



**Federal Interagency Committee on Emergency Medical Services
Response to
National Transportation Safety Board (NTSB)
Motorcoach Run-Off-the-Road and Rollover
U.S. Route 163, Mexican Hat, Utah
January 6, 2008**

Background

On January 6, 2008, about 3:15 p.m. mountain standard time, a 2007 Motor Coach Industries 56-passenger motor coach with a driver and 52 passengers on board departed Telluride, Colorado, en route to Phoenix, Arizona, as part of a 17-motorcoach charter. The motor coach passengers were returning from a three-day ski trip. The normal route from Telluride to Phoenix along Colorado State Route 145 was closed due to snow, and the lead driver planned an alternate route that included U.S. Route 163/191 through Utah.

About 8:02 p.m., the motor coach was traveling southbound, descending a 5.6-percent grade leading to a curve to the left, 1,800 feet north of milepost 29 on U.S. Route 163. After entering the curve, the motor coach departed the right side of the roadway at a shallow angle, striking the guardrail with the right-rear wheel and lower coach body about 61 feet before the end of the guardrail. The motor coach traveled approximately 350 feet along the fore slope (portion of roadside sloping away from the roadway), with the right tires off the roadway. The back tires lost traction as the fore slope transitioned into the drainage ditch. The weather was cloudy, and the roadway was dry at the time of the accident.

The motor coach rotated in a counterclockwise direction as it descended an embankment. The motor coach overturned, struck several rocks in a drainage ditch bed at the bottom of the embankment, and came to rest on its wheels. During the 360° rollover sequence, the roof of the motor coach separated from the body, and 51 of the 53 occupants were ejected. As a result this accident, nine passengers were fatally injured, and 43 passengers and the driver received injuries ranging from minor to serious.

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The National Transportation Safety Board (NTSB) conducted an investigation¹ and made a total of seven new recommendations, of which two were directed to the Federal Interagency Committee on Emergency Medical Services (FICEMS). They are as follows:

1. Develop a plan that can be used by the States and public safety answering points to pursue funding for enhancements of wireless communications coverage that can facilitate prompt accident notification and emergency response along high-risk rural roads, as identified under SAFETEA-LU criteria², and along rural roads having substantial large bus traffic (as defined by the criteria established in Safety Recommendation 4). (H-09-04)
2. Evaluate the system of emergency care response to large-scale transportation-related rural accidents and, once that evaluation is completed, develop guidelines for emergency medical service response and provide those guidelines to the States. (H-09-05)

The contents of this document comprise the FICEMS response to recommendation number 1.

Methodology

In developing a plan that can be used by the States and public safety answering points in response to recommendation number one, FICEMS adopted an outline for the plan that includes the following five components:

1. Needs Assessment/Gap Analysis
2. Options for Bridging Gap(s)
3. Funding Options
4. Collaboration
5. Additional Resources.

The approach included soliciting input for the plan from a variety of emergency communication, highway safety and motor coach stakeholders at the local, State, national and Federal levels, in both the public and private sectors. Individuals were interviewed to address the issues resulting from this crash and to identify current technologies to that could serve as options in bridging gaps. Emergency communication options included wireless forms of communication, including both existing and emerging technologies.

¹ The NTSB's Highway Accident Report (NTSB/HAR-09/01, Report #: PB2009-916201) is available at: <http://www.nts.gov/publictn/2009/HAR0901.pdf>

² 23 USC Sec. 148 Sec. 148. Highway Safety Improvement Program defines "high risk rural road". Specific details are available at: (<http://uscode.house.gov/pdf/2005/2005usc23.pdf>)

A Plan that can be Used by the States and Public Safety Answering Points

PART ONE: Needs Assessment/Gap Analysis

The first step in establishing a plan to enhance emergency communications and emergency response along high-risk rural roads and rural roads having substantial large bus traffic is to conduct an assessment of the current status of emergency communications and available technologies.

A needs assessment is a systematic process to acquire an accurate, thorough picture of a system's strengths and weaknesses in order to improve it and meet existing and future challenges. Needs assessments are used to identify strategic priorities, define results to be accomplished, guide decisions related to appropriate actions to be taken, establish evaluation criteria for making judgments of success, and inform the continual improvement of activities. Numerous models exist within the research community and a partial list of models (along with other needs assessment resources) is available at: <http://www.needsassessment.org/>.

Similarly, a gap analysis is defined within the systems engineering model as the determination of needed capabilities or functions that do not yet exist. Gaps are identified by comparing the current status of function with the desired level(s) of function. Gap analysis provides a foundation for measuring investment of time, money and human resources required to achieve a particular outcome.

Assessing Emergency Communications Capabilities

The emergency communications continuum as an end-to-end system includes several elements:



Figure 1. The Emergency Communications Continuum

To achieve optimal emergency communications, two-way, real-time, multimedia (voice, images, video, text and data) communications should exist among all components of the emergency communications system. The needs assessment/gap analysis of emergency communications should include all elements of the emergency communications system. This will include:

- **Public Access:** the level of access to 911 provided for the public by land line, wireless, Internet-based voice communications, satellite, and any other form of emergency communication. While wireless coverage maps are not available at the national level

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(due to their proprietary commercial nature for service providers), they are often provided for local, regional and State government entities with nondisclosure agreements.

