Orange County, North Carolina

"Unleashing the Power of Technology"

Technical Proposal for:

Countywide Radio Communications Interoperability and Consulting Services

RFP No. 5217

Federal Engineering®

March 1, 2016

"Unleashing the Power of Technology"

Federal Engineering®

Federal Engineering, Inc.
10600 Arrowhead Drive
Fairfax, VA 22030
703-359-8200

March 1, 2016

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

Dear Mr. Cannell:

Federal Engineering, Inc. (***FE***) is Orange County, North Carolina's best choice to fulfill the requirements defined in the County's RFP #5217 for Countywide Radio Communications Interoperability and System Engineering Services, as amended and clarified in Orange County's responses to questions via Addendum 1 dated February 8, 2016, Addendum 2 dated February 12, 2016, Addendum 3 dated February 23, 2016, and Addendum 4 dated February 24, 2016. As required, the addendum acknowledgment forms are provided in *Section 5—Required Forms*. With over 32 years of experience, ***FE*** leads the industry in providing public safety radio system consulting services.

FE's proposal is complete and fully compliant with all of the requirements in the RFP as noted herein and describes, in detail, how we will accomplish the required tasks. ***FE*** possesses all permits, licenses, and professional credentials necessary to perform services as specified in the RFP. In addition, we unconditionally accept the project specifics, goals, and contractor responsibilities as delineated in this proposal and hereby express our commitment to work under the directives provided by the designated County project manager.

Because Orange County is considered a key client, I will be your contact regarding this proposal and will participate in the negotiation of contractual issues. By my signature below, I hereby authorize submission of this proposal and bind Federal Engineering, Inc. to the terms and conditions of this proposal for a period of 90 days, beginning on the due date for proposals.

FE looks forward to working with Orange County, North Carolina on this project.

Sincerely,

Ronald F. Bosco

Ronald F. Bosco
President and Chief Executive Officer
Federal Engineering, Inc.

ORANGE COUNTY, NORTH CAROLINA

RFP #5217

COUNTYWIDE RADIO COMMUNICATIONS INTEROPERABILITY AND SYSTEMS ENGINEERING SERVICES

Submitted to

Mr. David Cannell, Purchasing Agent
200 S. Cameron Street
Hillsborough, NC 27278
Email: dcannell@orangecountync.gov
Phone: 919 245-2651

Closing Date

March 1, 2016

Federal Engineering Contact

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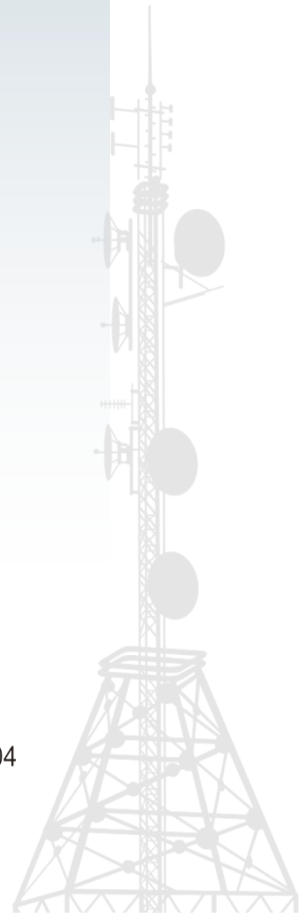

Proprietary Notice

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EXECUTIVE SUMMARY

Orange County, North Carolina, has a rich and prosperous history, contributing to the shaping of America, particularly the southeastern United States and the State of North Carolina. Its young population (the median age is 30) enjoys rolling hills, forests, and rural farming communities in addition to the teeming industrial, academic, and urban landscape. Its progressive culture makes Orange County a leader in embracing change.

It is home to the University of North Carolina (UNC) at Chapel Hill, the first public university in the nation, which among its many contributions fosters technological research. The area—anchored by North Carolina State University, Duke University, and UNC at Chapel Hill and includes the cities of Raleigh and Durham and the towns of Cary and Chapel Hill—comprises what is known as The Research Triangle. This area produces a highly skilled workforce and attracts skilled workers from other areas.

The current County population estimate is a little over 140,000, representing a consistent double digit growth since the 1950 U.S. Census. The enrollment at UNC adds another 29,000 transient residents, as well as visiting families of students and others who come to participate in academic and athletic events. The County has much to offer a young population. The County is home to the Orange County Speedway, boasting the fastest 3/8 mile track in the U.S. Orange County tourism contributes over $181 million annually to the tax base of the County.[1] In addition, Orange County is included in the Durham-Chapel Hill Metropolitan Statistical Area, which has a combined population of nearly 2 million people. The cities of Durham, Mebane, and Chapel Hill are situated partially in Orange County.

All these characteristics that make Orange County so desirable as a place to live, work, learn, and visit present many challenges to the public safety and public service agencies and schools that serve the County's population.

Project Understanding

Orange County recognizes the importance of effective, reliable radio communications among all the agencies that protect and support its way of life. The County uses North Carolina's statewide Voice Interoperability Plan for Emergency Responders (VIPER) network as its primary means of public safety voice communications. In 2012 the County engaged Federal Engineering (***FE***) to assess its radio communications operation and make recommendations for enhancing coverage. ***FE*** enjoyed a successful working relationship with the County and completed the project to the satisfaction of the County.

At the time of the previous system assessment, the County's primary concern was coverage. Since the completion of the 2012-2013 project, the County's population has grown by 7,000. The County

[1] http://www.visitchapelhill.org/information-statistics/tourism-statistics/

now faces challenges of coverage, capacity, and the age of its existing equipment. In addition, the communications system the County envisions will include public works agencies, public schools, and interoperability with the surrounding counties of Person, Durham, Chatham, Alamance, and Caswell. A replacement system must address the following issues:

- Expanding user needs
- Existing equipment limitations and desired features for replacement equipment
- Capacity of the existing equipment to accommodate current and anticipated growth
- Changes in coverage, interoperability and user expectations

The project entails collecting and analyzing user and stakeholder requirements, understanding currently available technology and options, and identifying workable solutions.

Why Federal Engineering?

Federal Engineering offers the County qualifications and experience unequaled by any other firm. Our recent work with Orange County, other North Carolina counties, and the State of North Carolina NG9-1-1 provides the FE team with insights into the Orange County infrastructure, terrain, operations, and culture that no other consulting firm can match. We offer Orange County greater services at less cost because FE already has intimate knowledge of your existing systems, operational requirements and user expectations.

FE has earned the reputation as a premier public safety information systems and communications consulting firm throughout North America. Our over 32 years of experience will enable the County to successfully and affordably meet its emergency communications system needs. ***FE's*** demonstrated knowledge will result in low risk and high user satisfaction for County staff and those they support.

Our proposal defines solid, proven approaches to executing each of the tasks required by the project. Orange County will benefit from the following:

- ***We understand Orange County's unique needs and conditions and are well versed in the latest technology available to meet those needs. FE assisted with the implementation of the first P25 Phase 2 systems deployed by each of three of the major equipment vendors in the U.S.***
- ***A financially healthy firm who has never been involved with a lawsuit related to our work nor failed to successfully complete a contract. A company who, in fact, has been brought in to complete projects other consulting firms have left behind***
- ***Our numerous successful public safety systems engagements throughout North Carolina and the region, resulting in intimate knowledge of similar agencies, operations, and first responder needs***
- ***System procurement specification vendor neutrality exhibited by client satisfaction and positive vendor feedback. No procurement involving an RFP written by FE has ever been protested***
- ***A consistent record of cost savings for our clients. FE contract negotiations support has resulted in millions of dollars in savings in systems costs.***

- ***A team with backgrounds specific to the requirements of the RFP with a deep staff bench that can be called upon to address all of the services needed for the project***
- ***And most importantly, Federal Engineering's proven commitment, exhibited in our previous engagements, to provide the highest quality services and the most knowledgeable staff for the required tasks.***

Public safety and public service information and communications systems consulting is Federal Engineering's business. This is our specialty. This is what we do. We provide "specialized professional services". We are not an architectural engineering firm, not a management consulting firm, and not a business consulting firm. ***FE*** will provide the County with local, knowledgeable skill sets in all aspects of the project. **We are the right team for the County's project.**

TAB 1—INTRODUCTION

1 INTRODUCTION (RFP SECTION 4.0)

The proposer should first provide an explanation of their understanding of the tasks they believe to be necessary to accomplish the objectives outlined in the RFP. For each of these areas the proposer is to describe in a simple and straightforward manner the overall approach the consultant proposes to use when completing the study, as well as a discussion of how options and recommendations will be presented to the review committee and Orange County.

1.1 Understanding of the Project

Orange County, North Carolina currently uses the state-owned and operated Voice Interoperability Plan for Emergency Responders (VIPER) 800 MHz trunked radio system. The County currently dispatches all law enforcement, fire, and emergency medical services (EMS) responders, as well as all County and local municipal users of that system.

The following tables identify law enforcement, fire, EMS, and local/municipal agencies that serve the citizens of Orange County.

Fire and EMS Departments Serving Orange County	
Caldwell Fire Department	Mebane Fire Department
Carrboro Fire Department	New Hope Fire Department
Cedar Grove Fire Department	North Chatham Fire Department - Station 2
Chapel Hill Fire Department	Orange Grove Fire Department
Efland Fire Department	Orange Rural Fire Department (Hillsborough)
Eno Fire Department	White Cross Fire Department
Orange County EMS	Alamance County EMS
South Orange Rescue Squad	

Law Enforcement Agencies Serving Orange County	
Orange County Sheriff's Department	Hillsborough Police Department
Carrboro Police Department	Mebane Police Department
Chapel Hill Police Department	UNC Public Safety

Local and Municipal Agencies Serving Orange County	
Orange County Animal Services	Orange County Social Services
Orange County Health Department	Carrboro Public Works
Orange County Asset Management Services	Chapel Hill Public Works

Users have experienced problems with the VIPER system, including lack of coverage in many areas of the County, lack of in-building coverage, and an imbalance in the number of frequencies used in the sites that serve Orange County.

The County also operates a VHF tone and voice paging system that is used to page the 12 fire departments that currently serve the citizens of Orange County. The County's major challenge is to address the fact that much of the VHF infrastructure equipment is beyond or very near end-of-life.

1.2 Overall Project Approach (RFP 5.B.1)

Building on the work that ***FE*** performed for Orange County in 2013, ***FE*** proposes a phased approach for the execution of this project. Our proposed scope of work is partitioned into the following phases and tasks:

Phase 1—Needs Assessment and Solution Selection

- Project initiation
- User interviews / needs assessment
- Analysis of site information
- Interoperability analysis
- Alternatives analysis
  - Coverage analyses
  - Budgetary estimates
- County selects system option for procurement

Phase 2—Procurement Support

- RFP preparation
- Vendor proposal review and recommendations
- Pre-bid meeting support (optional)
- Vendors' questions responses (optional)
- Attend vendor best and final presentations (optional)
- Contract negotiations support (optional)

Scope of Work Task	*RFP Task No.*	*Proposal Location*
Phase 1—Needs Analysis and Alternatives Analysis		
Perform Needs Analysis		3.2
Meet with management personnel and end users of the current infrastructure to develop a comprehensive needs analysis addressing functionality, capability and needs of all current infrastructure users.	5.C.1	3.2.1
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.	5.C.1	3.2.2
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.	5.C.2	3.2.2

Scope of Work Task	RFP Task No.	Proposal Location
Phase 1—Needs Analysis and Alternatives Analysis		
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.	5.C.3	3.2.7
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.	5.C.4	3.2.4
Perform Alternatives Analysis		3.2.3
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	5.B.3	3.2.3
Obtain and submit budgetary costs for alternatives presented, and assist the review committee to prioritize acquisitions and implementation	5.C.10	3.2.8
Recommend and submit a planned acquisition and implementation process based on the option approved by the review committee.	5.C.6	3.2.10
Phase 2—Procurement Support		
Develop a comprehensive migration plan for all current infrastructure users.	5.C.5	3.2.9
Development of a vendor-neutral request for proposal (RFP) suitable to be released to the vendor community for the purposes of procuring the approved alternative.	5.C.7	3.2.12
Facilitation of the RFP process, including staff support to the County in conducting a comprehensive evaluation of RFP responses received.	5.C.8	3.2.13
Create and submit computer aided design (CAD) drawings as required.	5.C.9	3.2.14

The specific tasks to be performed in completing Orange County's project are detailed in Section 3 of this proposal.

TAB 2—RESPONSE TO GENERAL REQUIREMENTS

2 RESPONSE TO GENERAL REQUIREMENTS (RFP SECTION 4.0)

2.1 Organizational Qualifications (RFP 4.B)

State the full name and address of your organization, including the name, address and telephone number of the person in your organization who has primary responsibility for developing this proposal and to whom technical questions may be addressed.

Corporate Information	
Full Company Name	Federal Engineering, Inc.
Address	10600 Arrowhead Drive Fairfax, VA 22030
Proposal Contact	Mr. Skip Funk 904-806-0221 sfunk@fedeng.com

2.2 Company Background

Over the last 32 years, ***FE*** has become the nation's leading specialist in local and state government land mobile radio (LMR) voice and broadband consulting. Our consultants have assisted many levels of government, including hundreds of local and county governments, in implementing billions of dollars in communications projects. We complement our analytical knowledge of wireless and wired technologies with practical, hands-on experience providing reliable, flexible, cost-effective solutions to our clients.

FE remains at the forefront of radio communications technology and operations. We continue to offer our clients knowledgeable, high-quality services as standards and technologies evolve, such as public safety LTE, P25 Phases 1 and 2, and as government mandates, such as rebanding and narrowbanding, continually impact our clients.

