design, and procurement support.

**Prince William Public Service Authority, Prince William County, VA.** The Water and Sanitation Water Department operates a complex radio controlled SCADA water network with over a 125 locations in a dense metropolitan area. AECOM is providing consulting for the large SCADA radio system and video-based surveillance and system monitoring. Creative solutions were required to obtain the needed bandwidth and coverage. AECOM coordinated vendor demonstrations which solicited new technology ideas and creative knowledge from the industry. Mr. Johnson is part of the engineering team evaluating design and cost tradeoffs and is continuing with the next step, developing the procurement documents for purchase and installation of the needed new systems.

**Spotsylvania County, 800-MHz Radio System Project, Spotsylvania County, VA.** AECOM designed and is currently implementing the Spotsylvania County's 800-MHz two-way radio system project. AECOM performed a functional needs analysis and proposal review to replace the system. Mr. Johnson as communications engineer participated in the needs assessment covering public safety and service users, conceptual design, cost estimates, and project planning. Special considerations included maintaining regional interoperability, acquisition of additional frequencies, high capacity service in urban areas, and seamless service in rural areas for firefighting. A phased strategic plan was developed in coordination with upgraded dispatch centers and included a financially feasible rollout plan.

# Karl Ryan, PMP

## Telecommunications

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### EDUCATION

BS, Housing and Urban Development, Arizona State University

### CERTIFICATIONS/ACCREDITATIONS:

Project Management Professional

### AREAS OF EXPERTISE

Contract Negotiation  
Budgeting and Forecasting  
Project Feasibility / Startup  
Land Development  
Presentation Skills  
Relationship Building  
Team Leadership  
Project Scheduling

### Summary

Mr. Ryan is a result-oriented, enthusiastic, and diversely skilled Technical Specialist with 14 years of experience in the land development and public safety industry. Strategic planner recognized for developing strong and lasting business relationships. Goal oriented with the ability to define priorities, manage time efficiently and drive results.

### Relevant Project Experience

**State of Oregon, Salem, OR.** Evaluated program health and developed Integrated Project Schedule, setting technology goals for deployment and commissioning. Oversaw and directed the design, procurement and installation of Microwave transport. Managed Public Safety Microwave Communication Transport and the \$16M State contract. Evaluated and advise as to project health, alternatives to system design, facilities, technologies, etc., taking into account risks, costs and functionality and making recommendations for the preferred solutions. Advised Integration Manager of all project issues and status, advising of any changes in scope, schedule or budget variances.

**Tucson Electric Power, Tucson, AZ.** Managed the development of Solar Power Generation Projects for Tucson Electric Power. Oversaw and directed the design, entitlement, permitting, procurement, construction and closeout of facilities. Managed 5 Megawatt, \$16M Greenfield development, driving schedule and budget to complete on time and under budget. Managed the construction of a \$350K Research & Development Battery Project for the use with a 1.6 Megawatt Tracking Solar Field.

**Pima County Wireless Integrated Network (PCWIN), AZ.** Managed master project schedule, developed contract scopes for construction and professional services, solicited and awarded site development contracts totaling \$2.9M. Managed vendor contracts

and enforced specifications and jurisdictional policies. Standardized project reports and communications for County Management, Project Stakeholders, and multiple Public Safety Agencies. Implemented site development "Close-Out" process for PCWIN team, streamlining the substantial-completion and final-completion tasks.

**Residential Development, Tucson, AZ.** Managed five residential development projects in the Greater Tucson Area with a combined total budget exceeding \$100M. Established, supervised and balanced project budgets, cash-flows and schedules, preparing monthly and quarterly cost schedule updates. Established and drove long term and short term goals supporting regional and national initiatives. Managed \$80M Sierra Morado Planned-Area-Development project, currently 57% complete with a build out of 1500+ homes. Managed \$18M Del Webb at Rancho Del Lago Planned-Area-Development project, currently 20% complete with a build out of 526 homes. Developed and maintained project budgets.

**Entitlement Process, Tucson, AZ.** Oversaw the platting of 1544 residential lots, block plats and commercial properties. Managed the design, recording, construction and acceptance of Public Right of Way. Produced narratives and reports for municipal submittals, coordinated plan submittals and followed up with project team members. Negotiated and executed Public Improvement Agreements, designing, constructing and delivering Public Right of Way. Created and distributed materials for public hearings and met regularly with city staff as well as appointed and elected officials throughout the development process. Managed the necessary engineers, lawyers, geo-technical firms, architects, landscape architects, surveyors and utility companies.

## Gregg Perez, EIT

### Telecommunications

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#### EDUCATION:

BS, Computer Engineering, Syracuse University

#### CERTIFICATIONS/ACCREDITATIONS:

Engineering-In-Training (NJ) #EIT-02077

#### AREAS OF EXPERTISE:

Land Mobile Radio (Trunked/Conventional, UHF/VHF/700/800 MHz, Analog/Digital, P25)

Distributed Antenna Systems (DAS)

Backhaul (Microwave, Fiber, IP/Ethernet)

Dispatch Console Systems

Digital Audio Logging Recorder Systems

Positive Train Control (PTC)

Communications Based Train Control (CBTC)

Mr. Perez has more than 11 years of professional experience leading and supporting teams providing analysis, design, integration, deployment and testing of various communications systems for Public Safety, Transportation and Commercial clients. He develops analyses, technical designs, cost estimates, project schedules, technical/operational requirements, RFP's and needs assessments, field surveys and system/site acceptance testing.

#### Relevant Project Experience

**Dallas Area Rapid Transit, Regional Positive Train Control, Dallas, TX.** Mr. Perez is providing technical and analytical support for the requirements definition and RFP development of the DART Positive Train Control system. Responsibilities include; surveying and documenting existing fixed radio tower and communications assets/inventory, developing a preliminary design which identifies all communications equipment and components to be furnished under the PTC effort and identifying the necessary modifications to their existing fixed infrastructure and backhaul network.

**Boingo Wireless Inc., Cellular DAS and Wi-Fi Network World Trade Center Complex, NY, NY.** Mr. Perez is providing design, construction management and test witnessing of the neutral host cellular Distributed Antenna System and Wi-Fi networks to more than 1.6M sq./ft. including the Transportation Hub, Vehicle Security Center and retail areas. Responsibilities include design, constructability review, design review and test planning/witnessing of the DAS and head-end.

**New York City Transit, 2<sup>nd</sup> Ave Subway DAS, NY, NY.** Mr. Perez is providing design support for the 2<sup>nd</sup> Avenue Subway DAS providing RF coverage for both

Public Safety and Operations personnel throughout two miles of tunnel and three new stations.

#### **Port Authority of NY/NJ, Public Safety Department 800 MHz Police Radio System Upgrade to P25, NY.**

Mr. Perez provided analyses, preliminary design and requirements definition for the PANYNJ Police Department radio system upgrade to P25. Including; surveying and documenting existing fixed and subscriber inventory, developing a design which identifies all equipment and components to be upgraded and/or replaced to both the primary trunked simulcast system and ancillary systems affected by the upgrade to P25.

#### **Port Authority Trans Hudson (PATH) CBTC Signal Project, Jersey City, NJ.**

Mr. Perez provided construction management support and test witnessing of the PATH Rail CBTC data communications systems including the wayside data communications network and wayside to on-board radio systems. Responsibilities include constructability review, design review and test planning for the data communications and wayside communications systems.

#### **Metropolitan Transportation Authority Police Department, Metropolitan Regional Radio System Infrastructure Improvements NY, NY.**

Mr. Perez provided technical and analytical support for the 30% design and RFP development of the MTAPD Metropolitan Regional Radio System. Mr. Perez conducted field surveys for potential RF sites, supported coverage/propagation modeling, designed notional in-door/in-tunnel coverage enhancements, interoperability solutions and the overall system architecture. Mr. Perez developed the Concept of Operations, technical / operational specifications and the final construction cost estimate, and co-authored the final vendor RFP.

#### **Metropolitan Transportation Authority Police Department, Metropolitan Regional Radio System Infrastructure Improvements Alternatives Analysis, NY, NY.**

Mr. Perez provided technical and analytical support for the alternatives analysis and conceptual design for a replacement MTAPD Regional Radio System. Responsibilities included, identifying potential system architectures, analyzing load/spectrum capacity, designing notional indoor/in-tunnel coverage enhancements, identifying potential interoperability solutions, and dispatch communications integration. In addition, Mr. Perez developed cost and construction estimates and was a contributor for all client deliverables.

## Capabilities and Experience

AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. AECOM was incorporated in California in 1970, and provides a blend of global reach, local knowledge, innovation and technical excellence.

The difference we help our clients make is felt in every region of the world. Clean water for developing communities. Iconic skyscrapers that swell a nation's pride. Power and security to fuel economic prosperity. Transportation that brings people together. Thoughtful planning that sustains cities and natural resources.

Our clients face tough, interrelated challenges that can only be solved by a company like ours. One with deep roots, diverse perspectives and an innovative approach. One with the people, technology and vision to deliver what others can only imagine

Within the AECOM framework, our technology experts operate as a Technical Center of Excellence in the United States and has been providing public safety consulting services for over 30 years. Established in 1984 as Communications Technology Associates, Inc., (CTA) quickly gained a national reputation for responsiveness, commitment, and service excellence. CTA merged with AECOM in January 2007, and has delivered communications solutions to more than 300 clients. We blend together the focus of a small group of technical experts with the capabilities of a firm with global presence, and offer these services from our offices in Raleigh, North Carolina and Lynchburg, Virginia.

AECOM's technology experts are a dedicated, in-house technology division working as an integrated team with our engineers and architects to design and implement data centers and communications facilities for classified government clients as well as for public safety communication systems, 911 centers, dispatch systems, and emergency operations centers.

- Voice/data systems that facilitate and support communication
- Public safety and critical utility infrastructure communications
- Emergency center integration
- Emergency center customer premise equipment
- Computer assisted dispatch systems
- Emergency and backup power
- Lightning protection
- System life-cycle planning
- Operations assessment
- Consolidation feasibility studies
- Cutover and relocation planning
- Budget planning and estimation

### AECOM's Capabilities and Areas of Expertise

AECOM offers Orange County over thirty years of consulting experience in all aspects of communications engineering for public safety and operational facilities. Clients throughout the United States, including federal, state, and local governments, utility, and private industries, are implementing our solutions. Our expertise encompasses all radio and wireless technologies, telecommunications networks, 911 and communications/dispatch systems, and facility/architectural design. We have delivered communications solutions to more than 300 clients. Our team of project managers, engineers, public safety consultants, and technical specialists work in concert to develop complex technologies, from conceptual design to operational readiness. By focusing on our clients' unique operational and interoperability requirements, we facilitate effective solutions to meet precisely your needs.



We include below areas of expertise, skills, and qualifications to demonstrate our knowledge relevant to your project:

- Project management
- Planning and Implementation of public sector telecommunications systems
- Telecommunications infrastructure & services
- Network security
- Business plan and budget development
- Two-way radio systems, including trunked systems
- Microwave and data systems requirements
- Electrical engineering (power, grounding)
- Mechanical engineering (HVAC, fire protection)
- Architects (planning, design, review)
- Organization / management of communications systems
- Maintenance and operations
- Licensure and approval of radio communications systems, tower sites, and associated facilities
- Systems development costing, estimating, scheduling
- Structural Engineering (tower, buildings)
- Software experience
- Mechanical discipline experience
- Electrical discipline experience
- FCC regulations
- Federal Aviation Administration (FAA) regulations
- Radio communications experience
- Information technology planning/implementation

AECOM's relevant experience and ability to perform is as much about our approach and philosophy as it is about our direct experience. In other words, how we accomplish our work is just as important, if not more

important, than the fact that our team members are experienced consultants. In our view, a competent and successful consulting firm and project team will offer you the following core capabilities and attributes:



Provide a team with **technical competence** regarding the systems and equipment that are associated with the project. They need to understand the technologies that are in play.



Provide a team with **professional competence** regarding the operational use of any deployed technology. They need to understand how you will be using the underlying technologies and facilities to support your operations.



Provide a team with **practitioner experience** that demonstrates an understanding of the operational, budgetary and service provision goals and objectives that the project is intended to accomplish. Consultant teams that include staff who have previously worked in public safety have the insights needed to understand your environment.



Provide a team with an ability and willingness to form a **collaborative partnership** with key client representatives where our work, on your behalf, becomes an extension of your organizations efforts to accomplish goals and objectives. A high performing team will be a collaborative effort, working together towards a successful project conclusion.



Serve as **your advocate**, looking out for your best interests, providing expert advice, watching for risk areas and identifying ways to mitigate that risk. We will fill in the gaps where you may not have the necessary internal expertise, or where you simply do not have the capacity to take on this extra effort on your own.



Being mindful of the project timeline, budget and scope so as to avoid cost overruns and schedule slippage. We strive to complete projects cleanly, and where there may be a few bumps in the road or unexpected circumstances, to **proactively manage** those events in order to minimize any negative impact on the project.

## Benefit From Our Depth of Experience and Expertise

The right consulting team will provide expertise and advice that will result in cost savings, expense avoidance and risk mitigation that will far exceed the cost of the underlying consulting fees. A consulting team that is “in-tune” with the client, the project, and any unique circumstances that exist, will provide a work product that matches what is needed to answer important questions, to provide relevant information, and to give the County decision makers solid information, from which you can base sound decisions. At AECOM, our consultants all strive to meet or exceed the above attributes and performance objectives.

**AECOM’s Full Service Capabilities.**

Our operational subject matter experts have over 30 years’ experience in direct environments, such as firefighting, law enforcement, government budgeting and planning, government procurements, training development, and communication center management. AECOM’s operations experience entails developing requirements for 911, CAD, RMS and GIS equipment, as well as the design of Dispatch Centers and Emergency Operations Centers (EOC).

AECOM has in staff people that have been 911 directors, and understand the requirements needed to go beyond Public Safety operations, and fire ground communication issues, facing emergency responders. The communications projects undertaken frequently require both communications expertise and structural, mechanical, or electrical expertise associated with A/E construction service providers. The A/E construction capabilities of AECOM complement our communications capabilities.

Our Operational subject matter experts have pioneered the 911 industry and consolidated dispatch operations required for modern communities. We have staff members who, prior to joining AECOM, managed large public safety communications departments for major municipal governments. Additionally, we have worked on over 20 projects in the recent years that entailed developing requirements for 911, CAD, RMS and GIS equipment, and the design of Dispatch centers and Emergency Operations Centers (EOC). We have a dedicated staff with over 25 years of experience in designing 911 / Dispatch systems.