- 911: the level of service provided by local 911 Authorities by 10 digit telephone number, basic 911 service, Enhanced 911 service (Phase I or II, as defined by Federal Communications Commission (FCC)), Next Generation (NG) 911, or Broadband connectivity. This information can be obtained from the State 911 Coordinator, or equivalent State entity.
- Emergency Responders: capability of emergency responders to communicate with 911 and others. This information should be available from Law Enforcement, Fire Services, and Emergency Medical Services, as well as other emergency responders deemed as essential to emergency response.
- Others: capability to communicate with other elements of the emergency communications system: e.g., Hospitals, Emergency Operations Centers, and Emergency Management Authorities.

Assessing High-risk Rural Roads

The High Risk Rural Roads Program (HRRRP) is a component of the Highway Safety Improvement Program (HSIP) sponsored by the U.S. Department of Transportation's (DOT) Federal Highway Administration (FHWA). The HRRRP provides approximately \$90 million of HSIP apportionment per year for high risk rural roads (HRRR) highway safety improvement projects. Projects may be selected on any public HRRR to correct or improve hazardous road locations or features. The State's HSIP, including the HRRR element, considers the safety needs on all public roads, whether state or locally owned. HSIP is a core Federal-aid highway program and is intended to achieve significant reductions in traffic fatalities and serious injuries on public roads. The HRRRP is a component of the HSIP and supports road safety program efforts through the implementation of construction and operational improvements on high risk rural roads.

States are required to identify these roadways (and expend the HRRR funds) according to the following definition:

"...any roadway functionally classified as a rural major or minor collector or a rural local road –

- A. on which the accident rate for fatalities and incapacitating injuries exceeds the statewide average for those functional classes of roadway; or
- B. that will likely have increases in traffic volume that are likely to create an accident rate for fatalities and incapacitating injuries that exceeds the statewide average for those functional classes of roadway."

More information on the roads designated as high-risk rural roads can be obtained from each State's Department of Transportation. Contact information for these State agencies can be found at: <http://www.fhwa.dot.gov/webstate.htm>. Additional information on implementing the HRRRP is available at: http://safety.fhwa.dot.gov/local_rural/training/fhwasa10012/.

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Assessing Rural Roads with Substantial Large Bus Traffic

Determining which rural roads have substantial large bus traffic may require obtaining information from multiple sources, such as:

- The Passenger Carrier Safety Web site of the Federal Motor Carrier Safety Administration (FMCSA) at: <http://ai.fmcsa.dot.gov/Passenger/home.asp> can be queried to find the interstate carriers on a specific State, region or locality
- State Tourism Boards
- State Chambers of Commerce
- Large tourist attractions³ or hotels within a specific State, region or locality or those requiring the use of HRRR to reach attraction/hotel as a destination
- Trade associations and organizations, such as the American Association of State Highway and Transportation Officials (AASHTO) and the American Bus Association (ABA)⁴.

Assessing Readiness of Motor Coach Personnel to Respond in the Event of a Crash

It is strongly recommended that all public and private agencies with responsibilities for motor coach safety adopt and exercise contingency plans for actions to be taken by motor coach personnel in the event of a crash. This plan should include the use an emergency communications mode that is appropriate for the type of road being traveled.

Once a needs assessment is completed, the status of emergency communication, the type and extent of emergency communication gaps should be identified and quantified. The next step is considering the options for bridging these gaps.

³ May also include large schools/colleges, sports attractions, casinos, outlet malls, ski resorts, etc.

⁴ More information on AASHTO is available at: <http://www.transportation.org/>. Additional information for ABA is available at: <http://www.buses.org/>.

PART TWO: Options for Bridging Gaps

The following five options were identified by stakeholders to bridge emergency communication gaps along high-risk rural roads and rural roads having substantial large bus traffic. A description of each of the technology options along with the benefits and considerations for implementation is presented. Costs, where provided, are estimated and would change based on individual user needs or requirements. Any use or description of products or vendors is used to illustrate the options available to the public and does not represent an endorsement of any kind. Several other technical considerations are included at the end of this section.

1. Enhanced 911 (E-911) Wireless Phase II

Description

The ability to locate a wireless 911 caller requires the implementation of “E-911 Wireless Phase II” technology. When a caller uses a wireless phone to call 911, the caller’s approximate location is determined through a network- or handset-based location determination method (depending on the wireless carrier). The network-based method uses cell site location, signal strength and other data to identify approximately where the caller is located. A handset-based system, uses the GPS capabilities of the calling device to provide latitude and longitude of the caller when someone dials 911. So called “hybrid” solutions, which employ technology within the network and handset device are also used by some wireless carriers (e.g., “Assisted GPS”).

Benefits

- For public safety answering points (PSAPs) which have implemented Wireless Phase II, callers who call 911 from their cellular phone can be located (to some degree of accuracy).
- The location determination process is automatic and transparent to the caller and 911 call taker.
- For callers whose locations are changing, the 911 call taker can perform a “rebid” every 25-30 seconds (or so, depending on the wireless service provider) to get updated caller location information.

Considerations

- Wireless Phase II is only available when the caller is within range of cellular service.
- The degree of location accuracy can vary greatly and can be affected by a number of elements, including: number of cell towers available, number of GPS satellites that the device can access, terrain, etc.
- Wireless Phase II has not been implemented by all PSAPs and some PSAPs have not enabled Wireless Phase II for all wireless service providers. As of August 1, 2010, the National Emergency Number Association (NENA) reports that 94.9% of 6,153 PSAPs have **some** Phase II.⁵

⁵ NENA 911 Statistics. Available at: <http://www.nena.org/911-statistics>

Costs

- The cost to implement Wireless Phase II differs for each PSAP and depends on the number of wireless service providers and the infrastructure that must be upgraded.