Our corporate organization, shown in Exhibit 1, exemplifies the depth of our public safety communications technical staff.

FE will provide Orange County with objective analyses, free from the influences of hardware vendors, software suppliers, or service providers. Our designs embody practical, cost-effective solutions customized to the specific needs of the County[2].

FE is a corporate affiliate of the following organizations:

- Association of Public-Safety Communications Officials (APCO)
- National Emergency Number Association (NENA)
- Project 25 Technology Interest Group (PTIG)
- Telecommunications Industry Association (TIA)

FE consultants are heavily involved in PTIG, P25 Phase 2 Industry Roundtables and Best Practices Workshops, the Telecommunications Industry Association (TIA) wideband and land mobile radio

[2] ***FE*** subscribes to the strict code of ethics of IEEE, Society for Technical Communication (STC), and Independent Computer Consultants Associate (ICCA), which explicitly forbid any conflict of interest in our consulting activities.

standards activities, the National Public Safety Telecommunications Council (NPSTC), and the Federal Partnership for Interoperable Communications (FPIC). Most recently ***FE*** consultants have been appointed by RadioResource Media Group to the MissionCritical Communications magazine editorial advisory board and by APCO to their International's Commercial Advisory Council. Our consultants chair national technical committees and have had papers published by many professional organizations.

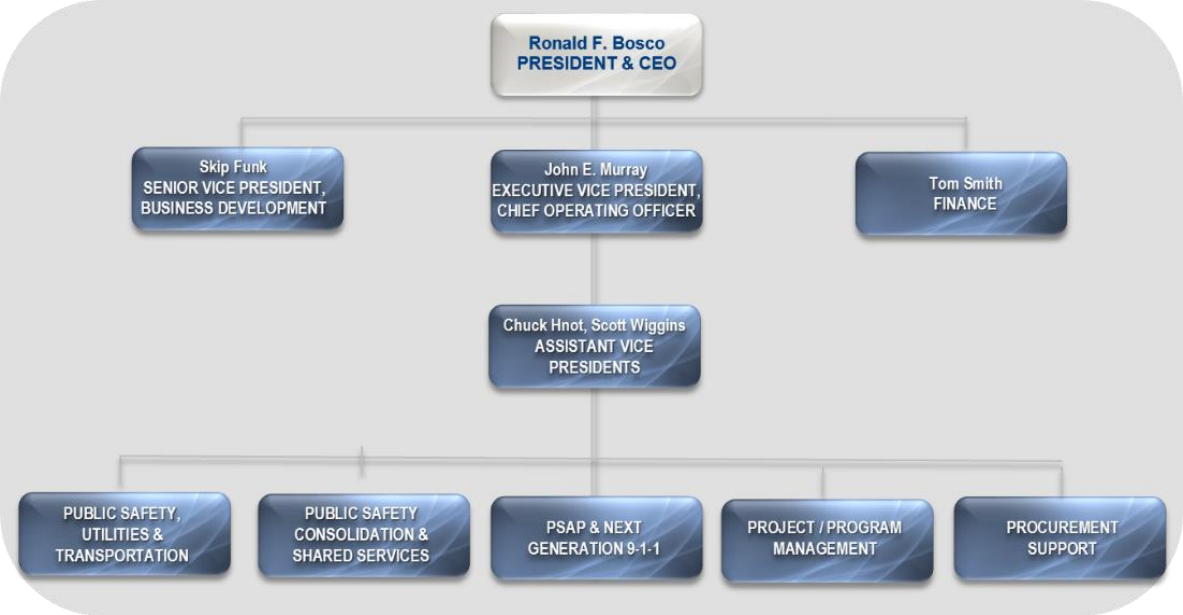

Exhibit 1—Federal Engineering's Corporate Structure

FE's corporate capabilities align with public safety voice and broadband radio system planning, design, and deployment.

FE has assisted numerous states, counties, cities, regions, and other organizations in major public safety and public service communications projects ranging from initial requirements definition through procurement and implementation support. ***FE's philosophy to "exceed client expectations to retain that client for life" has resulted client retention and repeat business since the firm's inception.***

2.2.1 Quality Assurance and Quality Control

FE applies rigorous quality assurance (QA) and quality control (QC) measures throughout our project activities. Our QA/QC program supports the successful execution of the project plan by not only applying specific and rigorous QA/QC measures to each project phase, but also applying them to ***FE's*** recruiting, administrative, accounting, and business development practices.

Through our industry contacts, client feedback, and use of subject matter experts (SME), we have developed a comprehensive deliverable review program, managed by our Quality Assurance Review Board, shown in Exhibit 2.

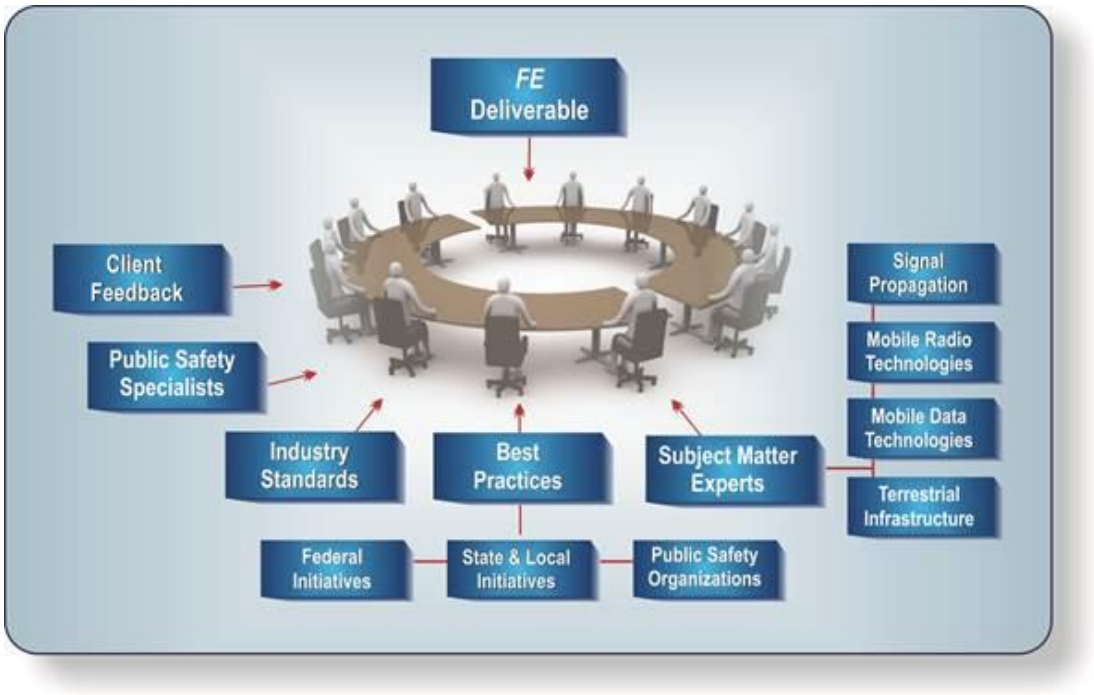

Exhibit 2—Quality Assurance Review Board

FE's quality assurance review process takes advantage of best practices, SMEs, and client feedback to assure the highest quality in our project deliverables.

Our Quality Assurance Review Board manages our peer review process to assure that our internal procedures and delivered documentation and reports are of the highest quality. Peer reviewers are individuals with skill sets directly applicable to the program. They are typically not involved in the day-to-day aspects of the program but, rather, serve in a "red team" capacity ***challenging the program team and assuring that all decisions have been well thought-out.*** Periodic technical reviews are conducted throughout the duration of the program and draft reports evaluated before delivery.

The County will be an active participant in our quality assurance process by providing ***FE*** with feedback on drafts so we can include necessary revisions in the final deliverables. All technical reviews include detailed issue tracking, target date adherence, and requirements recommendations. This methodology provides the County with the best value for its consulting services investment. ***FE's*** president, Mr. Ronald F. Bosco, and our executive vice president and chief operating officer, Mr. John Murray, manage the Quality Assurance Review Board.

2.2.2 North Carolina Experience

Orange County will immediately benefit from ***FE's*** strong presence in public safety consulting throughout the State and surrounding areas. We bring relevant experience and best practices from past projects performed for Orange County. ***FE is already intimately familiar with the culture, operations, and public safety requirements in the State of North Carolina and in Orange County. We have provided, or are currently providing, public safety systems consulting services to Orange County, New Hanover County, Buncombe County, Yadkin County, and other North Carolina clients as outlined below.***

Orange County, North Carolina—Orange County engaged ***FE*** to assist with resolving coverage issues they experienced with their public safety radio system. Orange County requested that ***FE*** assess their options for improving county radio coverage on the state VIPER Network and enhancing their paging coverage. ***FE*** conducted a user needs assessment, a system requirements assessment, and conducted a coverage workshop with the county to assess the coverage available from existing VIPER tower assets and determine what additional sites might be necessary to achieve the desired coverage. The assessment included a microwave path assessment and tower mapping. From the county's pre-defined coverage requirements, ***FE*** developed an alternatives report to assist the county in making an informed decision for the future of their public safety communications.

New Hanover County, North Carolina—FE conducted needs assessments and coverage analyses and developed recommendations for a new, countywide public safety mobile radio network. ***FE*** generated an RFP based on the design and provided procurement assistance, proposal evaluations, and contract negotiation support. ***FE*** conducted program management and implementation support for the county's new 800 MHz, digital public safety mobile radio network and continues that support as needed. We also provided program management and technical assistance or the county's 800 MHz rebanding. ***FE*** recently assisted the county by providing inside cable plant design, procurement, and implementation services for a new eight story government services facility.

Buncombe County, North Carolina—FE was selected by the county to provide system assessment and upgrade planning consulting services. ***FE*** evaluated the existing VHF system and developed a Federal Communications Commission (FCC) narrowband-compliant design and technical specifications. ***FE*** also developed a budgetary cost estimate for the system. ***FE*** continues to provide implementation oversight services for the first Phase 2 implementation by Cassidian. Most recently, the county selected ***FE*** to perform a needs assessment to ascertain the system requirements to provide the required coverage and capacity, verify spectrum availability, number of user subscribers and ensure that the system provides interoperability with the county's existing P25 700/800 MHz system that covers the interior of the jail complex and the campus grounds. Upon county agreement to the requirements resulting from the needs assessment, ***FE*** generated an RFP soliciting vendors to provide this system.

Yadkin County, North Carolina—FE was selected assist with the procurement process of acquiring a new public safety radio system to comply with FCC narrowbanding requirements. ***FE*** reviewed unsolicited system proposals the County had already received and recommended that the County issue an RFP. ***FE*** conducted an abbreviated needs assessment with baseline coverage study and developed an RFP. ***FE*** assisted the County with contract negotiations and implementation support, including tower structural analyses to verify the vendor's final design viability.

Most recently, ***FE*** was asked to perform tower mapping and tower structural analysis services. Specifically, recording measurements of existing towers, antennas and feedlines to create a tower mapping report for which the County will use to model a new tower.

FE was selected by the State of North Carolina to assist the North Carolina 9-1-1 Board in developing a concept of operations document describing the broad goals, general user needs, and a high-level view of the operating environment that the Board is attempting to achieve by developing an RFP for an ESInet and next generation-functional systems to all statewide PSAPs. The concept of operations will also serve to identify the operational scenarios to be supported and outline a transition plan for the orderly and error-free migration to new functional platforms. Ultimately, the concept of operations will form the basis for the general system design and requirements expressed in the RFP to the solution vendors.

Additional services that ***FE*** will provide at the request of the Board include evaluating current 9-1-1 needs, providing an ESInet IP backbone for NG9-1-1 applications, and increasing PSAP interoperability.

2.2.3 Technology Experience

The projects listed in subsequent sections demonstrate that ***FE*** has performed similar analyses on state, regional, and county systems of comparable size and subscriber base. We are one of the largest independent public safety consulting firms in the country and this is just a sampling of our extensive background.

FE consultants have worked on practically every type of system and in hundreds of project and operational situations. A sample of their knowledge includes the following:

Land Mobile Radio Systems
- Trunked
- Simulcast
- Multicast
- Analog
- Digital

Land Mobile Radio Technologies
- APCO TIA P25
- MPT1327
- TETRA
- DMR
- SCADA

Broadband/Advanced Wireless Technologies
- LTE
- WiMAX
- WiFi
- Integrated voice and data

Frequency Bands
- Low band
- T-band
- VHF
- UHF
- 700/800 MHz
- 900 MHz
- 2.4, 4.9, 5.8 GHz
- Other licensed and unlicensed bands

Manufacturers' Systems and Equipment
- Harris (M/A-COM)
- Motorola
- Tait
- Airbus DS (Cassidian)
- EF Johnson
- Raytheon
- DataRadio
- Others

Backhaul Systems
- Microwave
- T-carrier
- Optical fiber

2.2.4 Needs Assessment Experience

FE has provided public safety radio communications existing system review and analysis services to numerous states, regions, counties, tribal communities, and cities which include site surveys, existing system performance analysis, and/or system upgrade/migration compatibility studies. ***FE*** has also

completed needs assessments/requirements discovery services to develop a thorough understanding of current and future requirements.

In addition, ***FE*** is often involved with system and equipment configuration activities during implementation further broadening our base of system analysis knowledge. The following table lists numerous relevant projects.

