Welcome FirstNet and NTIA

Agenda

- Project Overview
- Reliability and Sustainability
- Innovative Applications
- Cost
- Lessons Learned
- Path Forward
- 911 Call Center Visit
- Twin Peaks Site Visit

Project Overview

San Francisco Bay Area

- 7 million population

- 5th largest tourist destination in the world

- High profile, critical infrastructure:

  - 3 international airports, critical highway/bridge network, 1 million passenger public transit system, Silicon Valley, 5 major oil refineries, 3 major ports.

The U.S. Department of Homeland Security ranks the Bay Area as the 4th highest urban area in nation for risk

Significant threats to critical infrastructure from terrorism and natural hazard incidents

The Bay Area rests upon one of the longest and most active earthquake fault systems in the world

Risks from wildfires and tsunamis are also of major concern

FirstNet's Microscope

- ➤ BayWEB provides greatest benefit to FirstNet and NTIA through lessons learned
  - ➢ Similar public/private partnership to FirstNet
  - ➢ Sample governance for FirstNet's review
  - ➢ Similar user base: Multi-jurisdiction, Multi-discipline
  - ➢ Major event experience – World Series, earthquakes, America's Cup, major Fires
  - ➢ Technical
    - ✓ Coverage: Terrain, building clutter, foliage clutter, tunnel
    - ✓ Capacity: Dense urban, urban, suburban, rural
    - ✓ Varying agency requirements: San Francisco - Pleasant Hill
    - ✓ Multiple existing CAD/RMS vendors in use
  - ➢ Silicon Valley application expertise
    - ✓ YouTube
    - ✓ Netflix

BayRICS Authority

➤ 12-Member Joint Powers Authority established in August 2011

State of California	**City/County of San Francisco**
City of Oakland	
Alameda County	**City of San Jose**
Marin County	**Contra Costa County**
Santa Clara County	**San Mateo County**
East Bay Hub Cities	**Sonoma County**
	South Bay Hub Cities

➤ Purpose: To provide governance for regional interoperable communications networks, including BayWEB

➤ Technical Advisory Committee: Review, evaluate and make recommendations about BayRICS projects, including BayWEB
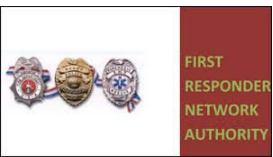
BayWEB

- BayWEB is a dynamic partnership among BayRICS, regional Public Safety agencies and Motorola Solutions, Inc.:
  - ➢ Motorola, using Broadband Technology Opportunity Program (BTOP) funding and matching funds, will build, operate and maintain the "middle mile" network, consisting of Evolved Packet Core (EPC), microwave backhaul network and eNodeB Radio Access Network (RAN).
  - ➢ Local public safety agencies contribute radio sites for the RAN and backhaul infrastructure (primarily dark fiber) through Site Use Agreements.
  - ➢ BayRICS Authority provides regional governance and oversight and will also be responsible for shared microwave and fiber backhaul, as well as specific "local control" functions (billing, subscriber provisioning, prioritization and certain training and support functions)

State of California

- The State of California:
  - ➢ Largest state economy and population in U.S.
  - ➢ 158,869 square miles, comparable to the combined areas of 11 Eastern States. Highly diverse geography and population density; complex political and governance challenges
- The Governor has identified the California Technology Agency, specifically the Public Safety Communications Office, in close cooperation with the California Emergency Management Agency to be California's contact point for the FirstNet Board.
- The State, BayRICS and LA-RICS have begun to work cooperatively to facilitate State deployment of FirstNet
  - ➢ The State is a member of BayRICS and the Vice-Chair is State of California representative
  - ➢ State participation in LA-RICS

