

- Wildlife and Fisheries Management and Enforcement;
- Urban Wildlife Mitigation and Public Protection;
- Environmental Protection and Enforcement;
- Habitat Management and Mining Enforcement;
- Boating Safety Enforcement;
- State Parks operations and Law Enforcement;
- Land Reclamation activities.

Protection of the public welfare is of paramount importance in each Forestry-Conservation endeavor. The Conservation Officers, Game Wardens, Forest Rangers and Firefighters, Boating Safety Enforcement Officers, Environmental Protection Officers and Park Rangers are quite often the only public officials in remote locations, becoming the sum total of the Law Enforcement and Fire Protection known by the citizens in the area.

In many areas, the specialized equipment operated by Forestry-Conservation agencies is quite often the only equipment available to mount rescue efforts during natural disasters:

- Patrol boats and expert operators during floods;
- Earth moving equipment in rural communities during fires or other disasters;
- Helicopters and experienced pilots for rescue efforts in mountainous terrain where main rotor clearances are measured in inches;
- Tranquilizing equipment and tactical knowledge used in subduing mountain lions, bears and other large carnivores in Urban settings;
- Fire fighting equipment able to leave paved roads to attack fires threatening structures in remote/rural settings.

Day-to-Day Interoperability

- The governmental entities charged with these Forestry-Conservation responsibilities require voice and data communications over wide geographical areas to accomplish their mission goals.
- Air-to-Ground communications are often used during forest wildfire detection and suppression operations, wildlife and fisheries surveillance, investigation and patrol, environmental hazard detection, cleanup and enforce-

ment, land reclamation evaluation and personnel transport in support of all these activities.

- Radio telemetry and tracking is utilized in the management of fish and wildlife species.

Mutual Aid Interoperability

- Due to the scope of wildfires, and the mobility of wildlife and persons in the outdoors, mutual aid is the rule rather than the exception in Forestry-Conservation. Multi-jurisdictional fires, wildlife crime, environmental disasters and search and rescue operations are only a few of the events which demand communications between Forestry-Conservation agencies and other Forestry-Conservation, Fire and Criminal Justice agencies.

- This interoperability is most often accomplished at the field level by unit-to-unit communications; however, it is common for radios in one agency's vehicles to have the frequencies for other cooperating agencies already installed and ready for use. This provides for the widest possible number of systems and frequencies to be used in a given situation, even when circumstances dictate operations across system, geographical or political boundaries.

Task Force Interoperability

Forestry-Conservation Task Force operations fall within two broad categories:

- *Wildfire Suppression Task Forces:* Federal, state and local government agencies concerned with fighting wildfire and boundary wildfire/structure fire have joined together in nearly every area of the nation. They have established standards, procedures and priorities in the area of radio communications. When a wildfire occurs, the responding units may come from the affected jurisdiction or a cooperating agency under terms agreed to in the cooperative's charter or procedure manual. If a large wildfire develops, units from any or all of the cooperating agencies respond. This could be in the form of Automatic Aid as previously discussed.

- *Natural Resource Law Enforcement Task Forces:* The federal, state and local government agencies concerned with Natural Resource Crime have established short and long term cooperative agreements to assist in the enforcement of natural resource laws. These activities include:

- joint "sting" operations with the U.S. Fish and Wildlife Service, State Wildlife agencies and local law enforcement agencies;
- covert operations involving organized crime and international sales of wildlife and parts of wildlife;

- radio, video and telemetric surveillance of known wildlife violators, environmental polluters and others who endanger the public and the natural resources of our nation and the world.

Conclusions and Recommendations

- Forestry-Conservation operations contain the essence of Fire and Criminal Justice operations found in other Public Safety services, while operating in places and in ways which are unique to natural resource agencies.
- Radio communications in the pursuit of Forestry-Conservation objectives are essential to the preservation of life, limb and property; both for the agency personnel in the course of their duties and for the public at large.
- Any operation achieved to date has been through cooperation and recognition of goal similarity between various governmental agencies. Any future legislation regarding interoperability must enhance actual interagency operations without eroding existing capabilities.

12.3.7.3 General Government

General government can be loosely defined as all governmental communications other than criminal justice, fire, emergency medical, highways, forestry-conservation, and emergency management. General Government services are generally related to basic infrastructures or they are necessary for the internal support of operational units of government. These support services are those which government undertakes for the public welfare, general economic betterment and for furnishing basic services to the populace. These include building inspection and public works engineering, water supply, solid and liquid waste management, streets and traffic signals, street lighting and often through government-owned utilities, electrical power and natural gas delivery. Some jurisdictions also include public health services and hazardous waste response and management separate from first responder organizations. Functions such as governmental administration (communications for elected officials, tax collection, etc.) may also be supported, particularly if immediate communications between these functions and first responders is required during emergencies. These services and facilities are taken for granted because of government's stewardship of them. In emergency conditions, however, these same services become critical to the protection of life and property.

Within the Federal Government (Department of Defense and Department of Energy facilities, for example) and on state college and university campuses, both of which are examples of wholly contained operations similar to a city, all functions are governmental in nature and are conducted on General Government communications systems.

General government communications is a vital component to most jurisdictions. Typically, these systems act in load sharing on communications systems as their use is heavy during day time and on week days. These are the off-peak times for the majority of police,

fire and emergency medical activities. They are not a burden on public safety systems as much as they allow more efficient and economic use by the jurisdiction. Because these systems are so interwoven into the fabric of governmental services, they provide a significant amount of intrajurisdictional interoperability. Police and fire units often need to communicate directly with personnel who furnish and maintain these general government services. In addition, most city and county services have continuing needs to talk between departments as field units go about the public's business.