FE Needs Assessment and Existing System Analysis Experience			
Counties	**Cities and Local Municipalities**	**Regions**	**States**
• Boone County, KY • ***Buncombe County, NC*** • Campbell County, WY • Camden County, GA • Caroline County, VA • Collier County, FL • Contra Costa County, CA • Cortland County, NY • Culpeper County, VA • Dane County, WI • El Paso County, TX • Essex County, NY • King & Queen County, VA • LaGrange County, GA • Lewis County, NY • Manitowoc County, WI • Mills County, IA • ***New Hanover County, NC*** • ***Orange County, NC*** • Pierce County, WA • Pinal County, AZ • Rappahannock County, VA • Rockbridge County, VA • San Francisco (City and County), CA • Sussex County, VA • Warren County, KY • ***Yadkin County, NC***	• Bowling Green, KY • Chesapeake, VA • Collierville, TN • Davenport, IA • El Paso, TX • Florence, AZ • Gillette, WY • Hampton, VA • Henderson, KY • Lakeland, FL • Nashville, TN • Newport News, VA • Portland, OR • Portsmouth, VA • Virginia Beach, VA	• Gainesville Regional Utilities • ORION, Hampton Roads Region of Virginia • San Diego and Imperial Counties, California • San Francisco BayRICS • State of Montana 15-90 Interoperable Communications Consortium • State of Montana Big Sky Consortium	• Arizona • Colorado • Iowa DPS • Iowa DOC • Minnesota • Nebraska • New Mexico • North Dakota • Oregon • Washington • Wisconsin • Wyoming

To execute an effective needs assessment and develop trusting relationships, ***FE*** relies heavily upon face-to-face sessions with individuals representing participating organizations. We employ a hierarchical approach, determining strategic direction from client management while determining systems performance and requirements from the actual users. ***FE*** also addresses the challenges of interoperability among a multitude of public safety organizations.

2.2.5 Request for Proposal Development and Procurement Support Experience

FE has provided technical specification, RFP development, and procurement support services to numerous states, regions, counties, and cities. The following is a sampling of RFPs we have recently prepared. The majority of the RFPs we have prepared for radio systems include specifications for microwave backhaul.

RFP Development	
Client	**RFP Title**
City of Bowling Green/Warren County, Kentucky	*RFP for Public Safety Voice Radio Communications System*
City of Henderson, Kentucky	*Request for Proposals for Communications System*
Arizona Public Service	*RFP for 800 MHz Radio Communications Systems*
San Diego County, California	*RFP for Digital Microwave Radio Network* *RFP for Conventional Systems Technology Refresh*
San Francisco Bay Area Regional Interoperable Communications System	*RFP for Radio Communications System (10 RFPs; one for each of the counties)*
City of Lakeland, Florida	*800 MHz Project 25 Radio Communications System*
Iowa State Department of Public Safety	*RFP for Interoperable Communications System Design and Implementation Plan*
State of Nebraska	*RFP for Public Safety Mobile Radio System*
State of Nevada	*RFP for Public Safety Mobile Radio System*
Chautauqua County, New York	*RFP for LMR Communications System*
Cortland County, New York	*RFP for Radio Communications System*
Essex County, New York	*RFP for Public Safety Radio Communications System:* *Civil Engineering and Site Development* *Electrical Engineering Design Services* *Generators* *Equipment Shelters* *Site Development, Construction, and Civil Engineering Services* *Public Safety Radio Communications System Tower*
Metropolitan Transportation Authority/ New York City Transit, New York	*RFP for 800 MHz Digital Land Mobile Radio System*
Buncombe County, North Carolina	*RFP for Radio Communications System* *RFP for Detention Facility of the Buncombe County Sheriff's Office Digital Trunked 800 MHz Radio Communications System*
New Hanover County, North Carolina	*RFP for Public Safety APCO 25 (P25) Digital Radio Communications System*
State of North Dakota	*RFP for Public Safety Mobile Radio Communications*
State of Oregon	*RFP for Oregon Wireless Interoperable Network (OWIN) Radio System; Services, Equipment & Software*

RFP Development	
Client	**RFP Title**
City of Portland, Oregon	*RFP for Public Safety Voice Radio Communications System*
Town of Collierville, Tennessee	*RFP for Radio Communications System* *RFP for Console System*
City of El Paso, Texas	*Radio System Procurement and Implementation Support Technical Specification*
El Paso County, Texas	*Radio System Procurement and Implementation Support Technical Specification*
King & Queen County, Virginia	*RFP for VHF/UHF Simulcast Radio Communications Network*
Overlay Regional InterOperable Network (ORION) ***Hampton Roads Region, Virginia***	*RFP for a "Turnkey" Service Solution for a Project 25 (P25) 700/800 MHz Radio Overlay System for ORION Member Agencies* *RFP for Project 25 700/800 MHz Subscriber Equipment to be used on the ORION System*
Pittsylvania County, Virginia	*RFP #11-02-01 700 MHz Project 25 Radio Communications System*
Dane County, Wisconsin	*RFP for Interoperable Voice Radio Communications System*
Manitowoc County, Wisconsin	*Public Safety Radio and Antenna System Technical Specification*

FE's extensive experience in this area provides our team with proven tools to develop a fair, vendor-neutral RFP for Orange County.

Orange County will receive specifications that specifically consider the County's issues and concerns. Our staff understands the technical, financial, funding challenges faced by local municipalities both large and small. We have guided our clients with large, complex systems such as the Oregon Statewide Radio Project, and the Iowa Statewide Interoperable Radio System; regional systems, as well as counties and cities such as Pittsylvania and King and Queen Counties in Virginia, in making critical decisions for the appropriation of funds. ***We help our clients determine what's right for them whether it be joining a regional or statewide system, funding a standalone system, procuring a system via competitive bid, or procuring from a sole source.***

FE's past and current clients have expressed satisfaction and given prompt approval of the RFPs we have written. We have received feedback from system vendors that RFPs developed by FE are fair and allow them to prepare comprehensive, clear responses. No award based on an RFP written by FE has been protested.

2.2.6 P25 System Design and Implementation Experience

It is important to Orange County that the consultant engaged to perform the required wireless communication engineering services have experience and qualifications in the areas central to the success of the County's project. The following table of relevant projects in P25 system design, implementation planning/supervision demonstrates the depth of ***FE's*** experience in each of these areas, including system design and implementation in the 700/800 MHz spectrum (*denotes 700/800 MHz systems).

Relevant Project Experience	
P25 System Design	**Implementation Planning and/or Supervision**
• San Francisco Bay Area Regional Interoperable Communications System* • City and County of San Francisco, CA* • San Diego/Imperial Counties, CA* • State of Arizona* • Florence, AZ • Pinal County, AZ • Arizona Public Service* • State of Iowa • Gainesville Regional Utility, FL* • Lakeland, FL* • Bowling Green Municipal Utilities, KY • Bowling Green/Warren County, KY* • Boone County, KY (microwave backhaul) • State of Montana • New York City Transit* • Cortland County, NY • ***Buncombe County, NC*** • ***Hew Hanover County, NC**** • State of Oregon* • El Paso, TX* • El Paso County, TX* • Overlay Regional Interoperable Network (ORION), VA* • Hampton, VA • Newport News, VA* • King and Queen County, VA* • Pittsylvania, VA • Portsmouth, VA* • Caroline County, VA • Dane County, WI* • Manitowoc County, WI* • Over 50 counties in Minnesota	• State of Arizona* • Florence, AZ • Pinal County, AZ • LA-RICS, CA* • San Diego/Imperial Counties, CA* • State of Iowa • Bowling Green Municipal Utilities, KY • Bowling Green/Warren County, KY* • Boone County, KY • State of Maryland* • State of New York • Cortland County, NY • Essex County, NY • ***New Hanover County, NC**** • ORION, VA* • Hampton, VA* • King and Queen County, VA* • Pittsylvania County, VA • Rockbridge County, VA • Dane County, WI* • Manitowoc County, WI*

FE is proud to share our involvement with three of the first P25 Phase 2 system procurements and implementations and the largest LTE system deployment in the United States:

- Buncombe County, North Carolina—***FE*** assisted with the procurement and is supervising the deployment of the first Airbus DS (formerly Cassidian Communications) P25 Phase 2 implementation.
- Bowling Green Municipal Utilities, Kentucky—***FE assisted with the procurement and supervised the first P25 Phase 2 system implementation in the U.S.***, a Motorola Astro 25 system.
- State of Oregon—***FE*** assisted with the procurement of the first Harris Corporation P25 Phase 2 implementation in the U.S.

- Los Angeles Regional Interoperable Communications System (LA-RICS)—The LA-RICS Authority's board of directors, representing the public safety agencies in 86 municipalities, awarded the project and construction management contract to the Jacobs team, with ***FE*** providing LMR and broadband LTE systems expertise and managing the vendor design, procurement, implementation, and operations activities.

2.3 Staff Qualifications and Facilities (RFP 4.C and 4.D)

Proposals shall identify each member of the consultant's staff who would be assigned to work on the project, the role they will be performing, and the hourly rate to be charged to Orange County for their services, or alternatively a fixed price for services based on the established scope of work. Additionally, a resume' stating the background and qualifications of each individual should be attached. Particular attention shall be given to the individual named as the project coordinator.

FE has assembled an exceptionally well-qualified team to provide Orange County with comprehensive technical consulting services in response to the RFP. Our project manager has experience with Orange County, having worked on the County's Emergency Radio Communication Tower and System Infrastructure Upgrade Plan project, giving the ***FE*** team intimate knowledge of the radio environment in Orange County. All proposed personnel have worked on projects with similar scope, and our staff members have, on average, over 20 years of experience in their field of expertise.

Our proposed project staffing for the Countywide Radio Communications Interoperability and Systems Engineering Services project is shown in Exhibit 3. The team is composed of our most senior talent in public safety communication systems technologies. Team member qualification highlights and project roles are provided in this section. Resumes can be found in Appendix A, and our fixed price for services in support of the scope of work is listed in Section 3.

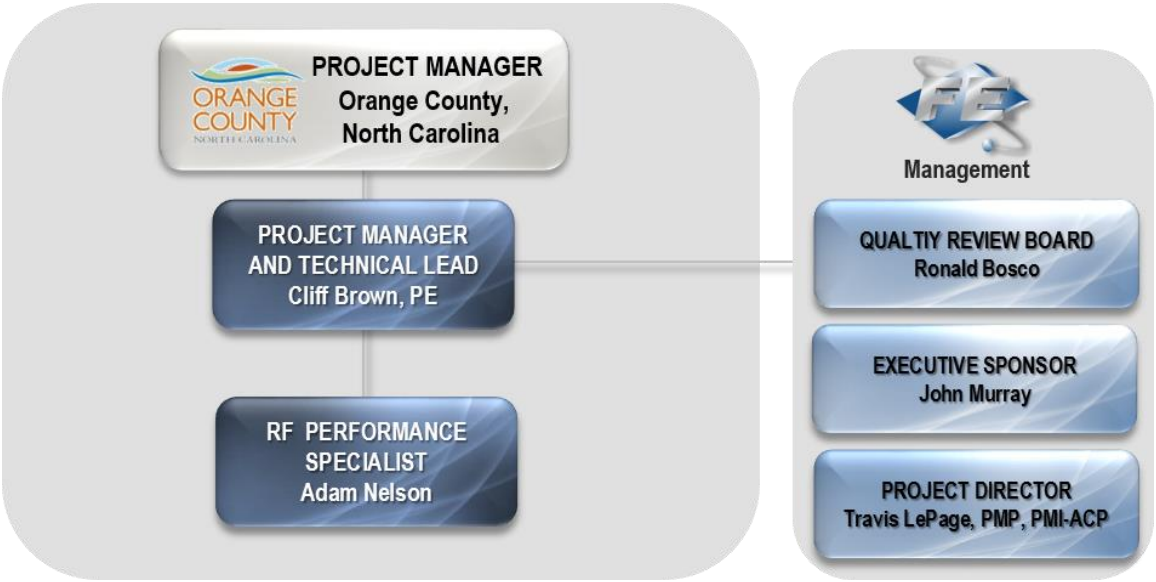

Exhibit 3—Orange County Project Organization Chart

The FE team brings a wealth of public safety and public service communications experience to the Orange County project.

Project Manager & Technical Lead

Mr. Cliff Brown, P.E. will manage the day-to-day progress to keep the project on schedule and on target. He brings extensive experience in turning customer needs into deliverable solutions, including planning; product and services development; engineering design; RFP process; site development; network implementation; network testing; and ongoing operations and maintenance. He possesses a clearly demonstrated history of exceeding goals by finding the right people for the job, and challenging them to the highest levels of performance.

Mr. Brown is very familiar with the challenges faced by Orange County radio system users, as he was part of the FE team that worked with the County on their Radio System Infrastructure Upgrade project in 2013. His experience includes the successful program and project management of systems ranging from citywide to nationwide in scope. He has managed multi-disciplinary teams consisting of planning, engineering, specification preparation and RFP response evaluation, deployment, ongoing O&M, finance, and management reporting. He is skilled in providing management and oversight in system and network designs to meet customer needs, using leading edge technologies such as P25, LTE, TV white space, WiFi, WiMAX, and public safety in-building DAS, among others.

RF Performance Specialist

Mr. Adam Nelson has over 12 years of experience providing consulting services in the fields of public safety, telecommunications, and information technologies. As a member of ***FE's*** Spectrum Center of Excellence, his specialties include radio frequency prediction and analysis, frequency and capacity planning, interference mitigation, LTE system design and analysis, and spectrum-related efforts pertaining to frequency licensing and coordination.

2.4 References (RFP 4.G)

Proposers must include in their RFP a list of organizations, including points of contact (name, address, and telephone number), which can be used as references for work performed in the area of service required. Selected organizations may be contacted to determine the quality of work performed and personnel assigned to the project. The results of the references will be provided to the evaluation team and used in scoring the written proposals.

