

of frequency resources. Present simulcast systems require accurate control over distribution network parameters like delay, levels, and distortion. It is conceivable with future systems on-site timing mechanisms may ease the need for such stable carrier channels, but current systems require them. Private microwave systems allow the system operator precise control over all critical parameters and control over the availability and reliability of the communication paths. The use of leased copper or fiber circuits provides less control over all distribution network parameters and over network reliability. This could result in decreased coverage, distorted messages, communication outages and high maintenance. Private microwave networks are an important requirement for public safety distribution networks.

Many public safety microwave systems also must carry telephone types of traffic. Sometimes this traffic is to connect Public Switched Telephone Network (PSTN) circuits to dispersed offices through agency owned central switching. Other times completely separate systems (separate from the PSTN) are agency provided. The main reason for agency provision of these systems is to assure continued telecommunications ability internal to the agency regardless of either the condition of the PSTN or overload of a distressed PSTN. Often there is also a security (encrypted) aspect of these communications which is better maintained through a private network.

**4.1.4 Data Requirements.** Wireless infrastructure links are frequently also required for transporting public safety data. Some data applications include user and equipment status updates, support of mobile/portable data and computer terminals, interfaces to numerous databases, geographic position and automatic location devices, computer aided dispatch, biomedical information, remote weather reading for fire management and a myriad of justice and other local and regional data systems.

Many law enforcement agencies have access to their jurisdiction's utility data base so that they have current resident information when they pull up to a specific address. Many public safety agencies also require high security and highly reliable telemetry for supervisory control and data acquisition purposes. Public safety agencies often use hundreds of circuits in voice, data, video, and telemetry applications.

The same kind of strict requirements for voice circuits are even more imperative for data circuit transport. For instance, the tolerances for simulcasting data are even stricter than for voice. Thus, system operator control over the availability, reliability, and technical parameters of the transport network is more critical. Private microwave links are an important requirement for public safety data distribution networks.

**4.1.5 Video Requirements.** Wireless (microwave and satellite) infrastructure is frequently required for routing video for numerous public safety applications. There are three types of video requirements, full motion, slower limited motion (compressed) and snap shot video.

Full motion wireless systems are required for supporting critical public safety, surveillance operations, field incidents, prison riots, major fires, robotics (i.e., the disarming of a bomb by a robot) and numerous other critical public safety operations. Microwave also routes video from the incident location to the command and control center.

Public Safety also requires full motion video for many training video applications because of the fast motion of the subject material. With the current state of the art of digital compression techniques at rates lower than 1.5 Mb/s, compressed video can jerk and smear as the motion of the subject increases in speed. In many police and fire applications this picture distortion can be unacceptable and wideband, full motion video is needed. Microwave can route video from an incident location to a command and control center. Microwave video is also routed between central facilities and outlying facilities for training purposes. Because of the content, this training video is often not suitable for carriage on common carrier networks. Infrared mapping of wildfires from air to ground is another wideband (video) application.

Compressed video circuits are transported on commercial wirelines and on microwave systems, as they require less spectrum than does full motion video. Numerous applications such as fingerprints from the vehicle to the command center, video teleconferencing and court arraignment applications can be supported by these types of networks.

## 4.2 CRIMINAL JUSTICE

4.2.1 Mission. The mission of the Criminal Justice working group is to catalog operational requirements for law enforcement and corrections organizations at federal, state and local levels.

4.2.2 Introduction. Reducing crime and its impact on the health and welfare of families continues to be a top priority in the United States. In recent years, the most successful anti-crime weapon in the criminal justice arsenal has been implementation of community-based policing in many areas of the country. The heart of this program is getting officers out of cars and into the community, whether it be on foot, bicycle or horseback. Community-based policing programs put an extraordinary demand on communications systems because they require portable coverage throughout the community. Additionally, the 100,000 new officers funded through the Violent Crime Control and Law Enforcement Act of 1994 (Public Law 103-322, commonly called the "Crime Bill") must be community-policing officers. The additional load placed on already overworked communications systems by these new officers has been noticeable.