Day to Day Interoperability Requirements

- Interoperability for general government most often occurs at the field level in unit-unit communications.
- Some interjurisdictional situations include government utilities such as water system construction and maintenance where individual public utilities share parts of larger systems.
- The most prevalent interoperability occurs within the jurisdiction itself. Police frequently need to communicate with street and transportation units as traffic signal problems occur. Police frequently must communicate with public works barricade people for hostages, SWAT, traffic, parade and many other reasons. Fire units very often must coordinate water delivery and pressure needs during major fires (more than two alarms). Fire also uses traffic and barricade personnel for landing helicopters and cordoning off fire scene. Fire also must communicate with local natural gas and electrical power agencies to shut off utilities during fires. Often these agencies are government-owned utilities belonging to the same, to a neighboring or to several jurisdictions.
- Local governments have many duties. Public works groups engineer infrastructure and public facility projects. These groups then oversee both public and private organizations which do actual construction. Building and engineering inspectors then perform code and specification adherence duties. Public utilities must coordinate with police, fire and street departments for construction and maintenance of utility infra-structure. Many cities maintain parks and recreational facilities which are publicly owned. There is often a need for these parks people to communicate with the police for law enforcement purposes. Police and fire also frequently must communicate with streets personnel for barricading and cleaning of roadways from accident and weather.

Mutual Aid Requirements

- The day-to-day load sharing mentioned above becomes critical during major incidents or disasters. The system capacity required to support General Government activities during day-to-day activities provides the paths to support the dramatic increase in communications paths required by first responders for mutual aid incidents. Using a pre-planned system of priorities on conventional

systems or automatic access priorities provided by modern public safety trunked systems, those who need capacity to support safety of life and property functions can have that capacity. *If General Government did not share these systems (by using commercial providers, for example) that capacity would be there but under utilized during non-emergency periods. More likely, this excess capacity would not even exist due to spectrum shortages.*

- The first example of interjurisdictional general government interoperability is transportation related. Coordination of street clearing and barricade efforts goes across political boundaries during wide area emergencies. Wind, storm, blizzards and flooding are all events which require massive general government response for the protection of life and property.

- During flooding, protection of the public's water source becomes a critical issue.

- During emergency conditions of snow, rain, wind and flooding, there is a critical need for interoperability between first responders and those responsible for maintaining open roadways. The ability of first responders to assist citizens in need is severely hampered if roadways are restricted or impassable.

Task Force Requirements

- Uses of task force interoperability for General Government is limited, but does exist.

- It is said in many parts of the country that there are two seasons; "winter and road construction". Particularly in rural areas, State, County and local road departments have the need to communicate with each other and with agencies having responsibility for traffic management and law enforcement. During non-emergency situations, maintenance and construction activities require coordination. Since state roads pass through communities, the maintenance of these roads (and the traffic signaling along the roads) is most often the State's responsibility. Joint efforts for maintenance and construction are usually preplanned and involve a number of different organizations.

Conclusions and Recommendations

- As communities better manage and coordinate their systems and as governmental systems consolidate, the infrastructure capacity provided to support General Government functions becomes critical for supporting the activities of first responders during daily peak traffic periods, as well as during major incidents or disasters.

- Access to interoperability must include general government. Specific communications paths that are allocated for interoperability must be allocated under the definition of public safety. These allocations should not be narrowed. They must not be restricted to only narrow portions of the public safety community. Users should be able to decide what interoperability needs are and use the resources to fit those needs.

12.3.7.4 Highway Operations

Highway operations organizations have generally been viewed as non-emergency agencies dealing with routine road construction and maintenance situations. This perception has never been accurate. Highway agencies have always had an important function in preserving and protecting the public well being. Highway operations agencies will play an increasingly critical role in the public safety effort as governmental budgets decrease and technology advances.

Highway operations agencies vary in size, funding and responsibilities. They include state-wide Departments of Transportation (DOT), large city departments of Public Works (DPW) and small road crews. While these organizations have many differences, they have one common function; each must ensure that other public safety agencies can move the necessary vehicles and personnel from staging locations to emergency situations as quickly as possible. This access is often taken for granted since the transportation infrastructure is well developed and maintained. When the infrastructure is unavailable due to damage, weather conditions or traffic congestion, it becomes very obvious that highway agencies are a key component of the public safety response. Given the importance of their functions, it is critical that highway operation agencies have communications access to all other public safety agencies.

The numerous benefits of highway operations interoperability can be seen by examining the workings of a major toll road utilizing a common radio channel for each division. This channel is typically controlled by the division dispatcher and shared by the highway maintenance vehicles, state police, tow truck operators, selected fire/EMS agencies and toll collectors. All the user groups have direct, instantaneous access to the others. The members of these user groups act as additional sets of eyes for the dispatcher and state police. Highway maintenance personnel frequently provide the first report of traffic accidents; unsafe driving and many other incidents requiring police intervention. Toll collectors transmit information on incidents reported by exiting drivers. Dispatchers often ask maintenance to check accidents or disabled vehicles since they are or may be the closest unit to the scene. All users will report vehicle sightings if they know the police are in a pursuit. All users on the system also hear notices broadcast on missing or wanted persons. There have been numerous instances where maintenance drivers or toll collectors have reported a wanted vehicle and the police have followed through with an arrest. Police, maintenance and tow truck drivers also use the channel for tactical purposes during accidents and lane closure incidents. The instantaneous sharing of real time information among the user groups allows an integrated public safety response that minimizes response time and maximizes efficiency.