The AECOM expertise includes a broad range of 911, PSAP, ECC/EOC capabilities, some of them listed below:

**Communication Center Design**

- Building design
- Radio consoles
- Computer Aided Dispatch (CAD)
- Records Management Systems
- Logging recorders
- Operations analysis/planning
- Relocation and cutover
- Network Control Management (NOC)
- Remote fault detection & fault isolation
- Information technology
- Grounding (to include R-56)
- Telephony

**911 / E911 / NG 911**

- 911 customer premise equipment
- 911 wireless phases I & II
- 911 wireless compliance testing
- PSAP consolidation
- 911 cyber security
- Network engineering

**Disaster Planning / Recovery**

**Information Assurance**

- LMR focused
- FISMA
- DIACAP (including DoDD 8500.1 &.2, AR 25-2, etc.)
- STIGs

**Physical Facilities**

- Site planning
- Tower, shelters, generators, UPS, HVAC
- Grounding, surge protection, installation
- Roads, fencing, foundations, geotech

**Staffing and Management Services**

- Staffing/benefits assessment
- System implementation
- Project management
- Resident site management
- Program Integration
- Costing/ budget
- Life-cycle cost analysis
- Business case analysis

We include below the areas of expertise, skills, and qualifications to demonstrate our knowledge that is potentially relevant to your project:

- Dispatch center surveys & assessments
- Dispatch center traffic analysis
- Workload analysis
- Technical issues analysis
- Operational issues analysis
- Financial issues analysis
- Wireless 911 and dispatch issues
- Site facilities and requirements analysis
- Site facilities definition
- Conceptual system designs
- Opinion of probable system cost analysis
- Dispatch equipment layout
- Equipment installation inspections
- Grounding specifications
- Equipment procurement
- Systems installation oversight
- Facility and infrastructure inspections
- Acceptance testing
- Operations testing
- Cutover planning
- Cutover oversight

Ranked Number 1 in the Top 100 "Pure Design" firms by Engineering News Record, AECOM's professionals work in an integrated fashion with multidisciplinary design teams worldwide to provide high technology project services including:

- Public safety systems including two-way radio systems, data communications systems, microwave and fiber systems, telephone and emergency 911 systems, and CAD and GIS planning and implementation
- Voice and data networks for Local, Metropolitan, and Wide Area Networks enterprise integration services
- Strategic technology planning integrated with master planning services
- Command and control center design
- Concept of operations and standard operating procedure definition and documentation
- Data centers and server rooms
- Emergency response planning, document storage, and recovery
- Secret and Top Secret communications systems

- Threat and vulnerability assessments, mitigation planning and design
- Cyber security
- Security system evaluation, enhancement planning, design
- Blast-resistant design, including structural hardening to resist explosive loads and design measures to mitigate progressive collapse and glass hazards
- Threat restriction, identification, and impedance
- Physical security, electronic security, and access control systems, including intrusion detection, IP camera surveillance, biometric systems and smart cards
- Perimeter security strategies, including entrance gate designs, anti-ram barrier design requirements and vehicle crash systems
- Audio-visual and multi-media services for corporate meeting rooms and command and control centers
- Public address, passenger display, security and other specialized systems for airport and transportation facilities
- Intelligent buildings design with fully integrated systems
- Building and utility system controls design
- Nuclear/biological/radiation/chemical threat mitigation planning and design
- Structured cabling infrastructure

AECOM clients benefit from our ability to support technology and mission critical facilities planning and projects with in-house support from AECOM's traditional A&E professionals. We design and construct highly specialized facilities incorporating clean rooms, cryogenics, seismic or vibration isolation, shielding, sophisticated security systems, classified communications, command and control functions, missile launch and nuclear weapons tracking, satellite and radar support, data retrieval/collection and process, and research and development. Many of these facilities have required unique and complex infrastructure and utility systems and have dealt with sensitive environmental issues. Our capability to support sensitive, critical military and federal government programs is extensive and requires the core capabilities we possess:

- Strategic facilities master planning
- Conventional and secure communications and data systems
- Physical and electronic security study and design
- Power quality, reliability and redundancy analysis, studies, and design
  - o Mechanical/heat load modeling (Computational Fluid Dynamic

## Modeling)

- Program and Construction Management, including Design-Build Services
- Change management and configuration control

Building upon our long history of providing technology solutions to clients nationwide, AECOM's team is well balanced and experienced in implementing large systems integration programs. We have demonstrated industry leadership in delivering networks, access control, intrusion detection, video technology, emergency communications, and open-platform solutions.

When required, we have dedicated in-house staff to support our IT and communications engineers with two-way radio systems. These services include propagation analysis and operations assessments as part of the needs analysis preceding radio system specifications, license applications, and the development of wide-area simulcast radio systems for government radio systems, and communications centers, including those involving multiple government agencies.

AECOM's facilities engineering team supports data center and emergency operation center design, equipment shelters, requirements for floor space, site development, towers, HVAC, fire protection, grounding systems, primary power and backup power systems.

AECOM provides a wide range of master-planning, architecture, security, engineering and building management services for NASA facilities in multiple locations.

These services include development and implementation planning, design review guidelines, security assessment and upgrade design, infrastructure planning, Historic District planning, cost and scheduling services, support studies and building management services. As part of these strategic facility planning and support services, our strategic facilities planning consultants are helping NASA Ames Research Center at Moffett Field develop their process for capital investment planning.

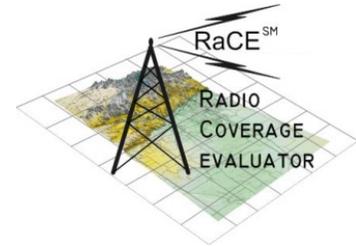
Since the 1970s, AECOM has performed the full range of A&E services, electronic security services including security assessment and engineering related to site security upgrades, perimeter intrusion detection, closed circuit television (CCTV) and access control systems, some of which communicate over fiber optic networks we can also design and install.

### AECOM's Tools, Facilities, and Specialties

In order to conduct a successful project, we describe below the various engineering tools, facilities, and specialties that AECOM has at our disposal and that can be utilized during the County's project.

### RaCE<sup>SM</sup> (Radio Coverage Evaluator Tool)

This automated coverage testing facility uses the human voice to measure the understandability of a radio signal. A series of recorded voice messages are transmitted through a radio network. Using a voice comparison algorithm, the "sent" message is compared to the "received" message, which delivers a "Delivered Audio Quality (DAQ)" figure associated with the degradation introduced by the network and the propagation loss.



**RaCE<sup>SM\*</sup>** is compatible with any vendor, technology, or frequency band, and is non-invasive so it can be performed on an operational system. It provides an end-to-end two-way evaluation, emulating human communications, while removing human subjectivity from the process. Inclusion of signal strength recording allows determination of the effects of outside interference, such as from a cellular base station. The measurements are repeatable, tracked automatically by GPS, and calibrated by telecommunications.

\* US Patent # 7,522,918 B2

### P-CALA<sup>SM</sup> (Propagation, Coverage and Loading Analyst)

Using the TAP program (a Softwright product) to analyze radio coverage as the engine, AECOM has developed a suite of interrelated and integrated applications that assist our engineers in radio coverage design. **P-CALA<sup>SM</sup>** uses USGS one second data as the terrain database, augmented by USGS land use factors. We have the ability to use a number of currently established radio coverage models including Okumura, Longley-Rice, and several of their variants. The **P-CALA<sup>SM</sup>** package also includes microwave path design applications, simulcast applications, loading applications, and a number of display applications.

### CAM<sup>SMv</sup> (Capacity Analysis Model).

The **CAM<sup>SM</sup>** application analyzes loading and capacity for single or multiple site systems. AECOM has developed loading profiles for various public safety user types, which are used as inputs to this model. We can also tailor the model to a client's specific loading profiles. This model is used as part of the **P-CALA<sup>SM</sup>** suite, and also as part of the **FAM<sup>SM</sup>** suite.

### Cost Budgeting Analyst<sup>SM</sup> (Cost Estimating and Analysis)

AECOM's cost analysis facility is based on actual equipment costs contained in proposals (both Competitive and Negotiated) made by equipment and systems vendors. Our base costs are updated with each procurement, and the facility weights recent

procurements higher than older procurements. As a predictive tool, this facility has consistently demonstrated to provide cost estimates within 5% to 10% of the actual cost upon procurement. The facility is used both in the design phase, to establish an estimate of probable cost, and in the procurement evaluation phase, to identify areas of excessive costs in order to establish the credibility of the quote that allows the resulting application to be more powerful.

**Surveyor<sup>SM</sup> (On-Line Survey Tool)**

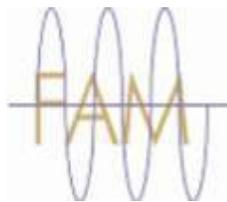


This is a web-based interactive survey tool used for data and information collection. **Surveyor<sup>SM</sup>** is designed to simplify the tasks for the responding agencies to improve their overall response. The survey will be designed for your project in a logical manner using simple techniques for an

attractive and intuitive web-based design. **Surveyor<sup>SM</sup>** provides a series of features that are entirely unique. It is full featured and easier to maintain than other commercial software available, and offers a seamless combination of essential capabilities

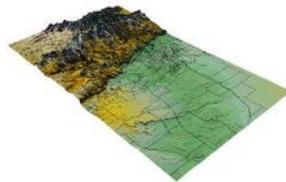
**FAM<sup>SM</sup> (Frequency Allocation Modular)**

This facility can provide an optimal frequency plan, using new frequencies, existing frequencies, or a combination of the two. It is useful in optimizing re-use of frequencies in a wide area, thus improving the ability to maximize capacity for a given frequency set. It is also useful in determining how many additional frequencies may be needed for a particular system design, and where.



**Impact Analysis Process<sup>SM</sup>**

The process has two inputs. AECOM engineers initially identify system requirements for each alternative. We then work with the client to assess the impact on operations or the presence (or absence) of each System Requirement. Our engineers then assess the ability of each Alternative to support



each System Requirement. Merging these two assessments provides a ranking which, when combined with estimated cost information and AECOM recommendations, enables the client to make an informed decision. AECOM helps our clients solve the toughest challenges: protecting national infrastructure, exploring space, providing global IT and communication systems, and caring for nuclear arsenals. Our projects span every continent in every hemisphere, from Antarctica to Greenland. We accomplish “one of a kind” engineering support for

highly complex and sometimes unique facilities worldwide. Today, AECOM is active in homeland security and anti-terrorism efforts, as well as technology design for luxury resorts and sports venue technology, corporate headquarters, laboratories and other research facilities, detention centers, “intelligent buildings,” and hundreds of other assignments with stringent security standards and the need for integrated technology planning and design.

Our professionals excel in design and integration of large telecommunications and information technology (IT) systems for government and commercial clients. If the challenge is over-the-horizon radar systems, digital video processing and storage systems in widespread locations, wireless and life safety issues involved in public emergency dispatch and hospital systems or the provisioning of continental telecommunications systems in the harsh environment of Antarctica, our engineers provide solutions to the most complex communications challenges in the market. We are at the forefront of new and emerging technologies and up to date on technological transfer from the military and national laboratories; at the same time we are careful to ensure technologies recommended to our clients perform as advertised and to find the most cost-effective and reliable solutions for our clients’ needs.

AECOM consultants have gained extensive experience by working closely with public safety entities both as AECOM employees and in some cases as previous employees of public agencies. Our combination of skills enables us to address all of the technologies applicable to your particular project with in-house people.

Several of our staff members have pioneered the 911 and consolidated dispatch operations required for modern communities. Who, prior to joining AECOM, managed large public safety communications departments for major municipal governments.

Our experience with administrative and operations planning, particularly public safety operations planning, has emphasized that many communications problems do not have exclusively **technical** solutions, but also require a knowledge of and sensitivity to your **operational** situation.

Building on our long history of providing solutions to clients nationwide, our team is well balanced and experienced in implementing large systems integration programs. We have demonstrated industry leadership in delivering networks, access control, intrusion detection, video technology, emergency communications, and open-platform solutions.

We specialize in state-of-the-art voice, data, audio-visual and broadband communications for internal facilities as well as external infrastructure design for outside plant telecommunications systems. Our IT/Telecommunications services include detailed systems design, specification, non-biased client

support for equipment selection, implementation management, acceptance testing, cutover, post cutover trouble-shooting, system expansion and upgrades. Our AECOM team offers a solid track record providing similar services to other clients in a manner that has met or exceeded their expectations.

We feel that the best prediction of future performance is past success, and therefore we feel confident in our approach and ability to meet the County's requirements.

The following table represents our experience and in all of the required areas of expertise:

**AECOM Experience in Required Areas of Expertise**

Project Experience	Orange County, North Carolina Assessment	Davidson County, North Carolina Emergency Communications Network Upgrade	Spotsylvania County 800 MHz Trunked Radio System	Harrisonburg and Rockingham ECC Radio System Design	Fauquier County, Virginia 800 MHz Trunked Radio System	Loudoun County, VA 800 MHz Trunked Radio System	Arlington County, Virginia 800 MHz Trunked Radio System	Virginia Statewide Agencies Radio System ( STARS)	Pima County Integrated Wireless Network (PCWIN), Arizona	Oregon Department of Transportation State Radio Project (ODOT)
Two-way radio Infrastructure & Equipment	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Communications Infrastructure Backbone (Microwave, Fiber, other)	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
New/Upgrade Towers, Shelters, UPS	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Communications Center/Backup	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Voice Paging Infrastructure	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Fire and EMS Alerting Infrastructure	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
RF System Design	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Radio Propagation	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Frequency Range / Spectrum Availability	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Encryption	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Voice logging	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Operating Protocol (conventional, trunking, combination)	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Radio Interoperability	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
P25 Phase 1 FDMA					◆		◆	◆		
P25 Phase 2 TDMA		◆	◆	◆		◆			◆	◆
P25 Simulcast Trunked		◆	◆	◆	◆	◆	◆		◆	
Cost Estimating	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Vendor Neutral RFP Development			◆	◆	◆	◆	◆	◆	◆	◆
Radio Coverage Performance Verification	◆			◆	◆	◆	◆	◆	◆	◆
Site design and construction oversight			◆	◆	◆	◆	◆	◆	◆	◆

AECOM is fortunate to have a significant presence within North Carolina, consulting with the following localities:

Client	State	Project Description
BURLINGTON	NC	Communications System Study, Specs, Procurement, Implementations, Acceptance
CAROLINA P&L	NC	Communications System Study
CARTARET COUNTY	NC	Emergency Communications Center & Radio Study
<b>CHATHAM COUNTY</b>	<b>NC</b>	<b>Infrastructure and Needs Assessment, Feasibility, Analysis, Conceptual Design</b>
CONCORD	NC	Communications System Study
DARE COUNTY	NC	Communications System Study & Update
<b>DAVIDSON COUNTY</b>	<b>NC</b>	<b>Communications System Study &amp; Update</b>
DURHAM	NC	Communications System Study, Specs, Procurement, Implementations, Acceptance
FAYETTEVILLE	NC	Communications System Study, Specs, Procurement, Implementations, Acceptance
GASTON / GASTONIA	NC	Communications System Study, Specs, Procurement, Implementations, Acceptance
GASTON / GASTONIA COUNTY JAIL	NC	Communications System Study, Specs, Procurement, Implementations, Acceptance
GASTON COUNTY	NC	Communications System Study, Specs, Procurement, Implementations, Acceptance
GUILFORD / GREENSBORO	NC	Communications System Study, Specs, Procurement, Implementations, Acceptance
HICKORY	NC	Communications System Study, Specs, Procurement, Implementations, Acceptance
HIGH POINT	NC	Communications System Study, Specs, Procurement, Implementations, Acceptance
ONLSOW	NC	Communications System Study
ORANGE COUNTY	NC	RaCE Coverage Testing
ORANGE COUNTY	NC	Communications System Study - Short & Long Term
PHILIP MORRIS	NC	Communications Study, Specs, Procurement, Implementations, Acceptance
PITT COUNTY	NC	Communications System Study
<b>RALEIGH</b>	<b>NC</b>	<b>Critical Public Safety Facility Design</b>
SHELBY	NC	Communications Study
WAKE COUNTY	NC	Communications Study, Specs, Procurement, Implementations, Acceptance
<b>WILMINGTON</b>	<b>NC</b>	<b>Subscriber Study</b>
WILSON	NC	Communications System Study
WINSTON SALEM / FORSYTH COUNTY	NC	Communications System Study

**Bold Text** indicates Current Clients

# Emergency Communications Assessment

Orange County, NC



## Project Owner:

Orange County, North Carolina

## Client Information:

Jack Ball

Orange County Emergency Services

## Project Dates:

2002 – 2005

## Deliverables:

- ✓ Radio Needs Assessment
- ✓ System Design
- ✓ Partnership with VIPER
- ✓ Coverage Testing

## Scope Synopsis

Orange County encompasses 400 square miles in the North central part of North Carolina. Approximately fifty-three percent of Orange County's residents live in Chapel Hill and Carrboro, located in the southeastern corner of the county. Two Public Safety Answering Points (PSAPs) provide public safety dispatch communications in Orange County. Orange County Emergency Management and University of North Carolina Department of Public Safety PSAPS serve five law enforcement agencies, twelve fire departments, Emergency Medical Services (EMS) and other public service agencies. The county's agencies communicate using a mix of VHF and UHF radio channels along with some commercial wireless.