State of California

- BayWEB and LA-RICS projects cover two of the largest metropolitan areas in the State.
  - Both the Bay Area and Los Angeles areas lie on major faults--it is not a matter of if, but when, another major earthquake will happen.
  - These two BTOP Grants projects are critical to the State's public safety responders located both within and beyond their coverage areas.
  - These projects are the key to quick and successful FirstNet deployment in the State
- Once the BayWEB and LA-RICS projects are built, these projects could be interconnected via regional fiber provided by prospective project partners.
  - Building and interconnecting these two highly populated areas within California would create lessons learned for regional connectivity solutions, traffic/usage patterns and application sharing between regions,
  - Sets the foundation for incremental expansion of FirstNet throughout the State.
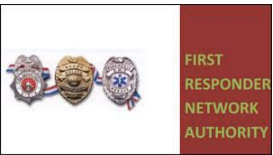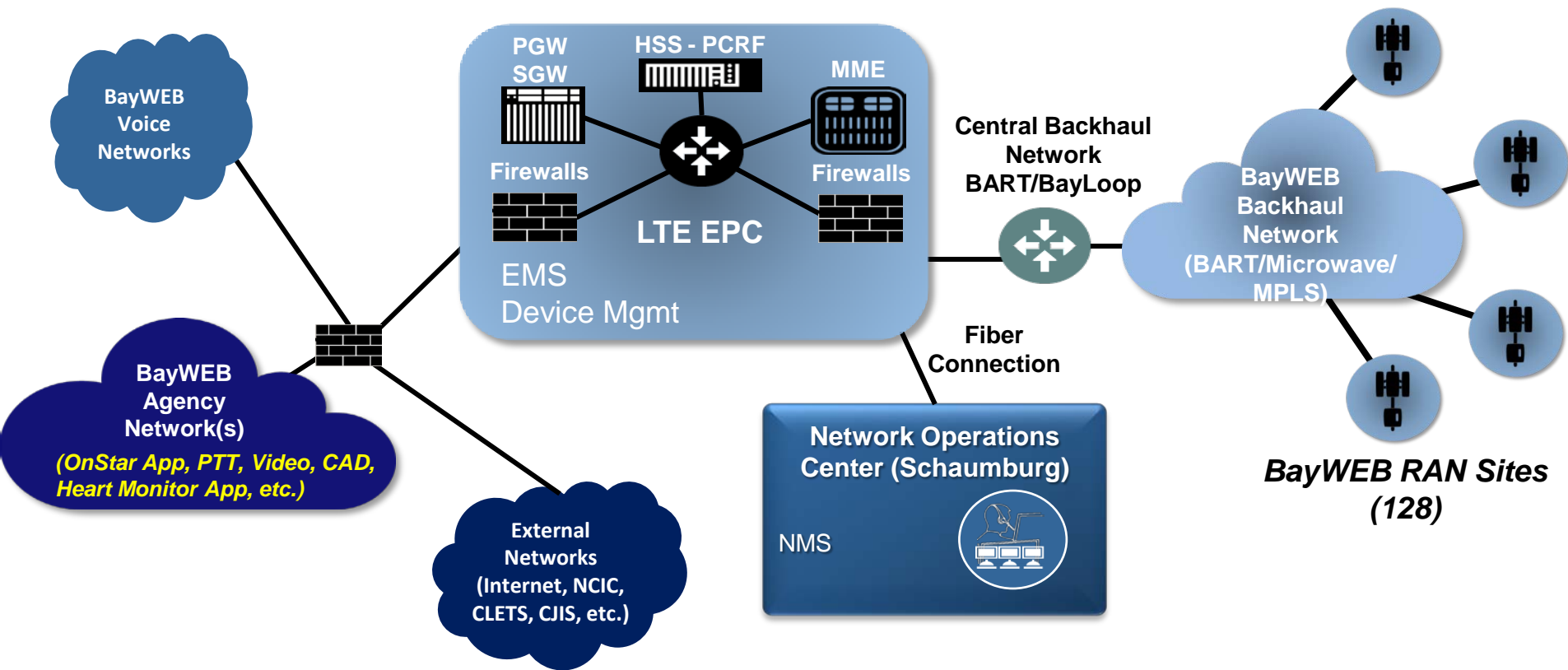
Accomplishments