This type of system would not be workable in many environments. Even in the controlled toll road environment, users complain of channel congestion and monitoring of unnecessary transmissions. However, if this type of interoperability could be provided on an as needed basis, integration of the public safety response would be significantly improved.

Day-To-Day Interoperability

This section details the day to day highway operations interoperability requirements with various other public safety agencies:

- Other Highway Operations Agencies:

Adjacent highway agencies have critical day to day interoperability needs since their operations often impact each other. At a minimum, highway agencies should be able to report incidents or conditions that require response from an adjacent agency. Beyond this minimum, the future of highway operations points to consolidated efforts from multiple agencies to provide overlapping services. To meet this need, the agencies must have communication links at all levels. This includes wide area voice connectivity, tactical voice, data and video. Wide area voice connectivity is needed so overall efforts can be coordinated. Agencies may move to consolidated dispatch/supervisory operations similar to 9-1-1 centers. Field units from multiple agencies will need the ability to contact a central dispatch point. Field units from multiple agencies will also need mobile to mobile communications to coordinate local efforts. Agencies will be sharing ITS and telemetry data. This data must be available to any highway agency within the region. Sharing of incident or site video from the mobile units will allow remote supervisors from multiple agencies to determine if additional resources are required.

- EMS/Fire

A major interoperability requirement will be incident detection reports from highway field units to EMS/fire dispatch points. Incidents could include fires, accidents, personal injuries/illnesses and dangerous conditions. These incidents could happen as a result of highway maintenance operations or could be incidents the highway crew observes. Voice connectivity between the field units and EMS/Fire dispatch points is required on an as needed basis. The fire/EMS dispatch points should know the locations of highway work sites and be able to contact field crews if a fire/EMS vehicle will be responding past that location. This will require voice connectivity between the dispatch point and field location. It will also require highway maintenance location data transmission to the dispatch point. The fire/EMS dispatch point should also have access to road/weather conditions, road closure information, and traffic conditions that can be provided by a highway operations organization. This will also require data connectivity between the field units and the dispatch point. A tactical voice channel is required between highway field units and responding EMS/Fire units. EMS/Fire needs to advise highways if a clear route is required.

Highway needs to be able to inform EMS/Fire of the best route to take to respond to incidents near construction sites or congested traffic areas.

- General Government

Interoperability in this area should be focused on improving the efficiency of general government response. Highway operations needs voice connectivity to a general government dispatch point to report incidents such as water main breaks, health hazards and unsafe work sites. Data connection is also required to acquire and transmit GIS based information from General Government databases.

- Law Enforcement

As with EMS/Fire, a major interoperability requirement is incident detection. Highway operations needs a voice connection to a law enforcement dispatch point to report accidents, criminal acts, suspicious behavior and any other observed activity requiring law enforcement intervention. Law enforcement should also have the capability to transmit wanted person/vehicle notices to highway field units in specific areas. Highway units can act as additional observers and report any observations to a law enforcement dispatch point. The law enforcement dispatch points should also be aware of significant highway work sites and be able to contact field crews if a law enforcement vehicle will be responding past that location. This will require voice connectivity between the dispatch point and field unit. It will also require highway maintenance location data transmission to the dispatch point. The law enforcement dispatch point should also have access to road/weather conditions, road closure information, and traffic conditions that can be provided by a highway operations organization. This will also require data connectivity between the field units and the dispatch point. A tactical voice channel is required between highway field units and active law enforcement units. Law enforcement needs to advise highway if a clear route is required in a construction area. Highway needs to be able to inform law enforcement of the best route to take to respond to incidents near construction sites or congested traffic areas.

- Mass Transportation

The main day to day interoperability requirement will be sharing information on traffic flow, weather and unsafe conditions. This will require voice and data connectivity. A tactical voice channel is needed to route mass transit vehicles around work sites that disrupt normal traffic flow.

- Public Service

The main interoperability requirements will be a voice link to report incidents that require public service response. These could be fallen power lines, damaged poles or unsafe track conditions at grade crossings. Highways also need a data link to access utility infrastructure information such as buried pipelines or power feeds. Public

service agencies may need assistance from highway crews to reach remote sites during inclement weather.

- ITS

The majority of Traffic Management Centers will be run by highway operation agencies. The TMCs will make the most of the ITS network. These centers will be information hubs for public safety as described in the ITS section of this report.

Mutual Aid Requirements

This section details the mutual aid highway operations interoperability requirements with various other public safety agencies:

- Other Highway Departments

Full interoperability is needed between all highway departments that could be involved in mutual aid operations. This could include state DOTs with local departments, cities with counties, towns with villages and many other combinations. Wide area voice channels, tactical voice channels, data and video connections are all required to achieve the required level of interoperability. Wide area voice is needed to coordinate overall operations. Tactical voice is needed between crews to coordinate local efforts. Data and video are required to share unit location and weather information among departments.

- EMS/Fire

EMS/Fire mobile units need a voice channel to a highway dispatcher to request road clearing during emergency response. This connectivity is critical during snowstorms or other events that make roads impassable. Fire/EMS also needs a tactical voice channel to ask for road closure assistance from on-scene highway crews. During major fires in cold weather, fire crews need a voice channel to highway crews to request road/sidewalk deicing operations at the scene. A data channel is needed to provide incident commander highway crew location information. Tactical voice channels are needed between EMS/Fire and highway so on-scene activity can be coordinated.

- Forestry Conservation

Interoperability is required with highway agencies during floods, fires or major storms. Forestry will require assistance from highway agencies in operating roads, repairing dams, shipping supplies and providing heavy equipment. Voice and data connectivity is required from highway field units to forestry supervisory locations. Forestry field units also require connectivity to highway agency supervisory locations. Field units need tactical voice channels to coordinate local efforts.