2. Satellite-Based Communications⁶

Description

Handheld and transportable satellite-based communication devices allow users to make telephone calls using orbiting satellites, instead of terrestrial-based wireless (cellular) phone systems. Devices are portable, allowing them to be quickly and easily moved from vehicle to vehicle and the service is available in very remote areas of the U.S., where traditional cellular service is not. Satellite phones require both an upfront equipment cost and recurring subscription cost to operate or they can be leased / rented for more infrequent or single-event use.

Benefits

- The system is designed to provide service in very remote areas, provided there is line-of-sight to the orbiting satellite (either geosynchronous or low earth orbit).
- Small, handheld devices are available that operate nearly identically to wireless (cellular) devices.
- Satellite phones are able to contact 911⁷ and automatically provide location information to the 911 call taker.

Considerations

- Satellite service is not universal and obstructions could hinder connectivity.
- Handheld phones operate on battery or plug adapter and need to be charged (or have a power source available).
- With their small physical size and nature, these phones could be lost or damaged in an accident.
- Voice quality provided by some satellite service providers is significantly poorer than others, with noticeable delays and echoes.
- An active subscription plan is needed to make phone calls, even emergency calls.
- Cost for the device and cost per call is significantly higher than cellular phone service.
- The degree of location accuracy can vary greatly and can be affected by a number of elements including: the number of GPS satellites that the device can access, terrain, etc.

⁶ Additional information about satellite-based communications devices is available at: <http://thetravelinsider.info/phones/aboutsatellitephoneservice.htm>

⁷ FCC's Mobile Satellite Service and 911 information page: <http://www.fcc.gov/pshs/services/911-services/mss.html>

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- Not all PSAPs in rural and remote areas have the capability of receiving automatic location information. As of August 1, 2010, the National Emergency Number Association (NENA) reports that 94.9% of 6,153 PSAPs have **some** Phase II.⁸

Costs

- Purchased –
 - Typical handheld devices cost between \$1,200 and \$1,800 each (some accessories extra).
 - A 75-minute, valid for a single month airtime plan, costs approximately \$150.
 - A 1000-minute, one-year valid airtime plan, costs approximately \$1,200.
- Leased –
 - There are a number of companies that will rent satellite phones on a weekly or monthly basis. Costs range from \$45-\$100 per week, with shipping, accessories, pre-paid service, and fees extra.

Notes

Broadband Global Area Network (BGAN) devices also use satellite communications through a vehicle-mounted or transportable satellite terminal device. Fixed-vehicle systems typically include an interior terminal (transceiver) and a roof-mounted, fully-autonomous tracking antenna that acquires and maintains an uninterrupted network connection. BGAN devices provide high-speed data transmission that supports voice telephony, location tracking, and potentially, the ability to transmit vehicle telematics data. Also, a BGAN device may provide the ability to support Internet access for passengers, possibly offsetting the cost of acquisition, operations and maintenance. However, BGAN devices have significant capital and operational expense and transportable devices require some setup, positioning and configuration that may not lend itself to emergency situations.

Hybrid Cellular-Satellite Phones are devices capable of communicating via traditional cellular networks and use satellite communications as a backup, when the user is unable to acquire a wireless signal from the terrestrial network. In September 2010, a major wireless service provider announced availability of TerreStar's Windows Genus smartphone,⁹ using their “satellite augmented mobile service”. The dual-mode device is reported to retail for \$799 with a two-year service contract and must be purchased with wireless voice and data plans and if desired, optional satellite service. Similar hybrid devices may be available in the future, perhaps by other service providers. These devices have the advantage of using the traditional cellular network and a device that looks and works like a “regular” cellular phone, but have the added feature to access the satellite network quickly, enabling the caller to complete their

⁸ NENA 911 Statistics. Available at: <http://www.nena.org/911-statistics>

⁹ AT&T. *TerreStar Genus™ Dual-Mode Cellular/Satellite Smartphone Now Available from AT&T*. September 21, 2010. <http://www.att.com/gen/press-room?pid=18505&cdvn=news&newsarticleid=31218>. Specific specifications for the TerreStar Genus device are available at: http://www.terrestar.com/inc/pdf/TerreStar_Handset.pdf.

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call even when outside of cellular coverage areas. These devices also provide automatic location information with 911 calls and can utilize the capabilities of both cellular and satellite access to provide this information to the 911 call center.

3. Personal Locator Beacons (PLBs)

Description

Personal Locator Beacons (PLBs) are pocket-sized transmitters which aid in the detection and location of people in distress. A PLB is a scaled down version of the EPIRB (Emergency Position Indicating Radio Beacon) and ELT (Emergency Locator Transmitter) used by boaters and pilots, respectively. The signals are monitored worldwide by COSPAS-SARSAT, a satellite-based search and rescue alert detection system. These devices transmit an alert signal that is picked up by low earth orbiting (LEO) satellites, along with a homing signal which further directs search and rescue personnel. In addition, some PLBs have integrated GPS capability. Each PLB has a unique digital code and must be registered with the National Oceanic and Atmospheric Administration (NOAA), enabling search and rescue personnel to immediately identify the owner of the beacon.