Recognizing the need for an independent, comprehensive study of the existing communications system and the future communications needs of Orange County, Emergency Management retained the services of AECOM (then CTA Communications), in January 2002. AECOM's Phase 1 was to assessing the County's existing radio systems and PSAPS, to determine how well the existing systems meet their requirements, recommend short-term fixes, and to provide an opinion of probable cost for budgeting purposes.

In June 2002, AEOCM submitted the Phase 1 report. The report included also a long-term recommendation for procurement, installation, and implementation of a wide-area, integrated, public-safety-grade trunked radio system. AECOM's Phase 2A began in October 2003 to provide the County with a long-term system design.

The Phase 2A report, issued in April 2004 updated survey information, identified system alternatives, evaluated several alternatives, performed coverage analysis and provided a preliminary system design with an opinion of probable cost for purchasing a county-owned 800 MHz Trunked Radio system.

In August 2004, AECOM followed up with a Phase 2B report, which addressed the County forming a partnership with the NC-State Highway Patrol on the VIPER (Voice Interoperability Project for Emergency Responders) system in lieu of purchasing a county-owned radio system. In addition, AECOM provided a grant analysis to assist the County in obtaining funding.

In April 2005, AECOM followed up with Optional Services to assist the County in the developing their Talk Group structure and Fleet Mapping plan for their partnership participation with the VIPER system. The Optional Services also, included AECOM, utilizing their RaCE<sup>SM</sup>; automated voice coverage testing facility is to qualify the VIPER system coverage and, to provide coverage studies for additional sites, which would be required for enhancing the County's coverage based on the results of the RaCE<sup>SM</sup> coverage testing.

## Emergency Communications Network Upgrade – P25 Phase 2

Davidson County, NC

**Project Owner:**

Davidson County, North Carolina

**Client Information:**

Dwayne Childress

Dwayne.childress@davidsoncountync.gov

336.242.2030

**Project Dates:**

2015 – Ongoing

**Deliverables:**

- ✓ Radio Needs Assessment
- ✓ System Design

By analyzing Davidson County's needs and developing specific requirements, AECOM was able to negotiate a design that fully met the County's needs at a significant discount than what was initially proposed by the vendor.

Using AECOM tools and methodologies our experts have identified to the County the additional existing sites that could be used and facilities at county or state locations that will need to be developed or improved to accomplish the required coverage.

Adjacent channel interference analysis was performed on the existing frequencies as part of the study to determine possibilities of upgrading the current VHF and UHF systems.

### Scope Synopsis

Davidson County, North Carolina has recognized the need to improve or replace the current conventional VHF/UHF radio system, as most of the equipment is reaching end of life. Davidson County is a 567 square mile county located in the Piedmont region of North Carolina. The existing communications systems serve individual user groups on dedicated channels making interoperability difficult.

AECOM provided professional consulting services beginning with an initial analysis in 2005 studying Davidson County needs, and developing a recommended approach and design. AECOM experts in communications technology provided the County with conceptual system designs, architectures, and budget estimates at that time. In 2015 Davidson County requested AECOM assistance in the evaluation and negotiation of a proposal submitted by a vendor. AECOM evaluated the proposal and determined the County needs were not fully addressed in the proposal and subsequently developed a set of requirements through interviews, surveys, and discussions with stakeholders that set forth a clear definition for a county-wide P25 trunked radio system. This set of requirements included site development, coverage requirements, and coverage acceptance testing.

## 800-MHz Trunked Radio System – P25 Phase 2

Spotsylvania County, VA



**Project Owner:**  
Spotsylvania County

**Client Information:**  
Jane Reeve  
JReeve@spotsylvania.va.us  
540.507.7552

**Project Dates:**  
2012 – Ongoing

**Deliverables:**

- ✓ Functional Needs Analysis
- ✓ Conceptual Design Planning
- ✓ Specification
- ✓ Procurement and RFP Solicitation Support
- ✓ System Acceptance
- ✓ Implementation

### Scope Synopsis

Spotsylvania County is a fast-growing community located midway between Washington, D.C. and Richmond, Virginia. Spotsylvania County's existing radio system is a Harris (formerly Ericsson) EDACS trunked radio system installed in 1999. The County has received notice that the system is nearing the end of its supported lifecycle. In December 2011, the County hired AECOM to perform a functional needs analysis of its existing communications system and review an unsolicited proposal from Harris to replace the system.

AECOM performed a comprehensive analysis of the County's communication needs and developed a system replacement strategy that will serve the County for the next 10 to 15 years. As part of this needs analysis, AECOM interviewed a representative sample of the County's radio system user community, surveyed the County's existing radio sites and Emergency Communication Center (ECC), reviewed documentation on the existing system and reviewed statistical data on system usage. We used the information gathered to identify strengths and

weaknesses of the existing system, perform a radio frequency (RF) coverage analysis of existing and proposed radio sites, and analyzed the capacity of the system to support current and future needs.

AECOM completed its functional needs analysis and presented the results in a draft report to the County in June 2012. In the report, AECOM recommended competitive procurement of a new Project 25 simulcast trunked radio system. The recommended system would provide medium-building coverage across the entire county with heavy-building coverage in urban/suburban areas. It would be supported by a combination microwave-fiber optic IP/MPLS backbone that, besides supporting the radio system, could provide additional capacity to the County's telecommunications systems. An emphasis was placed on using existing radio towers, though some "greenfield" sites will be necessary. The report included a conceptual design and budgetary cost estimate for the project.

Before the report was finalized, AECOM was asked to present its analysis to the County's Board of Supervisors. The Board of Supervisors decided at that time to move forward immediately toward a competitive procurement of a new P25 trunked radio system. At the request of the County, AECOM compressed its schedule and delivered complete radio system specifications (including connectivity network and physical facilities) in six weeks. The RFP was released on August 21, 2012 and proposals were received by September 18. AECOM has evaluated the proposals received for compliance with the RFP and delivered of a report summarizing the proposal evaluation and recommending the County pursue a contract with the highest-rated proposer. AECOM presented its recommendations to the Board of Supervisors.

AECOM assisted the County during contract negotiations with the selected proposer. Currently AECOM is assisting the County with the implementation of a Harris radio system.

## Radio System Design – P25 Phase 1, Transitioning to Phase 2

City of Harrisonburg & Rockingham County, VA



### Project Owner:

Harrisonburg-Rockingham Emergency Communications Center (HRECC)

### Client Information:

Jim Junkins  
jjjunkins@hrecc.org  
540.434.2006

### Project Dates:

1999 - Ongoing

### Deliverables:

- ✓ Radio Needs Assessment
- ✓ Specifications
- ✓ Implementation

### Scope Synopsis

Rockingham County and the independent City of Harrisonburg are located in the heart of the Shenandoah Valley of Virginia. The City and County were using a variety of conventional radio channels and equipment operating in the UHF and VHF bands. Radio system users were experiencing severe problems with their existing systems. On November 1999, Harrisonburg and Rockingham County hired AECOM to conduct a Two-Way Radio Needs Assessment of the City's and County's public safety and general government radio systems, and 911 Emergency Operations Centers.

AECOM completed the Needs Assessment in 2002, recommending competitive procurement of a wide-area 800 MHz trunked radio system. AECOM prepared specifications for the radio system and guided the City and County through the selection of a vendor and contract negotiations. Harris Corporation (formerly M/A-COM) was awarded the contract in 2004. The final system configuration consisted of two EDACS-IP simulcast "cells" or systems. The first simulcast system had 8 sites with 11 channels; the second simulcast system I had 2 sites with 5 channels. There was also a third 5-channel EDACS site which had an RF link to the

2-site simulcast cell; Harris refers to this as a "virtual" site. The simulcast systems were in a multi-site configuration for improved coverage in mountainous areas. AECOM assisted the County throughout the implementation and acceptance of the radio system. The radio system was accepted in 2009.

AECOM prepared license applications and Regional Planning Committee (RPC) application packages for 800 MHz channels needed for the new system. AECOM interfaced with the Region 42 RPC, the National Radio Quiet Zone (NRQZ), the frequency coordinator and the FCC to assist HRECC in obtaining the necessary frequencies. The needs assessment also recommended that the City and County develop a consolidated 911 center to serve both jurisdictions. AECOM architects participated in the project to determine the requirements to integrate the current public safety 911 operations into the new Emergency Communications Center facility in downtown Harrisonburg. AECOM provided design and management of the implementation of the ECC on the fifth floor of the building. In a separate contract, AECOM provided services relating to the renovation of the entire building, including cutover and relocation of systems and equipment to the new center. The new joint 911 center became operational in July 2005.

Due to unique regional frequency and power limitations which impacted certain aspects of system design finalization, final testing occurred in 2011, after which AECOM recommended system acceptance. Fall 2014 Update: AECOM has recently been contracted to assist the City and County in their evaluation of a system upgrade proposal from their current vendor, which will transition them to P25 Phase 2 technology. Our services will include evaluating the vendors proposed design and pricing, providing implementation oversight services and serving as advocates for the client as they implement next generation technology.

# 800 MHz Trunked Radio System

Fauquier County, VA



## Project Owner:

Fauquier County Government Procurement

## Client Information:

Susan R. Monaco, CPPB  
540.428.8713

## Project Dates:

1999 - 2009

## Deliverables:

- ✓ Functional Needs Analysis
- ✓ Specification Writing
- ✓ Procurement Support
- ✓ System Implementation

## Scope Synopsis

Fauquier County is a rural community located in northeast Virginia, within easy commuting distance from the Metro D.C. area. The largest community in Fauquier County is the Town of Warrenton, which is also the County seat.

The County's previous Public Safety radio systems utilized various low band and VHF high band radio frequencies, supporting approximately 400 radio users in the Sheriff's Office and 13 volunteer Fire/Rescue companies. The users reported problems with poor radio coverage, frequency crowding, frequency congestion, interference, aging equipment, and lack of modern features. In February 1999, the County retained AECOM (formerly CTA Communications) to address these problems and to recommend a solution that would provide adequate coverage and capacity, as well as interoperability among County agencies, with the Town of Warrenton and with its neighbors.

AECOM completed its initial study in December 1999, with a "Radio System Needs Assessment Report" that included a preliminary design and budgetary cost estimate for conversion of the current radio system to a digital 800 MHz trunked simulcast system. The project included the design, implementation, and acceptance of the microwave connectivity network, linking the radio repeater sites to the master site location. AECOM also assisted the County in obtaining adequate frequencies

in the 821 MHz band for the new system. AECOM and the County then proceeded with the development of functional specifications as part of a competitive Request for Proposals (RFP). Two vendors responded to the RFP, and through the evaluation process developed by AECOM, Motorola was selected. AECOM assisted the County with contract negotiations, which were concluded with an award in January 2002.

Fauquier County contracted with AECOM to follow the project through all stages of implementation, concluding with System Acceptance Testing. AECOM's participation included oversight of the construction and installation work, implementation, and finally system testing and recommendations to the County for final acceptance.

During the course of the project, it was determined that some of the tower sites selected by Motorola during the proposal phase were unsuitable. The County expanded AECOM's scope to assist with the engineering design, specification development, and construction administration for three tower sites.

AECOM's contribution included geotechnical investigations, surveys, site plans, oversight for the demolition of an old tower, construction of 3 new self-supporting towers, electrical service (including back-up generator and UPS), grounding and surge protection, fire suppression, access road design, fencing, concrete inspection & sample testing, and overall project coordination between the general contractors, the County and Motorola.

AECOM has also assisted the County with the development of a new UHF paging system for its fire and rescue companies, which was installed in parallel with the 800 MHz radio system. The new communications system has improved Fauquier County's operating abilities and allowed for future growth in its public safety mission.

By partnering with AECOM for facilities engineering and oversight of construction, and for its overall project coordination, the County estimates that it has saved hundreds of thousands of dollars – more than paying for AECOM's professional fees. Construction activities were completed in early 2004, with acceptance testing and cutover accomplished in the fall of 2004.

AECOM is continuing its relationship with the County by assisting in the 800 MHz rebanding process, engineering, and implementation of a new broadband Ethernet microwave backbone network, and adding an additional 800 MHz radio repeater site.

## Radio Communication Consulting Services

Loudoun County, VA



### Project Owner:

Loudoun County Government

### Client Information:

Bob Burlingame  
Robert.Burlingame@loudoun.gov  
703.777.0436

### Project Dates:

1990 - 2012

### Deliverables:

- ✓ Functional Needs Analysis
- ✓ Specification Writing
- ✓ Procurement Support
- ✓ System Implementation

### Scope Synopsis

Beginning in 1990, Loudoun County retained AECOM (then CTA Communications) to examine county Fire Department communications and to make upgrade recommendations. These upgrades were designed to improve the infrastructure and overcome the problems of crowding, interference, and poor radio system coverage.

Returning in 1996, AECOM reexamined the communications environment in Loudoun County. Our final report recommended a plan to consolidate the entire county communications infrastructure. This report also recommended that the county deploy an over-the-air mobile data system.

In 1997, AECOM developed specifications and requirements for a new public safety radio communications system. As a negotiated procurement with a sole source radio supplier pre-selected by the County, AECOM provided assistance during the contract and technical negotiations. AECOM chaired the Detailed Design Review, and then provided oversight of the design process and construction administration. AECOM also monitored system installation and acceptance testing of the new radio system. Construction began in 1998 and Final System

Acceptance was granted by the County in December 2002.

The completed radio system was initially an eight-site, eight-channel, dual mode (analog and digital), simulcast, trunked 800 MHz voice radio system. In addition to the voice radio system, a four site, 3-channel ultra-high frequency (UHF) mobile data system and a four-site low band simulcast paging network were deployed.

After deployment, Loudoun County noted intermittent problems in the system operation. The manufacturer was called, but was unsuccessful in finding the problem. AECOM used our patented Radio Coverage Evaluator (RaCE) test facility to assess the radio system. Using the data collected in the test, our engineers clearly identified the problem. Loudoun County was able to implement a solution that restored the County's radio functionality.

In 2006 in response to the Federal Communications Commission's rebanding requirements, Loudoun County again turned to AECOM. AECOM served Loudoun through the difficult planning agreement and final reconfiguration agreement negotiations. AECOM continues to serve Loudoun County through the reconfiguration implementation and through the closeout processes.

In 2008, Loudoun County became aware that their system manufacturer intended to reduce their maintenance commitments to critical infrastructure equipment. AECOM was challenged to do a complete needs assessment. Included in this assessment was upgrading to the P25 standard, increasing the microwave system capacity, modernizing the low band paging system and increasing the mobile data to a faster High Performance Data (HPD) model.

Put on a fast track, the project quickly moved through the procurement phase with contract negotiations completed at the end of December 2008. AECOM participated in presenting the new system to the Loudoun County Board of Supervisors.

Staging of both radio and microwave subsystems were completed in the summer of 2009. Construction activities are underway. The completion for the P25 phase 1 (Frequency Division Multiple Access (FDMA) system was in late 2009.

The contract with the radio supplier includes an upgrade to P25 Phase 2 (two-slot, Time Division Multiple Access TDMA). All equipment, including mobile and portable radios, are capable of P25 Phase 2 operation via a software upgrade

# 800 MHz Trunked Radio System / ECC Relocation and Mobile Data Project

Arlington County, VA



## Project Owner:

Arlington County

## Client Information:

Radio System Manager  
703.228.7935

## Project Dates:

2001- 2008

## Deliverables:

- ✓ Functional Needs Analysis
- ✓ Specification Writing
- ✓ Procurement Support
- ✓ System Implementation

## Scope Synopsis

Arlington County retained AECOM to design three of their critical public safety infrastructure systems; the voice radio system, the 911 dispatch center, and the mobile information system. Each of the systems required major updates to enable police, fire, and emergency medical services to achieve their service delivery goals. For each of the three system components AECOM was actively involved in advisory, design, and oversight roles during all project phases. AECOM began the project with a comprehensive needs evaluation to establish baseline requirements and bring the project stakeholders into the project. The Public Safety radio system was an aging 15 channel 800 MHz implementation lacking proper coverage. 911 personnel had outgrown the dispatch center. The mobile information system (laptops in emergency vehicles) was being removed due to lack of vendor support.