- General Government

Interoperability will be needed for highway agencies to contact general government vehicles and supervisory locations. This will require voice connectivity. Highway agencies will also require a data connection to general government to acquire GIS database information.

- Law Enforcement

The incident commander in a mutual aid operations needs voice and data connection to highway crews. Voice connections is also required to highway dispatch centers. Voice will be used to direct crews in road clearing/closing operations, development of detour routes and numerous other operations. Data connectivity is required to show location and status information of the highway and crews. There are many scenarios in which highway operations will be part of a mutual aid operation. Most major incidents result in disruption of normal traffic flow. During these disruptions, highway operations has the main responsibility for ensuring congestion is minimized and routes are available for emergency vehicles. The incident commander will also rely on information provided by local Traffic Management Centers as detailed in the ITS section of this report.

- Mass Transportation

Mass Transit needs connectivity to highway operations to plan emergency evacuation routes and coordinate the movement of on-scene transit vehicles. Highways must also be able to provide real time detour information to mass transit during incidents. Voice and data connectivity area required.

- Public Service

Public service needs connectivity to highway operations to provide road clearance or closure during emergency repair work. Highway operations could also be involved when a train derailment results in a haz mat incident requiring containment/clean-up assistance from a highway agency. Voice and data connectivity is required.

- Emergency Management

Interoperability is required with highways during major incidents such as hurricanes, tornadoes, blizzards and earthquakes. Full connectivity is needed between highway agencies and the Emergency Management Command Center. Voice, data and video links are required from field units and supervisory locations to the command center. Since the command center has wide area responsibilities, the links must be available on a statewide basis. Sufficient capacity must be provided to accommodate multiple simultaneous incidents.

Task Force Requirements

This section details the Highway Operations task force interoperability requirements.

Highway operations needs wide area voice, tactical voice, data and video connection interoperability during task force activities. Highways will play a key role in planning and implementing traffic routing measures needed to ensure the success of the task force. Highway vehicles may be used as observation points for other task force members and should be capable of transmitting data and video from the vehicle to the task force operation center. Highway crews may be needed to quickly close or open roads if plans are changed during the operation.

Conclusions and Recommendations

Highway operation agencies play a key role in preserving the safety and well being of the general public. The scope of their obligations goes well beyond the routine tasks of road maintenance and construction. Within the period considered by this report, highway agencies will have the main responsibility for implementing and monitoring ITS systems. The combination of ITS systems and expansive field operations will force highway operations to play a key role in creating the shared information environment needed to develop an integrated public safety response.

In order to fully utilize highway operations resources, well developed communications interoperability is required with other public safety organizations. Achieving the required level of interoperability will require sufficient spectrum, funding, technological compatibility and well defined interagency policies.

12.3.7.5 ITS (Intelligent Transportation System)

The relationship between ITS and public safety has several aspects including the safety of the traveler, whether on public or private vehicles and the array of new technologies and services that will be available to personally owned vehicles as well as vehicles owned and operated by emergency service providers and traditional public safety agencies. The ITS user services involve the use of in-vehicle electronics as well as roadside and other types of electronic communications systems. There will also be a mix of procurement, installation, and operation of systems by state and local governments, and fee-for-service functions provided by private service providers. Existing communications services and equipment will be used provided they can meet ITS requirements. The decision on which system is chosen will be made by the implementing jurisdiction. Information requiring wide-area distribution will require either broadcast (e.g. FM subcarrier) or two-way wide area wireless systems (e.g. data over cellular radio, PCS, or an agency's privately owned system). Some ITS services (for example, most of the commercial vehicle safety-related functions) will require dedicated short range communications (such as microwave systems that use roadside readers and vehicular mounted transponders). Other safety-related functions may require the use of systems such as collision avoidance radar.

One of the functions of ITS is to collect and provide information on real time traffic conditions. Traffic control and incident response decisions are made based on analysis of the data. Since ITS may cover multiple jurisdictions, the information must be distributed quickly to multiple agencies and field units. The public safety community must develop ways to allow the seamless transfer of data among organizations. Institutional agreements on distribution and use of information among agencies and organizations must be developed in parallel with technological advances.

The issue of wireless communications interoperability for Intelligent Transportation Systems should be focused on two major categories:

Interagency Interoperability: Interoperability among Traffic Management Centers (TMCs), Emergency Management Centers, and deployed public safety and public service personnel is needed. These agencies need connectivity with all other public safety agencies that can provide or need access to traffic flow, incident detection and response, emergency response and safety-related information. In most cases, multiple centers are in operation within a geographical region and inter-jurisdictional cooperation is necessary.

ITS Device Interoperability: Public safety mobile units need direct access to ITS related information on a nationwide basis using either the primary radio system deployed by public safety organizations or by procuring multiple communications equipment. The key issue is how public safety field units will exchange data with numerous ITS information sources without purchasing different equipment for each system for each region of operation.

Interagency interoperability

Interoperability between traffic management centers and other public safety agencies will be a mutually beneficial relationship. Traffic management centers will benefit by receiving real time traffic and incident information from public safety mobile units. Public safety and public service agencies will use ITS data to improve incident detection/response time and to aid in law enforcement. Public Safety agencies will also benefit from being able to make traffic control recommendations during incidents.

One of the goals of the traffic management centers is to improve traffic flow and reduce congestion. In order to meet this goal, the traffic control agencies need real time data from incidents that will disrupt normal traffic patterns. While some of this data can be provided by ITS devices, the majority will come from reports by field deployed public safety units. A consistent, automated path for funneling this information from the field to the traffic management centers is needed.