The following project summaries illustrate ***FE's*** similar project experience in radio communications and interoperability planning, design, and implementation support.

Orange County, North Carolina

Infrastructure Upgrade Plan and Coverage Analysis

Project Dates
Nov 2012 – Sep 2013

Project Snapshot
- Assessed options for improving radio coverage
- Conducted a user needs assessment
- Conducted system requirements assessment
- Conducted a coverage workshop
- Developed alternatives report
- Performed coverage and capacity analyses

Project Reference
Jim Groves
Former Orange County
Emergency Service Director
919-560-0660

Situation
Steeped in American history, Orange County is located in the middle of North Carolina and includes rolling terrain, forested areas, and many rural farming communities. With a population of approximately 134,000, Orange County is home to the University of North Carolina in Chapel Hill, high technology research areas, and growing suburban areas. These characteristics provide diverse challenges for the public safety communications in the County, including coverage and varied operational environments. The County selected ***FE*** to recommend a solution to resolve the County's public safety radio system coverage and capacity deficiencies.

Approach
FE conducted a thorough user needs assessment with County fire, law enforcement, and EMS agencies to fill information gaps and gather requirements for the upgraded system. Our team explored the current portable, mobile, and in-building coverage and capacity issues in depth with County agency representatives during the needs assessment.

Using this information, ***FE*** developed a set of high-level requirements for enhancements to the VIPER network that can be used to provide an upgrade to a viable digital system for County agencies. Based on the County-approved requirements,

FE performed coverage and capacity analyses to recommend a radio site constellation and set of channels, determine required modifications to existing towers, specify equipment needs to upgrade to P25, consider the inclusion of a backup conventional subsystem that includes a station and unit paging system, and outline the tower type and construction for any new sites.

Results and Benefits
FE's evaluation of user needs, combined with baseline assumptions, VIPER and technology trends, allowed for the identification of specific system requirements that will be used in the development of RF coverage improvements for the 800 MHz VIPER system, as well as for the station alerting and paging systems in use.

Buncombe County, North Carolina

Existing System Assessment & Narrowband Upgrade Planning On-call Technical Consulting, and RFP Development

Project Dates
June 2010 – Present

Project Snapshot
- Perform system propagation analysis
- Prepare propagation maps
- Conduct needs analysis
- Conduct infrastructure assessment
- Provide estimated costs for site improvements
- Develop and submit Needs Assessment and System Recommendation Report
- Develop and submit Conceptual Design Report
- Present recommended solution to the county
- Provide on-call technical consulting services regarding PSMR technology, microwave systems, consoles, and dispatch center systems
- Develop RFP

Project References
Clint C. Gorman
Radio Administrator
59 Woodfin Place
Asheville, NC 28801
828-250-6834
clint.gorman@buncombecounty.org

Bryan Dillingham
Network and Communications Manager
59 Woodfin Place
Asheville, NC 28801
828-250-6807
bryan.dillingham@buncombe county.org

Situation
Buncombe County, North Carolina needed to upgrade the County's existing system to meet the FCC's narrowbanding mandate. The County engaged Federal Engineering to evaluate the existing system, plan for the upgrade, design a compliant system, and recommend a solution.

Approach
FE conducted a needs analysis, collecting, compiling, and analyzing key information obtained from county public safety wireless systems users. We also conducted an assessment of the county's existing infrastructure, surveying the five simulcast transmit sites and the one receive-only site used for radio coverage to determine if they were suitable for continued use or if modifications are required for an upgraded system. Estimated costs associated with improving the sites to meet the county's needs were provided.

FE performed system propagation analysis to analyze outdoor and in-building coverage and modeled coverage in the VHF, UHF and 700 MHz frequency bands. We also developed a conceptual design for the system infrastructure, backhaul, and capacity meeting the County's requirements and developed the County's *RFP for Detention Facility of the Buncombe County Sheriff Office Digital Trunked 800 MHz Radio Communications System.*

Results and Benefits
FE recommended cost-effective, shared, reliable mobile wireless infrastructure enhancements which met the County's requirements.

The County retained ***FE*** to provide on-call technical consulting services regarding public safety mobile radio technology, microwave systems, consoles, and dispatch center systems.

New Hanover County, North Carolina

Public Safety Needs Assessment, System Design and Implementation

Administration Building Inside Cabling Design and Specification

Project Dates
January 2005 – Present

Project Snapshot
- Collect information on and assess radio infrastructure, licenses, applications, operations, channel usage, and sites
- Assess all existing sites and several potential sites
- Develop system specifications and features RFP
- Assess vendor technical proposals and recommend compliant vendor to county
- Provide program management and IV&V services
- Rebanding program management
- Low voltage systems design and implementation oversight for Admin Bldg

Project Reference
Mr. Warren Lee
Director of Emergency Management
New Hanover County Department of Emergency Management
230 Market Place Drive
Suite 115
Wilmington, NC 28403
910-798-6900 (office)
910-798-6904 (fax)
wlee@nhcgov.com

Situation
New Hanover County, North Carolina was in need of a consultant to provide needs assessment, design, RFP generation, system procurement, and implementation services for their 800 MHz public safety system.

Subsequently, the county required the design of low voltage signaling infrastructure for IT, telecom, and security systems to support the daily operations of the County Administration Building.

Approach
FE assessed the needs of the county's mobile and portable radio users by collecting information about the existing radio infrastructure, licenses, applications, operations, channel usage, and sites via interviews and questionnaires.

The ***FE*** site survey team assessed existing sites and several potential sites for an additional tower to improve coverage. ***FE*** consultants then developed system specifications and features for both the land mobile radio system and the microwave network and incorporated them into an RFP. To facilitate the procurement process, ***FE*** developed an evaluation matrix for ranking the vendors' technical proposals, conducted the vendor pre-bid conference, reviewed vendor questions, and prepared the responses and RFP addenda.

FE evaluated new vendor technical proposals in accordance with the approved evaluation matrix, processed the vendors' cost proposals, combined the technical and cost proposals to rank the vendor proposals, and recommended a compliant vendor to the county.

FE also provided program management and Independent Validation and Verification (IV&V) activities for all phases of the program, including assistance in license applications for 800 MHz and 6 GHz frequencies for the microwave system. During the implementation phase, ***FE*** coordinated the *Installation and Implementation Oversight Plan* with the installation and equipment vendors' plans. This detailed oversight plan guided ***FE*** to oversee and evaluate the implementation of each site (for both radio stem and microwave installation) and the dispatch center. It also listed validation criteria for items such as coverage, subscriber use, system and equipment programming and optimization, system simulcast operation and system cutover for our engineers to use for each other areas.

FE also provided program management and technical assistance for the county's 800 MHz rebanding as well as design and implementation oversight for low voltage systems in the County Administration Building.

Results and Benefits
The 800 MHz P25 countywide system is currently operational and meets New Hanover County's requirements for a reliable first responder network.

Yadkin County, North Carolina

Procurement and Implementation Support

Tower Inspection Services

Project Dates
April 2013 – Present

Project Snapshot
- Reviewed unsolicited system proposals received by the County
- Provided recommendation that the County issue an RFP
- Conducted abbreviated needs assessment with baseline coverage study
- Developed RFP
- Assisted County with contract negotiations and implementation support
- Tower structural analyses

Project Reference
Lisa Hughes
Deputy County Manager
217 East Willow St.
Yadkinville, NC 27055
336-679-4200 (o)
lhughes@yadkincountync.gov

Situation
Yadkin County, North Carolina, was operating a three-site Tait Quasi-Sync wideband VHF public safety mobile radio system supporting 12 combination (paid/volunteer) fire and/or rescue agencies, countywide emergency medical services, the County sheriff (court, detention, patrol, civil and investigations divisions), animal services, County public safety answering point, and other County agencies. The system supported the police departments and other departments within the municipalities of Boonville, East Bend, Jonesville, and Yadkinville. Federal Engineering (***FE***) was selected to provide procurement support for upgrades or modifications to the system that will satisfy the narrowbanding requirement.

Approach
FE assessed the current Tait Communications proposal and made recommendations, performing the following activities:

- Reviewed the work products of the previous consultant including the initial assessment and recommendations
- Presented the findings and recommendations to the County Administrator and County Board

FE conducted a coverage assessment and produced a set of maps for both mobile and portable subscriber units depicting major geographical landmarks and the area topography, including scale, color schemes, highway/road data, jurisdictional boundaries, and desired performance characteristics.

FE provided the following services to support the procurement of the Yadkin County radio system.

- Develop technical specifications to serve as the basis for an RFP for vendors to submit consistent proposals and to be verifiable through acceptance testing
- Updated the technical specifications based on County review and comments and submitted a final version to be used in a competitive RFP
- Reviewed the vendor proposal selected by the County, assisted the County with contract negotiations, and provided support for technical issues

FE assisted the County in resolving radio and microwave (MNI) vendor implementation issues, oversaw the vendor's punch list development and resolution process, identified vendor performance issues, and made appropriate recommendations to the County.

FE conducted tower mapping and tower structural analysis services to create a tower mapping report that the County will use to model a new tower.

Results and Benefits
FE was engaged by the County to review and continue the work of another consultant and complete the procurement and implementation of a new system. The County is very satisfied with the execution of these services, the contract with the radio system vendor, and the implementation of the system.

TAB 3—RESPONSE TO TECHNICAL REQUIREMENTS

3 RESPONSE TO TECHICAL REQUIREMENTS (RFP SECTION 5.0)

3.1 Statement of Objectivity (RFP 4.E)

It is the intent of Orange County to hire a firm that is neutral with respects to radio communications companies or equipment. Proposals will be accepted only from independent consultants not engaged in or associated with the business of selling, servicing, or renting communications equipment. Respondents must clearly state the independence and objectivity of the consultant. The selected firm shall not be allowed to provide provisioning services.

FE's certified independence guarantees that Orange County will receive totally objective analyses, free from the influences of hardware vendors, software suppliers, and service providers. Unlike some consulting firms, ***FE*** has no business relationship with any suppliers of public safety communications equipment or software. ***FE*** is not engaged in, nor are we associated with, the business of selling, servicing, or renting radio communications, telephony, CAD, or any other systems. ***Because we have no affiliation with equipment manufacturers or service providers, we are truly your trusted advisor; our recommendations and designs are not biased toward any particular technology, product, or approach.*** However, since many of our professionals have worked for equipment manufacturers in the past, our designs embody practical, cost-effective solutions customized to the specific needs of our clients.

At ***FE***, we take pride in the vendor neutrality of our recommendations, system designs, and specifications. The results of some recent system procurements shown below are evidence that ***FE's*** involvement has resulted in a wide range of major system vendor selections.

Client	*Radio System Vendor*
State of Oregon	Harris
King and Queen County, Virginia	Tait
City of Virginia Beach, Virginia	Motorola
ORION, Hampton Roads Region, Virginia	Motorola
Buncombe County, North Carolina	Airbus DS (Cassidian)
Manitowoc County, Wisconsin	Motorola
Dane County, Wisconsin	Harris
Pittsylvania County Virginia	Harris

3.2 Work to be Performed (RFP 5.C)

3.2.1 Comprehensive Needs Analysis (RFP 5.C.1)

1. *Meet with management personnel and end users of the current infrastructure to develop a comprehensive needs analysis addressing functionality, capability and needs of all current infrastructure users. 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.*

Existing Documentation Review

Prior to an on-site project initiation meeting, ***FE*** will request and review County-supplied system documentation, including previous studies, FCC licenses, site surveys, inventories, maintenance contracts, and other relevant documentation to begin assessing the existing system. ***FE*** will also review the information we provided to the County in 2013. Performing a detailed review of the current documentation provides our team with a common starting point and a foundation for a complete understanding of the current status of the communications system.

Project Initiation Meeting Agenda

- Introductions
- Clarify roles
- Review project objectives and expectations
- Review key issues
- Review key milestones and schedule
- Review and clarify deliverables
- Plan interviews and identify interview participants
- Review status reporting methodologies
- Determine progress review meeting schedule
- Resolve immediate issues
- Build relationships

Project Initiation Meeting

FE will conduct a project initiation meeting with the County project manager and other officials from participating agencies as identified by the County on a mutually agreed upon date following contract signing. This initial meeting will establish a common understanding of the project goals, objectives, and vision, items best understood through a close working relationship between our respective management teams and staffs.

Based on the outcome of the meeting, ***FE*** will deliver a project plan and timetable that will serve as guiding documents throughout the program. We will also use this meeting to renew our ongoing relationships.

Needs Assessment and Requirements Discovery

Federal Engineering's requirements discovery methodology places considerable emphasis on ***consensus building and accurately determining the needs of the system owners and system users,*** both for the county and participating agencies. Our approach can be summarized as follows:

- Work with the County project manager to identify the participants to be interviewed
- Allow time during the interview session to discuss each agency's issues and requirements as well as their comments on a new countywide system
- Request agencies categorize their priorities so that commonalities and differences are easily identified across the agencies
- Define a prioritized set of needs and requirements to highlight stakeholders' 'must-haves'
- Based on the collected needs, explore what resources can be shared among agencies and what assets can be reused to achieve cost savings for the County.

Stakeholder Interviews

Once ***FE*** has reviewed available documentation and any other applicable standards and guidelines, we will be able to discern gaps in the information as we prepare for the user interview. We will work with the County project manager to define an assessment questionnaire that will be used during the interviews. The questionnaire will highlight current issues and concerns, as well as future requirements for an upgraded LMR system.