Benefits

- Unlike mobile phones, which have limited range and coverage in remote areas, PLBs have the capability of being detected anywhere in the world.
- Relatively low cost, in comparison to other satellite-based solutions.
- Small, handheld devices which are very easy to use.
- PLBs have a self-test feature to ensure operability.

Considerations

- Must be manually activated.
- Devices must be registered and provide emergency contact information.
- One-time use only, but typically have a 10-year serviceable lifetime.
- PLB are intended for use only in situations of **“grave and imminent danger”**. Experts recommend that a PLB should be the method of last resort when attempting to contact search and rescue responders. If other communications methods are available to summon emergency assistance (e.g., cell phone, satellite phone, or radio transceiver), they should be used before a PLB is activated.
- PLBs could be used by individuals or groups under a variety of circumstances. However, the signal transmitted will not convey any information to 911 call takers about the size or type of emergency thus making it very difficult to determine the type of response needed.

Costs

- PLBs are generally available for purchase at \$200-\$500 each.

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- Although there are some companies that rent PLBs, costs are often in the range of \$50-\$75 per week (not including shipping costs), making device purchase potentially a more cost effective solution.

4. Communication / Weather Balloons¹⁰

Description

Using balloon-borne wireless repeaters or transceivers, cellular and radio networks can be extended hundreds of miles to provide wide-area communications support in remote locations not served or poorly served by existing wireless technologies and service providers. Once deployed, citizens and emergency responder alike would be able to access terrestrial commercial wireless networks using existing cellular devices. A vendor that offers this service in south-central U.S. currently provides data connectivity across a multi-state area, using leased 900 MHz spectrum¹¹. The company reports that balloons, launched every 8-12 hours, each provide coverage circle of over 400 miles in diameter. This model could be used to provide coverage in un-served areas or to supplement terrestrial coverage in areas where existing infrastructure has been damaged or failed.

Benefits

- Extends wireless coverage to very remote areas.
- Can be used to extend the coverage area of radio frequencies used by responder agencies and personnel.
- Very low capital expense costs (as compared to site acquisition and cell tower construction costs).
- Offers rapid deployment, with minimal personnel and logistics requirements
- Can be deployed to support emergency communications needs when traditional wireless networks are unavailable.

Considerations

- Deployment requires trained launch personnel / team.
- Requires preplanning to support a desired coverage area.
- Multiple launch kits (balloon, lifting gas, and transmitter) and launch teams may be required to achieve large coverage areas.
- Typically, balloons must be launched 2 – 3 times daily to maintain coverage
- Each balloon is operational for 12 – 18 hours (limited by loft time, battery life).
- Payloads are tracked and retrieved using GPS so that they can be reused.
- Operational costs may exceed revenue generated from a commercial enterprise.
- Satellite service is not universal and obstructions could hinder connectivity.

¹⁰ The Register. (November 23, 2009). *Weather balloons no longer a crazy idea for rural coverage*. Retrieved October 6, 2010, from: http://www.theregister.co.uk/2009/11/23/space_data_weather_balloon_base_station/

¹¹ SpaceData markets their “SkySite™” data communications system that could be used to extend commercial wireless services. More information is available at: <http://www.spacedata.net/skysite.html>

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- The degree of location accuracy can vary greatly and can be affected by a number of elements, including: the number of GPS satellites that the device can access, terrain, etc.
- Not all PSAPs in rural and remote areas have the capability of receiving automatic location information. As of August 1, 2010, the National Emergency Number Association (NENA) reports that 94.9% of 6,153 PSAPs have **some** Phase II.¹²

Costs

- The electronics payload, carried by each balloon has been reported to be valued at \$1,500 and is designed for reuse (re-launched after recharging).
- The cost to launch the balloon and subsequently retrieve the electronics has been reported to be \$150.
 - Assuming 3 launches/retrievals per day, the approximate monthly cost to operate a single 420-mile coverage circle is \$15,000.

5. Roadside Call Box

Description

Roadside call boxes (also called emergency telephones or motorist aid systems [MAS]) have been a staple of highway and road systems across the nation for several decades. Typically placed at regular intervals, call boxes provide access to emergency services either through a traditional phone or by activating a button to summon assistance. Call boxes are used on many major expressways, highways and at bridges and crossings throughout the U.S. California maintains one of the nation's largest call box systems via funding authorized by vehicle registration surcharge.

Modern roadside call boxes can alert an emergency call center through FM frequencies, cellular technology, or via a landline telephone system. Call boxes may be powered through traditional means (i.e., directly connected to a power source) or employ solar or user-powered methods.

Studies have indicated that even with the increased ubiquity of cellular phones that many citizens would still be willing to pay for implementation and maintenance of a call box system.¹³

¹² NENA *911 Statistics*. Available at: <http://www.nena.org/911-statistics>

¹³ Button, Dr. Kenneth, et al. *Consumer Reactions To Call Boxes On The Dulles Toll Road In Virginia*. Retrieved October 6, 2010, from: <http://www.gmupolicy.net/its/transportf/callbox/paper-Button-DullesCallboxEvaluation.pdf>

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Benefits

- Provides access to emergency services where cellular coverage is unavailable or incomplete or when the individual does not have a cell phone.
- Fixed location makes location determination easier than other means.
- Infrastructure can be used to transport other data, such as traffic cameras and public safety radio communications.
- Newer-design call boxes are compliant with the Americans with Disabilities Act (ADA) requirements and support mobility- and hearing-impaired call box users.