Wireless communications support is crucial to assure quality criminal justice services and create the safest possible working environment for corrections and law enforcement personnel. The following discussion is the product of discussion and correspondence with corrections and law enforcement officials from various locations in the United States. The emphasis of the working group has been on identification of present and future operational needs, dependent on wireless communication, without regard to cost or the current availability of technology. Needs are categorized first into the broad areas of law enforcement and corrections and then are further divided into the three basic categories of voice, data and video.

### 4.2.3 Law Enforcement

4.2.3.1 Voice Requirements. In general, voice communications for law enforcement must include coverage from portable to portable unit, through a system, radio to radio, or some other technology. Officers must be able to speak with each other via the portable radio if they can see each other. Likewise, officers from one end of a jurisdiction must be able to talk to officers in another part of the jurisdiction on a jurisdiction-wide path. Voice coverage from personal portable radios must include the ability to communicate from within buildings with a high degree of reliability.

4.2.3.1.1 In particular, the law enforcement voice communications system must be expandable to support a relatively unlimited number of users quickly, i.e., 1 to 3 hours. Normal day to day police radio operations may not require high capacity. However, when a man-made or natural disaster strikes, the system must have the ability to expand to meet demand.

4.2.3.1.2 Voice communications for law enforcement must feature multiple levels of encryption. Routine operational traffic will require one level of encryption. Other operations such as executive protection, high level drug and organized crime unit operations and federal security needs often will warrant a higher level of transmission security. Some routine traffic may be "unencrypted", but devices must be able to monitor both encrypted and non-encrypted messages simultaneously.

4.2.3.1.3 Voice Dispatch. Voice communications routinely occur between officers in the field and central dispatch points. Information conveyed commonly includes both operational instructions and information. The law enforcement voice communications system must support routine dispatch communications.

4.2.3.1.4 Officer to Officer Voice Communications. Voice communications routinely occur between one officer in the field and one or more other officers in the field. Information conveyed commonly includes both operational instructions, administrative information, and general coordination. The law enforcement voice communications system must provide support for routine voice communications between officers working within a particular jurisdiction.

4.2.3.1.5 Air to Ground Voice Communications. Aviation units are a common part of most major law enforcement agencies. Aviation units perform traffic enforcement missions, routine patrol and detection, search and tracking duties, and provide airborne command and control support. Because aviation units commonly work with a separate or distinct group of ground units for a particular operation or event, the law enforcement voice communications system must provide support for routine voice communications between aviation units and officers and commanders on the ground who are working with one or more aircraft. The same path could support air to air communications between aircraft of the employing jurisdiction.

4.2.3.1.6 Special Operations Communications. Special investigations, task forces and other discrete activities are a commonplace aspect of today's law enforcement community. A voice communications capability that is separate from normal operations voice traffic is required to support each special operation. These paths must have available the ability to provide highly secure encrypted communications.

4.2.3.1.7 Nationwide calling or Travel Channels. A need exists for nationwide calling or travel channel(s) for use for dignitary protection and emergency units working out of their home area. The channels would be used daily for units traveling across the county for prisoner transport or dignitary protection. The most significant use of these channels would be at events like the National Governors' Conference or during a major disaster like the Oklahoma City bombing, where multiple units from various federal, state and local agencies detail personnel for a specific incident. The channels must be monitored nationwide and be installed in mobile and portable units nationwide. This concept has significant impact on interoperability and is further discussed in Section 7.5 of the Working Group 3 "Future Interoperability Needs Report" prepared by the Interoperability Subcommittee.

4.2.3.2 Data Requirements. The basic law enforcement requirement for data is immediate, clear transfer and display of text and graphical information for all law enforcement personnel, in support of both routine and emergency operations.

4.2.3.2.1 Expansion of wireless data systems offers many technological assets for law enforcement. One of the most significant advantages is access to data repositories containing critical law enforcement information such as image identification, fugitive information, stolen articles and criminal histories. Repository systems such as the National Crime Information Center (NCIC) 2000 system and the Integrated Automated Fingerprint Identification System (IAFIS) are preparing to provide mission critical data to law enforcement more effectively and efficiently; they will certainly prove to be a force multiplier in the war on crime. For the first time, field officers will be able to positively and rapidly confirm the identity of persons in the field by transmitting a fingerprint to state or federal processing centers. The officer will be able to obtain a photograph of any person who has been cataloged by these systems. These systems, in conjunction with the National Performance Review IT04 initiative (establishment of a national law enforcement/public safety wireless network) are preparing for wireless data transfer and will spur the growth of wireless data communications for law enforcement.