- Grant application and award: August 2010
- BayRICS governance established
- BOOM agreement negotiations commenced: November 2010
- BOOM agreement executed: December 2011
- SAU agreements executed: 12 agencies over 100 sites
- System architecture fully vetted with individual agencies
- Equipment contract negotiated
- Zoning process well underway
- BTOP projects partially suspended: April 2012
- BayRICS maturity: 18 months

- Network architecture design
- Coverage planning and design
- TAC team formation
- Fiber/backhaul partner negotiations
- Agency/TAC marketing/education
- Competitive awards
  - Equipment
  - Personnel contractors
  - Civil work
- Site walks (250+ sites)
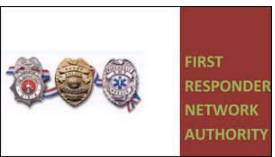- Environmental Section 106 completed
- Microwave frequencies licensed (60+)

BayWEB Architecture

BayWEB Voice Networks

PGW SGW

HSS - PCRF

MME

Firewalls

LTE EPC

Firewalls

EMS
Device Mgmt

Central Backhaul Network BART/BayLoop

BayWEB Backhaul Network (BART/Microwave/ MPLS)

BayWEB Agency Network(s)

(OnStar App, PTT, Video, CAD, Heart Monitor App, etc.)

Fiber Connection

Network Operations Center (Schaumburg)

NMS

External Networks (Internet, NCIC, CLETS, CJIS, etc.)

BayWEB RAN Sites (128)

FIRST RESPONDER NETWORK AUTHORITY

Coverage

Large format displays of coverage maps available for FirstNet to review.

Reliability and Sustainability

Reliability

- Redundant/Fault Tolerant core components
- Redundant/Fault tolerant network equipment
- Microwave loop or hot standby spur
- MPLS protocol
- Public Safety hardened sites
  - Generator
  - Security
  - UPS
  - Redundant backhaul
  - Spares
  - COWS
  - 24 x 7 site access and monitoring

General O/M Provisions

- Ten year contract following grant period
- Sites and backhaul facilities, power, etc. contributed to the project by owners
- UE monthly fees
  - 1st year – Motorola assesses a $38/month/device
  - JPA assesses a $5/month/device fee for admin costs
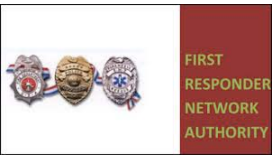
BayWEB Partnership Responsibilities

Motorola Responsibilities

- Backhaul
  - eNB Sites
- System Maintenance
  - Network Operations Center
  - Preventative maintenance
  - Network optimization
  - Provisioning
  - On site repair
  - Asset management FNE
  - Service Level Agreements
  - Maintenance releases
- Billing reports to BayRICS
- Manage system upgrades
- Disaster recovery
- Coverage

BayRICS Responsibilities

- Backhaul
  - Fiber
  - BayLoop
- User equipment maintenance
  - First echelon
  - Asset management
- UE billing
- FCC quarterly compliance report
- Manage interagency dispute resolution
- Disaster recovery
- Increasing capacity and performance of the system
- Backhaul costs
- System refresh
- Coverage enhancements
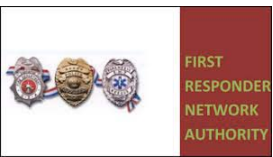
Local Management

Local emergency incidents require a local response – Bay Area Public Safety must have the ability to manage the network locally to ensure a timely and effective response.