Because we recognize that this task establishes the foundation for all future work, we will gather sufficient information necessary to accurately document the County's needs. Typically, the questionnaire will cover areas that include the following:

- Functionality
- Physical infrastructure
- Backhaul
- Daily and tactical operations
- Performance including any coverage, capacity, and interference issues
- Spectrum use
- Current and future interoperability within the County and with other jurisdictions, agencies, and organizations
- Number, type of subscriber units, and feature sets used
- User needs and expectations

The questionnaire will also consider the following specific County concerns:

- Potential new site locations
- In-building and underground coverage
- Available and expected funding
- Specialized operating features
- Additional functional requirements/goals
- Current and expected level of service
- Network management needs
- Disaster recovery

FE proposes conducting a needs assessment interview with County system users, stakeholders, and local agency technical representatives. We propose that the interview, to be conducted immediately following the project initiation meeting, includes the technical representatives in the same sessions as users and stakeholders to promote synergy among the disciplines and help achieve consensus. This combined session will adequately collect the current concerns and future requirements, as well as identify any issues affecting the modification and continued use of equipment sites.

FE will meet with the designated personnel and, using the pre-approved assessment questionnaire as a basis for discussion, discover and document the County's issues, concerns, and expectations for the future. ***FE*** will catalog the collected information and conduct follow-up discussions with participants as necessary to complete the assessments.

3.2.2 Site Data and Equipment Inventory Review (RFP 5.C.2)

2. 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.

FE already has the County's site data from previous projects. We will review our existing site data to verify that it is current. We will refresh this data, as necessary, via information collected during the needs assessment interviews (described above). The County may have added sites since we conducted our previous analysis. We will review available data the County has for those sites as well

and discuss with the County the impact of adding additional sites in the future. Because we already have the detailed knowledge about the County's sites and equipment, we will save the County money, reduce the schedule time, and reduce the risks. Although we believe we have the current site data, as an *option* and if the County desires, ***FE*** can perform physical site surveys and structural analysis on all sites.

We will analyze both the transmitter and dispatch sites. Our analysis will include control equipment, backhaul equipment, repeaters, base stations, dispatch equipment, and other critical communications infrastructure installations. We will evaluate the capability of existing equipment to be used in the new, upgraded radio system.

FE will identify any issues that affect the modification and use of the sites for a new/upgraded Orange County system. ***FE*** will use the results of our analysis in subsequent system alternatives analysis tasks.

High-level Requirements Definition

FE will develop a set of high-level requirements based on the needs assessment meetings and assumptions agreed upon with the County. We will typically define requirements for the following:

- Basic functionality
- Mobile and portable coverage needs
- Mobile and portable roaming needs
- Infrastructure and backhaul components
- Number and basic functionality of subscribers
- Network management
- Capacity and spectrum
- Interoperability among local agencies and public service departments, adjacent counties, state and federal agencies
- Dispatch center capabilities
- Maintenance and service level

We will consider the desired and feasible use of the County's site and equipment investments for each applicable requirement.

Deliverable—Needs Analysis Report (RFP 5.B.2 and 5.C.1)

> *B.2. Documentation and assessment of existing communications capabilities; including review, summarization and validation of previous documents and studies.*
>
> *C.1.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.*

FE's needs analysis report will include the following:

- Discussion of issues and existing system capabilities/vulnerabilities
- Analysis of interoperability gaps
- Mobile, portable, and in-building coverage requirements

- Functional, performance, and operational requirements
- Paging system requirements

FE will include the needs analysis in the *Orange County Radio System Alternative Report* and present our findings to the Orange County project team, users, and governing committee as described in Section 3.2.3 below.

3.2.3 Alternatives Analysis (RFP 5.B.3)

Once ***FE*** has completed and analyzed the information from the project initiation meeting, user needs interviews, and site and equipment documentation, we will develop a mutually agreed upon number of radio system alternatives. Our alternatives will provide a uniform approach to developing a countywide network that reuses as many County assets as possible and that relies on industry best practices stemming from numerous similar, successful projects. The alternatives will provide the same or better reliability and redundancy as the existing system, and will be focused on improving the coverage provided by the current system.

These alternatives will be subjected to the analyses described in Sections 3.2.4 to 3.2.8 below. The alternatives will address the advantages, disadvantages, issues and considerations specific to the needs of Orange County users, and focus on coverage (outdoor and in-building), capacity, and interoperability. Areas to be considered will include the following:

1. Frequency range (low band, high band, UHF, 700, 800) and an analysis of spectrum availability within each frequency range
2. Wide band versus narrow band radios
3. Analog, digital or combination including P25 Phase I and II air interface compatibility
4. Encryption options and capabilities
5. Countywide radio communications interoperability and systems engineering services
6. Operating protocol (conventional, trunking, combination)
7. One infrastructure or more, meaning the following:
    i. A single infrastructure to serve the combined needs of all users in the County, or
    ii. Two or more infrastructures (one or more to serve the urban/metro area, and/or one or more to serve the areas outside the urban/metro area) with appropriate interoperability capabilities
8. Procurement scope, meaning the following:
    i. County procures the core infrastructure, and each user entity (towns, OWASA, schools, and other end users) must procure their own end-user equipment (base, mobile and portable radios, and pagers)
    ii. County procures all core infrastructure and all end user entity equipment (based on the number of end user equipment items in service at the time of the needs analysis)
    iii. County procures all core infrastructure and all end user entity equipment, but individual end user entities need to procure infrastructure enhancements to improve coverage or other issues above and beyond what is provided by the current infrastructure

9. With respect to the potential options above, interoperability with the following:
   i. Agencies serving Orange County residents both on a day-to-day and event related basis. This includes State of North Carolina and University of North Carolina entities, and fire and EMS entities in adjoining Counties that serve territories in Orange County.
   ii. Interoperability with adjoining county emergency service entities (for adjoining county units responding into Orange County and for Orange County units responding into adjacent counties). This includes the Alamance, Chatham, Caswell, Person, and Durham systems.

The alternatives assessments will include coverage analyses as defined in subsequent sections. ***FE*** will accomplish the following:

1. Model existing system to determine current coverage
2. Identify gaps between current coverage and user needs derived from the needs assessment
3. Develop alternatives
4. Model the alternatives
5. Identify the best alternative selection that meets users' needs

Budgetary cost estimates will also be presented for each viable alternative.

At the conclusion of these alternatives analysis, a draft *Orange County Radio System Alternatives Report* will be delivered to the County. ***FE*** will facilitate a meeting with the County review committee to assess the alternatives and select one alternative for the further analyses described in Sections 3.2.8 to 3.2.10 below. ***FE*** will gather comments during the meeting and issue a final *Orange County Radio System Alternatives Report* which will include the selected alternative.

3.2.4 Existing System Coverage (RFP 5.D.3)

3. 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.

FE will use our in-house tool, ***FEPerformancePro™*** to provide coverage analysis for the County's current system. This integrated set of tools provides our consultants with state-of-the-art network modeling technology to analyze the performance of a system. These tools include the following:

- ***FECoverage™*** – complete coverage analysis tool
- ***FEMapper™*** – high-resolution mapping tool
- ***FENetwork™*** – reliable capacity analysis tool
- ***FEMitigate™ (optional)*** – system-wide interference analysis

FEPerformancePro™ uses ATDI's powerful ICS Telecom industry standard network propagation and planning software as its engine. ICS Telecom's accuracy in modeling communications networks, performing interference analyses, and facilitating frequency planning has been validated by the federal government in field tests. ***FEPerformancePro™*** will be used to demonstrate the coverage provided by Orange County's current system***.*** We will provide coverage maps that depict current mobile, portable, and paging coverage and identify coverage gaps.

Deliverable—Existing System Coverage Performance (RFP 5.D.3)

3. *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.*

FE will produce a mutually agreed upon set of coverage maps for both mobile and portable subscriber units depicting major geographical landmarks and the area topography, including scale, color schemes, highway/road data, jurisdictional boundaries, and desired performance characteristics. Exhibit 4 shows an example of a coverage map that ***FE*** prepared for Orange County in 2013, depicting coverage provided by the current VIPER 800MHz system.

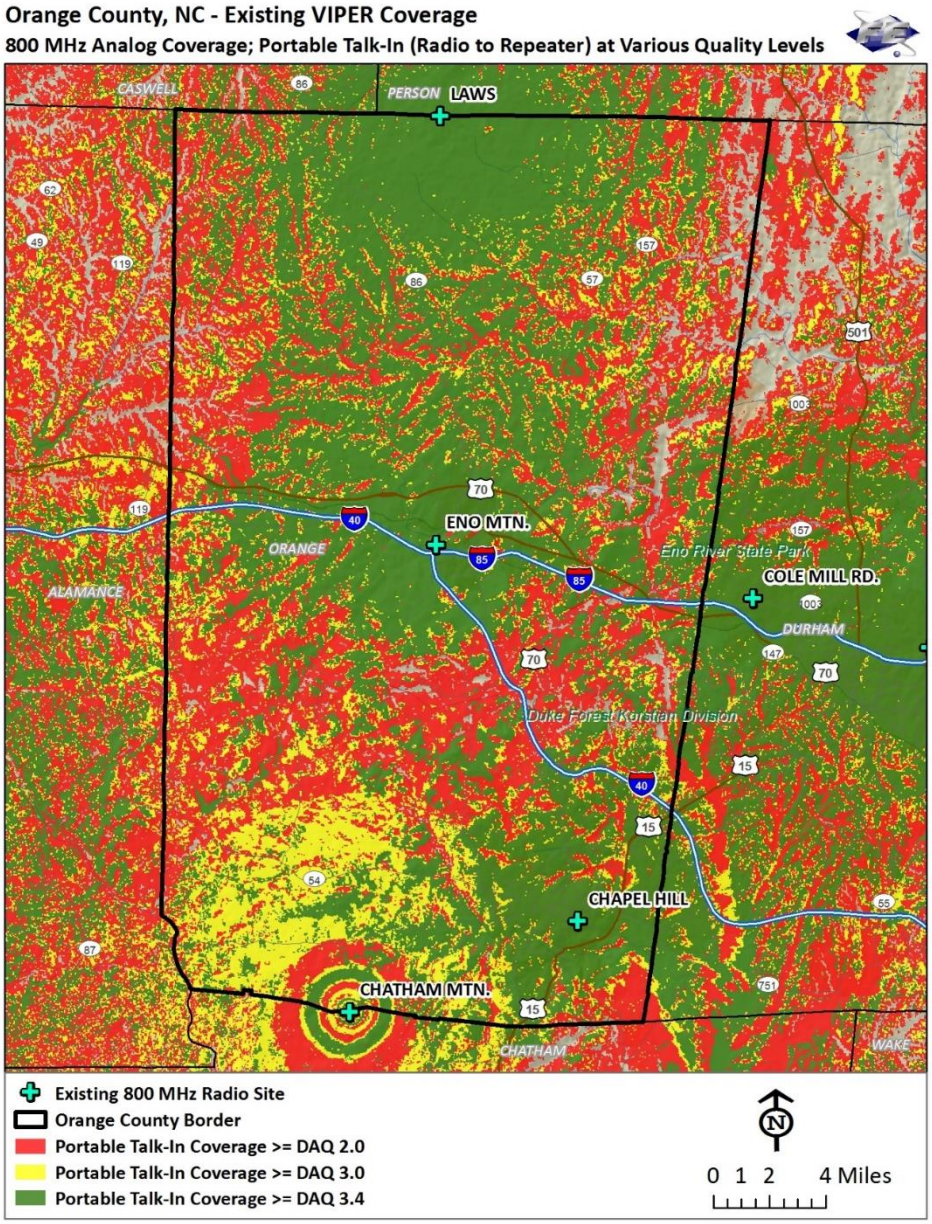

Exhibit 4—Sample Orange County VIPER Portable Coverage Map

3.2.5 Proposed System Coverage Analysis (RFP 5.C.4)

4. 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. (RFP 5.C.4)

FE will then model the coverage of the alternative systems. Alternatives will leverage existing sites and potential new sites to fill coverage gaps. In addition to coverage analyses, ***FE*** will also perform the following for the viable alternatives:

- ***Coverage Analysis—FE*** will use ***FEPerformancePro™*** to provide coverage analysis of each of the viable alternatives as assess how they meet the users' needs.

- ***Capacity Analysis—FE*** will use the approved requirements to assess the expected traffic load of the system. We will then estimate the number of sites and channels required to meet Orange County's needs.

- ***Backhaul Analysis—FENetwork™*** facilitates backhaul network analysis and design. Our consultants will assess the backhaul needs for the County based on requirements. As an *option*, we can use ***FENetwork™*** to graph individual path profiles for each link or provide a representation of the entire backhaul network.

- ***Interference Analysis—***As an *option*, ***FE*** will analyze both co-channel interference (also known as "carrier interference") and adjacent channel interference (interference from a frequency that is directly adjacent to the desired frequency). Both of these types of interference can degrade audio quality when a subscriber unit's antenna simultaneously receives signals broadcast from different sites. ***FEMitigate's™*** powerful analysis engine can evaluate either global (all received channels at a given location) or best server (the strongest received channel at a given location) to provide the information needed to determine a recommended solution.

- ***Spectrum Planning—***Proper frequency planning is necessary to implement a successful public safety communications system. ***FE*** has provided frequency planning, allocation, rebanding, narrowbanding, and licensing services to multiple agency levels, from local to statewide. Our experience covers all public safety frequency bands including VHF, UHF, 700 MHz, 800 MHz, and 900 MHz, and includes the discovery of available frequencies, consideration and allocation of FCC rules, ensuring interoperability, and accurate FCC license filing and coordination.

  To help the County establish a future spectrum strategy, ***FE*** will analyze spectrum needs based on the results of the interviews. We will evaluate the potential use of low band, high band, UHF, 700 and 800 MHz frequencies for use in an upgraded network and indicate if the County should acquire additional spectrum to meet their anticipated needs. ***FE*** will consider interoperability among public safety and public service agencies who will use the new network, interoperability with state systems, and interoperability with surrounding counties and jurisdictions.