4.2.3.2.2 Future information technology requirements for state and local law enforcement will most certainly include wireless data and voice systems utilizing encryption. In order to maximize the effectiveness of personnel in the field, a mobile office environment utilizing wireless data communications must be developed. This mobile office would provide instantaneous voice, data, and video access to other criminal justice personnel, various law enforcement data repositories, personnel from other public safety disciplines and commercial networks. At some point, law enforcement may incorporate these mobile offices into a paperless environment inclusive of multimedia transfer.

4.2.3.2.3 Mobile/Personal Data Computer/Terminal Applications. A need exists for real-time support of wireless mobile and portable computer systems capable of transmitting

and receiving routine data queries and responses, electronic mail, location data and other graphics including fingerprints and mug shots, along with incident-specific data and intelligence. Based on the rapid market penetration of portable two-way radios into law enforcement patrol ranks in the 1970's, the International Association of Chiefs of Police Communications Committee has presented the possibility that over 75% of the nation's patrol force could be equipped with portable data terminals in the 2005-2010 time frame, given that affordable equipment and the required infrastructure become available.

**4.2.3.2.4 Geographic Position and Automatic Location Data.** Law enforcement requires the ability to transmit location data, determined by geographic position technology or other means, automatically or on demand, to other locations. Examples of this need include constant updating of vehicle positions for dispatch and officer safety purposes, constant updating of individual officer location for safety purposes when the officer is outside of her/his vehicle, and the ability to trigger position transmitting devices on lost or stolen equipment items.

**4.2.3.2.5 Emergency Signals.** Officers who need emergency assistance must be able to activate an alarm that sends an automatic distress notice to a central monitoring point and other officers in the field.

**4.2.3.2.6 Transmission of Reports.** This system should accommodate transmission of forms and reports to central sites from mobile and remote locations. This capability will be used to transmit accident, arrest and incident reports, citation information and investigative reports to central locations in long data streams of up to several seconds. This capability will reduce paper transactions, increase officer field time, and speed transmission of vital information to command and administrative staff.

**4.2.3.2.7 Electronic Messaging.** Personnel require the ability to input messages into a data transmission device for transmission to single or multiple agencies, including other officers and other public safety providers.

**4.2.3.2.8 Remote Device Monitoring.** Law enforcement requires the ability to monitor remote device indicators via data transmission. For example, the real-time ability to monitor air quality standards at chemical and nuclear incidents is needed to help establish evacuation plans. Data transmission capabilities must support transmission of wind speed and direction, temperature, and a time and date stamp. The data bank of remote device transmissions must be accessible by remote computer or terminal for incident tracking and decision-support by field personnel.

**4.2.3.2.9 Emergency Vehicle Signal Priority.** Emergency units when activating lights or siren should emit a signal that is received by traffic control devices along the route of travel to change signal lights and accord the emergency vehicle the right of way. The emergency unit's signal should also be transmitted and received by school buses, mass transit and rail carriers indicating that an emergency vehicle is in the area using emergency equipment. Ultimately, a mapping device should be available that allows rail and mass transit units to see a graphical portrayal of the location and route of emergency vehicles.

4.2.3.3 Video Requirements. Multiple agencies may need to be able to monitor another agency's video transmissions, but the ability to access public safety video must be based on a "need to know" or incident management basis.

4.2.3.3.1 Incident Video. Some incidents like high risk surveillance, prison riots, high risk drug transactions, and emergencies require real-time video. While these incidents may be infrequent in some areas, others will have a more frequent demand for real-time video. The capability must exist for both point-to-point and broadcast use of the video. For example, full motion video must be transportable from the incident scene to an incident command post, and also to a remotely located emergency operations center. Prison riots, chemical/nuclear incidents, etc., may require monitoring of the incident from more than one location.