➤ Provisioning: Need to manage system users and add users on the fly to respond to emergencies

➤ Applications: Local agencies will need flexibility in using applications – with regional oversight in applications management (TAC)

➤ Maintenance: Will require quick and timely response to system outages and repair needs

➤ Prioritization: Localized response requires local planning and local control over user and application priority

➤ Disaster recovery: In a major disaster, local process must be in place to identify outages and take action to implement repair or work-around
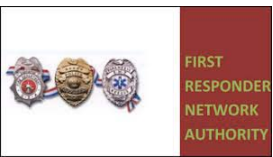
BayRICS System Funding Plan

◆ System funding plan three-year summary of costs: Hand-out

Innovative Applications

Innovative Applications

✦ BayRICS and its member jurisdictions have conducted extensive research and planning for data applications anticipated to be available on BayWEB.

✦ Public safety agencies and users will be the best source of ideas for new applications, based on their experiences and needs in the field.

✦ Anticipating the early deployment of the BayWEB project, Bay Area public safety officials have developed detailed application projections based on current and future needs. See handout for examples.

✦ Types of applications:

  ➢ Currently used data applications that will migrate to BayWEB from existing delivery platforms

  ➢ Distribution of data files too large to be transmitted via existing systems: photos, video, maps, floor plans, other graphics files

  ➢ Automated applications that combine or "mashup" data from multiple data sets to provide detailed, real-time intelligence to first responders.

Innovative Applications

- The San Francisco Bay Area is uniquely positioned to lead the development and testing of public safety applications
  - Robust Applications Developer Communities (Silicon Valley, SOMA, etc.)
  - Research university presence (Stanford, Berkeley, California State University system)
- High tech industry leaders are engaged to replicate successes in smart phone and social media applications development:
  - Twitter; YouTube; Netflix; Google; Yahoo; Facebook
  - Local Agencies have experience in facilitating the development of mobile apps
    - ✓ San Francisco Police Department partnered with Hewlett Packard and ArcTouch, both local Bay Area companies, to develop a mobile field-based reporting application.
- BayWEB can draw on this experience to develop incentives to encourage developers to create new public safety apps, which can then be tested and deployed to first responders via BayWEB
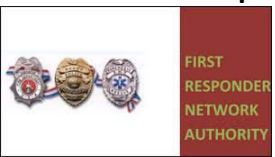
Next Generation (NG) 9-1-1 Pilot Projects

➔ The State has overall infrastructure/network responsibility for California's 9-1-1 program (462 PSAPs).

➔ Both BayWEB and LA RICS were designed to interconnect with 9-1-1 Public Safety Answering Points (PSAPs); the State was involved during the concept phase of the grant project submittals.

➔ BayWEB and LA RICS projects position California to be an early adopter to deploy and test convergence scenarios utilizing LTE/Broadband technologies and Next Generation 9-1-1 network integration.
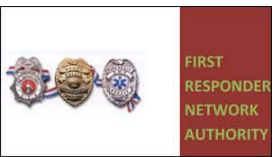
NG 9-1-1 Pilot Projects

- State pilot project to test Next Generation 9-1-1 infrastructure connection to the BayWEB network.

  - Sending crash test data from systems currently installed in automobiles (ex., Ajero, On-Star) through Next Generation 9-1-1 IP infrastructure directly to first responders in the field via the BayWEB LTE network.

- Other NG 9-1-1 applications could combine multiple data sets ("mashups") delivered to first responders concurrently with the 9-1-1-dispatch information:

  - Integration of implanted heart monitor data and other vital health data with 9-1-1 dispatch information delivered to EMS in route to a medical emergency;

  - Comprehensive information from multiple data sets (floor plans, fire hydrant location, building occupants, hazardous materials locations, etc.) delivered in a mobile app format to firefighters in route to a fire.