Other public safety organizations will benefit if relevant information collected by the traffic management centers can be forwarded to the agencies responsible for incident and emergency response. This will allow the responding agencies to maximize the efficiency and expediency of their response.

Key Issue: Do public safety field units need a direct communication channel with traffic management centers? Field units need to provide incident data to the traffic management centers. Traffic management centers need to provide information on incidents, traffic control decisions, road hazards etc., to public safety field units. What is the most effective means of transferring this information?

Day-To-Day Interoperability

The following sections detail the ITS user services listed in the "**ITS and Public Safety Wireless Services**" report and the operational requirements from the Operational Requirements Subcommittee report that would benefit **day-to-day** interoperability with public safety communications systems.

Automatic Collision Notification: Driver and Personal Security

These systems will be used to notify monitoring organizations that an incident or collision has occurred. A RF data channel is needed from private vehicles and public transit vehicles to a network access point for the monitoring organization. If a public safety response is warranted, the appropriate agencies must be notified. Since the vehicle could be moving during the incident, a RF data channel is needed to provide incident location information to the responding public safety units. The key requirement for this process will be an automated, electronic transfer function for routing the data from the monitoring agency to the public safety agencies. The data must be in a format that the public safety agencies can immediately transmit to their field units.

Enroute Driver Information: Incident Detection

These systems will be used to inform drivers with in-vehicle ITS equipment of relevant traffic conditions. Traffic management agencies need access to real time incident, weather, and traffic data so drivers can be notified. A source of information will be field reports over voice and data channels from public safety units. Network connections will be used to transfer the field data to traffic management centers. Drivers of public safety vehicles will need to receive the notifications expeditiously over various communications links.

Emergency Vehicle Route Guidance

This service will have a function similar to Enroute Driver Information. In order for the system to be successful, accurate, real time incident data must be available to traffic management agencies, and efficient routing information must be provided to drivers of public safety vehicles.

Emergency Vehicle Signal Priority: Priority Treatment for Transit

This service will enable adjustments to be made to traffic control devices to maximize the efficiency of the transportation systems, minimize response time by emergency

service providers, and aid in law enforcement. Traffic management will need real-time incident data in a format that can be processed by traffic control decision-making systems. Traffic management agencies will also collect requests for traffic control that public safety vehicles and transit vehicles will need. Devices that allow direct traffic signal pre-emption from a public safety vehicle may be required.

Public Travel Security

Alarm systems installed in transit stations, bus stops, and public transit vehicles will be monitored by private or public agencies depending on the location and scope of the system. Private agencies will need a communications path to notify public safety agencies when assistance is required.

On-board Safety Monitoring

Data monitoring and communications systems onboard commercial vehicles collect safety data pertaining to critical vehicle components, condition of the cargo, and the fitness of the driver. Law enforcement officials need to be notified of the vehicle, its location, and the nature of any safety violation requiring attention.

Mutual Aid Requirements

The following sections detail the ITS user services listed in the "ITS and Public Safety Wireless Services" report and the operational requirements from the Operational Requirements Subcommittee report that would benefit from mutual aid interoperability with public safety communications systems.

Route Guidance and Enroute Driver Information

Incident liaison officers will need to provide incident data to the traffic management agencies. The incident commander may make recommendations on data that drivers should receive. RF data, voice, and video channels will be needed to connect the liaison officer to the traffic management center.

Incident Detection and Management

Data, voice, and video connectivity via RF channels are required between the incident liaison officer and the TMC. The TMC will be making decisions about wide area traffic flow while the incident commander makes decisions at the site of the incident. These decisions need to be closely coordinated.

Traffic Control

Data and voice RF connectivity are required between the incident liaison officer and the TMC. The incident commander needs to be informed of traffic control decisions

made at the TMC that impact the area of operations. The incident commander also needs the ability to request specific traffic control measures be taken.

Enroute Transit Information

The incident liaison officer will need to provide incident data to the transit management centers and traffic management centers. The incident commander may make recommendations on data transmitted to transit vehicles. Voice and data channels are required between the incident liaison officer and the agency controlling transit information.

Public Transportation Management

System operators will need accurate information from the incident liaison officer to verify that management recommendations produced the desired effects. Voice and data connectivity is required. The incident commander needs the capability to dispatch these vehicles if large scale evacuations are required. This will require RF voice/data connectivity with the agency responsible for controlling these vehicles.

Public Travel Security

The incident commander may need access to data from wide spread security devices. Data connectivity is needed between the incident liaison officer and the organization monitoring the security devices.

Hazardous Materials Incident Response

The incident commander needs access to all HAZMAT data collected by the responsible monitoring organization. This will require voice/data RF connectivity between the incident commander and the agency. The incident commander will need a portable reader if the HAZMAT vehicle has HAZMAT data stored in an on-vehicle Dedicated Short Range Communications (DSRC) transponder.

International Border Crossing

DSRC systems are used to allow pre-cleared (safety status, credentials, weight etc.) commercial vehicles to proceed across international borders without stopping. Location and other pertinent information on commercial vehicles attempting to cross in violation needs to be sent to registration, fuel tax, immigration, law enforcement, customs, and state transportation agencies.

Emergency Vehicle Management (EVM)

The incident commander needs full access to this system. A real time GIS display showing vehicle locations would be invaluable. Since the response will involve multiple agencies, the individual emergency vehicle tracking systems must be

compatible. Data connection via an RF channel is needed to each responding agency that is utilizing an EVM system.