4.2.3.3.2 Aerial Surveillance Video. Many law enforcement agencies operate routine surveillance of traffic, crime in progress situations and other events from airborne platforms. Full motion video transmissions from airborne platforms to command and control locations and supervisors on the ground is required.

4.2.3.3.3 Robotics Video. Hazardous material and explosive disposal response frequently benefits from use of robotic devices. Full motion, generally short distance (up to 1000 meters), video transmissions from the robotic device to a locally-located control site is required to support such robotics activities.

4.2.3.3.4 Surveillance and Monitoring. Law enforcement requires the ability to transmit video snap shots at the rate of one frame each 5 seconds for surveillance and monitoring purposes. For example, person and building surveillance, low risk drug transactions, and building security would be adequately served by this quality of video transmission.

4.2.3.3.5 Officer Safety and Operational Video Transmission (Two Way). Many patrol cars used by law enforcement agencies now are equipped with mobile video cameras. Video recorded by these cameras provides evidence usable in criminal trials, and documents officer actions in the event professional standards concerns are voiced. The ability to transmit full motion video from mobile video cameras directly to dispatch and other command and control installations is required on demand. Although constant transmission of this data from each individual officer or mobile unit is not required, the ability to monitor video from a unit is needed on an episodic basis in the event of officer assistance situations and other high risk events, or operations of high command interest. In addition, the system must support retransmission of full motion video to mobile and remote locations, where command and control personnel and other mobile officers can monitor, perform decision-making and provide assistance based on the video transmission.

4.2.3.3.6 Still-Photographs. Law enforcement requires the ability to transmit still photographs on demand to other locations. For example, an officer in the field should be able to transmit a digital image of the violator in custody to a remote location upon demand.

#### 4.2.4 Corrections

4.2.4.1 Wireless communications support is crucial to assure quality correctional services and create the safest possible working environment for correctional personnel. These needs are into two sub-categories of correctional services: 1) Jails and prisons for facilities based operations; and 2) Parole and probation for community based operations.

4.2.4.1.1 Correctional organizations across the country are a mix of both sworn and non-sworn personnel and have a unique and varied public safety mission. The operational public safety radio communications needs of correctional organizations will mirror one or more of those of all of the other commonly recognized public safety and public service organizations. Correctional organizations provide public safety in the forms of law enforcement, fire services, emergency medical services, emergency management and disaster services. They also provide public service in the forms of highway maintenance, fire prevention, conservation, the reintegration of offenders back into society and community public works.

4.2.4.1.2 Prisons and jails can be viewed as small but fully autonomous communities. In addition to the custody staff, a variety of support staff are needed. Cooks, laundry workers, firefighters, doctors, dentists, educators and maintenance people are needed to ensure inmates are housed, clothed, and fed accordingly. Activities, tasks and communications that may appear mundane, routine or administrative in normal circumstances take on significant public safety and security implications in the correctional environment.

4.2.4.2 Voice Requirements - Prisons and Jails. In general, voice communications for correctional personnel must include coverage from portable to portable unit, with or without use of infrastructure. Prisons and jails pose formidable challenges to intra- and interbuilding communications due to their labyrinth design and heavy reliance on concrete and steel construction. Voice coverage from portable radios must include the ability to communicate from within these secure structures with a high degree of reliability. Correctional personnel must be able to speak with each other via a personal portable radio when they cannot see each other, whether between adjacent housing units or floors, or from one end of a secure campus style multi-unit facility to the other.

4.2.4.2.1 The majority of prison and jail operations result in a high concentration of users in a relatively small, confined geographic setting. When traveling away from correctional facilities, voice communications requirements for correctional personnel mirror that of other law enforcement wide area coverage needs.

4.2.4.2.2 The prison and jail voice communications system must be expandable to support a relatively unlimited number of users quickly, i.e., 1 to 3 hours. Normal day-to-day correctional operations may not require high capacity. However, when an inmate disturbance or some form of man-made or natural disaster impacts facility safety and security, the system must have the ability to expand to meet demand. The correctional environment requires the ability to remotely, across the air, selectively inhibit lost or stolen radios. A functional radio in the hands of an inmate significantly compromises the safety and security of an institution

and the staff and inmates assigned therein. The ability to remotely "hot-key" a radio microphone aids in equipment recovery and/or intelligence gathering if equipped staff are taken hostage.