AECOM's replacement system designs solved some special challenges for this important County in the Washington DC area. The radio system had to enable firefighters to work in predominantly very large buildings, a challenge for permeation by radio waves. All disciplines work in a daily environment of interagency and regional cooperation. Simple and ready radio interoperability was necessary.

Medics, Police, and Fire had previously invested in making all their information sources and databases

available on-line. To bring this investment to bear on real life field situations, they needed not only mobile data laptop access, but office-like high bandwidth to view items such as building floor plans and utility cutoffs for fire, patient information for medics, and mug shots for police. The solution involved three-way mobile data access using; private channels for routine CAD dispatch, commercial wireless for out-of-county access, and Wi-Fi for the broadband access. Network switching was handled automatically for the user on both laptops and handheld smart phones.

The Emergency Communication Center, a nationally recognized leader in public safety emergency communications, uses innovative procedures and state-of-the-art technology including: Enhanced 911, Computer Aided Dispatch, 800 MHz Trunked Radio, Computerized Emergency Medical Dispatch Pre-Arrival Instruction, Mobile/Portable Data Terminals, Instant Foreign Language Interpretation and on-line telephone books. The fifty-some 911 staff needed adequate space in a newly renovated existing building in which to conduct 24/7 911 services as well as handle special emergency situations. AECOM worked with architects and equipment manufacturers to create, not only workable systems, but an effective work environment.

AECOM developed competitive specifications for the new radio system, new CAD and related dispatch equipment and the mobile data system. Through this process, the County was able to evaluate the best-of-breed solutions and receive competitive pricing. AECOM assisted and advised the county during contract negotiations bring AECOM experience to bear on setting up a successful project.

During implementation of the systems and construction of the workspaces, AECOM inspected intermediate results managed any needed corrections to help ensure that errors would not cause the County rework, delays, and cost overruns. AECOM worked alongside the contractors and County personnel during comprehensive acceptance testing procedures to make sure all systems were stable and fully functional. AECOM worked with the contractors and County to develop workable cutover plans, and then, worked side-by-side executing the plans.

In the end, the County was pleased with outcome of all three major project elements; voice radio, 911 center, and mobile data. AECOM's mobile data design was a 2005 ISA award winner from the American Council for Technology, selected for innovative design and multi-agency collaboration.

# Statewide Agencies Radio System (STARS) Land Mobile Radio & Digital IP Microwave Network Systems Upgrade P25 Phase 1

Commonwealth of Virginia



**Project Owner:**  
Virginia State Police (VSP)

**Client Information:**  
Thomas Struzziere  
Thomas.struzziere@vsp.virginia.gov  
804.674.4384

**Project Dates:**  
2000 – 2012

## Scope Synopsis

The Commonwealth of Virginia and 23 of its State Agencies cooperated to upgrade their statewide VHF State Police Land Mobile Radio and Microwave Networks, sites and facilities. AECOM (formerly CTA Communications) began working with the Commonwealth in July 2000 as the Design, Implementation, Integration, and Quality Control Consultant.

AECOM has overseen or directly contributed to transitioning the system from a **conceptual design to an operational statewide radio communications system**. The overall project consisted of seven overlapping implementation phases. AECOM support included:

- Evaluate and document State Police infrastructure for 100+ locations
- Assess the radio needs of each participating State Agency
- Research and assess viable technologies
- Design statewide digital upgrade to microwave network and sites
- Prepare technical specifications for statewide radio system and facilities
- Analysis of responses to the technical functional specifications
- Supported vendor negotiations and contract

award process

- Prepare a preliminary talk group fleetmap for the statewide system
- Perform on-site construction monitoring and coverage testing support
- Prepare and maintain a budget and schedule for the life of the project
- Assist in the final testing and system acceptance

**Major Advantages.** Major advantages of a fully implemented Statewide Agency Radio System (STARS) network will be a statewide VHF integrated wireless voice and data system for participating state agencies, and each of the seven State Police Divisions; the ability for full inter- and intra-agency communications; and a capability that enables coordinating communication links between state, federal, and local agencies, that is especially important during emergencies and disasters. Among the system’s features is a completely transportable communications site that can be moved anywhere in the State, and then set up within one hour to maintain crucial emergency communications capabilities.

**Summary.** For the \$329 million Commonwealth of Virginia STARS project, AECOM’s consulting contract of \$19.9 million developed a system concept, and prepared detailed functional specifications and a Request for Proposal document, that was based on information gathered from 23 state agency, interviews and 102 tower site surveys and assessments. During procurement, AECOM evaluated vendor proposals, and made recommendations on the vendor’s ability to translate the system design into a functioning Statewide Radio System. AECOM assisted with contracts negotiations, award and provided Independent Validation and Verification (IV&V), as well as inspection oversight.

The project is completing the implementation phase, as AECOM continues to assist the State Police in overseeing the project’s installation and implementation of 121 radio and/or SONET microwave (MW) sites throughout the State, ensuring the new systems’ quality, and providing non-law enforcement user training. AECOM also performed the critical task of ensuring the system implementation meets or exceeds the system design and specification. We also assisted the Commonwealth with configuration management and risk identification and analysis.

**From Assessment to Implementation.** AECOM’s investigation of the VSP infrastructure/sites was in depth, completely documenting the existing microwave,

the resident radio equipment, and the condition of each. Documentation was sufficient to identify facilities capacity (space, HVAC, main and backup power, etc.) and to estimate the condition of the towers, shelters, security fencing and other legacy radio equipment. This included site sketches, dimensions critical to the installation of specific equipment, non-dimensioned floor plans, antenna location diagrams, and other information as deemed necessary by AECOM, to adequately describe and assess site conditions for purposes of developing future solicitations.

AECOM coordinated closely with the VSP and finalized a detailed work plan and comprehensive schedule for surveying the VSP's 45 land mobile radio (LMR) and 87 microwave only sites. The work-plan involved developing a list of and acquiring the materials and equipment needed to conduct the site surveys, developing a template that lists the categories of information the survey teams are to gather at the sites, and allocating the resources needed to conduct the surveys. VSP technical or maintenance personnel were available during the surveys to answer technical questions about the site.

During the site surveys, AECOM visited each site to determine if the following information is generally in conformance with previous documentation provided by the VSP. The information provided by VSP was developed into an extensive database, including notes indicating general conformance or non-conformance on a site-by-site basis. AECOM investigated the accuracy of that information and assessed the condition of the site equipment and physical facilities.

AECOM has overseen or directly contributed to transitioning the system from a conceptual design to an operational statewide radio communications system. The overall project consists of seven overlapping implementation phases.

- A Systems Integrator contract was signed in July of 2004
- Phase 1 – Division 1 radio sub-system installation was completed in 2005
- Phase 2 – Division 5 radio sub-system installation completed in 2007
- Phase 3 – Division 2 & 7 radio sub-system have been implemented and completed in 2010.
- Phase 4 – Divisions 3, 4 & 6 radio sub-system have been implemented and completed in early 2011

AECOM provided Land Mobile Radio licensing support and status tracking for all STARS-related Land Mobile Radio and Microwave requirements. In support of these tasks, AECOM used our Frequency Allocation Modular SM. Throughout the project, AECOM used our Propagation, Coverage and Loading Analyst, to assist our engineers in microwave path and radio coverage

design. During the implementation of each project phase, AECOM provided the following services:

- AECOM reviews Contractor's Geotechnical reports and tower structure documents for new tower structural designs, and AECOM reviews existing tower loading analysis reports provided by the Contractor and provides comments and recommendations to STARS.
- For each radio and digital microwave site, AECOM conducts an EME paper study, once Contractor's drawings have reached a stage where antenna locations and ERP are known. STARS is provided with a study report containing recommendations for signage and use of RF monitors for personnel working near active antennas.
- AECOM Independently Verifies and Validates the Contractor's frequency Plan utilizing AECOM's proprietary frequency planning and evaluation tool (FAM) then provides recommendations to STARS based upon results.
- AECOM represented STARS at the microwave and radio Factory Staging, and participated in tests at Contractor's facility. AECOM supported STARS with on-site field testing.
- With support from our AECOM engineering and architecture colleagues in Roanoke, VA, AECOM performed needs assessment, design specifications, procurement support and construction administration for two facilities containing the Network Operations Center, Zone Master equipment and dispatch, and office space. One facility is located in Richmond, the second in Salem, Virginia.
- The STARS communications network has a number of sites influenced by the National Radio Astronomy Observatory (NRAO) facility located in Green Bank, WV. AECOM supported STARS licensing efforts by coordinating with and obtaining concurrence for sites requiring NRAO concurrence.
- AECOM participated in additional spectrum meetings, supported development of Spectrum purchase specifications, proposal evaluation, usefulness of spectrum offered and support negotiations with owners.
- AECOM reviewed STARS LMR and digital Microwave system loading during migration (simultaneous legacy and trunked LMR) and transition as both systems must handle traffic originating from legacy systems with reduced channel capacity until the legacy systems were fully decommissioned.
- AECOM downloaded then analyzed microwave and SONET node alarm reports for faults and identified to STARS where trends indicate hops or rings have greater than contracted outages or

degradation.

- AECOM actively searched for alternate sites to allow microwave ring design reducing the number of sites required, enhancing the microwave ring design and to place LMR sites in areas needed to provide radio coverage in critical areas. AECOM provided detailed RF propagation studies to support the recommended changes.
- Create and continually updated frequency and licensing related trackers for FAA, ASR NRAO process steps for Microwave and LMR licensing. Provide reminders of upcoming Construction and license renewals required in a timely manner. Prepare FCC documents for STARS to file.
- AECOM conducted on-site inspections representing the STARS prior to and during foundation concrete pours, ground ring inspections, generator tests, UPS tests and provided STARS with Inspection Reports.
- Participated in contractor's R56 audit, reviewed documentation, and provided recommendations as necessary.
- AECOM worked closely with STARS and participating agency representatives to develop Policy and Procedure documents for all aspects of the network's operations.
- Supported diagnostic and troubleshooting efforts as the radio network was being implemented including digital Microwave and VHF Integrated Voice & Data alarm subsystem reports.
- AECOM drafted NPSPAC Regional 800 MHz applications for four Tunnel systems in the Tidewater area of VA, and two tunnels in the mountains in western VA, plus one transportable site.
- AECOM provided personnel to perform on-site construction monitoring and coverage testing support
- AECOM prepared and maintained a budget and schedule for the life of the project
- The STARS infrastructure and subscriber units have a number of Contractor's product "firsts". Due to this, issues during implementation surfaced. AECOM assisted STARS in reviewing data, diagnosing problems, providing opinions and recommendations.
- AECOM developed co-location evaluation steps in three phases for additional agency or potential locality participation on the STARS network.
- AECOM developed a set of requirements for STARS to use when localities or commercial communications companies request to co-locating on a STARS tower.

AECOM developed Policies and Procedures for the new VHF P25 trunked statewide radio system implementation:

- Radio System Management and Operations
- Radio System Configuration and Allocation
- Agency and Locality Interoperability
- Service and Maintenance Support.

Please take a moment to visit the Virginia Police Statewide Agencies Radio System (STARS) website for updated information on this project and the opportunity to review the AECOM Agency Needs Assessment Report.

<http://www.vsp.state.va.us/stars.shtm>

## Countywide Integrated Wireless Network – P25 Phase 2

Pima County, AZ



### Project Owner:

Pima County Sheriff's Office

### Client Information:

Chief Paul Wilson  
Paul.wilson@sheriff.pima.gov  
520.741.4878

### Project Dates:

2006 –2014

### Deliverables:

- ✓ Radio Needs Assessment
- ✓ System Design
- ✓ Specifications
- ✓ Implementation
- ✓ Procurement and RFP Support
- ✓ System Acceptance Testing
- ✓ Radio Coverage Testing

### Scope Synopsis

Pima County, Arizona established the Pima County Wireless Integrated Network (PCWIN), as a regional network supporting 29 public safety and governmental agencies and Tribal agencies in the 10,000 square mile county located along the U.S.-Mexican border. Today, PCWIN serves as a regional public safety voice and data communications network, includes a regional communications center, and improves public safety radio interoperability.

AECOM provided professional consulting services beginning with analyzing PCWIN requirements, and developing the Pima County Wireless Integrated Network design. AECOM experts in communications technology provided the County with conceptual system designs, architectures, and specifications for the *hardware and software* necessary to implement large and small public safety communications systems, including statewide interoperable solutions. The completion of our concept development, requirements analysis and design, resulted in meeting the client's objectives. AECOM guided Pima County using the following steps.

**Business Model and Analytics Planning:** Knowing PCWIN would be a major undertaking, the County needed a comprehensive plan to align constituent agency goals with the business side of deploying and running a regional radio system. AECOM developed this plan that considered funding resources, phased implementation, annual budgeting, operation,

maintenance, staffing, and future lifecycle upgrades. Using this plan, project leaders were able to clearly communicate to County decision makers that PCWIN would be a sensible, fiscally responsible investment that would further the County's higher objectives of being a regional leader. This was communicated in the PCWIN Business Plan.

**Conceptual Design Planning:** AECOM performed a comprehensive needs assessment by conducting county agency interviews, facility and radio site surveys, tower site assessments, and cost – performance trade-off analysis. AECOM staff gathered and analyzed the information from the interviews and surveys with 31 agencies using our Impact Analysis Process<sup>SM</sup>. The results of this task formed the basis for the assessment, design, specification, cost analysis, performance and feasibility analysis, procurement and acceptance services for our client. AECOM evaluated several alternatives to determine the best system that would meet user needs. Throughout the execution of these tasks, AECOM used our Impact Analysis Process<sup>SM</sup>, Cost Budgeting Analyst<sup>SM</sup>, and Capacity Analysis Model<sup>SM</sup>. This plan was communicated through the User Needs Assessment, Legacy Systems Characterization, Systems Alternatives and Recommendations, and Concept of Operations reports.

**Radio Site Detailed Design:** AECOM's engineering team developed detailed designs and biddable scopes of work for radio facilities at about 25 tower sites. This included shelter space, towers and antenna loading, power panels/distribution, backup power generators, grounding systems, and solar/battery plants for remote sites. PCWIN's qualified contractors built the AECOM-specified designs.

**Procurement and RFP Solicitation Support:** On AECOM's recommendation, PCWIN opted for a multi-procurement approach to project implementation. With PCWIN doing the top-level project management, the goal is to maintain a high level of project control and to complete the project saving significant cost over a single system integrator approach.

Four procurements were undertaken using AECOM-developed RFP and bid packages. First, the LMR infrastructure was contracted based upon the functional and RF coverage requirements. This step establishes the tower sites and other physical locations. Next, the supporting microwave system was bid saving cost by taking advantage of existing microwave and fiber assets. Having established LMR and connectivity equipment, the next step was to bid physical facilities including real estate, shelters, towers, and power systems.

**Technical and Project Management Oversight:**

AECOM provided construction administration and technical assistance throughout the project. Physical facilities (tower sites and dispatch) were constructed, followed by connectivity installation, radio system installation, and finally system integration and test. Concurrent activities demanded considerable coordination efforts. Our staffing included project managers, engineers, technical specialists, and cost accountants. As a result the project was completed efficiently, quickly, and with considerable cost savings as compared with turn-key projects managed by equipment integrators.

**System Acceptance Testing:** AECOM was called in to oversee system optimization and acceptance testing for the microwave and LMR subsystems. Engineers verified that the contracted functional and performance characteristics had been delivered.

**Radio Coverage Testing:** PCWIN recognized that all-important coverage testing performed by a third-party would be a fair and unbiased assessment. AECOM preformed the test using its unique **RaCE<sup>SM</sup>** coverage test facility. **RaCE<sup>SM</sup>** tests coverage as users understand it; using real-voice and directly measuring Delivered Audio Quality. Over 5000 square miles of gridded area was tested, witnessed by all parties, and recorded as a permanent baseline record.