Cost

Agency Expenditures

- **BayRICS Members – 5000 Hours**
  - BOOM negotiations
  - Site Access and Use Agreement Negotiations
  - Administration
- **Agency Staff – 5000 Hours**
  - Technical design reviews
 - Site walks
- **Agency Costs - >$1M**

One-Time Costs for One Representative County

One Time Costs*	Year One	Year Two	Year Three	Total
System construction, installation and equipment costs* *	$0	$0	$0	$0
Environmental Review	$7000	0	0	$7,000
Department of Real Estate Staff Time to Negotiate Site Leases	$77,000	$0	$0	$77,000
Permitting Fees	$45,000	$0	$0	$45,000
Staff Time for Escorting Contractors on Sites	$150,000	$0	$0	$150,000
Total One-Time Costs	$279,000	$0	$0	$279,000

*One-Time Cost estimated from BayRICS Authority System Funding Plan for Urban County with 20 sites (6 leased sites)
**Agency will pay $0 for site construction, installation and equipment costs.
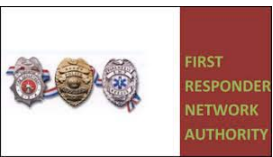
Recurring Costs for One Representative County

Recurring Costs	Year One	Year Two	Year Three	Total
Utilities*	$25,200	$50,400	$50,400	$126,000
Leases*	$72,000	$144,000	$144,000	$360,000
Service Fees**	$151,200	$302,400	$441,000	$894,600
Total Recurring Costs	$248,400	$496,800	$635,400	$1,380,600
TOTAL COSTS (One Time + Recurring)	$527,400	$496,800	$635,400	$1,659,600

*Assuming 14 sites and 6 lease agreements

**Assuming 875 users over three years:

- Year One - 300 USB Modems;
- Year Two - 200 USB Modems and 100 Vehicle Modems;
- Year Three - 100 USB Modems and 175 Vehicle Modems.

Lessons Learned

Contracting - BOOM

- Interagency political requirements and approval cycles were found to be the most costly and time-consuming elements of project

- Governance development/parallel negotiations were challenging
  - Importance of a single body with authority to oversee BOOM negotiations
  - Consensus for overall system requirements

- Achieving buy-in from less-enthusiastic agencies

- UE commitment difficult to forecast

- Network requirements consensus challenging

- Ability to raise awareness of project capabilities and benefits required significant regional governance efforts

- Operational goals inconsistent
  - Require more system management than currently available from commercial carrier
  - Require public safety features commercial carrier does not provide
  - Require cost competitive with commercial carrier

Contracting - SAU

- No one entity can speak for all sites in constellation
- Contractual terms vary significantly from agency to agency
- Technical requirements vary significantly
- Approval process varies significantly
- Government security interest is extremely challenging
- Final site constellation elusive due to evolving requirements
- Many sites leased vs. owned, cause delay and complications
- Allocating/Limiting liability risk of site use

Contracting - Vendors

◆ Public Safety experience

➢ Public Safety market is new to commercial vendors

- ✓ Coverage guarantees
- ✓ Performance guarantees
- ✓ System uptime - 99.999%
- ✓ Implementation standards
  - R56
  - Public Safety grade "hardening"
- ✓ System provider vs. equipment provider
- ✓ Serviceability
  - Spares
  - 24 Hour technical support
  - Minimum response times
- ✓ Immediate issue resolution - patches
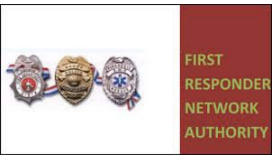
Lessons to be Learned

Governance
Lessons to be Learned

- Sample governance model for FN evaluation
  - Multiple agencies
  - Multiple disciplines
  - Distributed management
- State of California
  - Demographically diverse
  - Politically diverse
  - Economically diverse