4.2.4.2.3 Voice communications for most routine prison and jail operations do not require encryption. However, other operations such as disturbance control, staff investigations, and prison gang task forces often will warrant a higher level of transmission security. Devices must be able to monitor both encrypted and non-encrypted messages simultaneously.

4.2.4.2.4 Staff to Staff Voice Communications. Voice communications routinely occur in an "advise and assist" format one a one-to-one, or one-to-many basis between correctional staff in a facility. Information conveyed commonly includes general coordination, operational instructions, administrative information, as well as tactical and emergency communications. The correctional voice communications system must provide support for routine voice communications between staff working throughout a facility.

4.2.4.2.5 Voice Dispatch. The need for voice dispatch in a "command and control" format varies depending on facility size and design. In some facilities, voice communications may routinely occur between correctional staff dispersed throughout a facility and central dispatch points. In others it only occurs during the response to an incident. Information conveyed commonly includes both operational instructions and information. The correctional voice communications system must support routine dispatch communications.

4.2.4.2.6 Special Operations Communications. Disturbance control response team operations and special investigations are a commonplace aspect of today's larger correctional facilities. A voice communications capability that is separate from normal operations voice traffic is required to support each special operation. These paths must have security (encryption) available.

4.2.4.2.7 Nationwide Calling or Travel Channels. A need exists for nationwide calling or travel channel(s) for use for prisoner transportation. The channels must be monitored nationwide and in mobile and portable units nationwide. Hundreds of thousands of convicted, often dangerous felons are transported within and between federal, state and local jurisdictions. Often times as these ground transports move through communities today, they are without any form of routine or emergency communications. Direct access to the nearest public safety agency with the ability to provide emergency response is crucial as these ground transports are often hundreds of miles removed from their home jurisdiction. This concept has significant impact on interoperability and is further discussed in Section 7.5 of the Working Group 3 "Future Interoperability Needs Report" prepared by the Interoperability Subcommittee.

4.2.4.2.8 Interoperability. Mutual aid considerations are essential to correctional organizations. Large scale inmate disturbances or the pursuit of escapees requires multi-agency coordination. Correctional organizations often provide and supervise large inmate labor forces to assist in multi-agency recovery efforts in response to man-made and/or natural disasters.

4.2.4.2.9 Voice Messaging Alarms. Operating safe and secure prisons and jails is very staff intensive and personnel costs are the largest share of operating budgets. To reduce the ongoing operational costs of incarceration, correctional organizations are searching for improved strategies. The incorporation of various electronic deterrence and detection systems have proliferated to reduce the need for staff resources. Many of these systems incorporate roving alarm notification systems to provide rapid voice based alarm information to responding correctional personnel, thus allowing less staff to patrol a larger area.

4.2.4.3 Voice Requirements - Probation and Paroles. In general, voice communications for probation and parole personnel mirrors that of law enforcement. Probation and parole officers must be able to speak with each other or with other law enforcement officers. Probation and parole personnel often cover more than one law enforcement jurisdiction. Voice coverage from portable radios must include the ability to communicate from within buildings with a high degree of reliability.

4.2.4.3.1 Voice communications for most routine probation and parole operations does not require encryption. However, joint operations such as parolee-at-large sweeps; narcotic eradication sweeps, etc. will often warrant a higher level of transmission security. Devices must be able to monitor both encrypted and non-encrypted messages simultaneously.

4.2.4.3.2 Voice Dispatch. Voice communications routinely occur between probation and parole personnel the field and central dispatch points. Information conveyed commonly includes both operational instructions and information. The probation and parole voice communications system must support routine dispatch communications.

4.2.4.3.3 Officer to Officer Voice Communications. Voice communications routinely occur between one probation or parole officer in the field and one or more other officers in the field. Information conveyed commonly includes both operational instructions, administrative information, and general coordination. The probation and parole voice communications system must provide support for routine voice communications between probation and parole officers working throughout a particular jurisdiction.