  Federal Engineering's Spectrum Center of Excellence has immediate access to FCC databases and is constantly apprised of all issues surrounding frequency acquisition and

use. ***FE*** monitors the FCC's rules and regulations, as well as the latest reports, orders, notices, and memoranda that pertain to the wireless regulatory arena. We will put the County on our watch list for any items that may affect the existing FCC licenses

As an option, ***FE*** can prepare FCC Form 601 license applications, frequency coordination forms, and FAA forms and file applications with the designated frequency coordinator or other appropriate entity on behalf of the County, or file directly with the FCC when frequency coordination is not required for simple license modifications, special temporary authority, rule waiver requests, and certain license applications.

Deliverable—New System Coverage Performance (RFP 5.D.4)

4. *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.*

FE will produce a mutually agreed upon set of coverage maps of the recommended new system for both mobile and portable subscriber units depicting major geographical landmarks and the area topography, including scale, color schemes, highway/road data, jurisdictional boundaries, and desired performance characteristics.

3.2.6 FETeamCoverage™ (Optional Task)

As an option, we offer ***FE Team Coverage™***, our powerful, interactive tool that involves clients in the system design process. The process is facilitated by a subject matter expert from our *Spectrum Center of Excellence™*. ***FE Team Coverage™*** is a unique Federal Engineering offering based upon proven modeling software and has been consistently lauded by our clients. It builds user consensus and facilitates "buy-in" of the eventual system. The following are addressed during the ***FE Team Coverage™*** workshop:

- System users' coverage needs
- Other participating jurisdictions' coverage needs
- Coverage problem areas identified during the needs assessment
- How to meet fire-ground and in-building coverage needs
- Areas where traditional tower-based coverage is not possible (*i.e.*, locations that are environmentally protected, difficult access, or have no power)
- Leveraging existing sites and potential new sites to fill coverage gaps

As radio coverage is modeled and gaps are indicated, ***FE's*** subject matter expert will interactively, and in real-time, manipulate the model and display the effects of changing site equipment or placing additional sites in the network. Workshop attendees will immediately be able to evaluate the impact of these changes and determine what should be done to meet user requirements.

At the conclusion of the workshop, ***FE*** will produce a mutually agreed upon set of coverage maps, customized to your needs, depicting major geographical landmarks, area topography, highway/road data, jurisdictional boundaries, and desired performance characteristics.

FE Team Coverage™ can be provided over the Internet via collaborative software or in a classroom environment at your option.

3.2.7 Interoperability Analysis (RFP 5.C.3)

3. 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.

As the County is aware, SAFECOM's continuum indicates an agency's level of interoperability based upon criteria in each lane: Governance, Standard Operating Procedures, Technology, Training & Exercise, and Usage. As shown by the continuum in Exhibit 5, true interoperability increases as agencies are able to demonstrate that they align on the right side of the continuum. The third lane, Technology, defines the steps to achieve SAFECOM's highest level of communications equipment and systems interoperability: the ability of public safety and public service agencies to communicate across disciplines and jurisdictions, exchanging voice and/or data with one another on demand, in real time, when needed, and as authorized.

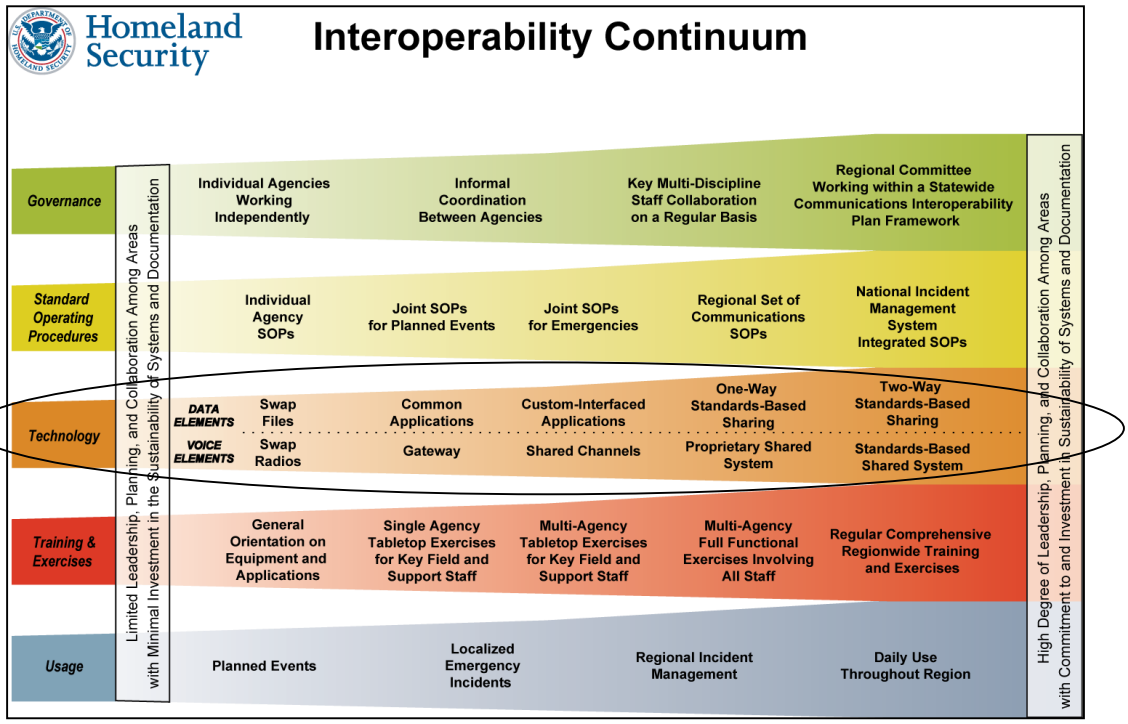

Exhibit 5—SAFECOM's Interoperability Continuum[3]

During the user and stakeholder interviews, ***FE*** will discover the County's desired levels of regional interoperability with adjacent municipalities and counties, the North Carolina State Police, and federal agencies. Our analysis will specifically address the Technology lane and associated interoperability, interfaces, and interactions among County agencies, surrounding jurisdictions, and other state and federal agencies as requested.

[3] http://www.safecomprogram.gov/SiteCollectionDocuments/Interoperability_Continuum_Brochure_2.pdf

FE's analysis will use the SAFECOM Continuum and the SAFECOM Interoperable Statement of Requirements (SoR) as guides to identify user's interoperability needs, and how those needs are, or are not being met by the current system.

Deliverable—Interoperability Gap Analysis (RFP 5.D.2)

> *Analysis of interoperability gaps as provided through interviews of the various existing infrastructure users. Coverage Analysis*

Included in the *Orange County Radio System Alternatives Report*, ***FE*** will provide Orange County with interoperability requirements identified by the users, and an analysis identifying where those needs are or are not being met by the current system.

3.2.8 Budgetary Costs (RFP 5.C.10)

> *10. Obtain and submit budgetary costs for alternatives presented, and assist the review committee to prioritize acquisitions and implementation*

Using our in-house ***FECostPro™*** tool, ***FE*** will estimate the cost of each viable alternative. ***This high-level, quantitative analysis relies on our team's knowledge base, which spans numerous similar county projects.*** Cost estimates will be further refined for the single alternative chosen by the County review committee.

3.2.9 Migration Plan (RFP 5.C.5)

> *5. Develop a comprehensive migration plan for all current infrastructure users.*

Orange County will benefit from our experience preparing migration plans for hundreds of public safety entities, including municipalities, counties, and states. ***FE*** will work with the County to define a user migration plan for the selected solution. This top level plan will outline the steps necessary to efficiently transition to a new system and focus on these key areas:

1. Implementation planning
2. Financial alignment
3. Operational planning
4. System cutover

FE's migration plans typically address the following activities related to the overall new or upgraded system, so that internal planning can be done in a logical sequence well in advance of vendor contract award.

- Radio site development
- Dispatch center development
- Procurement
- Negotiations
- Deployment
- Training
- Acceptance testing
- Acceptance
- Cutover

Deliverable—Comprehensive Transition Plan (RFP 5.D.5)

> *5. A comprehensive transition plan for all current infrastructure users to the new/proposed infrastructure. The plan shall be designed to ensure no loss of functionality and/or capabilities during the transition.*

FE will include migration planning considerations in the *Orange County Radio System Alternatives Report.*

3.2.10 Acquisition and Implementation Process Recommendation (RFP 5.C.6)

> *6 Recommend and submit a planned acquisition and implementation process based on the option approved by the review committee.*

FE has extensive experience working with clients to determine the best means of procurement. Our expertise allows our clients to realize significant cost savings in their system implementations.

FE will work closely with the Orange County project manager and purchasing organization to determine the best means of procuring the new radio system. This will entail analyzing the alternatives outlined in Section 5.B.3.g of the County's RFP and recommending the best alternative for the selected system solution.

3.2.11 Generation of Recommendations Report

At the conclusion of the above tasks and before the procurement phase of this project, ***FE*** will deliver to the County, a draft *Orange County Radio System Recommendations Report*. ***FE*** will meet with the County to review the report, gather comments, and then issue a final report. This final report will serve as the basis for the development of the equipment vendor RFP.

3.2.12 Vendor Neutral RFP Development (RFP 5.C.7)

> *7. Development of a vendor-neutral Request for Proposal (RFP) suitable to be released to the vendor community for the purposes of procuring the approved alternative.*

FE will develop a set of technical specifications for an Orange County public safety P25 radio system based on the County-approved requirements and selected solution for use in an RFP. These specifications will describe the radio system's functional and performance requirements in sufficient detail for vendors to submit consistent proposals, will be verifiable through future acceptance testing, and will stress the use of existing investments wherever possible. The detailed design of the system will be left to the radio system vendor to allow for innovative approaches and to ensure the vendor remains responsible for system performance in accordance with the specifications. These specifications will be the foundation for vendor proposal evaluation and as acceptance criteria.

FE's specifications are properly crafted to tightly define performance and at the same time encourage competition and innovation. ***FE*** typically includes the following in our specifications:

- System functional, protocol, and operational requirements
- Regulatory and standards compliance
- Leverage existing resources
- Expandability to accommodate future growth
- Backhaul connectivity
- Network management

- Infrastructure equipment
- Suggested site locations and development
- Site subsystems (power, HVAC, etc.)
- Site/shelter modifications
- System delivery and installation
- Dispatch equipment
- Subscribers (mobiles, portables)
- System reliability and redundancy
- Required coverage and capacity
- Spectrum usage and restrictions
- Local, regional, state, and federal interoperability
- System functional, protocol, and operational requirements
- Network and physical security
- Overall project schedule and implementation plan
- Migration and cutover/transition requirements for continuity of operations
- User (operational) and technical staff training requirements
- Network management
- Required legacy and new interfaces
- Factory, interoperability, coverage, site, system, and acceptance test guidelines and criteria
- Regulatory and standards compliance

Orange County will receive specifications that address the County's needs. Our staff understands the technical, financial, funding challenges faced by local municipalities both large and small.

FE's past and current clients have expressed satisfaction and given prompt approval of the RFPs we have written. We have received feedback from system vendors that RFPs developed by FE are fair and allow them to prepare comprehensive, clear responses. In addition, no procurement that FE was involved in has been protested by a vendor. This is a testament to our outstanding project management methodologies and team.

Deliverable—Vendor Neutral RFP (RFP 5.D.6)

> *6. 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.*

FE will develop a complete *Orange County Radio System RFP* incorporating the technical specifications, boilerplate terms and conditions, and other local purchasing requirements. We will submit the draft RFP to the County for review and comment, update based on the County's review, and submit a final RFP.

3.2.13 RFP Process Facilitation (RFP 5.C.8)

> *8. Facilitation of the RFP process, including staff support to the County in conducting a comprehensive evaluation of RFP responses received.*

In addition to vendor proposal evaluation, ***FE*** can provide expert technical recommendations and advice to the County during the entire competitive solicitation. As an option, the following tasks not called out in the County RFP can be performed in close consultation with the County.

- Attend and assist the County with the vendor pre-proposal conference
- Respond to any technical questions from the bidders concerning the RFP
- Generate addenda to the RFP as necessary

- Attend and assist with vendor best and final presentations as necessary

Deliverable—Vendor Selection Criteria (RFP 5.D.7)

7. Criteria to be used for vendor selection.

FE will work with the County to develop evaluation criteria for determining vendor qualifications and capabilities, compliance with functional/technical specifications, and any other evaluation factors. This will include criteria for assessing and comparing the cost of vendor proposals.

Certain criteria we expect to be "pass/fail". These include financial stability of the vendor, whether or not the vendor is debarred or suspended from doing business, and completeness of the vendor's proposed response (evaluates whether all required items included in the proposal).

TYPICAL RFP RESPONSE EVALUATION CRITERIA

- Feasible P25 design
- Adequate coverage and capacity
- Sites proposed—paying specific attention to any new sites
- Complete equipment list
- Adequate factory, coverage, functional, performance, and acceptance test plans
- Adherence to the technical specification and other requirements
- Backhaul design or upgrade
- Required interoperability
- Reliability and redundancy
- Schedule

3.2.14 CAD Drawings (RFP 5.C.9)

9. Create and submit computer aided design (CAD) drawings as required.

We do not expect there to be a need for CAD drawings.

Deliverable—CAD Drawings (RFP 5.D.8)

8. CAD drawings as required.

If required, ***FE*** will provide CAD drawings on an optional basis.