Task Force Requirements

The following sections detail the ITS user services listed in the "ITS and Public Safety Wireless Services" report and the operational requirements from the Operational Requirements Subcommittee report that would benefit from task force interoperability with public safety communications systems.

Enroute Driver Information: Route Guidance, Enroute Transit Information

Task force commanders need the ability to coordinate with the TMC responsible for sending information to drivers so that traffic flow would be routed to aid the task force operations. This will require a voice/data RF channel between the task force and the TMC.

Incident Management

Data and voice connectivity via RF channels are required between the task force commanders and the Traffic Management Center. The task force commander needs to be aware of any TMC decisions impacting the operations of the task force such as traffic flow, safety messages, traffic alerts.

Traffic Control

Data and voice RF connectivity are required between the task force commander and the TMC. The commander needs the ability to request specific traffic control measures be taken.

Public Transportation Management

System operators will need accurate information from the task force commanders to verify that management recommendations will produce the desired effects. Voice and data connectivity is required. The incident commander needs the capability to dispatch these vehicles if large scale evacuations are required. This will require RF voice/data connectivity with the agency responsible for controlling these vehicles.

Emergency Vehicle Management

Task force commanders need full access to this system. A real-time GIS display showing vehicle locations would be invaluable. Since the response will involve multiple agencies, the individual EVM systems must be compatible. Data connection via an RF channel is needed to each agency that is utilizing this system.

Interagency ITS Interoperability Conclusions

The following items must be addressed to achieve a high degree of interoperability:

- Standardized ITS data formats and interfaces are required to ensure that real time incident data can be shared by multiple agencies.
- Agencies need an automated, electronic means of sharing incident data on a day to day basis.
- Agencies need to develop policies to ensure that relevant data is shared with other organizations.
- Incident and task force commanders need full coordination capabilities with all affected traffic management centers. This will require voice/data/video connectivity over RF channels.

ITS Device Interoperability

The second aspect of ITS interoperability is the requirement that data from ITS devices must be accessible to field deployed units from multiple agencies on a nationwide basis. Technology and frequency plan standards must be developed and implemented if this goal is to be reached using public safety radio systems for wide area communications. ITS communications based on one-way broadcast (likely using FM subcarrier) or DSRC transponders will require public safety vehicles to be equipped with these new systems. Efforts are underway by various organizations to standardize the protocols for reception of FM subcarrier and DSRC. If successful, single nationwide interoperable devices will be available for use by public safety personnel. Wide area communications are expected to be based on commercially available services such as cellular radio, ESMR and PCS and is expected to vary from region to region.

The key issue is how public safety field units will receive data from numerous types of ITS devices without purchasing a different receiver for each system and for each region of operation. Wide area mobile communications for ITS will be selected by the locality or the service provider offering the ITS user service. Public safety agencies have the option of installing a data interface with a TMC, transit management center, or independent service provider, and integrating the required ITS-related information onto the public safety radio systems. If these systems have interoperable modes, then ITS information can be made interoperable provided the message formats are standardized.

ITS Device Interoperability Conclusions

The following areas must be addressed to achieve the desired interoperability:

- Technology and message format standards are required for broadcast and DSRC systems providing ITS-related information. Message format standards are required for wide area wireless systems.

- Public Safety agencies that are not leasing commercial wide-area wireless communications services have the option of integrating information from traffic management, transit management, and emergency management centers over their own radio system, and developing the ability to share the information over mutual aid, task force, or any other interoperable wireless channel. Agencies leasing commercial wide area wireless service will likely have to lease equipment from a service provider that is offering the ITS services in the location the agency needs to operate in.

- A national frequency plan would ensure data are available to any responding agency in any location.

12.3.7.6 Criminal Justice

Overview of Requirements & Methodologies

Within the Criminal Justice community, law enforcement resources are among the “front line” responders of all public safety agencies. Their communications needs, both for technology and for transmission of information, are critical.

As first responders to “all risk” incidents, they are often involved with multiple agencies, either responding or at scene.

At times these incidents are critical or catastrophic in nature, ranging from low-risk reports of cold crimes to in-progress felonies with armed suspects, vehicle and aircraft crashes, and haz-mat spills.

Fire and rescue members are increasingly exposed to law enforcement activities, with all of the attendant risks.

Efficient, concise, and interoperable communications is the foundation for all law enforcement communications, potentially determining whether human life and property is saved or lost.

Day-to-Day Interoperability

More than any other public safety discipline, law enforcement officers use day-to-day interoperability to enhance their own safety and that of the public. In many cases this is due to the overlap of jurisdictions, a phenomenon not commonly found with other public safety disciplines.

Interagency Operations links used by law enforcement officers during pursuits and other similar incidents (particularly those with the potential to rapidly cross

jurisdictional boundaries represent a special case of day-to-day interoperability which must be met.

Many law enforcement field units routinely monitor neighboring agencies or agencies with concurrent jurisdiction. As required, they interact with field units of these other agencies either on their own link (with the other agencies monitoring their link), through a dispatcher, or preferably directly on the other agencies working link. One of the classic day-to-day interoperability situations is the "officer needs help" call which normally elicits an emergency response from all units within the officer's agency, as well as from all surrounding communities and concurrent jurisdictions. It is not unusual to have 30 or more field units arrive at the scene of one of these incidents which are usually initiated only when the officer's life is in immediate danger.

For corrections agencies, in particular probation/parole agents and corrections transportation units, interoperability with the agency having jurisdiction where they are working or traveling may be the only communications available and is critical in high-risk situations.