4.2.4.3.4 Special Operations Communications. Probation and parole officers routinely participate in special investigations, task forces and other discrete activities that are a commonplace aspect of today's criminal justice community. A voice communications capability that is separate from normal operations voice traffic is required to support each special operation. These paths must have security (encryption) available.

4.2.4.4 Data Requirements - Prisons and Jails. The basic prison and jail requirement for data is immediate, clear transfer and display of text and graphical information for all correctional personnel, in support of both routine and emergency operations.

4.2.4.4.1 Mobile Data Computer/Terminal Applications. A need exists for real-time communications support of wireless mobile and portable computer systems capable of transmitting and receiving routine data queries and responses, electronic mail, location data and other graphics including fingerprints and mug shots, along with incident-specific data and

intelligence. Within a facility this may take the form of secure wireless LAN connectivity, or short hop microwave connections. Portable, wireless access to facility floor plan layouts for fire suppression or the development of tactical assault plan for special teams is essential to save lives. When traveling away from correctional facilities, wide area mobile data applications are required to manage transportation routing and scheduling.

4.2.4.4.2 Geographic Position and Automatic Location Data. Correctional organizations require the ability to transmit location data, determined by geographic position technology or other means, automatically or on demand to other locations. As correctional organizations must monitor larger and larger inmate populations with less and less staff, prisons and jails have identified a need to monitor individual inmate movement and location within large facilities. Such systems may also provide for early detection of escapes between physical counts. Outside of facilities, there is the need for constant updating of vehicle positions for transportation dispatch and transportation officer safety purposes.

4.2.4.4.3 Emergency Signals. Correctional personnel in prisons and jails who need emergency assistance must be able to activate an alarm that sends an automatic distress notice to a central monitoring point and other staff in the facility. The sophistication of such systems varies from simple "panic buttons" that will activate a general alarm, to more complex systems that incorporate multiple features such as unique unit identification, automatic unit registration, mercury activated person-down switches and automatic unit location. Often times these systems are stand-alone from other communications systems such as voice radio in order to provide staff security to those who would otherwise not require a portable communication device.

4.2.4.4.4 Remote Device Monitoring. Prisons and jails require the ability to monitor remote device indicators via data transmission in order to maintain safe facility operations and secure perimeters. For example, the ability to monitor plant operations systems such as electrical power generation, water or sewer processing, and perimeter detection systems for any sign of failure. While loss of such services in the community for short periods can be inconvenient, in the correctional environment they can produce disastrous consequences. Additionally, the ability to remotely control or disable various plant or security operations is essential to isolating and containing an inmate disturbance from spreading to adjacent facilities.

4.2.4.5 Data Requirements - Probation and Parole. The basic probation and parole requirement for data is immediate, clear transfer and display of text and graphical information for all probation and parole personnel, in support of both routine and emergency operations. Probation and parole require the same law enforcement network access described in Section 4.2.3.2.1 above.

4.2.4.5.1 Mobile Data Computer/Terminal Applications. A need exists for real-time communications support of wireless mobile and portable computer systems capable of transmitting and receiving routine data queries and responses, electronic mail, location data and other graphics including fingerprints and mug shots, along with incident-specific data and intelligence.

**4.2.4.5.2 Geographic Position, Automatic Location Data, Remote Device Monitoring.** Probation and parole organizations require the ability to transmit location data, determined by geographic position technology or other means, automatically or on demand to other locations. A major role in incarceration is now being played out in the community by probation and parole organizations, where their charges are sequestered in their homes by remote electronic monitoring. This use of "house arrest" has risen tremendously. Additionally, there is a mounting movement to develop systems and process to continually monitor and know the whereabouts of probationers, parolees and early release inmates on a continuous basis. Proposed requirements have included a location accuracy of a few meters and a minimum five minute interval report time.

**4.2.4.5.3 Emergency Signals.** Probation and parole personnel who need emergency assistance must be able to activate an alarm that sends an automatic distress notice to a central monitoring point and other staff in the field.

**4.2.4.5.4 Transmission of Reports.** This system should accommodate transmission of forms and reports to central sites from mobile and remote locations. This capability will be used by probation and parole personnel to transmit arrest reports, report violations, request warrants and to update case records files to central locations in long data streams of up to several seconds. This capability will reduce paper transactions, increase probation and parole officer field time, and speed transmission of vital information to command and administrative staff as well as other law enforcement agencies.