Deliverable—Training Requirements Recommendation (RFP 5.D.9)

9. Recommended training requirements for the new communications system

The RFP that ***FE*** develops for Orange County will include requirements for the selected vendor to provide training for multiple audiences. Typically vendors are required to provide training in the following subject matter areas:

- End user training
- System administrator training
- System maintenance training

FE will review the vendors training plans submitted with their proposals, and will provide the County with recommendations for modification if needed.

3.2.15 Optional Tasks

FE offers the following options for consideration. These options are not priced in this proposal; however, pricing can be provided upon County request.

Radio System Vendor Contract Negotiations—FE can provide the County with experienced contract negotiations support. ***FE*** has considerable experience negotiating public safety radio systems, equipment, and services, with a proven track record of saving millions of dollars for our

clients. Because of their dealings with radio system vendors on a regular basis, our consultants have insights into vendors' negotiation methods and practices and can assist the County in resolving negotiation issues. As an example, in one of our current county projects in Virginia, our negotiations resulted in a savings of approximately 40 percent of the total cost of the system.

Grant Research and Application Support—FE can assist with researching grant and other funding sources to subsidize the implementation of the County's system. We can also assist with completing and submitting applications.

Implementation Oversight and Management—FE is fully capable of providing unbiased and objective implementation oversight and management services should the County desire. Many of ***FE's*** clients who have contracted our firm to provide needs assessment, design, and/or procurement services have also retained ***FE*** to oversee implementation. ***FE*** can provide these services to Orange County as well, refining the activities based on the final radio system specifications and approved vendor contract. These activities may include the following.

- Detailed System Design and Acceptance Test Plan Reviews
  - Detailed system design and ATPs (vendor produces and presents, ***FE*** reviews)
  - Shop drawings including structures (vendor or engineer produces, ***FE*** reviews)
  - Factory test plan(vendor tests, ***FE*** verifies results)
- Equipment Inspections
  - Equipment list (vendor produces, ***FE*** reviews)
  - System component delivery (vendor orders, ***FE*** verifies)
- Installation Inspections
  - Site and subscriber installation inspections (radio and construction vendor, ***FE*** observes and verifies)
  - Site inspections – workmanship, structural and civil work, etc. (radio and construction vendor, ***FE*** observes and verifies)
  - Dispatch center console inspections (radio and console vendor, ***FE*** observes and verifies)

Testing Oversight Services—FE can also provide radio system testing oversight services. The following list of activities would be refined based on the final radio system specifications and approved vendor contract.

- Factory Testing
  - Factory testing at system vendor location (radio vendor tests, ***FE*** observes and reviews test results)
- Field and Coverage Testing
  - Radio system coverage testing (radio vendor tests, ***FE*** reviews test results)
  - Other system performance testing (radio vendor tests, ***FE*** reviews test results)
  - System interoperability testing (radio vendor tests, ***FE*** reviews test results)
  - Submit test results (radio vendor)
  - Rework unaccepted tests (radio vendor, ***FE*** reviews test results)

- System Acceptance Testing
  - Final system acceptance test inspection and certification (***FE*** reviews, evaluates, and provides recommendation)

Governance for Radio—Whether you are installing a new radio system or are managing an existing one, governance is critical. Who decides how the system will be used, who will use it, and how it will be maintained, expanded, and refreshed? And how do those decision-makers reach their decisions? The ***FE*** team brings tremendous depth in the design, evaluation, and support of governance structures for public safety communications. We propose to evaluate your current structure, recommend improvements, and—to the extent desired by the client—support that structure's meetings and deliberations.

FE will tailor its approach to your particular needs, gaining a thorough understanding of the legal and policy underpinnings of your current structure as well as an informed view of its strengths and challenges through both documentary research as well as interviews with informed governance participants. Examples of potential deliverables include governance structure evaluation reports, charters and bylaws, and proposed legislation.

3.3 Project Schedule and Work Plan (RFP 4.F)

As part of this proposal the vendor must submit a proposed project work plan and schedule. The vendor must identify all assumptions and constraints on which the project schedule and work plan are based.

The schedule shown below provides a nominal schedule for ***FE*** to perform the project described in the RFP assuming contract execution and notice is received on or before April 4, 2016.

Milestones	*Weeks After Contract Execution*
Phase 1—Needs Assessment and Solution Selection	
Existing documentation review	2
Project initiation meeting	3
Needs assessment and requirements discovery	3
Stakeholder interviews	3
Site data and equipment inventory review	4
Deliverable: Draft *Orange County Radio System Alternatives Report*	10
Meeting with Orange County to review the draft report and select alternative	11
Deliverable: Final *Orange County Radio System Alternatives Report*	11
Deliverable: Draft *Orange County Radio System Recommendations Report*	14
Meeting with Orange County to review the draft report	15
Deliverable: Final *Orange County Radio System Recommendations Report*	15

Milestones	*Weeks After Contract Execution*
Phase 2—Procurement Support	
Deliverable: Draft *Orange County Radio System RFP*	18
Deliverable: Final *Orange County Radio System RFP*	19
Develop vendor evaluation criteria	19
Support vendor proposal evaluations	TBD

This schedule is tentative and will be adjusted to meet the needs of the County. ***FE*** will work with the County project manager to finalize the above schedule as well as invoicing milestones. All assumptions and constraints are provided in the cost proposal.

TAB 4—COST PROPOSAL

4 COST PROPOSAL (RFP SECTION 6.0)

The cost proposal should show personnel classifications including sub-contractors, hourly wage, and anticipated hours on the project. A summary of personnel costs should accompany the cost proposal. Other Direct Costs (ODC) should include travel, lodging, and meals, printing, postage, and other non-personnel/sub-contract costs associated with completing this project. A summary of ODC costs should accompany the cost proposal.

Two (2) copies of the cost proposal should be submitted in a separate envelope with the written proposal. The proposal will be scored using a standard quantitative calculation where the most cost criteria points will be awarded to the proposal with the lowest cost.

As required by the RFP, ***FE*** is submitting two copies of our cost proposal in a separate sealed envelope.

TAB 5—REQUIRED FORMS

5 REQUIRED FORMS (RFP SECTION 7.0)

The following forms just be completed and submitted with the proposal in accordance with the instructions provided in section 2.0. Blank forms are in the following attachments:

- *Attachment A Signature Affidavit*
- *Attachment B Vendor Data Sheet*
- *Attachment C References*
- *Attachment D Cost Summary Page*

The required forms listed below are provided on the following pages.

- Attachment A—Signature Affidavit
- Attachment B—Vendor Data Sheet
- Attachment C—References
- Attachment D—Cost Summary Page is provided in the separately sealed cost proposal
- Addendum 1 Acknowledgment
- Addendum 2 Acknowledgment
- Addendum 3 Acknowledgment
- Addendum 4 Acknowledgment

The balance of this page is intentionally left blank.

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.

Ronald F. Bosco
Name (Type or Print)

President
Title


Signature

Federal Engineering, Inc.
Firm

10600 Arrowhead Drive #160, Fairfax, VA 22030
Address: (Street, City , State, Zip Code)

703-359-8200
Telephone

703-359-8204
Fax

rbosco@fedeng.com
E-Mail

2/11/2016
Date

Attachment B

VENDOR DATA SHEET

1. **Proposing Company Name** Federal Engineering, Inc.

   Telephone 703-359-8200 Toll Free Telephone N/A Fax 703-359-8204

   Address: 10600 Arrowhead Drive

   City: Fairfax State: VA Zip + Four: 22030-7321

2. **Contact Person in the event there are questions about your proposal**

   Name: Skip Funk Title: Senior Vice President, Business Development

   Telephone: 904-806-0221 Toll Free Telephone: N/A

   Address: 10600 Arrowhead Drive

   City: Fairfax State: VA Zip + Four: 22030-7321

3. **Mailing address where County purchase orders/contracts are to be mailed and person the Department can contact concerning orders and billing.**

   Name: Ronald F. Bosco Title: President/CEO

   Telephone: 703-359-8200 Toll Free Telephone: N/A

   Address: 10600 Arrowhead Drive

   City: Fairfax State: VA Zip + Four: 22030-7321

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: Buncombe County, North Carolina
Company Address: 59 Woodfin Place, Asheville, NC 28801
Telephone/email: 828-250-6834 (Gorman) / 828-250-6807 (Dillingham) / clint.gorman@buncombecounty.org / bryan.dillingham@buncombecounty.org
Contact Person: Clint Gorman, Radio Administrator and Bryan Dillingham, Network and Communications Manager
Services provided by proposer/vendor:
Existing systems assessment, narrowband upgrade planning, on-call technical consulting, and RFP development

Company Name: New Hanover County, North Carolina
Company Address: 230 Market Place Drive, Suite 115, Wilmington, NC 28403
Telephone/email: 910-798-6900 / wlee@nhcgov.com
Contact Person: Warren Lee, Director of Emergency Management
Services provided by proposer/vendor:
Public safety needs assessment, system design, and implementation; Administration Building inside cabling design and specifications

Company Name: Yadkin County, North Carolina
Company Address: 217 East Willow Street, Yadkinville, NC 27055
Telephone/email: 336-679-4200 / lhughes@yadkincountync.gov
Contact Person: Lisa Hughes, Deputy County Manager
Services provided by proposer/vendor: Procurement and implementation support and tower inspection services

Company Name:
Company Address:
Telephone/email:
Contact Person:
Services provided by proposer/vendor:

Company Name:
Company Address:
Telephone/email:
Contact Person:
Services provided by proposer/vendor:

ORANGE COUNTY
NORTH CAROLINA

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 / (919) 245-2651

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

Company Name: Federal Engineering, Inc.

By: Laura L. Cross, Proposal Manager

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
NORTH CAROLINA

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 / (919) 245-2651

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

Company Name: Federal Engineering, Inc.

By: Laura Cross, Proposal Manager

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
NORTH CAROLINA

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 / (919) 245-2651

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

Company Name: Federal Engineering, Inc.

By: Laura L. Cross, Proposal Manager

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
NORTH CAROLINA

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 / (919) 245-2651

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

Company Name: Federal Engineering, Inc.

By: Laura Cross, Proposal Manager

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

APPENDIX A—RESUMES

APPENDIX A—RESUMES

TRAVIS C. LEPAGE, PMP, PMI-ACP

Project Director

GENERAL BACKGROUND

Mr. Travis LePage is a highly talented and accomplished consultant on the ***FE*** team with a demonstrated track of successfully leading and managing complex multi-million dollar programs and enterprise/agency-wide projects for state and municipal governments and public and private organizations. Travis has several years of experience delivering project results to meet the unique needs, requirements, and expectations of stakeholders.

Mr. LePage is an expert in program and project management; stakeholder requirements analysis; land mobile radio (LMR), microwave radio, LTE, and paging system implementations and operations; radio site development (civil works); interoperable communications plan development; public safety communications systems; RF spectrum management; and voice/data network engineering.

EDUCATION & TRAINING

- Advanced Master's Certificate, Program Management, George Washington University, 2010
- Master of Business Administration, Technology Management, State University of New York, 2006, Senator's Scholar
- Bachelor of Science, Telecommunications Engineering, State University of New York, 2002, with Honors

AREAS OF EXPERTISE

- Program and project management
- Public safety and commercial carrier communication systems analysis, design, and implementation
- Stakeholder needs analysis
- Public safety interoperable communications plan development
- RF spectrum planning and management
- System integration project management
- Voice/data network optimization
- Organizational and technology planning and positioning
- Procurement support and vendor management

PROFESSIONAL ORGANIZATIONS

- Association of Public Safety Communications Officials (APCO)
- Project Management Institute (PMI)
- Toastmasters International

PROJECT EXPERIENCE

Erie County, New York Interoperable Communications Project, Project Manager and Lead Consultant

- Spearheaded the planning and execution of a five-phased interoperable communications program, comprising a tactical interoperable communications plan (TICP) and Communications Assets and Survey Mapping (CASM) update, interoperability channel sharing plan, multi-agency training program, lifecycle cost analysis, and narrowbanding support
- Project benefits include the consolidation and sharing of VHF, UHF, and 800 MHz interoperability channels, the development of a comprehensive inventory and cost analysis for regional communications assets/capabilities, and the establishment of a regional training program

Schenectady County, New York Unified Communications Center (UCC), Lead Consultant and Project Manager

- Led a team of engineers, business process analysts, and procurement professionals to develop a UCC migration plan
- Effort involved performing existing system analyses, developing design documents and procurements specifications, and evaluating alternative system configurations
- Project benefits include cost savings and improvements in service delivery by consolidating multiple dispatch centers serving six jurisdictions, 23 fire departments, seven law enforcement agencies, and three EMS providers

City of Portland, Oregon Voice Radio System Design and Specifications Development, Project Manager

- Led a multidisciplinary team comprising engineering and management personnel to develop detailed specifications and a conceptual design for the city's public safety voice radio system
- Effort involved validating system inventory, performing user needs analysis, and evaluating alternative solutions

- Project results positioned the city to sustain an efficient, interoperable, and reliable public safety voice radio system

Chautauqua County, New York Public Safety Communication System Evaluation, Project Manager and Lead Consultant

- Evaluated the existing public safety communication system
- Recommended alternative solutions
- Developed business case and financial analysis
- Project provided County, local, and mutual aid users with an efficient, reliable, and interoperable radio communications system

Onondaga County, New York UASI TICP Development, Lead Consultant

- Developed and completed TICP
- Established governance structure
- Captured procedures and policies for UASI resources and personnel
- Provided TICP implementation support
- Developed interoperability initiatives
- Established interoperability partnerships with surrounding jurisdictions
- Project resulted in the establishment of a TICP, integral for day-to-day operations and natural and manmade disaster response

Rochester-Monroe County, New York UASI TICP Exercise Development and Evaluation Services, Exercise Design and Evaluation Consultant

- Designed a TTX and FEX for the UASI
- Evaluated exercises in accordance with HSEEP
- Prepared the TTX and FEX AAR/IP
- Project provided first responders with visibility into target improvement areas concerning policies, processes, and communication procedures

CERTIFICATIONS

- Project Management Professional (PMP)
- Project Management Institute-Agile Certified Practitioner (PMI-ACP)
- Certified ScrumMaster (CSM)
- Lynncole XiT Electrical Grounding
- Nortel Digital Multiplex Switch

SHORT COURSES

- State Environmental Quality Review Act (SEQRA)
- Harris OpenSky System Administration
- Harris OpenSky Fleetmap Design

WORKSHOPS & COMMITTEES

- Project Management Institute (PMI) Special Interest Group (SIG)
- SrumAlliance
- Northeastern U.S. FCC Regional Planning Committees

PREVIOUS AFFILIATIONS

- NYSTEC
- Global Crossing
- Smith Broadcasting

Lewis County, New York Public Safety Communication System Evaluation, Project Manager and Lead Consultant

- Evaluated the existing public safety communication system
- Performed alternative analysis
- Conducted coverage workshop
- Developed conceptual design and business case
- Provided grant guidance support
- Project benefited the County by outlining radio system replacement alternatives and discovering grant funding opportunities

CLIFTON P. BROWN, P.E.