Considerations

- Requires some method of wired or wireless connectivity, regular testing and maintenance, and sometimes a monthly cost to provide service.
- Call boxes may be prone to theft, vandalism, and effects of the elements.
- With cellular phones so commonplace, a number of call box systems have been downsized or eliminated (or are being considered for elimination), due to increasing operations and maintenance costs and decrease call box usage.

Costs

- Costs include capital expenses for the actual call box and the infrastructure to connect the call box to call answering personnel.
- A 2003 study¹⁴ indicated an initial installation cost of \$5,000 to \$8,000 per box, plus \$60,000 in base station / computer costs. Additionally, annual operations and maintenance costs ranged from \$67 to \$400 per box.

Several Other Considerations

1. Two-Way Radio Systems

Description

Motor coaches may consider becoming equipped with two-way radio systems which use frequencies reserved for various personal and business uses across the radio spectrum, with different handheld and fixed-mount radio communications devices. The transmit power and location of the device, the frequency range used and a host of other factors (including the weather) will determine the ability for the radio transmission to be received by the intended party.

¹⁴ Paul, Harold R., *Evaluation of Roadside Emergency Call Box Technology*. Technical Assistance Report No. 03-3TA. April 2003. Retrieved October 6, 2010, from: http://www.ltrc.lsu.edu/pdf/2010/03_3TA.pdf

Benefits

- Typically easy to use devices that require little to no training. Users simply pick up the device or microphone, press a transmit button and talk.

Considerations

- Emergency responders may or may not regularly monitor radio frequencies, including Citizens' Band (CB) Radio and Family Radio Service.
- Range of communications may be significantly limited.
- Users would need to be able to accurately determine their location to request assistance.
- FCC licenses may be required for some frequencies and/or devices.

Costs

- Costs will vary greatly from device to device; however, CB radios can be purchased for \$40 - \$250.

Notes

Amateur Radio (often called “ham radio”) is a class of radio users and equipment that use reserved frequencies for voice and data communications. Users must be licensed by the FCC after passing a proficiency exam. Amateur radio equipment is capable of transmitting and receiving signals over very long distances (i.e., thousands of miles). These frequencies may be monitored by emergency responder personnel, especially in remote areas, or other individuals that could contact public safety agencies. Amateur radio organizations also provide support to public safety and emergency management, such as the American Radio Relay League's (ARRL) Amateur Radio Emergency Service (ARES). Amateur radio systems are not reliant on existing infrastructure systems to operate and may provide communications where traditional services cannot. However, having a trained / licensed amateur radio operator and equipment available, may not be a feasible option for commercial bus transportation.

2. Shared Infrastructure

Description

Telecommunications infrastructure sharing may offer opportunities to improve and/or extend wireless service areas using resources or assets repurposed (or multi-purposed) for the benefit of additional users. Sources show ¹⁵ three main methods of infrastructure sharing: site sharing, network sharing, and spectrum sharing.

¹⁵ Booz Allen Hamilton. *Telecom Infrastructure Sharing*. November 19, 2007. Retrieved October 6, 2010, from: http://www.boozallen.com/media/file/Telecom_Infrastructure_Sharing.pdf

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Site Sharing Site sharing typically involves multiple entities using the same site space, outbuildings, tower(s), and transmission equipment, a common occurrence used by operators in both urban and rural environments. Sharing a site reduces costs for all parties, improves efficiency, and maximizes use of available tower capacity.

As of September 2010, the U.S. Department of Agriculture (USDA) Rural Utilities Service (RUS) has awarded 99 grants from its Weather Radio Transmitter Grant Program¹⁶. This program provides funds to finance the installation of new transmitters to extend the coverage of the National Oceanic and Atmospheric Administration's Weather Radio system (NOAA Weather Radio) in rural America. Some of these grants provided for tower construction in rural areas, which potentially could have space for radio transmitters for cellular service providers or emergency communications systems.

Network Sharing and Spectrum Sharing Shared telecommunications infrastructure could also be implemented using partnerships between cellular service providers and other industries that are currently maintaining large wireless systems. For example, the Burlington Northern and Santa Fe Railway Company (BNSF) pursued transferring much of its wireless operations from its own systems to commercial cellular service providers.¹⁷ According to published reports, “BNSF owns and operates a private microwave system that covers 14,000 miles of right of way in 27 Western states, with electronics and microwave dishes installed on some 700 towers.”¹⁸ With that significant technologic investment and infrastructure footprint, BNSF looked to leverage the commercial carriers to improve and diversify the coverage area for their trains, as well as that for the carrier’s customers in rural America who are not covered by cellular service.

Benefits

- Shared infrastructure and resources reduce costs and increase efficiencies.
- Ability to provide better cellular coverage areas for carriers.
- Leveraged resources may improve access to emergency response in rural and remote areas

Considerations

- Sharing infrastructure requires high levels of cooperation, sometimes between competitors.

¹⁶ More information on this program is available at: http://www.rurdev.usda.gov/UTP_WeatherRadio.html

¹⁷ Brewin, Bob. Computerworld, *BNSF eyes wireless for numerous projects*. November 19, 2003. Retrieved October 6, 2010, from: http://www.computerworld.com/s/article/87322/BNSF_eyes_wireless_for_numerous_projects

¹⁸ Ibid.