**4.2.4.5.5 Electronic Messaging.** Probation and parole officers require the ability to input messages into a data transmission device for transmission to single or multiple agencies, including other officers and other public safety providers. Due to their constant contact with the offender population, these staff often can provide substantive information to other law enforcement agencies.

**4.2.4.6 Video Requirements - Prisons and Jails.** The basic prison and jail requirement for video is immediate, clear wireless transfer of video for routine and emergency operations.

**4.2.4.6.1 Incident Video.** Some incidents like major inmate disturbances or hostage situations require real-time video. The capability must exist for both point-to-point and broadcast use of the video. For example, full motion video must be transportable from the incident scene to an incident command post, and also to a remotely located emergency operations center.

**4.2.4.6.2 Surveillance and Monitoring.** As correctional organizations must monitor larger and larger inmate populations with less and less staff, prisons and jails have identified the need to use real-time video to monitor multiple secure areas from remote locations. Additionally, remotely operated video cameras are a great assets in reducing the introduction of contraband into facilities via visiting room settings. There are some prison locations where wired video systems are not practical or where portable video systems requiring wireless links are required.

4.2.4.7 Video Requirements - Probation and Parole. The basic probation and parole video requirement is for immediate, clear wireless transfer of video for routine and emergency operations.

4.2.4.7.1 Surveillance and Monitoring. Probation and parole require the ability to transmit video snapshots at the rate of one frame each five seconds, for surveillance and monitoring purposes. For example individual, gang, building and low risk drug transaction surveillance would be adequately served by this quality of video transmission.

4.2.4.7.2 Still-Photographs. Probation and parole operations require the ability to transmit still photographs on demand to other locations. For example, a probation or parole officer in the field should be able to transmit and/or receive a digital image of probationers or parolees to and/or from other officers and central dispatch points.

### 4.3 FIRE, EMERGENCY MEDICAL AND RELATED LIFE AND PROPERTY PROTECTION SERVICES

4.3.1 Mission. The mission of the Fire, Emergency Medical and Related Life and Property Protection Services working group is to catalog operational requirements for those public entities that provide services to the public, encompassing emergency life saving and the critical care of the sick and injured, as well as emergency property protection.

Historically these services have been categorized as Fire Service and Emergency Medical Service (EMS), and in many jurisdictions all or part of the functions contained herein are managed exclusively by Fire and EMS providers. For example, the County of Los Angeles Fire Department provides a broad scope of services including fire suppression and prevention, emergency medical paramedic, hazardous materials, urban search and rescue, technical and mountain search and rescue, swift water rescue, and ocean lifeguard services.

This broadening scope of service displays significant growth from the historic perspective of fire suppression and first aid. Due in part to this increased responsibility placed upon the public protectors of life and property, we now find many of these services provided by a variety of public safety provider agencies, both as combined service and single service providers.

To reasonably represent all of these providers without regard to umbrella agency categorization, this working group includes a description of the common and unique operational requirements for each of the following life and property protection services:

- Fire Suppression and Prevention
- Emergency Medical Services
- Hazardous Materials
- Urban Search and Rescue/ Technical Search and Rescue
- Swift Water Rescue
- Ocean Lifeguards/ Blue Water Rescue

## Other Property Protection and Preservation

4.3.2 Introduction. Wireless command, control and communications support is crucial to assure quality life and property protection and to create the safest possible working environment for Fire, Emergency Medical and related Life and Property Protection services personnel. Wireless technologies are the emerging backbone of command, control, communications, and computerized synthesis of intelligence gathering and distribution (C4I.)

The following material is the product of discussion and correspondence with Fire, Emergency Medical and related Life and Property Protection officials from various locations throughout the United States. The emphasis of the working group has been on identification of present and future operational needs, dependent on wireless communication, without regard to cost or the current availability of technology. Needs are categorized into three basic areas of wireless communication: voice, data, and video.