Partnership Lessons to be Learned

- Sample partnership for FN evaluation
  - Unique business model
  - Non traditional responsibilities
    - Procurement
    - Deployment
    - Operations
    - Future expansion considerations
  - Risk considerations
    - UE loading
    - Site acquisition/buildout
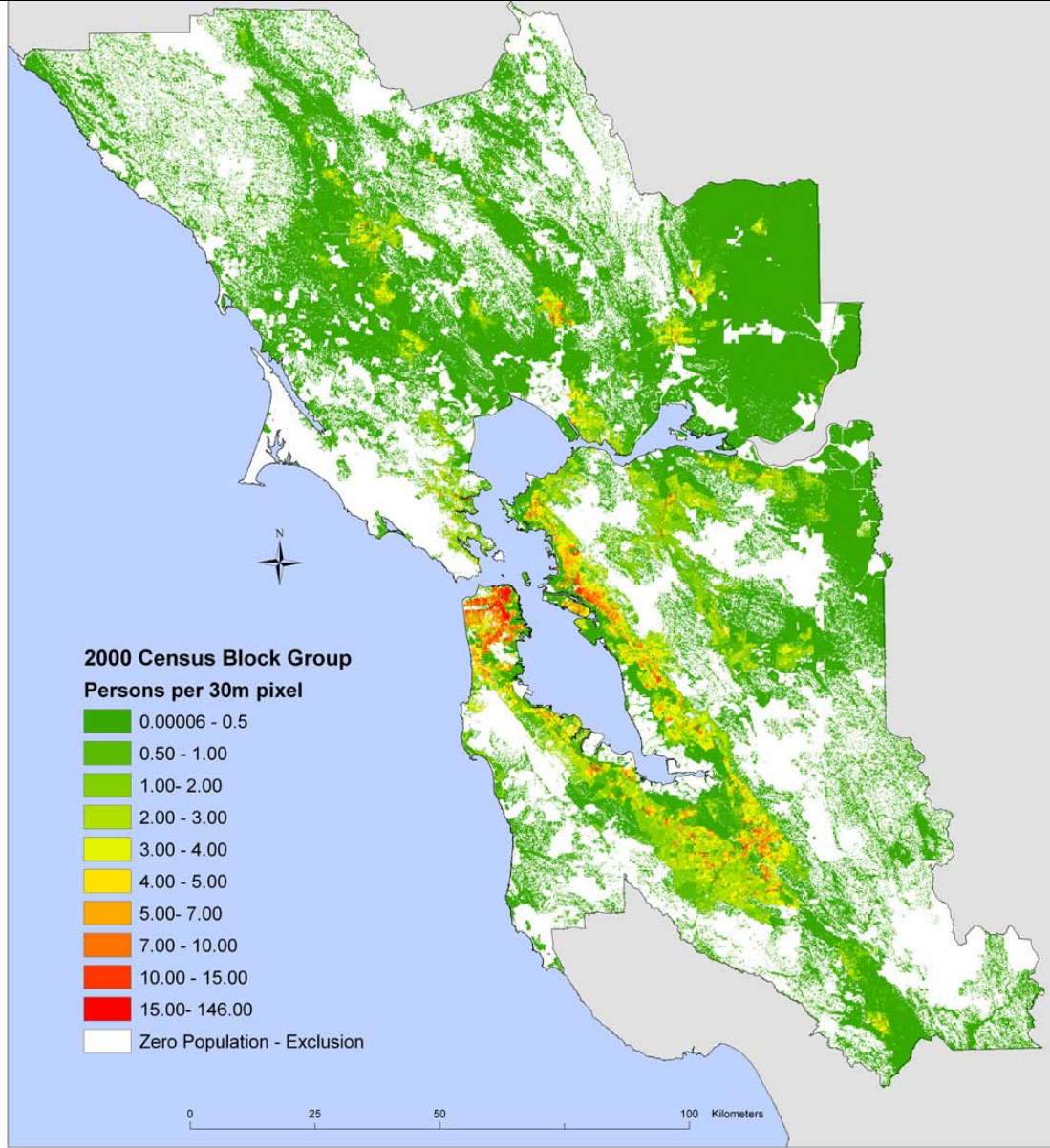
Terrain – Unique to BayWEB

2000 Census Block Group
Persons per 30m pixel

- 0.00006 - 0.5
- 0.50 - 1.00
- 1.00 - 2.00
- 2.00 - 3.00
- 3.00 - 4.00
- 4.00 - 5.00
- 5.00 - 7.00
- 7.00 - 10.00
- 10.00 - 15.00
- 15.00 - 146.00
- Zero Population - Exclusion