**Tactical Interoperable Communications Planning:**

AECOM has assisted Pima County in developing and implementing a Tactical Interoperable Communications Plan (TICP) for all agencies in the County. AECOM will continue to assist Pima County with implementation of its new countywide communication system to help them meet the operable and interoperable needs of the radio users in the County.

AECOM offers a comprehensive professional consulting staff with a broad background in communications and operations requirement analysis, conceptual systems design, budget planning and cost estimation, functional specifications development, system migration planning and implementation and project management. Services in all of these specialty areas were provided to Pima County over a period of time that spanned more than eight years.

## Oregon Statewide Radio Project – P25 Phase 2

Statewide, OR



### Project Owner:

Oregon Department of Transportation

### Client Information:

Richard Upton, Project Delivery Manager  
Richard.Upton@odot.state.or.us  
503- 934-6943

### Project Dates:

2010 – Ongoing

### Deliverables:

- ✓ Ethernet/OC3 Microwave & MPLS Network
- ✓ 700 MHz Trunked Radio
- ✓ VHF Narrowband project
- ✓ Network Management Alarm System (NMS)
- ✓ Dispatch Console Systems

### Scope Synopsis

The State of Oregon had established an organization to design and implement the Oregon Wireless Interoperability Network (OWIN) combining resources from multiple State agencies, primarily the Oregon Department of Transportation (ODOT), Oregon State Police (OSP), Oregon Department of Corrections (ODOC), and Oregon Department of Forestry (ODOF). To support this system, a separate but related project is already in progress to replace an aging analog microwave backbone with a full digital microwave backbone network. The State Radio Project has four main objectives:

Narrowband the ODOT and OSP VHF systems,  
Replace the current analog microwave with an MPLS digital microwave network and a network management monitoring system,  
Make improvements to communications facilities, and  
Construct a 45 site (+/-) Project 25 (P25) digital trunked radio system at 700 MHz to cover 70% of Oregon's population. The project is currently in the implementation phase.

In June 2010, AECOM entered into an agreement with the State to provide consulting services to assist in the selection and engagement of the radio system contractor, as well as throughout the current State Radio Project in the design, installation, testing, acceptance, and implementation of the system. Also included in this agreement is the quality management of the project to ensure that conformance to the requirements are as developed and identified by the client from pre-contract to completion.

AECOM's original role was to assist the State in procuring the best solution at the lowest cost that would fulfill the objectives for the trunked radio system, and then provide the assistance and expertise to ensure that system is implemented properly and performs to expectations. AECOM completed the initial task of assisting the State in identifying the vendor who proposed the best solution and advised the State through negotiations to reach a price agreement. Additionally, AECOM assisted the State in the negotiations with Harris, Inc., the selected vendor. This effort included the development of the P25 System Requirements Specification that was based on the initial RFP and the vendor's response to that RFP. This document forms the baseline requirements for any future purchases contemplated by the State or other Agencies within the State who wish to leverage the statewide system.

AECOM provided an analysis of the microwave network the State was building to support the radio system. Subsequently, AECOM was tasked to redesign the microwave network and engineer all of the remaining microwave paths.

AECOM produced the System Requirements and the System Architecture documents which dictated the design considerations for the Microwave, 700 MHz Trunked Radio, VHF Narrowband project, NMS, and Console systems.

Currently AECOM is responsible for the following services on the State Radio Project:

- Quality assurance related to the implementation and acceptance of the P25 trunked radio system of the SRP.
- On-site support and implementation coordination of the microwave, VHF conventional and trunked 700 systems.
- Network management system design, which includes the development of a needs assessment and specification, assist in the competitive procurement, and implementation and acceptance services.
- On-site coordination of all aspects of the project.
- Design of the microwave network and supervision of its implementation, testing and acceptance.
- Develop the console specification; assist in competitive procurement, and provide implementation and acceptance services.
- Global project management services as needed related to the State Radio Project.

**700 MHz Trunked Radio** - The SRP has held the preliminary design review of the statewide trunked radio system. This included a coverage analysis, traffic loading analysis and a statewide frequency plan. AECOM has reviewed the design documents and issued our report on this preliminary statewide plan. As the trunked radio system project progresses, we will review and comment the detailed design review documents for the portion of the system to be implemented. An important component will be evaluating the vendor's guaranteed coverage. Our services will include also assisting ODOT in the negotiations of the final methodologies for the Acceptance Test Plans and procedures, as well as witnessing the testing. We will oversee the verification of the infrastructure installation and maintain the master punch list. Another important component is to verify that the radio system coverage meets the vendor's guarantee. AECOM has an option to provide independent testing of the radio system coverage. Finally, we will review all field accepting testing and final system design drawings, and make a recommendation on final system acceptance.

**Network Management Alarm System** - AECOM completed a network management design needs assessment. In this report we identified the monitoring systems used today for the OSP and ODOT radio sites. These included not only sites on the current microwave network, but also SCADA systems on remote sites such as solar sites or other sites with limited energy resources. The new SNMP-based network management system will need to incorporate over 200 sites consisting of legacy sites, the new trunked radio sites, VHF narrowband sites, and digital microwave radio sites. We proposed several possible options for the network management system configuration. AECOM has also completed the technical specification for the competitive procurement of the network manager. Future work on this project will include the development of acceptance test plan to test the network management system, the installation verification, witness field acceptance testing (including the alarm reporting for each site, the system management platform and network functionality), review of the final design and recommendation on final acceptance.

**Ethernet/OC3 Microwave** - AECOM has completed the design configuration of the statewide microwave network. The design incorporated ring and monitored hot standby configurations to provide both link and equipment redundancy. AECOM performed the analysis of the network equipment data rate requirements on a site by site and system basis and utilized this analysis to insure that the microwave design has sufficient capacity to meet the connectivity requirements in the event of equipment and link outages. AECOM is in the process of designing each of the 100 plus microwave links to determine antenna locations and types required to meet 99.999% hop availability criteria. Due to the complex nature involved

in implementing new digital microwave within hops that currently have analog traffic, for each applicable hop, AECOM has developed Scopes of Work that detail the preparation, installation and tests required to assure successful completion of the associated tasks with minimal service interruptions.

**MPLS Network** – AECOM assisted the ODOT Wireless technicians in provisioning, testing, and deploying the Alcatel Lucent SAR MPLS routers within the microwave network.

**Dispatch Consoles** - AECOM is assisting ODOT and OSP in the technical specification development for an IP-based dispatch console system that will interface to the Harris trunked radio system via the P25 CSSI, as well as to the existing telephone systems and the VHF conventional radio system. AECOM assisted in dispatch console procurement through evaluation criteria, addenda preparation as needed, provided advice and comment on the proposal evaluations and assisted with contract negotiations. Future work will include providing technical and expert assistance to ODOT and OSP in the planning, implementation, testing and acceptance of the consoles.

*Timeliness of Performance.* The initial contract was for procurement and negotiations, and was completed within the client's schedule. The additional microwave analysis was also completed timely. While this microwave portion of the system is still in the design stages, AECOM has completed our reviews of the vendor's overall preliminary statewide trunked radio system design. AECOM is responsible for scheduling and implementation management working with Harris, Aviat and the NMS vendors to ensure the systems are properly installed and tested. The network management system, microwave, and console specifications have been developed and accepted by SRP.

*Customer Satisfaction.* ODOT has been satisfied with our work and extended our initial contract to include quality assurance on the implementation and acceptance of the trunked radio system, microwave network, as well as added the network management system design and procurement and console specifications. We have provided on-site staff augmentation to ODOT to coordinate and integrate the microwave, MPLS and land mobile radio components of the SRP design and implementation.

## Statement of Objectivity

AECOM is independent of and has no affiliation with any vendor, manufacturer, supplier, or dealer of equipment, software, or services. Our history of recommendations in competitive procurements proves our objectivity. In the midst of a highly competitive marketplace with a proliferation of marketing hype, this objectivity provides our clients with a fully, impartial perspective.

## Project Schedule and Work Plan

AECOM's Project Team is committed to schedule development and adherence. As part of our preparation to offer our services to Orange County, AECOM has developed a preliminary Project Work Plan and Schedule, which defines and identifies project tasks, time frames, interdependencies, deliverables, critical paths, and responsibilities. Tasks that are specific responsibilities of AECOM are designated as such in the Project Work Plan and Schedule. Tasks that must be the responsibility of Orange County are likewise designated.

The Project Work Plan and Schedule align with the Project Approach will be an important part of our Project Team's review and management activities. As we progress through the Project, completion dates are included, and additional tasks or sub-tasks are inserted in both the Project Work Plan and Schedule and the Project Approach as appropriate. Responsibilities are assigned, and every participant is fully aware of the impact of their contribution to the overall Project and Schedule.

The Project Work Plan and Schedule will use Microsoft Project software and will updated on a regular basis to deliver to the County a dynamic and useful management tool. The Project Work Plan and Schedule is displayed on the following pages in a Gantt chart format, but if requested, AECOM could also display it in a PERT chart format.

## Requirements for Support from Orange County or other Assumptions

### Assumptions

1. The County will provide a project manager who will be the single point of contact for this project. This individual will coordinate all activities for Orange County.
2. The County will provide necessary escort(s) to access sites.
3. The County will provide review and approval of submittals and draft reports according to the proposed schedule, and respond with consolidated comments.
4. This proposal is valid for 90 days from the proposal date. It may be extended by mutual agreement between the Orange County and AECOM.

Proposed Project Schedule

ID	Task Name	Resource Names	Start	Finish	January 1		June 11		November 21		May 1		October 11	
					11/1	1/17	4/3	6/19	9/4	11/20	2/5	4/23	7/9	9/24
0	<b>AECOM Project Work Plan</b>		<b>Mon 3/21/16</b>	<b>Thu 11/29/18</b>										
1	<b>Phase I</b>		<b>Mon 3/21/16</b>	<b>Tue 9/6/16</b>										
2	Notice to Proceed	Orange County	Mon 3/21/16	Mon 3/21/16										
3	<b>Initialization</b>		<b>Tue 3/22/16</b>	<b>Mon 3/28/16</b>										
4	Initialization Letter	AECOM	Tue 3/22/16	Tue 3/22/16										
5	Preliminary Data	Orange County	Wed 3/23/16	Fri 3/25/16										
6	<b>Initialization Meeting</b>	<b>Meeting</b>	<b>Mon 3/28/16</b>	<b>Mon 3/28/16</b>										
7	<b>Data Gathering</b>		<b>Wed 3/23/16</b>	<b>Tue 5/3/16</b>										
8	Interview Schedule	Orange County	Wed 3/23/16	Fri 3/25/16										
9	<b>Interviews</b>	<b>AECOM</b>	<b>Tue 3/29/16</b>	<b>Fri 4/1/16</b>										
10	Draft Interview Records	AECOM	Mon 4/4/16	Fri 4/8/16										
11	Survey Sites	AECOM	Tue 3/29/16	Fri 4/1/16										
12	Draft Site Survey Records	AECOM	Mon 4/4/16	Fri 4/8/16										
13	Review Records	Orange County	Mon 4/11/16	Fri 4/15/16										
14	Edit Records	AECOM	Mon 4/18/16	Wed 4/20/16										
15	Finalize Records	AECOM	Thu 4/21/16	Fri 4/22/16										
16	<b>Draft Existing Communications Capabilities</b>	<b>AECOM</b>	<b>Mon 4/25/16</b>	<b>Tue 5/3/16</b>										
17	<b>Propagation</b>		<b>Mon 4/4/16</b>	<b>Thu 4/21/16</b>										
18	Existing Coverage Analysis	AECOM	Mon 4/4/16	Fri 4/8/16										
19	<b>Draft Existing Coverage Analysis Document</b>	<b>AECOM</b>	<b>Mon 4/11/16</b>	<b>Mon 4/18/16</b>										
20	Identify Sites	Orange County	Mon 4/4/16	Wed 4/6/16										
21	Future Coverage Analysis	AECOM	Thu 4/7/16	Fri 4/15/16										
22	<b>Draft Future Coverage Analysis</b>	<b>AECOM</b>	<b>Mon 4/18/16</b>	<b>Thu 4/21/16</b>										
23	Radio Traffic Analysis	AECOM	Mon 4/4/16	Thu 4/7/16										
24	<b>Alternatives Analysis</b>		<b>Mon 4/4/16</b>	<b>Tue 5/24/16</b>										
25	Interoperability Analysis	AECOM	Mon 4/4/16	Fri 4/8/16										
26	<b>Draft Interoperability Analysis</b>	<b>AECOM</b>	<b>Mon 4/11/16</b>	<b>Fri 4/15/16</b>										
27	System Attributes	AECOM	Mon 4/4/16	Mon 4/11/16										
28	Identify Alternatives	AECOM	Fri 4/22/16	Fri 4/29/16										
29	Cost Analysis	AECOM	Mon 5/2/16	Thu 5/5/16										
30	Impact Analysis	AECOM	Fri 5/6/16	Tue 5/10/16										
31	<b>Draft Alternatives Analysis</b>	<b>AECOM</b>	<b>Wed 5/11/16</b>	<b>Fri 5/20/16</b>										
32	<b>Review Meeting</b>	<b>Meeting</b>	<b>Mon 5/23/16</b>	<b>Tue 5/24/16</b>										
33	<b>Draft Needs Analysis</b>		<b>Wed 5/25/16</b>	<b>Tue 7/5/16</b>										
34	System Design Review	Meeting	Wed 5/25/16	Wed 5/25/16										
35	System Design	AECOM	Thu 5/26/16	Wed 6/8/16										
36	Outline Development	AECOM	Wed 5/25/16	Fri 5/27/16										
37	Develop Draft Document	AECOM	Mon 5/30/16	Fri 6/10/16										
38	Finalize Draft	AECOM	Mon 6/13/16	Fri 6/17/16										
39	<b>Publish Draft Needs Analysis</b>	<b>AECOM</b>	<b>Mon 6/20/16</b>	<b>Fri 6/24/16</b>										
40	<b>User Group Meeting #1</b>	<b>Meeting</b>	<b>Mon 6/27/16</b>	<b>Mon 6/27/16</b>										
41	<b>User Group Meeting #2</b>	<b>Meeting</b>	<b>Tue 6/28/16</b>	<b>Tue 6/28/16</b>										
42	Draft Approval	Orange County	Wed 6/29/16	Tue 7/5/16										
43	<b>Final Needs Analysis</b>		<b>Wed 7/6/16</b>	<b>Tue 9/6/16</b>										
44	Acquisition Process	AECOM	Wed 7/6/16	Tue 7/12/16										
45	Implementation Process	AECOM	Wed 7/6/16	Tue 7/12/16										
46	Migration Plan	AECOM	Wed 7/13/16	Tue 7/19/16										
47	Cost Analysis	AECOM	Wed 7/20/16	Mon 7/25/16										
48	Finalize Pre-Final	AECOM	Tue 7/26/16	Mon 8/1/16										