Interoperability takes place between personnel outside of their own jurisdictions (acting as reporting parties) and dispatchers, dispatchers to other dispatchers, dispatchers to responding field units of other agencies, and unit to unit.

Criminal justice agencies often install multiple radios into field units to provide interoperability with other agencies. For example, the FBI annually budgets \$2-3M to provide radios for interoperability with other federal, state and local agencies.

Available and adequate spectrum and radio systems dynamic enough to handle the entire range and complexity of the incident (or multiple incidents) are a necessity.

Infrastructures have to be maintained and expanded, either on demand or as the result of population and workload.

Available and adequate training is essential for all personnel dealing with day-to-day communications.

As with Fire and EMS, the concept of "Auto-Aid", dispatching of the closest available unit to an incident regardless of jurisdiction, is beginning to take hold in the law enforcement community. Auto-aid is a preplanned response; it is not called for by an on-scene incident commander. The importance of "Auto-Aid" agreements must be understood by all participating parties. As with Community Based Policing, auto-aid agreements will increasingly play a key roll in successful operations. Resources from any agency may be dispatched automatically on the first call to any type of incident. The closest resource responds, be it federal, state, or local.

Auto-Aid agreements require pre-planning, especially for communications interoperability; dispatch procedures, channel/talk-group assignment(s), and on-scene contacts; all are very basic principles.

It is absolutely essential that technology and spectrum be made available for Auto-Aid resource dispatching and communications.

Mutual Aid Requirements

Mutual aid occurs at two levels. The first is comprised of long term, pre-planned agreements, utilized on an occasional basis, such as civil disorder or riots.

The second is the "cry for help" when everything is unraveling, and the Incident Commander, resources assigned, or dispatch centers need additional resources, either in numbers or uniqueness of function. This should not, however, be confused with the "officer needs help" interoperability described previously.

Mutual aid is normally requested by the on-scene incident commander. While there are often general response plans and guidelines, mutual aid differs from auto aid discussed previously in that the response is not automatic.

Pre-planning of communications scenarios is essential. Jurisdictional program managers have the direct responsibility to talk to one another, and play the "what if" game.

Technology and available spectrum has to exist for mutual aid to actually perform as designed.

Common interoperable frequencies must be assigned for the worst case scenario: the small county, perhaps out of state, local government resource responding to an Oklahoma City bombing type of incident.

A nationwide Mutual Aid Frequency plan should be mandated.

Task Force Requirements

Perhaps more than any other public safety discipline, the criminal justice community uses Task Forces made up from federal, state and local resources to address major problems such as drug enforcement, and smuggling

Unit to unit communication within the Task Force, and Task Force leader to next command level communications is essential.

Conclusions and Recommendations

The basic responsibility of criminal justice resources is to protect and serve the population.

Through general awareness, consolidation, and necessity, multi-jurisdictional participation in emergency incidents is becoming the norm rather than the exception.

Without the ability to communicate, the criminal justice mission is severely compromised, exposing all participants (civilian as well as responder) to loss of life and property.

12.3.7.7 Mass Transportation

Overview of Requirements & Methodologies

Public Mass Transit entities are governmental providers of a service at regional, state, and local levels. Public Mass Transit entities are a specialized form of General Government.

Mass Transportation personnel are often the first to report, respond to, and arrive at incidents within their respective transportation systems. Immediate action and incident information transferal to the appropriate entity are critical for effective public safety service resource management.

The regions that are covered by mass transportation entities often bisect numerous local, county, and state jurisdictions. Each jurisdiction may have different Incident Command Structures and separate radio frequency operational bands.

Mass Transportation incidents have the potential to become large scale multiple casualty incidents due to the large number of passengers often carried within regional transportation systems.

Rail Mass Transportation systems areas of operation are often "harsh" areas which vary from highly populated urban areas through rural areas. Areas of operation include underground tunnels, bridges over land and water, marshes, deserts, forests, and mountains.

Communications capabilities in remote areas, underground areas, and similar harsh areas may not be available or very limited to Police, Fire, and EMS personnel.

Emergency interoperability needs are based on the need to contact and to be contacted by response agencies during an emergency.

Interfacing with Public Safety agencies in large urban areas is a daily occurrence with respect to medical emergency calls and police activities.

Interfacing with Public Service entities is a daily occurrence and a major part of routine operations. Commuter rail service often operates in conjunction with other railroad entities. The tracks are a common highway for the massive heavy rail equipment. Very few properties are available for rail expansion in major metropolitan areas. It is a common practice to coordinate usage of tracks for freight, hazardous materials, in addition to passengers.

Day-to-day Interoperability

- Interoperability occurs at all levels of communications infrastructure:
- Transportation Communications Center dispatchers to other Communications Center dispatchers of Police, Fire, EMS, General Government, Environmental Conservation, Public Service (Commercial Railroads, Utilities etc...);
- Field Transportation Units to other Communications Centers & Field Units; and
- Field Units to other Field Units.
- Communications difficulties arise due to the highly specialized functions of mass transportation entities. Specifically, communications in the harsh areas as described previously in this section.

Mutual Aid Requirements

- Governmental agencies as well as Emergency Management personnel recognize the importance of mass transportation as a viable tool for the evacuation of a large number of personnel, when necessary.
- Mass Transportation vehicles are used to support public safety operations during mobilizations of enforcement personnel, creation of remote or multiple field command posts, and to access remote areas on railroads.
- During severe weather conditions, Mass Transportation may be the only safe and effective means of transportation for the general public.

Task Force Requirements

- For preplanned events affecting the transportation of the general public, public safety entities must notify mass transportation providers to divert operations.
- Constant communications are necessary during the progress of an event to ensure mass transportation can meet the needs of the public safety community without affecting the general public.