3. Microcells (Picocells and Femtocells)

Description

The main radio transmitter / receiver on a radio tower or other structure is often referred to as a “macrocell” and provides a large coverage area (e.g., 1/2 mile to 20 miles) for a cellular service provider. In a similar fashion, a “microcell” is a bit smaller, has less power and provides a coverage area of perhaps 1/8 mile to 2 miles. Microcells are often used to solve coverage or capacity issues for a specific geographic area, such as a transportation or business hub (e.g., airport, shopping mall, large office complex, etc.) or to solve a temporary issue with capacity. Some microcells are transportable (sometimes known as a “Cell On Wheels” or simply, “COW”) and can be used to improve service for special events (e.g., major sporting event, convention, etc.) or disaster situations where a large number of people may overwhelm the existing service capabilities (or the existing system becomes unavailable). A “picocell” is smaller yet, providing a coverage area of typically less than 600 feet. Often used to improve in-building coverage, picocells help for relatively small areas to resolve gaps in coverage or to increase capacity (e.g., inside a train station). Femtocells have the smallest coverage area, typically 50 feet or less and are best suited to improve in-home coverage (and to offload wireless calls onto wired infrastructure).

Benefits

- Microcells are much less expensive to implement than their macrocell counterpart.
- Strategically placed, microcells (and perhaps picocells) improve the cellular coverage area that could provide cellular service to un-served (or underserved) communities.
- Recent technologic developments touted by the vendor community indicate a vastly improved coverage area for picocells, with one manufacturer advertising a significantly improved coverage area of nearly **25 miles**.¹⁹

Considerations

- Requires broadband connectivity from the micro-/pico-/femto- cell to the carrier’s network or at least to the Internet.
- Many (if not most) micro-/pico-/femto- cells are carrier-specific (only that carrier’s device would work with that cell).

¹⁹ Roke Manor Research Ltd. *Roke Launches World's First Wide Area Coverage Femtocell and Extends Area 40,000 Times*. July 27, 2010. Retrieved October 6, 2010, from: <http://www.roke.co.uk/20100707509/press-releases/roke-launches-worlds-first-wide-area-coverage-femtocell-and-extends-area-40000-times.html>

PART THREE: Funding options

Funding for planning, implementation, operations and maintenance is essential to bridge emergency communication gaps on high-risk rural roads and rural roads with substantial large bus traffic. The following is a list of potential funding sources.

1. Federal Highway Administration: Field Offices

FHWA has field offices in all States and territories. Based on the needs assessment, gap analysis and determination of High Risk Rural Roads, funding to improve safety may be available. More information on each State's Highway Safety Improvement Plan and High Risk Rural Roads Program can be found through the State's field office. A listing of each field office can be found at: <http://www.fhwa.dot.gov/field.html>.

2. U.S. Department of Agriculture – Rural Development Program (USDA RUS)

The financial programs of USDA RUS support such essential public facilities and services as water and sewer systems, housing, health clinics, emergency service facilities and electric and telephone service. USDA RUS promotes economic development by supporting loans to businesses through banks, credit unions and community-managed lending pools. They offer technical assistance and information to help agricultural producers and cooperatives get started and improve the effectiveness of their operations. USDA also provides technical assistance to help communities undertake community empowerment programs.

USDA Rural Development achieves its mission by helping rural individuals, communities and businesses obtain the financial and technical assistance needed to address their diverse and unique needs. More grant information can be found at: http://www.rurdev.usda.gov/RD_Grants.html.

3. Department of Homeland Security (DHS)

DHS, through the Federal Emergency Management Agency (FEMA), manages a number of grant and assistance programs, "to help strengthen the nation against the risks associated with potential terrorist attacks and other hazards." Currently, the Homeland Security Grant Program (HSGP) is the primary funding mechanism for DHS to build and sustain the nation's preparedness capabilities. Besides the HSGP, other grant programs may be available to offer funding, including the Interoperable Emergency Communications Grant Program (IECGP) or the State Homeland Security Program. An overview of these DHS grant programs can be found at: <http://www.fema.gov/government/grant/index.shtm>. Additionally, <http://www.grants.gov/> is a government-wide system used by federal agencies for posting grant announcements and access to online grant submissions and may be an additional source of data.

4. National 911 Program

In September 2009, the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) and the U.S. Department of Commerce's National Telecommunications and Information Administration (NTIA) received a one-time appropriation and awarded more than \$40 million in grants to help 911 centers nationwide implement next-generation technologies, and enabling other features that could improve emergency response or enhance safety. More information about the grants that were awarded is available at: <http://911.gov/grants.html>.

5. Motor Carrier Safety Assistance Program (MCSAP)

DOT's Federal Motor Carrier Safety Administration (FMCSA) administers the Motor Carrier Safety Assistance Program (MCSAP) and is focused on reducing the rate of large truck- and bus-related fatalities. More information on MCSAP is available at: <http://www.fmcsa.dot.gov/safety-security/safety-initiatives/mcsap/mcsap.htm>.

6. State 911 Funds

Currently, 911 is funded through a mixture of state (and sometimes local) taxes or surcharges on wireline and wireless devices. Some states also tax Voice over IP (VoIP) subscribers and pre-paid ("pay-as-you-go") wireless devices at the point of sale. The laws and regulations that specify the eligible uses of that funding differ from state to state. Implementing Phase II Wireless technology is often a permissible use of funding. The National Association of State 911 Administrators (NASNA) maintains a list of its members at: <http://www.nasna911.org/members.php>.