ID	Task Name	Resource Names	Start	Finish	January 1		June 11		November 21		May 1		October 11	
					11/1	1/17	4/3	6/19	9/4	11/20	2/5	4/23	7/9	9/24
49	Publish Pre-Final	AECOM	Tue 8/2/16	Mon 8/8/16										
50	Review Pre-Final	Orange County	Tue 8/9/16	Mon 8/15/16										
51	Review Comments	AECOM	Tue 8/16/16	Thu 8/18/16										
52	Technical Edit	AECOM	Fri 8/19/16	Wed 8/24/16										
53	Finalize Document	AECOM	Thu 8/25/16	Wed 8/31/16										
54	Publish Final Report	AECOM	Thu 9/1/16	Mon 9/5/16										
55	Board Meeting	Meeting	Tue 9/6/16	Tue 9/6/16										
56	System Procurement Support		Wed 9/7/16	Fri 8/11/17										
57	Propagation Finalization	AECOM	Wed 9/7/16	Tue 9/20/16										
58	Review/Approve System Coverage	Orange County	Wed 9/21/16	Tue 9/27/16										
59	Finalize System Coverage	AECOM	Wed 9/28/16	Tue 10/4/16										
60	Draft RFP		Wed 10/5/16	Thu 12/15/16										
61	Telecom Specifications	AECOM	Wed 10/5/16	Tue 10/18/16										
62	Equipment Specifications	AECOM	Wed 10/5/16	Tue 10/18/16										
63	Non-Fixed Equipment Finalization	Orange County	Wed 10/5/16	Tue 10/18/16										
64	Facility Specifications	AECOM	Wed 10/5/16	Tue 10/18/16										
65	Radio System Functional Design Plan	AECOM	Wed 10/5/16	Tue 10/11/16										
66	Sample Terms & Conditions	AECOM	Wed 10/5/16	Tue 10/11/16										
67	System Specifications	AECOM	Wed 10/12/16	Tue 11/1/16										
68	Terms & Conditions	Orange County	Wed 10/12/16	Tue 10/25/16										
69	Cost Sheet Preparation	AECOM	Wed 10/19/16	Tue 11/1/16										
70	Draft Assembly	AECOM	Wed 11/2/16	Thu 11/3/16										
71	PM Review	AECOM	Fri 11/4/16	Tue 11/8/16										
72	Technical Edit	AECOM	Wed 11/9/16	Tue 11/15/16										
73	Finalize Draft RFP	AECOM	Wed 11/16/16	Tue 11/22/16										
74	Publish Draft RFP	AECOM	Wed 11/23/16	Wed 11/23/16										
75	RFP Review Meeting	Meeting	Thu 12/1/16	Thu 12/1/16										
76	Review / Approval of RFP	Orange County	Fri 12/2/16	Thu 12/15/16										
77	Final RFP		Fri 12/16/16	Fri 1/6/17										
78	Finalize Document	AECOM	Fri 12/16/16	Thu 12/29/16										
79	Publish Final RFP	AECOM	Fri 12/30/16	Fri 12/30/16										
80	Release RFP	Orange County	Mon 1/2/17	Fri 1/6/17										
81	Proposal		Mon 1/9/17	Fri 3/10/17										
82	Pre-Proposal Conference	AECOM	Mon 1/9/17	Fri 1/27/17										
83	Proposal Preparation	Proposer	Mon 1/9/17	Fri 3/10/17										
84	Review Proposer Questions	AECOM/Orange	Mon 1/30/17	Fri 2/3/17										
85	Respond to Proposer Questions	AECOM/Orange	Mon 2/6/17	Fri 2/10/17										
86	Addenda	AECOM	Mon 2/13/17	Fri 2/17/17										
87	Technical Evaluation		Mon 1/9/17	Wed 5/3/17										
88	Evaluation Methodology	AECOM	Mon 1/9/17	Fri 1/20/17										
89	Review/Approve Evaluation Methodology	Orange County	Mon 1/23/17	Fri 1/27/17										
90	Technical Proposal Opening	Orange County	Mon 3/13/17	Mon 3/13/17										
91	First Pass Evaluation	AECOM/Orange	Tue 3/14/17	Mon 4/3/17										
92	Request Clarifications	AECOM	Tue 4/4/17	Mon 4/10/17										
93	Clarification Response	Proposer	Tue 4/11/17	Mon 4/17/17										
94	Final Technical Evaluation	AECOM/Orange	Tue 4/18/17	Mon 4/24/17										
95	Vendor Presentations	AECOM/Orange	Tue 4/25/17	Mon 5/1/17										
96	Evaluation Committee Meeting	Meeting	Tue 5/2/17	Wed 5/3/17										
97	Cost Evaluation		Tue 4/25/17	Tue 5/9/17										

ID	Task Name	Resource Names	Start	Finish	January 1		June 11		November 21		May 1		October 11	
					11/1	1/17	4/3	6/19	9/4	11/20	2/5	4/23	7/9	9/24
98	Cost Proposal Opening	Orange County	Tue 4/25/17	Tue 4/25/17										
99	Cost Evaluation	AECOM/Orange	Wed 4/26/17	Tue 5/9/17										
100	Negotiations		Wed 10/5/16	Fri 8/11/17										
101	Preliminary Evaluation Report	AECOM	Wed 5/10/17	Tue 5/16/17										
102	Request Vendor BAFOs	Orange County	Wed 5/17/17	Tue 5/23/17										
103	Evaluate Vendor BAFOs	AECOM	Wed 5/24/17	Fri 6/2/17										
104	Negotiations	Orange County	Mon 6/5/17	Fri 6/23/17										
105	Document Negotiations	AECOM	Mon 6/26/17	Fri 6/30/17										
106	Final Evaluation Report	AECOM	Mon 7/3/17	Fri 7/7/17										
107	Technical Contract Structure	AECOM	Mon 7/10/17	Fri 7/14/17										
108	Prepare Eval Presentation	AECOM	Mon 7/17/17	Fri 7/21/17										
109	Review/Approve Presentation	Orange County	Mon 7/24/17	Fri 7/28/17										
110	Presentation to Board	AECOM	Mon 7/31/17	Wed 8/2/17										
111	Approve Contract	Orange County	Thu 8/3/17	Wed 8/9/17										
112	Contract Sign	Orange County	Thu 8/10/17	Fri 8/11/17										
113	Licensing		Wed 10/5/16	Tue 6/6/17										
114	License Application Preparation	AECOM	Wed 10/5/16	Tue 11/1/16										
115	License Submission	Orange County	Wed 11/2/16	Tue 11/8/16										
116	License Application Approval	RPC	Wed 11/9/16	Tue 1/31/17										
117	Frequency Coordination	Coordinator	Wed 2/1/17	Tue 3/14/17										
118	License Approval	FCC	Wed 3/15/17	Tue 6/6/17										
119	Project Implementation Support		Thu 8/3/17	Thu 11/29/18										
120	Project Management Support	AECOM	Thu 8/3/17	Mon 7/30/18										
155	Design Review		Mon 8/14/17	Tue 3/13/18										
163	Physical Facilities		Wed 10/4/17	Tue 6/19/18										
169	Test Plan		Wed 10/4/17	Thu 10/11/18										
176	Installation		Wed 3/21/18	Tue 8/21/18										
181	Optimization	Contractor	Wed 8/22/18	Tue 9/4/18										
182	Acceptance		Wed 8/22/18	Thu 11/15/18										
205	Cutover	Contractor	Wed 10/31/18	Tue 11/13/18										
206	Final System Acceptance Report	AECOM	Wed 11/14/18	Thu 11/15/18										
207	Detailed Document Review	AECOM	Fri 11/16/18	Thu 11/29/18										

## Proposer References

We believe our familiarity and knowledge of public safety agencies enables us to coordinate with diverse work groups and achieve objectives, essential to the quality services we provide every client. We include below project descriptions that should help describe our qualifications and demonstrate our knowledge in more detail. Our clients' satisfaction is the best indicator of our success.

### Reference #1

<b>Company Name:</b>	Spotsylvania County, VA
<b>Company Address:</b>	8800 Courthouse Road, Spotsylvania, VA 22553
<b>Telephone/email:</b>	540-507-7552, <a href="mailto:JReeve@spotsylvania.va.us">JReeve@spotsylvania.va.us</a>
<b>Contact Person:</b>	Jane Reeve
<b>Services provided by proposer /vendor:</b>	AECOM performed a comprehensive analysis of the County's communication needs and developed a system replacement strategy that will serve the County for the next 10 to 15 years. AECOM developed an RFP and assisted the County during contract negotiations with the selected proposer. Currently AECOM is assisting the County with the implementation of a P25 Phase 2 radio system.

### Reference #2

<b>Company Name:</b>	City of Harrisonburg & Rockingham County, VA
<b>Company Address:</b>	101 North Main Street, Harrisonburg, VA 22802
<b>Telephone/email:</b>	540-434-2006, <a href="mailto:jjunkins@hrecc.org">jjunkins@hrecc.org</a>
<b>Contact Person:</b>	Jim Junkins
<b>Services provided by proposer /vendor:</b>	AECOM performed a comprehensive analysis of the County's communication needs and recommended a 800 MHz trunked radio system. AECOM developed an RFP and assisted the County during contract negotiations with the selected proposer. Currently AECOM is assisting the City and County with the implementation of a radio system. AECOM also designed the Emergency Operations Center. AECOM was recently contracted to assist the City and County in their evaluation of a system upgrade proposal from their current vendor, which will transition them to P25 Phase 2 technology. Our services include evaluating the vendors proposed design and pricing, providing implementation oversight services and serving as advocates for the client as they implement next generation technology.

### Reference #3

<b>Company Name:</b>	Davidson County, VA
<b>Company Address:</b>	913 N. Greensboro Street, Lexington, NC 27293
<b>Telephone/email:</b>	336-242-2030, <a href="mailto:Dwayne.childress@davidsoncountync.gov">Dwayne.childress@davidsoncountync.gov</a>
<b>Contact Person:</b>	Dwayne Childress
<b>Services provided by proposer /vendor:</b>	AECOM provided professional consulting services beginning with an initial analysis in 2005 studying Davidson County needs, and developing a recommended approach and design. AECOM experts in communications technology provided the County with conceptual system designs, architectures, and budget estimates at that time. In 2015 Davidson County requested AECOM assistance in the evaluation and negotiation of a proposal submitted by a vendor. AECOM evaluated the proposal and determined the County needs were not fully addressed in the proposal and subsequently developed a set of requirements through interviews, surveys, and discussions with stakeholders, that set forth a clear definition for a county-wide P25 trunked radio system. This set of requirements included site development, coverage requirements, and coverage acceptance testing.

# Response to Technical Requirements

# Response to Technical Requirements

AECOM understand the purpose of the study is to determine the most economical, efficient, reliable and state-of-the-art method for designing and provisioning a new countywide radio communications systems used by local government entities to meet the long term voice communications, paging, and voice interoperability needs of the emergency and non-emergency agencies serving residents, workers, and visitors of Orange County.

## Recommendations as to a proposed approach to the overall study, including:

### Identification of key project milestones.

The following are key project milestones:

- Notice to Proceed
- Initialization Meeting
- Interviews / Surveys
- Draft Existing Communications Capabilities
- Draft Existing Coverage Analysis
- Future Coverage Analysis
- Draft Interoperability Analysis
- Draft Needs Analysis
- Final Needs Analysis
- Draft FRP
- Final RFP
- Issue RFP
- Technical Proposal Opening
- Cost Proposal Opening
- Preliminary Evaluation Report
- Final Evaluation Report
- Contract Signing

### Number of expected meetings with the review committee.

- Stakeholder Meeting / Interviews
- Alternatives Analysis Review Meeting
- User Group Meeting to review Draft Analysis #1
- User Group Meeting to review Draft Analysis #2
- Board Meeting
- RFP Review Meeting
- Pre-proposal Conference
- Evaluation Committee Meeting
- Evaluation Presentation to Board

## Recommended timeline for the project, mapped out for compatibility with the County budgeting cycles.

We understand the CIP budgeting process works in correlation with the Operating Budget cycle for the County. This means to include the cost of a Countywide system in the next CIP budget the County will need to have solid budget information in May prior to the County Manager submission of a balanced recommend budget to the Board of County Commissioners (BOCC). This will allow us to assist you in answering questions during the working sessions and give the BOCC the confidence to include funding in the CIP and approve in June.

If we can begin this project in mid to late March (March 21), AECOM can provide to the County preliminary Alternatives data that can be used in the CIP budget process (May 20).

## Recommendations on effective stakeholder engagement throughout the process.

Our staff includes experts on each of the components of the radio system that Orange County is seeking to improve or replace. We are committed to professionalism, efficiency, technical excellence, and a keen understanding of the County support needs. We see ourselves as an extension of your staff and we will strive to be County advocates helping you attain your goals and objectives in a cost effective manner.

AECOM can establish a dedicated project website with a URL selected to appeal to a broad spectrum of potential readers. This website will not replace the County site, which speaks in a general way to activities of the County. Instead, it will present a "user-friendly" and relatively non-technical face to the project, in order to (1) make relevant interoperability information more accessible; (2) assist local non-government entities to participate; (3) provide a dedicated resource for local government and smaller jurisdiction public safety officials; and (4) promote the goals of emergency response and communications interoperability to the general public.

## Development of a comprehensive needs analysis addressing functionality, capability and needs of all current infrastructure users. Inputs shall include information obtained from current infrastructure users and previous studies completed for Orange County.

### On-site Project Kickoff Meeting

Beginning with a notice to proceed from the County, AECOM proposes to begin with an on-site project kickoff meeting. The purpose of the on-site meeting is to re-affirm the County's future vision and expectations, and review project plans, goals and details. We will

also review the project schedule and task milestones, responsibilities for both AECOM and the County, deliverables, background information needs, on-site meeting requirements and logistics.

Prior to this meeting, our project manager will send a letter to:

- Confirm the project team assignments
- Establish the agenda, expected participants and dates
- List materials and information needed as part of the assessment of the current radio system

### Background Information Review

AECOM was very privileged to work with Orange County in 2002 assisting with an assessment for long-term recommendation of a public safety grade system. In 2004, we were asked to update the assessment for an 800 MHz trunked radio system. In 2004, we assessed the County joining the statewide VIPER system and in 2005, we performed a coverage analysis and assisted with Talk Group Structure for participation on the VIPER System. These opportunities to collaborate with Orange County were both successful and rewarding for our team and we look forward to renewing our relationship with the County. AECOM has retained all of this information and will begin this project with a full understanding of all work previously completed and with this knowledge will be able to move the project forward in a rapid manner.

Our project team will review documentation on the County's existing operations on both the VIPER system and County VHF voice-tone paging system, the conventional paging system, microwave connectivity, ECC facilities and equipment, inventories, site data, FCC documents, the logging recording system, interoperability connectivity, and other records. This information will help us to better understand your current needs.

### Stakeholder Interviews

During the week of the kickoff meeting, we will complete a series of stakeholder interviews. AECOM's project manager and engineers will meet with the County's management and key stakeholders (designated by the County). Here, we will gather the information about today's operations, features, coverage, and performance issues

**Deliverable:** Documentation and assessment of existing communications capabilities; including review, summarization and validation of previous documents and studies.

**Gather, analyze, and document operational, functional, and specific technical information of existing fixed sites and associated equipment for various emergency service departments that serve Orange County residents (may be an Orange County based agency or a Department in a County adjacent to Orange County that serves/protects**

**geography within Orange County), or Orange County emergency service departments that serve residents outside Orange County in order to understand the present status of our communications capabilities.**

### Fixed Site Surveys

During this same time period, we will visit and survey your existing tower sites. Our detailed site and facility survey process and tools, along with discussions with your radio maintainers, will give us a thorough understanding of the condition of your current equipment reusable assets and inventory, and what needs to be upgraded or replaced. We anticipate focusing on the site addition, the tower replacement, necessary microwave upgrades, and evaluation of the power systems, space availability, and dispatch equipment.

As one of the foremost Architectural and Engineering companies in the world, AECOM can certainly bring to bear structural engineer to perform a structural analysis on each tower to be considered. This will be a significant expense to the project and the analysis will likely not be accepted by the winner vendor as they will need to perform an independent analysis to protect their risk. AECOM proposed to conduct a thorough pictography survey which will provide us sufficient information to make a determination of suitability for each tower considered.

AECOM will survey your existing dispatch center to determine the current state of each console system and other dispatch systems. AECOM's dispatch center experts will review the existing systems to determine their compatibility with system replacement or upgrades and other functions or capabilities that are needed.

Our surveys include but are not limited to:

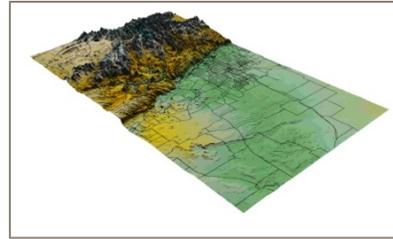
- Compile client and FCC database information
- Document site conditions, site access roads, space availability, and site security
- Document shelter conditions and space availability in shelters
- Photo document the site infrastructure and equipment
- Assess power generator systems and fuel systems
- Assess visible grounding systems
- Compile client and FCC database information
- Document site conditions, site access roads, space availability, and site security
- Document shelter conditions and space availability in shelters
- Photo document the site infrastructure and equipment
- Assess power generator systems and fuel systems

- Assess visible grounding systems
- Document detail on the tower, antenna types and heights
- Inventory and assess radio and microwave equipment
- Inventory and assess Logging Recorder system and Console systems
- Inventory and assess other communication facility dispatch equipment

From the completed stakeholder interviews and our survey documentation of your current facilities, sites and equipment, we will develop a document that outlines the new systems' functional requirements.