Conclusions and Recommendations

- The Mass Transportation Provider requires interoperability capabilities to immediately relay information on transit vehicle locations, access, & preliminary on scene incident reports to effectively advise responding public safety agencies.
- Common communications infrastructures are required to furnish communications in harsh areas where limited or no communications exist for public safety agencies.
- Multi-jurisdictional and multi-discipline coverage areas require state, regional, and national Interoperability plans utilizing common frequencies and baseline technologies.
- Governmental Transportation entities require dedicated communications links with Public Service entities in order to fulfill their mission.

12.3.7.8 Public Service

Overview of Requirements & Methodologies

Public Service entities typically require a single point of communications with the Public Safety agencies as opposed to in-depth interaction with many levels of operations associated with multiple agencies. Instances such as firefighters requesting the interruption of utility service typically could be accomplished with communications between the Fire Department dispatcher to the utility dispatcher. The utility dispatcher would then utilize the communications system developed for the utility organization to communicate the request to the field personnel.

Train derailments also require a single point of communications with the Public Safety agencies. When a derailment occurs, the Public Safety agencies and the railroads perform initial coordination relating to the specifics of the derailment, i.e. hazardous materials, collisions with other trains or vehicles, etc. After this initial communications, both groups commence handling their duties external to each other's communications networks with periodic communications between the Public Safety entities and the railroads on an as needed basis.

Disaster assistance agencies require initial coordination to establish the proper care for the situation at hand, i.e. food, shelter, and or clothing for victims of disaster. Periodic communications with the Public Safety agencies is needed to assist in maintaining the proper amount of effort and supplies for the duration of the incident.

Day-to-day Interoperability

Day-to Day communications between the Public Service and Public Safety entities is typically in the form of dispatcher to dispatcher links, which may be via

radio or land-line, or both (one is a back-up to the other). The respective dispatchers then communicate the requests to the field personnel, via their own communications systems, for implementation. However, unit to unit communications between Public Service and Public Safety entities does occur on a small scale. However, the Public Safety activities need to be restricted to Public Safety personnel to minimize interference and misunderstandings of verbal instructions.

The Department of Energy (DOE), a department within the Federal Government, has a requirement for direct communications with a number of power utility companies throughout the country. For example, the Western Area Power Administration (WAPA) operates and maintains a power transmission system (grid) for a fifteen (15) state region has requirements for voice interoperability with both federal and non-federal entities, in the course of operating the system. These requirements include electric power utility companies that are interconnected to the WAPA power transmission grid or that are customers serviced by WAPA, the U.S. Army Corps of Engineers and the U.S. Bureau of reclamation personnel associated with operating power generation facilities that provide power generation for WAPA, and local law enforcement and emergency response that operate within the WAPA operational area. The Bonneville Power Administration (BPA) has similar requirements, although a smaller coverage area. In some cases, BPA has given permission for mission specific use of BPA mobile radio frequencies by the Bureau of Reclamation, as well as public utilities' vehicles and aircraft, to achieve unit-to-unit interoperability. Typically, both the WAPA and BPA provide interoperability through their respective dispatchers to the utility or other entities' dispatcher to achieve interoperability.

Mutual Aid Requirements

Mutual Aid communications may be required between Public Safety agencies and utilities, Red Cross and other support organizations during major events. For example, communications between a water utility and fire agencies handling a major fire may be critical. Likewise, communications between Red Cross shelters and public safety agencies responsible for law enforcement, fire protection and emergency medical services is essential in the early stages of a disaster when commercial telephone service is not available.

Mutual Aid communications may be required between and among public safety agencies and public service agencies responding from wide areas for major disasters. For example, after hurricanes or earthquakes, it is common for utility companies from a wide area to be involved in restoring service. Their interface with public safety agencies must be coordinated.

Task Force Requirements

Task Force interoperability with Public Service entities is limited to the initial establishment of need for the entity's expertise or function. There are, however,

periodic communications for the purposes of ensuring that any status changes are communicated.

It is recognized that public service agencies will require communications links for interoperability between agencies of their own disciplines. However, these links must be provided from spectrum within the radio services provided for these organizations, and not from public safety spectrum.

Conclusions and Recommendations

Voice communications between Public Safety agencies and Public Service agencies is necessary for unit to unit on-scene use, primarily at the command level. Additionally, a common on-scene tactical voice link should be available to all on-scene responders. For incidents where extensive communications is necessary, a radio could be loaned to the agency performing a task or function.

Data communications interoperability appears to have the most value for augmenting the interactions between Public Safety and Public Service entities. A common data base and wireless access method structured for each type of Public Service entity would enhance the safety, accuracy and efficiency of operations for all involved.

Data communications could aide in the response and containment of hazardous material derailments by providing critical information on a timely basis. This same data communications network could be utilized to collect and assimilate sensor information from EPA sites and provide an estimated area to be evacuated.

Fire departments could utilize data communications to request utility disconnect by type and location. As each utility complies with the request to disconnect, they could log the information in a record associated with the address of the structure. Fire department personnel would then have a record of which utilities were disconnected at the address in question.

Disaster support agencies could utilize data communications with the Public Safety entities for the purposes of inventory assessment . As the magnitude of the disaster changes, the support agency would be able to respond more effectively by knowing what is needed as well as the amount needed for the incident.

For future communication interoperability between Public Safety and Public Service entities the recommendations are as follows:

If a high degree of interaction is required, and where practicable, a common command-level voice communications link should be made available for all Public Service functions involved in an incident.