TAC: Lessons to be Learned

- Development of local/regional applications review
- Procedures for local monitoring of Service Level performance
- Procedures for local provisioning, priority, billing and subscriber support
- Recommendations for new device needs

NTIA Condition 5
Lessons to be Learned

- Public Safety operational lessons learned
  - Diverse mix of risk/response factors: earthquakes, tsunami, wildfires, urban unrest, large public events, etc.
- Application performance
  - Opportunity to apply new applications to diverse risk factors.
- LTE system/voice system interoperation
- Public Safety local management
  - Governance
  - Priority and QoS: Priority Service Manager
- LTE capacity testing
- PSAP integration
- LTE security capabilities
  - NCIC
  - CJIS
  - HIPPA
- System availability
  - Site visits
  - Field tests
  - Leadership/staff availability

Path Forward
Long Term Network Operations

Benefits to FirstNet

- Bay Web should be implemented because it provides the greatest lessons learned of all the BTOP projects
- Leverage for State of CA to opt in
- Understand coverage required by Public Safety and provided by LTE systems
- Understand performance guarantees required by Public Safety and provided by system integrator
- Evaluate a Public Private Partnership
  - Subcriber loading model
  - Site acquisition/buildout
- Evaluate a governance model
- Evaluate billing solutions
- Evaluate maintenance options
- Evaluate an operating model

Network Aspirations

- Partner with FirstNet/NTIA, State, BayRICS, Motorola
- Demonstrate interoperability capabilities with FirstNet's national system
- Implement model Public Safety grade broadband network
- Demonstrate benefits of sharing financial risk
  - UE loading model
  - Site acquisition/buildout
- Demonstrate benefits of experienced Public Safety system operator
- Demonstrate an operating model
- Demonstrate system architect capabilities
- Demonstrate integration capabilities
- Demonstrate operational capabilities
- Resolve urgent need for improved Public Safety operational capabilities
- Transfer of assets

- Overcome commercial carrier limitations
  - World Series
- Preserve investment:
  - Governance structure
  - Multiple contract negotiations
  - Staff time
  - Funding and resources
  - Obtaining buy-In from Public Safety and elected officials
- Deliver on our promise to Bay Area Public Safety to provide a broadband data network quickly
- Meet the interoperability requirements and time deadlines as specified by NTIA and FirstNet
- Successfully expand the system to serve all of Bay Area and beyond, and successfully integrate the system with FirstNet
- System as a test-bed for new PS apps

Pros

1. Satisfy immediate needs and keep promises to Bay Area Public Safety
2. Test an innovative public-private business model
3. Test take rate, usage and traffic assumptions in a diverse urban-suburban-rural area
4. Validate coverage, capacity, and throughput assumptions over multiple interoperable agencies and in a variety of real world incident scenarios (RAN and backhaul)
5. Leverage Silicon Valley/SOMA developer community to create test bed for new applications
6. Test various application loads (RAN and backhaul)

Cons

1. ???
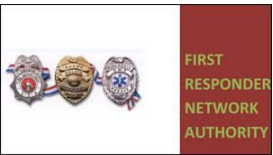
Pros and Cons of Terminating the Project

PROS

1. ???

CONS

1. Stranded resources
2. Wasted expense and effort
3. Unraveling complex agreements
4. Lost Credibility of FN with Public Safety in region
5. Risk of criticism if the big one hits and no service is available
6. No opportunity to test pilot business model, apps development, real world testing/lessons learned
7. Lost opportunity for state of CA deployment of FirstNet
8. Loss of $50 Million grant contribution to FN

Discussion Items

- FirstNet timeline for BayWEB decision

- Decision criteria

- Operating plans

- Timeline for route/budget modification approval

- Timeline for spectrum decision

- Resolution of indemnification language and federal interest issues

- Resolution of federal requirements for local sites and backhaul

- Develop a cooperative relationship with FirstNet to address coverage and geographic expansion