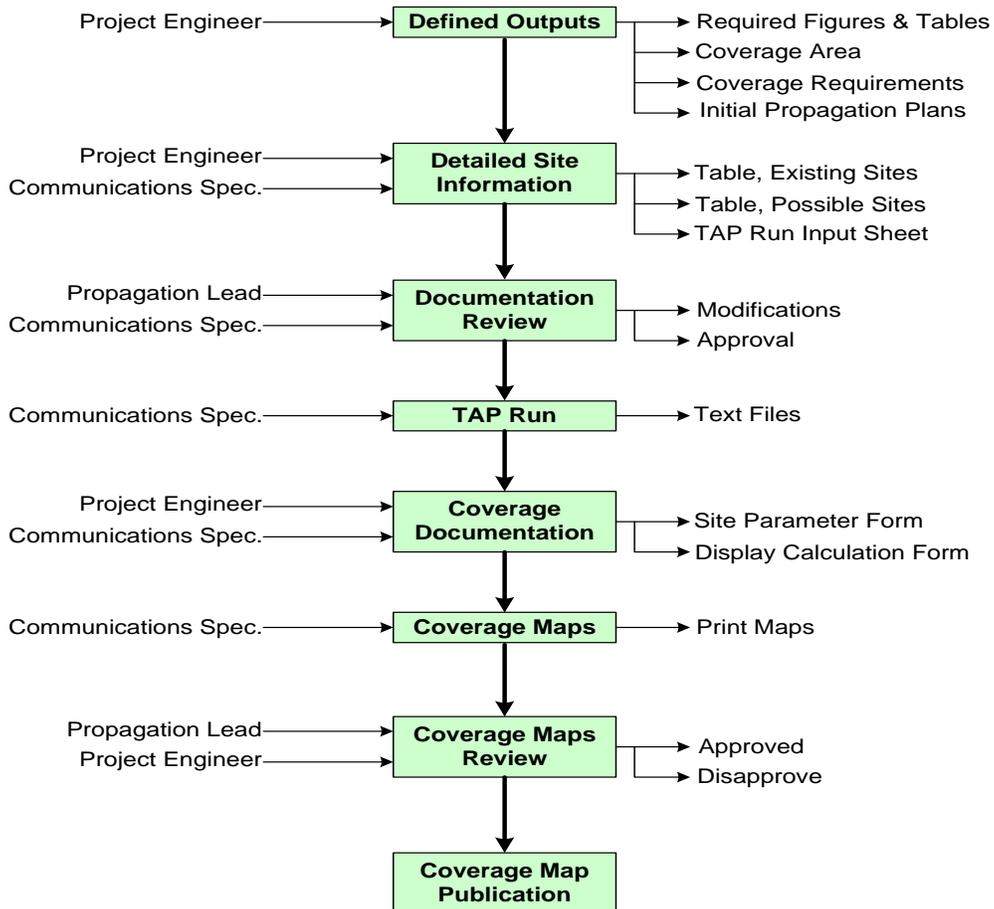
### Existing Coverage Analysis

AECOM has developed a proprietary Propagation, Coverage, and Loading Analyst (P-CALA) SM software to predict coverage. This tool was tested at the federal level against all of the commonly used



predictive tools in the industry and rated the highest in accuracy based upon actual system coverage testing. AECOM will utilize this tool to provide the current coverage prediction and verify coverage gaps. We will provide the coverage maps in Draft form to the County for review and comment.

AECOM will utilize the following propagation process and review methodology:



**Deliverable:** Coverage maps depicting current public safety infrastructure user performance for both mobile and portable radios, and paging receivers, to verify gaps as noted from the various interviews.

**Conduct and analyze coverage studies of proposed infrastructure based on multiple tower sites in order to provide countywide coverage including the potential of new communications sites, additional “satellite” receiver sites, and/or paging sites.**

AECOM will make recommendations for locations where future build-out sites would be located geographically and include a revised site map of the system showing the current and proposed sites.

**Coverage Analysis**

The functional requirements document will specify coverage and performance requirements for the upgraded/new P25 trunked digital system. Coverage requirements will be based on use of the portable, mobile, and paging subscriber units as well as in-building requirements. With coverage requirements solicited from the County’s user community, our team will use P-CALA<sup>SM</sup> software, to develop a Coverage Design using a combination of existing radio sites augmented by new sites located to minimize “dead spots”. We will incorporate operation from within buildings, and differentiate between the types of buildings constructed in various parts of the County. The Coverage Design provided by our P-CALA<sup>SM</sup> specialists will establish a system configuration, and identify preliminary locations for radio sites.

**Radio Traffic Analysis**

The functional requirements will specify the requirements for P25 capacity, system reliability, and availability. “System Availability” includes two aspects: *Capacity* (availability of a radio channel when the user needs to talk), and *Coverage* (sufficient radio signal at the location where the user needs to talk). Using AECOM’s **Capacity Analysis Model (CAM)**<sup>SM</sup> software, with inputs derived from the Survey and other information provided by the County, our CAM<sup>SM</sup> specialists will carefully look at the County’s user requirements to establish the size of the system based on an acceptable *Grade of Service* projected for the busiest hour of any week.

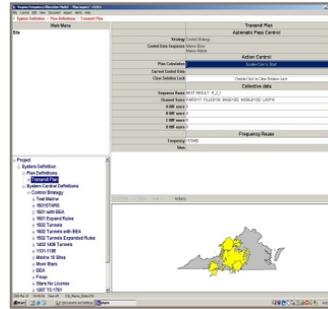
**Deliverable:** Propagation studies showing expected coverage of the recommended system at standards identified by end user needs and as approved by the committee for both mobile and portable radios, and paging receivers.

**Review interoperability needs with all agencies serving citizens and/or territory within the county and those law and fire/EMS agencies bordering Orange County, including gateway or P25 ISSI needs for users not served by the proposed infrastructure (i.e.: ambulances from outside Orange County needing inter-communications with**

**Orange County based hospitals) as may be identified.**

**Interoperability Requirements**

AECOM will review the current interoperability arrangements with neighboring agencies and will reach out to key interoperability partners in the region as appropriate to understanding current and future interoperability plans and needs. AECOM will review this information



with the end goal of providing a logical and effective means of interoperability to and from the new radio system.

Interoperability has been defined in a number of ways. At AECOM, we define interoperability as the ability of people from different agencies to communicate with each other. With the focus on the end result, it is clear that interoperability involves more than just a technical solution. In order for interoperability to be successful, there must be careful and extensive planning and training for all of those involved. The planning must be done well in advance. When the storm is bearing down on the County, it’s too late. The training must not only be done early on, it must be repeated frequently so that the appropriate actions to facilitate interoperability become routine.

The Public Safety Wireless Network program (PSWN) has identified three different types of interoperability:

- Day-today interoperability covers routine public safety operations, such as responding to a building fire that requires backup from a neighboring fire department, or a vehicle chase that crosses between towns.
- Mutual aid interoperability supports a joint and immediate response to catastrophic accidents, large scale incidents and natural disasters. It supports tactical communications in response to airplane crashes, bombings, forest fires, earthquakes, hurricanes, and other similar events that occur without warning.
- Task force interoperability supports local, state, and federal agencies collaborating for an extended period of time to address a particular problem. For example, a task force might lead extended recovery operations, provide security for major events, or respond to prolonged criminal activity. These are activities that must be planned in advance.

AECOM personnel have the operational experience and they have been actively involved in many of the organizations and groups that have set the standards for interoperability at state and national levels. Our

people have participated in the Public Safety Wireless Advisory Council, been chapter officers of several state chapters of APCO and the National Emergency Number Association (NENA), participated in numerous APCO Projects (3, 13, 16, 16a, 17, 25, 35 and 37). In addition, AECOM personnel have been active participants in the APCO Homeland Security Task Force.

We will bring this knowledge to bear to determine the appropriate interoperability recommendations for both intra and inter County communications.

**Deliverable:** Analysis of interoperability gaps as provided through interviews of the various existing infrastructure users.

**Presentation of infrastructure alternatives to the review committee for the purposes of narrowing the alternatives down to one (1) recommended solution to be approved by the committee that will be the basis of the balance of the project. Alternatives that will be presented shall include pros, cons, advantages, disadvantages, issues and considerations specific to the needs of Orange County users. Obtain and submit budgetary costs for alternatives presented, and assist the review committee to prioritize acquisitions and implementation.**

#### System Attributes

The functional requirements will also specify the requirements for P25 features and functionality. The first step is to establish the System Attributes, which are the operational features that reflect the needs of your user community. While in the course of developing the Conceptual System Design, we may identify several potential viable configurations, each of these configurations will be evaluated against their ability to fulfill your System Attributes.

Finally, the new systems' functional requirements will specify the numerous supporting systems that are required for to operate a successful and resilient communications system, including tower, site, shelter, power, microwave, and ECC facility requirements.

One of the key success factors for the County and AECOM will be the ability to choose between a large range of configurations. AECOM possesses the knowledge and experience in this type of project to develop, with the County, multiple approaches to a solution. Our experience has shown that each locality is unique and as such will require a unique solution. AECOM will explore each possible solution with the County and most importantly, explain the advantages and drawbacks inherent to each solution. The ultimate goal is to prepare the County's leadership to make informed and effective decisions for your Interoperability needs.

AECOM will identify the potential approaches that could meet the County's needs. From that list, we will select the most viable approaches, and perform sufficient analysis and design to enable us to rank these alternatives in order of applicability to the County's operations.

- The design of the Radio System, Microwave System, and the Data System become interdependent and begin to merge. AECOM will integrate these networks into a cohesive communications system, in a conceptual form. At this point we will have the information required to understand what capacity reserves are available and can be offered to other potential users, such as: County engineers, human services, municipal utilities, rural electric cooperatives, energy companies, education (primary/secondary/post-secondary) institutions, public safety organizations, hospitals and the health network system, and other entities that are identified during the process.
- Frequency range and spectrum availability
- Wide band versus narrow band
- Analog, digital, P25 Phase 1 & 2
- Encryption options and capabilities
- Operating protocol (conventional / trunking)
- Infrastructure Configuration Options
- Procurement options (ownership and funding)
- Interoperability requirements
- Propagation studies
- Budgetary cost estimates
- User requirement matrix

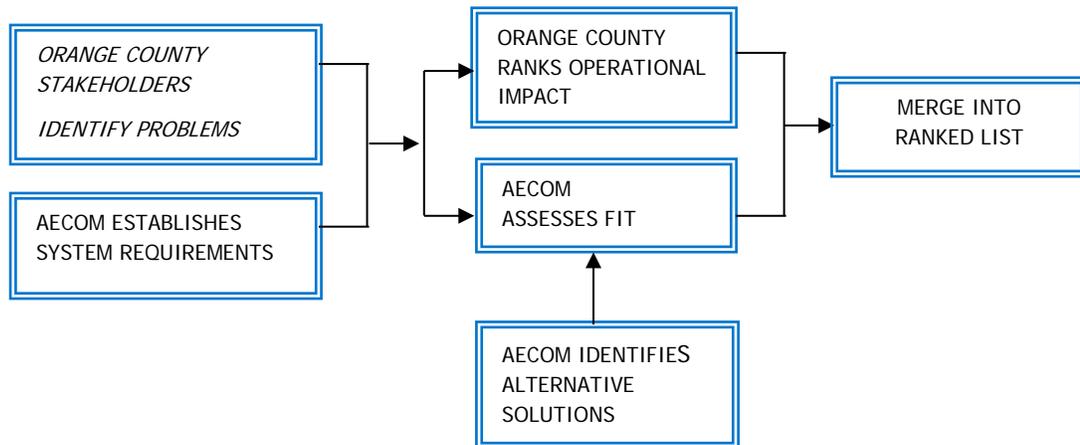
### Impact Analysis

All of the AECOM tools and methodologies we have developed over the last 30 years, to gather and analyze data have been developed to provide a well thought out system design to meet your goals and vision. The study will describe how the alternatives ranking, frequency plans, and coverage design will benefit your County and the participating users.

We recognize how important it is to have a rigorous decision making process for large capital projects considering multiple possible alternatives. To this end, we have developed our interactive **Impact Analysis Process<sup>SM</sup>**.

We will work with the County to assess the impact on its operations of the presence (or absence) of each System Requirement established earlier. We will then assess the ability of each Alternative to support each System Attribute. Merging these two assessments provides a ranking which, when combined with estimated cost information and AECOM recommendations, will allow you to make informed decisions. The process, shown below provides sufficient resolution that the benefit-cost results can be tailored to the County's budget.

### Impact Analysis Flow Chart



AECOM has experience with supporting clients to achieve radio system awards (both competitive and negotiated) for each of the major radio equipment manufacturers. In addition, AECOM also has great experience and examples where we have helped customers achieve significant cost savings through structuring separate procurements for microwave, tower and site civils, and subscriber radios.

AECOM will critically review options of upgrading the existing system or new system procurement when evaluating best system procurement options. Our experience generally has found that issuing a competitive specification that contains a module for each of the components listed above allows the County the most flexibility. Each component is specified independently, thus allowing the opportunity to negotiate and procure as a turnkey system or separate systems, to potentially achieve significant cost savings. This is an approach we have utilized for many localities with great success.

We look forward to sharing with the County our knowledge and discussing the pros, cons, and potential cost benefits of such strategies as we work together to find the best acquisition that will fit your CIP budget and allow for a smooth migration for your user community.

**Deliverable:** Alternatives analysis, budgetary costs for alternatives presented, and recommendation to committee to prioritize acquisitions and implementation.

**A draft needs analysis shall be presented to the end-users for validation in at least two group meetings, and then to the committee for final approval.**

AECOM will perform the analysis and draft the upgrade options, costs estimates, and potential upgrade benefits. We will capture weaknesses in the existing communications, future requirements, potential coverage improvements, upgrade schedule/logistics and cost/benefits to include expected life, value, and replacement costs for dispatching and radio operation equipment. This information will be delivered as our Draft Needs Analysis Report. AECOM will meet with end users, in two group meetings, to review the draft information, answer questions, collect feedback, and work toward a consensus project approach.

Upon achieving consensus on an appropriate project approach, we will present the needs analysis, alternative, and the group consensus to the County committee for final approval.

**Deliverable:** Draft needs analysis, two user group meetings, and a County Committee meeting.

**Recommend and submit a planned acquisition and implementation process based on the option approved by the review committee. Develop a comprehensive migration plan for all current infrastructure users. Develop a comprehensive cost analysis.**

**Acquisition/Implementation Process**

AECOM has experience with supporting clients to achieve radio system awards (both competitive and negotiated) for each of the major radio equipment manufacturers. In addition, AECOM also has great experience and examples where we have helped customers achieve significant cost savings through structuring separate procurements for microwave, tower and site civils, and subscriber radios.

Our experience generally has found that issuing a competitive specification that contains a module for each of the components listed above allows the County the most flexibility. Each component is specified independently, thus allowing the opportunity to negotiate and procure as a turnkey system or separate systems, to potentially achieve significant cost savings. This is an approach we have utilized for many localities with great success. We look forward to sharing the County our knowledge and work together to find the best acquisition/implementation strategy for the County.

AECOM recognizes that localities often cannot afford to complete a major radio system upgrade over a short timeframe. We routinely work with clients to develop budget/phasing options which suit the clients’ needs. Orange County is interested in phasing in new consoles, radio infrastructure, and subscribers in a sensible and fiscally responsible way. We will consider the stakeholder needs, all the analysis described above, and any budget constraints to develop phased project options/costs/recommendations for the County’s consideration.