Project Manager & Technical Lead/Senior Consultant

GENERAL BACKGROUND

Mr. Clifton Brown is a highly motivated, creative, and versatile manager in the wireless telecommunications industry, with extensive experience in turning customer needs into deliverable solutions, including planning; product and services development; engineering design; RFP process; site development; network implementation; network testing; and ongoing operations and maintenance. He possesses a clearly demonstrated history of exceeding goals, finding the right people for the job, and challenging them to the highest levels of performance. As a result, financial targets, revenue and margins, and schedules were met and often exceeded.

Mr. Brown's experience includes the successful program and project management of systems ranging from citywide to nationwide in scope. He has managed multi-disciplinary teams consisting of planning, engineering, RFP preparation and RFP response evaluation, deployment, ongoing O&M, finance, and management reporting. He is skilled in providing management and oversight in system and network designs to meet customer needs, using leading edge technologies such as LTE, TV white space, WiFi, WiMAX, public safety in-building DAS, P25, MESH-based SmartGrid, broadband backhaul (fiber, MOE, microwave), and cloud-based network management.

EDUCATION & TRAINING

- Bachelor of Science, Electrical Engineering, Illinois Institute of Technology

AREAS OF EXPERTISE

- Program management
- Project Management
- Engineering management
- Risk assessment
- Asset Management
- Product and services development
- Engineering design
- RFP process
- Site development
- Network implementation; and testing;
- Ongoing operations and maintenance
- Profit and loss management

PROFESSIONAL ORGANIZATIONS

- Institute of Electrical and Electronics Engineers (IEEE)

LICENSES & CERTIFICATIONS

- Professional Engineer, State of Illinois (inactive)

AWARDS

- JD Power Award for Customer Service in 1996, 1997, 1998

PREVIOUS AFFILIATIONS

- LCC International/Wireless Facilities, Inc.
- Bell South DCS
- Bell Atlantic Mobile
- United States Cellular
- Terence J. Collins Associates, Inc.
- AT&T Network Systems
- Motorola Communications and Electronics, Inc.

PROJECT EXPERIENCE

Orange County, North Carolina Infrastructure Upgrade Plan, Project Manager

- Conduct research into geographical areas, urban structural interference and other anomalies negatively affecting transmission and reception for the 800 MHz VIPER system, as well as the County Fire Station Alerting and Paging system
- Perform data analysis on the information gathered and provided by the county, NCSHP VIPER and other third-parties and stakeholders
- Provide needs assessment of communications requirements, identifying required coverage levels both on-street and in-building
- Recommend possible VIPER and Fire Station Alerting/Paging system infrastructure upgrades
- Ensure compliance with County Unified Development Ordinance
- Provide recommendations for tower heights, siting, and construction to ensure County coverage requirements are met

State of North Carolina NG9-1-1 System Planning and Procurement, Associate Project Manager

- Preparation of Concept of Operations for the statewide NG9-1-1 system, including ESInet, Hosted Call Solution, GIS, Network Monitoring and Assistance center, CAD interoperability, and radio interoperability
- Preparation of Cost Analyses of new NG9-1-1 system
- Development of Conceptual Designs and RFPs for ESInet, Hosted Call Solution, GIS interfaces, Network Monitoring and Assistance Center, CAD interoperability, and radio interoperability
- Procurement support for each RFP process

- Evaluation of RFP responses

City of Henderson and Henderson County, Kentucky P25 Phase 2 System Consulting, Project Manager

- Conduct City and County needs analysis for replacement radio system for Sheriff, Police, Fire, and EMS, including interfaces to City/County CAD and 911 systems, VHF paging, and Fire Station Alerting
- Development of RFP specifications for procurement of a P25 Phase 2 system, providing full County and City coverage, including in-building coverage for critical buildings and schools
- Provide technical assistance to City and County during the procurement phase: pre-bid meeting, development of answers to vendor questions, and preparation of technical addenda
- Review and evaluation of multiple vendor Proposals, submitted in response to RFP, determination of technical compliance to RFP requirements
- Provided vendor contract negotiation support to City and County

New Kent County, Virginia P25 Phase 2 Radio System Implementation Support, Project Manager

- On-call technical support as requested by County
- Provide technical support for review of detailed system design, and recommendations to County
- Provide review of test plans: factory staging; equipment and system acceptance; RF coverage
- Review vendor acceptance test results and provide County with recommendations
- Review vendor's proposed system optimization plans, and system optimization results
- Monitor vendor's project schedule and identify risk areas
- Review and provide recommendations on County acceptance of system documentation and Final System Acceptance

City of Chesapeake, Virginia P25 Phase 2 Radio System Procurement and Implementation Support, Project Manager

- Review of multiple vendor Proposals, verify compliance to RFP requirements
- Prepare "pros" and "cons" for each vendor Proposal
- Attend vendor presentations and determine RFP compliance
- Prepare negotiation points for Chesapeake
- Verify vendor's proposed RF coverage through in-house propagation studies
- Provide technical support for review of detailed system design, and recommendations to City
- Provide review of test plans: factory staging; equipment and system acceptance; RF coverage
- Review vendor acceptance test results and provide City with recommendations
- Review vendor's proposed system optimization plans, and system optimization results
- Monitor vendor's project schedule and identify risk areas
- Prepare master codeplug (subscriber template) for City use
- Review and provide recommendations on City acceptance of system documentation and Final System Acceptance

City of Bartlett, Tennessee Replacement Radio System, Project Manager

- Conduct city needs analysis for replacement radio system for police, fire, and EMS, including interfaces to VHF paging
- Development of RFP specifications for procurement of a P25 Phase 2 system, providing full city coverage, including in-building coverage for critical buildings and schools
- Provide technical assistance to city during the procurement phase: pre-bid meeting, development of answers to vendor questions, and preparation of technical addenda
- Review and evaluation of multiple vendor proposals submitted in response to RFP, determination of technical compliance to RFP requirements
- Provided vendor contract negotiation support to city and county

City of Bowling Green/Warren County, Kentucky Public Safety/Wireless Communications Consulting, Project Manager

- Review and assist with preparation and issuance of an RFP
- Participate in pre-bid/pre-proposal meetings
- Prepare written response to all technical questions posed by vendors, prepare technical Addenda
- Review vendor RFP responses for compliance with technical specifications

ADAM S. NELSON

RF Performance Specialist/Senior Consultant

GENERAL BACKGROUND

Mr. Adam Nelson has over 15 years of experience providing consulting services in the fields of public safety, telecommunications, and information technologies. As a member of ***FE's*** Spectrum Center of Excellence, his specialties include radio frequency prediction and analysis, frequency and capacity planning, interference mitigation, LTE system design and analysis, and spectrum-related efforts pertaining to frequency licensing and coordination.

Mr. Nelson's background includes performance engineering, optimization, and systems design of both public and private wireless communications systems. His background also includes the management and maintenance of various municipal wireless networks, specifically in the realm of public safety communications. He has participated in all phases of communications system lifecycle from needs assessment, system recommendations, RFP development, through implementation.

EDUCATION & TRAINING

- Master's Degree, Geographic Information Systems, The Pennsylvania State University, 2014
- Post-baccalaureate Certificate in Geographic Information Systems, The Pennsylvania State University, 2011
- Bachelor of Science, Information Technology, University of Phoenix, 2003, with honors

AREAS OF EXPERTISE

- RF propagation prediction/ analysis for LMR voice and data
- RF interference assessment and mitigation
- Broadband wireless system design, traffic modeling, and analysis, LTE systems
- System capacity planning
- Frequency planning
- Frequency coordination and licensing
- GIS coordination, curation, analysis, and modeling
- Intermodulation assessment and mitigation
- Network operations and maintenance
- Voice/data communications
- Information technology fundamentals
- Web-based application development
- TCP/IP and networking protocols

PROJECT EXPERIENCE

RF Coverage Prediction, Capacity Analysis, Interference Analysis, and/or Channel Planning for the following projects:

County Projects

- Boone County, Kentucky Microwave Network
- Buncombe County, North Carolina Radio System Design Alternatives and Recommendations
  - Detailed design of transmit/receive sites
  - Channel availability studies
  - Development and submission of FCC licensing documentation per RPC requirements
  - Oversight of vendor design and implementation efforts
- Camden County, Georgia Radio Consulting
  - Coverage analysis of existing VHF system
  - Coverage analysis of alternative systems in VHF, UHF, and 700/800 MHz
- Caroline County, Virginia Land Mobile Radio System Design
- Collier County, Florida Radio System Consulting
  - Coverage analysis of existing EDACS system
  - Coverage analysis of potential P25 Ph2 system, including in-building coverage
- Dane County, Wisconsin Radio Consulting
  - Coverage analysis; focus on in-building analysis of new design
  - Evaluating vendor studies for providing requisite in-building coverage
- Essex County, New York Radio Consulting
  - Intermodulation studies
  - Low-band VHF spectrum analysis
  - FCC licensing support
- Cortland County, New York Interoperable Emergency Communications System
  - Design, procurement, and implementation
  - Spectrum availability analysis and frequency licensing
- Henry County, Georgia Radio System Consulting
  - Radio coverage analysis

  - Conducted Spectrum and Coverage Workshop
- Isle of Wight County, Virginia System Analysis
  - Analyze mobile and portable coverage of existing VHF countywide system
  - Evaluate potential candidate sites to bolster coverage holes throughout county
  - Coverage workshop with county personnel, demonstrating results of analysis
- King William County, Virginia
  - Analysis of vendor-proposed RF and microwave design
  - Licensing of 700 MHz interoperability channels
- Lewis County, New York System Analysis
  - Analysis of existing public safety network infrastructure and performance
  - System design effort for potential countywide radio system
  - Frequency availability study
- New Kent County, Virginia Radio Consulting
  - 800 MHz channel availability study
  - FCC licensing support
- Pitt County, North Carolina VHF System Expansion with Narrowband Migration
- Pittsylvania County, Virginia Radio System Design Alternatives and Recommendations
- Rockbridge County, Virginia Public Safety Mobile Radio Consulting

CERTIFICATIONS & TRAINING

- Simulcast Radio Systems, Motorola Certified Training
- Integrated Voice and Data Systems, Motorola Certified Training
- RAPTR Certified Training
- ATDI Developer Training
- ArcGIS Developer Training

PROFESSIONAL ORGANIZATIONS

- Association of Public Safety Communications Officials

PREVIOUS AFFILIATIONS

- City of Phoenix, Arizona
- Sprint PCS
- BellSouth Mobility
- US West/Qwest Wireless
- Voicestream Wireless

PROFESSIONAL PROFICIENCIES

Propagation Analysis

- Subject matter expert in radio frequency propagation analysis and GIS mapping
- Versed in many propagation models including:
  - Okamura Hata (National Public Safety Planning Advisory Committee [NPSPAC]-approved)
  - ITU R.P370, ITU R.525/526, and ITU-R 1812-2, as described in TSB-88.2-C
  - Deygout diffraction model
  - Irregular Terrain Model, also known as Longley Rice (NTIA- recommended, NPSPAC-approved)
  - Free Space (NPSPAC-approved)
  - CCIR (NPSPAC-approved)
- Produces clear and concise reports and visual representations of RF coverage analysis that are individually tailored to meet a client's specific requirements
- Effectively employs ***FE's*** RF network analysis tool suite, ***FEPerformancePro™*** in carrying out radio coverage analysis, developing propagation maps, performing radio frequency analysis, and assessing network channel loading
- Fluent in FCC rules for frequency licensing - including contour evaluations, interference analyses, co-channel and adjacent channel conflict studies, and filing requirements.
- Works regularly with Regional Planning Committees who oversee distribution of 700 MHz and 800 MHz frequency allocations to government entities.
- Incorporates current and comprehensive GIS layers such as population distribution, growth projections, political boundaries, and various topological features into RF system design efforts to deliver results tailored to specific client needs
- Develops throughput analysis, site selection, and coverage maps for LTE and other broadband technologies

Noise and Interference Analysis

- Proficient in transmitter noise and power analysis, and receiver sensitivity analysis
- Subject matter expert in interference analysis including co-channel, adjacent channel, and intermodulation studies, as well as simulcast interference analysis and mitigation
- Successfully designed many systems requiring frequency reuse among radio sites, in both simulcast and multicast environments

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