7. Other Options

Funding options at the federal, State, and local level (and even within the private sector) may exist that may provide options to help improve emergency communications in rural areas. For example, the Food, Conservation, and Energy Act of 2008, (also known as the 2008 Farm Bill)²⁰, included language to permit loans to improve 911 and other emergency communication capabilities in rural areas.²¹

²⁰ (P.L. 110-234)

²¹ See also "Federal Funding for 911 in Rural Areas" Congressional Research Service, *Emergency Communications: Broadband and the Future of 911*. Report R41208. Page 22-23. Available at: <http://opencrs.com/document/R41208/>

PART FOUR: Collaboration

Bridging emergency communication gaps on high-risk rural roads and rural roads with substantial large bus traffic is more easily accomplished with the cooperation and collaboration of key stakeholders at the local, regional or State level, such as:

1. **State 911 Coordinator** – State 911 Coordinators are a single officer or governmental body of the State that is responsible for implementing 911 services within the State. The National Association of State 911 Administrators (NASNA) maintains a list of its members at: <http://www.nasna911.org/members.php>.
2. **State Utilities Commission** – The State Utilities Commissions regulate the utilities that provide essential services such as energy, telecommunications, water, and transportation. The National Association of Regulatory Utilities Commissioners maintains a list of State Utilities Commissions at: <http://www.naruc.org/commissions.cfm>.
3. **Statewide Interoperability Coordinator (SWIC)** – The Statewide Interoperability Coordinator often is responsible for public safety communications and interoperability issues for their state. Although it varies from state to state, SWICs are typically assigned to the state's department of homeland security, emergency management agency, wireless / public safety communications office, or information technology agency.
4. **State Chief Information Officer** – The State chief information officers and information technology executives and managers from the states, territories, and the District of Columbia are senior officials from state government who have executive-level and statewide responsibility for information technology leadership. Some state IT agencies are responsible for public safety communications and networks. The National Association of State Chief Information Officers (NASCIO) maintains a list of State CIOs at: <http://www.nascio.org/aboutNASCIO/stateCIOs/>.
5. **State Emergency Management Agency** – State emergency management agencies have diverse responsibilities across the states and territories, but typically are responsible for the preparation, response and recovery from natural and manmade disasters. FEMA maintains a listing of state emergency management agencies, available at: <http://www.fema.gov/about/contact/statedr.shtm>.
6. **Statewide Law Enforcement Agencies** - The American Association of State Troopers maintains a listing of state highway patrol and state police agencies at: <http://www.statetroopers.org/States.htm>.
7. **State EMS Office** – State EMS agencies are responsible for the overall planning, coordination and regulation of the EMS system within the State, as well as licensing or certifying EMS providers. A list of each State's EMS Agency can be found at: <http://www.nasemsd.org/About/StateEMSAgencies/StateEMSAgencyListing.asp>.

- 8. State Field Offices of the Federal Motor Carrier Safety Administration (FMCSA) –**
These offices can provide guidance concerning the Federal Motor Carrier Safety Regulations and information on the MCSAP. They may also be able to provide information regarding motor coach companies with active routes through individual states. A list of the FMCSA state field offices is available at:
<http://www.fmcsa.dot.gov/about/contact/offices/displayfieldroster.asp>.
- 9. Local Governments** have legal authority for the operation of city and county governments (e.g. county commissions, city councils, etc.). They can be an invaluable source of information and collaboration related to working with local representatives of public and private agencies. Their support and direct involvement can be a powerful asset.
- 10 State Highway Safety Offices** address the problem of unsafe highways. Governors select a Highway Safety Representative to administer the program and oversee the activities of the office in reducing death and disability related to traffic crashes. Many State Highway Safety Offices (SHSOs) are located within their state's Department of Transportation. Others are part of the Public Safety Department or other state agency. A few are independent offices with state government. A list of State Highway Safety Offices can be found at: <http://www.ghsa.org/html/links/shsos.html>.
- 11. State Departments of Transportation** are responsible for coordinating and developing comprehensive transportation policy for the State; coordinating and assisting in the development and operation of transportation facilities and services for highways, railroads, mass transit systems, ports, waterways and aviation facilities; and, formulating and keeping current a long-range, comprehensive statewide master plan for the balanced development of public and private commuter and general transportation facilities.

The State Highway Safety Office is responsible for establishing a Highway Safety Plan (HSP). Highway Safety Plans (HSP's) provide a comprehensive framework for State activities for reducing highway fatalities. They are also commonly called: Strategic Highway Safety Plan (SHSP), State SHSP Integrated Highway Safety Plan (IHSP) and Safety Management System (SMS). Their purpose is to provide and manage a cost-effective, multi-agency process to improve the attributes of roads, drivers, and vehicles to reduce traffic-related deaths and injuries. and a list of State Highway Safety Offices can be found at: <http://safety.fhwa.dot.gov/>.