**Migration Plan**

AECOM will provide a migration plan for each participating entity. Best Practices and essential elements to be incorporated into a migration plan:

- The most schedule efficient and cost effective implementation plan would be one where the entire project was planned, funded and scheduled as one sequential and cohesive effort
- The plan needs to maintain operational capability during migration
- The plan should sequence and prioritize dependent activities to avoid a negative cascading schedule impact
- Assign adequate County resources to be in Project Management (PM) and Coordination roles

- Develop and follow a project communications plan to keep all impacted individuals updated as to status, necessary actions and schedule
- Assess risk potential and develop risk avoidance and mitigation strategies

**Cost Analysis**

AECOM will provide detailed cost estimates for the system equipment and scopes of work to be done for all the solicitations developed. The costing information is obtained from historical AECOM cost files and vendor pricing of comparable projects. The various costs are compared and weighted in order to derive an average "list price" type of estimate. Estimates reflect expected list, negotiated, and competitive bidding pricing:

**List Estimate**

Items and categories of equipment are applied to the List Costs database that AECOM has created. This database is created by our compilation of all known costs converted to this list costs status, creating a common basis of estimation. List Costs figures are the inputs for all of our calculations and all estimates begin with a List Cost level.

**Negotiated Estimate**

We have adjusted the List Costs for the effect of negotiating with a sole source vendor or system integrator. The Lists Costs are reduced by the percentages that we have typically seen in this type procurement. Each cost element is affected in differing ratios based on the experience in previous procurements.

**Competitive Estimate**

Estimates are further reduced to reflect the cost reduction we have seen in highly competitive areas. Again, the cost elements are reduced in differing ratios to account for the impact of competition on purchasing.

Estimates will be developed for the major categories of equipment as they apply to the County radio system. The costs of a modern radio communication system consider a number of interrelated factors:

- Present and future requirements
- Coverage
- Interoperability
- Performance
- Capacity
- System reliability
- Maintainability
- Features

Our cost database is updated with each new project. As a predictive tool, our process produces cost estimates within 5% to 10% of the realized cost. This allows us to easily spot irregularities in price proposals.

**Deliverable:** Final Needs Analysis, to include a transition plan for all current infrastructure users to the new/proposed infrastructure and detailed cost estimate.

**Develop a vendor-neutral Request for Proposal (RFP) suitable to be released to the vendor community for the purposes of procuring the approved alternative.**

AECOM's philosophy for procurement for communications systems has always been functional in nature. Our specifications have been refined over many years, and inherently encourage the radio system supplier to choose the sites and equipment needed to meet the capacity and coverage requirements. We have developed evaluation techniques that complement this functional philosophy. These techniques are sufficiently robust that after some 50 competitive procurements of systems ranging from single sites to over 200 sites, **there has never been a successful protest of an award.** Indeed, the process is so complete that there has only been one protest in our entire history, and that was defeated on the basis of the process we have evolved.

Purchasing a multi-component communications system can be a complex and detailed process. To provide for the most fiscally responsible procurement strategy, AECOM views the County's project in terms of elements that must all come together within a specified period of time:

- Voice/Data System
- Connectivity System
- Subscriber Equipment

AECOM recommends issuing an RFP that contains a module for each of the various elements independently, thus allowing the opportunity to negotiate and procure separately for each element.

Proposers should be allowed to bid on more than one element if they so desire. However, it should further be required that the proposers provide a full and separate submission for each element proposed, to include complete pricing for each element independent of the other elements. If a proposer chooses to submit proposals on more than one element, they are encouraged to provide a multiple system discount if the County contracts with them for two or more elements.

**Frequency Licensing**

AECOM will complete a review of your existing FCC licenses and determine what changes need to be made to accommodate the proposed system design.

**Functional Specifications Development**

AECOM will develop the Functional Specifications portion of the procurement documentation for the radio and, microwave systems. State-of-the-art radio systems can be complex, and by necessity, unique to each situation. Our functional/operational approach to specifications allow system proposals the latitude to

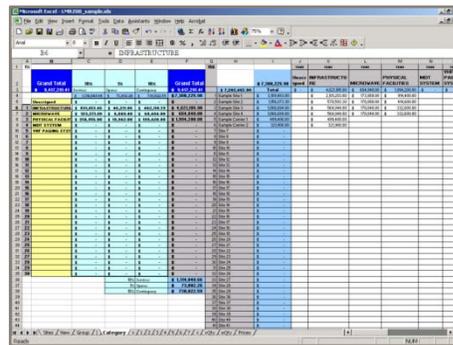
offer their own configurations, while retaining interoperability and meeting other essential requirements and operational characteristics developed specifically for the County.

**Facilities Specifications Development**

AECOM will review the need to develop any facility enhancement or new facility specifications as part of the total procurement package. We will coordinate with your staff to provide input regarding facilities specifications that will emphasize reliability by requiring redundancy in support systems, and physical security for all equipment. Air conditioning should be redundant, and electric supply should be backed up by UPS and standby generator. Grounding and surge protection should meet the highest standards, and buildings and fuel tanks should be designed to resist vandalism.

**Price Specifications Development**

AECOM will develop pricing specifications related to the vendor price proposals, including financing terms and options, and milestone payments. In addition, AECOM will create forms to submit price information, and associated Offeror instructions.



**Evaluation Criteria Development**

A well-formulated and logical evaluation process is essential for the smooth execution of a competitive procurement. To this end, AECOM will assist you in developing evaluation criteria, including our recommendations for weighted evaluation factors and an overall scoring system. When the evaluation criteria are included in the procurement documentation, it tends to establish vendor concurrence with the process for the record.

**Draft Functional Specifications**

AECOM will issue the functional specifications in draft form for your review and comment. You will be asked to provide a single consolidated list of changes or comments. The functional specifications include our recommended payment milestones and proposal requirements.

**Specification Review Meeting**

AECOM will meet with your staff (via teleconference) to review and discuss the status of the specifications and answer any questions concerning RFP - Functional Specifications development.

**Final RFP - Functional Specifications**

Our project team will revise the Draft Functional Specifications, incorporating your comments and will

provide the finalized RFP - Functional Specifications to you. The procurement pricing section will also be provided in Excel format with the expectation the vendors will use this format to submit their system pricing and facilitate an accurate and efficient evaluation process.

**Deliverable:** A vendor-neutral Request for Proposal (RFP), including recommended tower requirements suitable to be released to the vendor community for the purposes of procuring the approved alternative.

**Facilitation of the RFP process, including staff support to the County in conducting a comprehensive evaluation of RFP responses received.**

#### Evaluation Criteria

A well-formulated and logical evaluation process is essential for the smooth execution of a competitive procurement. To this end, AECOM will assist the County in developing evaluation criteria, including our recommendations for weighted evaluation factors and an overall scoring system. When the evaluation criteria are included in the procurement documentation, it tends to establish vendor concurrence with the process for the record.

#### Pre-Proposal Activities

AECOM will support the County by answering proposer's technical questions during the proposal evaluation period. We will also hold a pre-proposal teleconference in which we will walk the proposers through the RFP and answer questions. We will provide follow up on any questions and support the purchasing department as requested with any addenda issuance.

#### Technical Evaluation

AECOM will assist your proposal evaluation team throughout the process. We will serve as your technical and price advisor, and as you request, not submit a vote or score to your committee.

AECOM will provide careful attention to detail and documentation throughout the evaluation process in order to mitigate the risk of protest by any unsuccessful vendor(s). The Evaluation Process begins with AECOM creating a Proposal Evaluation Matrix for each vendor submission. This Matrix will be used throughout the Evaluation Process to properly document the Technical and Price Evaluations.

Our Project Team will prepare a detailed Technical Evaluation of up to three proposals (which may include alternate proposals from the same vendor). Our Project Team will implement a multi-step technical evaluation process in which our Project Team first reviews each proposal for technical content. Then, in consensus with the County's selection committee, the Project Team will request clarifications from the vendors where required, review responses, and update the technical portion of the Proposal Evaluation Matrix.

#### Price Evaluation

After completion of the Technical Evaluation, the AECOM Project Team will next review the price proposals for technical accuracy and reasonableness, which may entail requesting additional clarifications from each proposer. Each vendor's price information will be entered into the AECOM Proposal Variance Analyst<sup>SM</sup> software, and combined with the Technical Evaluation information to determine total proposal variance for each of the vendor submissions.

AECOM's price evaluation process and software is highly integrated. It relies on a pricing database, constantly updated from our recent price proposals. The prices we evaluate at this step should be highly correlated to the cost estimates we provided you during options review and budgeting. Proposal prices generally come in with a few percent of our estimates. Our process has also proven very useful in spotting proposal price errors. We can also solicit lifecycle support costs, a very important consideration in the County budgeting process. We can offer our experience with all the major vendors current support packages and their recent pricing.

#### Vendor Presentations/Demonstrations

AECOM can participate in vendor presentations or demonstrations held at a County location, upon concurrence with the County on the vendors to be interviewed. Based upon new information gathered at these presentations, our Project Team will update the technical portion of the Proposal Evaluation Matrix and establish each vendor's proposal's compliance according to the RFP's technical evaluation factors.

#### Evaluation Report

AECOM will document our Evaluation Process and prepare an Evaluation Report that will include Technical and Price Evaluation results, and AECOM's recommendation for the most responsive and cost effective proposal for the County. AECOM's Proposal Variance Analyst<sup>SM</sup> software is unique in that it allows our Project Team to include as part of Evaluation Process an unbiased and impartial overall ranking of the vendor proposals.

#### Negotiations Support

To help achieve a strong contract, AECOM will recommend that the following items be included with the vendor's proposal for our review during negotiations:

- Detailed vendor statements of work for all work to be performed
- Well defined coverage proposal and test plans
- Well defined acceptance testing plans with definitive pass/fail criteria.
- Well defined cutover plans.
- Warranty and support plans with contract terms to ensure vendor performance and schedules are met, including liquidated damages,

retention of fees and proper warranty guarantees.

As an option, AECOM will provide on-site contract negotiations support and assistance during negotiations with the selected vendors. Our experience and technical knowledge with the implementation of complex radio projects will help the County to understand both the competitive industry costs and technical requirements in order to achieve a best-value contract and to minimize costs to the County. We believe that our presence during negotiations can provide client value and help establish good relationships for the remainder of the project phases.

**Deliverable:** Criteria to be used for vendor selection. Evaluation support, evaluation meeting, and evaluation report. Negotiations support.

**Create and submit computer aided design (CAD) drawings as required. Recommend training requirements.**

AECOM will provide necessary CAD drawings in support of the Conceptual Design and the Specification. AECOM's Project Team will review the Contractor's Training Plans for completeness and conformance to the specifications.

**Deliverable:** CAD drawings as required. Recommended training requirements for the new communications system

# Cost Proposal

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# Cost Proposal

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Per Addendum 4 dated February 24, 2016, we have included two copies of our Cost Proposal information along with a copy of Attachment D – Cost Summary Sheet in a separate sealed envelope.

# Required Forms

**Attachment A**

**SIGNATURE AFFIDAVIT**

In signing this proposal, we also certify that we have not, either directly or indirectly, entered into any agreement or participated in any collusion or otherwise taken any action in restraint of free competition; that no attempt has been made to induce any other person or firm to submit or not to submit a proposal; that this proposal has been independently arrived at without collusion with any other proposer competitor or potential competitor; that this proposal has not been knowingly disclosed prior to the opening of proposals to any other proposer or competitor; that the above statement is accurate under penalty of perjury.

The undersigned, submitting this proposal, hereby agrees with all the terms, conditions and specifications required by the County in this Request for Proposal, and declares that the attached proposal and pricing are in conformity therewith.

Cheryl S. Giggetts, PMP, CHS-III  
Name (Type or Print)

Senior Vice President  
Title

*Cheryl S. Giggetts*  
Signature

AECOM Technical Services of North Carolina, Inc.  
Firm

701 Corporate Center Drive, Suite 475, Raleigh, NC 27607  
Address: (Street, City , State, Zip Code)

434.582.5500  
Telephone

434.239.9221  
Fax

Cheryl.Giggetts@aecom.com  
E-Mail

February 18, 2016  
Date

**Attachment B**

**VENDOR DATA SHEET**

**1. Proposing Company Name** AECOM Technical Services of North Carolina, Inc.  
Telephone 434.582.5500 Toll Free Telephone N/A Fax 434.239.9221  
Address: 701 Corporate Center Drive, Suite 475  
City: Raleigh State: North Carolina Zip + Four: 27607-5238

**2. Contact Person in the event there are questions about your proposal**  
Name: Cheryl Giggetts Title: Senior Vice President  
Telephone: 434.582.5500 Toll Free Telephone: N/A  
Address: 701 Corporate Center Drive, Suite 475  
City: Raleigh State: North Carolina Zip + Four: 27607-5238

**3. Mailing address where County purchase orders/contracts are to be mailed and person the Department can contact concerning orders and billing.**  
Name: Cheryl Giggetts Title: Senior Vice President  
Telephone: 434.582.5500 Toll Free Telephone: N/A  
Address: 20715 Timberlake Rd Suite 106  
City: Lynchburg State: Virginia Zip + Four: 24502-2780

## Attachment C

## REFERENCES

Provide company name, address, contact person, telephone number, and appropriate information on the product(s) and/or service(s) used for three (3) or more installations/services with requirements similar to those included in this solicitation document. If vendor is proposing any arrangement involving a third party, the named references should also be involved in a similar arrangement.

**Company Name:** Spotsylvania County, VA  
**Company Address:** 8800 Courthouse Road, Spotsylvania, VA 22553  
**Telephone/email:** 540-507-7552, [JReeve@spotsylvania.va.us](mailto:JReeve@spotsylvania.va.us)  
**Contact Person:** Jane Reeve

**Services provided by proposer/vendor:** AECOM performed a comprehensive analysis of the County's communication needs and developed a system replacement strategy that will serve the County for the next 10 to 15 years. AECOM developed an RFP and assisted the County during contract negotiations with the selected proposer. Currently AECOM is assisting the County with the implementation of a P25 Phase 2 radio system.

**Company Name:** City of Harrisonburg & Rockingham County, VA  
**Company Address:** 101 North Main Street, Harrisonburg, VA 22802  
**Telephone/email:** 540-434-2006, [jjunkins@hrecc.org](mailto:jjunkins@hrecc.org)  
**Contact Person:** Jim Junkins

**Services provided by proposer/vendor:** AECOM performed a comprehensive analysis of the County's communication needs and recommended a 800 MHz trunked radio system. AECOM developed an RFP and assisted the County during contract negotiations with the selected proposer. Currently AECOM is assisting the City and County with the implementation of a radio system. AECOM also designed the Emergency Operations Center.

AECOM was recently contracted to assist the City and County in their evaluation of a system upgrade proposal from their current vendor, which will transition them to P25 Phase 2 technology. Our services include evaluating the vendors proposed design and pricing, providing implementation oversight services and serving as advocates for the client as they implement next generation technology.

**Company Name:** Davidson County, VA  
**Company Address:** 913 N. Greensboro Street, Lexington, NC 27293  
**Telephone/email:** 336-242-2030, [Dwayne.childress@davidsoncountync.gov](mailto:Dwayne.childress@davidsoncountync.gov)  
**Contact Person:** Dwayne Childress

**Services provided by proposer/vendor:** AECOM provided professional consulting services beginning with an initial analysis in 2005 studying Davidson County needs, and developing a recommended approach and design. AECOM experts in communications technology provided the County with conceptual system designs, architectures, and budget estimates at that time. In 2015 Davidson County requested AECOM assistance in the evaluation and negotiation of a proposal submitted by a vendor. AECOM evaluated the proposal and determined the County needs were not fully addressed in the proposal and subsequently developed a set of requirements through interviews, surveys, and discussions with stakeholders that set forth a clear definition for a county-wide P25 trunked radio system. This set of requirements included site development, coverage requirements, and coverage acceptance testing.