PART FIVE: Additional Resources

1. **National 911 Resource Center** – The National 911 Program (<http://www.911.gov>), managed by the NHTSA’s Office of Emergency Medical Services (OEMS) provides a federal focus for 911 and serves as an informational clearinghouse on 911 technical, operational, and policy issues. The Program manages the 911 Resource Center (<http://www.911resourcecenter.org>), which provides technical assistance and information to PSAPs and 911 authorities.
2. **SAFECOM:** (<http://www.safecomprogram.gov/SAFECOM/>) SAFECOM is a communications program of the Department of Homeland Security (DHS). SAFECOM provides research, development, testing and evaluation, guidance, tools, and templates on interoperable communications-related issues to Federal, State, local, and Tribal emergency response agencies. As a program driven by emergency responders, SAFECOM works with existing Federal communications initiatives and key emergency response stakeholders to help develop better technologies and processes for multi jurisdictional and cross-disciplinary coordination of existing systems and future networks.
3. **Interoperable Communications Technical Assistance Program (ICTAP):** (http://www.dhs.gov/xabout/structure/gc_1189774174005.shtm) Managed by the DHS Office of Emergency Communications (OEC), ICTAP helps to enhance interoperable emergency communications among Federal, State, local, and Tribal governments by providing assistance on governance, SOPs, technology, training and exercises, usage, and engineering issues. The ICTAP leverages and works with other Federal, State, and local interoperability efforts whenever possible to enhance the overall capacity for agencies and individuals to communicate with one another.
4. **Statewide Communication Interoperability Plans (SCIP):** (http://www.dhs.gov/files/programs/gc_1225902750156.shtm) Each of the 56 states and territories have a DHS-approved SCIP that is a locally-driven, multi jurisdictional, multi disciplinary, statewide plan to enhance emergency communications. Each SCIP addresses critical elements for improving gaps in statewide interoperability.
5. **DHS Office of Emergency Communications (OEC) – The mission** is to support and promote the ability of emergency responders and government officials to continue to communicate in the event of natural disasters, acts of terrorism, or other man-made disasters, and work to ensure, accelerate, and attain interoperable and operable emergency communications nationwide. The OEC supports the Secretary of Homeland Security in developing, implementing, and coordinating interoperable and operable communications for the emergency response community at all levels of government. They have been charged with implementing the National Emergency Communications Plan (NECP) and have multiple programs and products available to support State and local emergency communications systems. More information about OEC is available at: http://www.dhs.gov/xabout/structure/gc_1189774174005.shtm.

6. **Strategic Highway Safety Plan (SHSP)** – The purpose of an SHSP is to identify the State's key safety needs and guide investment decisions to achieve significant reductions in highway fatalities and serious injuries on all public roads. The SHSP allows all highway safety programs in the State to work together in an effort to align and leverage its resources. It also positions the State and its safety partners to collectively address the State's safety challenges on all public roads and is generally established by the State Department of Transportation. <http://safety.fhwa.dot.gov/>.
7. **Motorcoach Safety Action Plan** – In 2009, DOT developed an integrated Motorcoach Safety Action Plan to evaluate motorcoach safety issues, identify actions to address outstanding safety problems, and develop an aggressive multi-agency schedule to implement those actions. The plan is available at: http://www.fmcsa.dot.gov/documents/safety-security/MotorcoachSafetyActionPlan_finalreport-508.pdf
8. **National Emergency Number Association (NENA)** – NENA is a national professional organization solely focused on 911 policy, technology, operations, and education issues. It has 48 State chapters across the United States. State and county 911 coordinators provide information on readiness of states, counties and PSAPs for wireless E911. More information on NENA and its State chapters is available at: <http://www.nena.org>.
9. **American Bus Association (ABA)** – ABA represents approximately 1,000 motorcoach and tour companies in the United States and Canada. Its members operate charter, tour, regular route, airport express, special operations and contract services (commuter, school, transit). Another 2,800 member organizations represent the travel and tourism industry and suppliers of bus products and services who work in partnership with the North American motorcoach industry. More information is available at: <http://www.buses.org/>.
10. **United Motorcoach Association (UMA)** – The UMA is a national association of professional bus and motorcoach companies. UMA's membership includes over 875 motorcoach companies, and another 215 motorcoach manufacturers, suppliers and related businesses as “Associate” members of UMA. More information is available at: <http://www.uma.org/>.
11. **American Public Transportation Association (APTA)** – APTA members are public organizations that are engaged in the areas of bus, paratransit, light rail, commuter rail, subways, waterborne passenger services, and high-speed rail. Members also include large and small companies who plan, design, construct, finance, supply, and operate bus and rail services worldwide. Government agencies, metropolitan planning organizations, state departments of transportation, academic institutions, and trade publications are also part of our membership. More information is available at: <http://www.apta.com/>.

12. **Association of Public Safety Communication Officials (APCO)** – is national association of communications professionals that provides leadership; promotes professional development; and, fosters the development and use of technology for the benefit of the public. There are currently 49 State chapters and a list of them can be found at: <http://www.apcointl.org/new/membership/chapters.php>.

Summary Conclusion

To improve emergency response along high-risk rural roads and roads with substantial large bus traffic, States, PSAPs and other stakeholders should conduct a needs assessment and gap analysis to identify areas within their jurisdiction that travelers will have difficulties in contacting first responders in an emergency situation. These areas may be due to gaps in cellular phone coverage or low population density areas without significant infrastructure.

This paper provides potential technical options, possible funding sources and other suggested resources to help improve notification of the emergency response system along high risk rural roads. Depending on the State or local jurisdiction, the resources may be different. Strong collaborative efforts among local, State, Federal and non-governmental partners is essential to achieve adequate emergency communications.

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