### 4.3.3 Fire Suppression and Prevention.

4.3.3.1 Voice Requirements. The basic requirement for voice is immediate, clear voice communications for all fire suppression and prevention personnel upon all demands, major and minor, created by fire-related emergencies. Adequate voice communication paths must be provided for safe, efficient, and effective operations at all incidents. It is not unusual for major incidents to require in excess of 150 separate and distinct voice communication paths to ensure positive, effective incident operations. This large requirement for communication paths is incumbent upon many factors such as, the wide variety of tactical assignments that must be performed simultaneously for rapid containment and control, the need to coordinate between multiple layers of the command structure, the need to coordinate between the incident command structure sections, i.e. operations, logistics, planning, and finance, the need to coordinate with those cooperating agencies that provide support services to the incident, and the need to coordinate with those automatic and mutual aid agencies assisting in fire suppression and prevention activities. These communication paths must be immediately available and expandable to accommodate the rapid change from day-to-day operations to major disaster requirements.

4.3.3.1.1 Tactical Voice. Tactical voice communication requirements exist at the actual situation or suppression level of an incident. Tactical assignments vary significantly by location and function. Separate tactical voice paths are required for each strike team, task force, or functional group. The total number of tactical voice paths will vary in accordance with the size and nature of the incident, as well as the number of units required for containment and control. Incidents of magnitude similar to the Old Topanga Incident (1993 Malibu wildland urban interface fire), the 1991 Oakland Hills Fire, or the 1992 Los Angeles civil disturbance fires created tactical voice path demands in excess of 80 distinct tactical paths.

4.3.3.1.2 Command Voice. Command and Control voice communication requirements exist at each successive level of command above the tactical levels. Generally, separate command voice paths will be required for each leader in the chain of command upon which

all leaders immediately subordinate will operate. The total number of command voice paths will vary in accordance with the size and nature of the incident. Standard operating procedures for the Incident Command System dictate that a five to one ratio of subordinates to commander is ideal. Large incidents may require in excess of 30 command voice paths.

4.3.3.1.3 Interoperability Voice. The Interoperability subcommittee report examines the need for interoperability voice in detail; however, this communication need must be stressed and catalogued as an operational requirement. Large fire incidents require the aid of a multitude of public safety and public service agencies to effectively save lives and protect property. The Old Topanga Incident (1993 Malibu wildland urban interface fire) called upon the services of 458 assisting agencies from twelve states and in excess of twenty cooperating agencies for containment and control. It is impossible to effect efficient command and control without the ability to communicate with assisting and cooperating agencies on major incidents.

4.3.3.2 Data Requirements. The basic need for data is immediate, clear multiplex wireless transfer and display of data (text and graphics) for all fire personnel upon all demands, major and minor, created by fire-related emergencies. The ability to transmit, receive, and display intelligent data will greatly enhance and support the overall mission of fire command and control. The advantage of digital text and graphic data in conjunction with voice is accuracy and storage for future recall. Text can be recalled unlimited times to assure correct interpretation of the information. In addition, digital information can be stored and integrated into other data for the purposes of incident reporting and documentation. Data transmission requires less air time than voice, allowing increased availability of voice communication paths.

4.3.3.2.1 Mobile Data Computer/Terminal applications. A need exists for communications support of wireless mobile and portable computer systems capable of transceiving incident specific data and intelligence. Support for these systems should accommodate transmission of text, such as electronic mail secure and unsecure individual and group messaging, multilayered geographic information data (GIS) as well as real time data, such as automatic vehicle and personnel location, weather and atmospheric conditions, hazardous material conditions and incident intelligence received from remote sensors or directly keyed.

4.3.3.2.2 Automatic Location Information. A need exists for automatic communication of location information generated to report accurate location of vehicles and personnel into a synthesized computer command and control system. This system should also accommodate associated data, such as emergency situation alert function, personnel vitals and equipment status and needs such as fuel and water. Automatic location information will accomplish several goals in the mission of life and property protection; emergency responders dispatched with regard to actual incident proximity will trim precious life and property saving response times; incident commanders will accurately assign and monitor units/personnel to accomplish strategic efficiency; and fire fighters will report emergency situation location by the push of a button, speeding help their way and reducing the likelihood of injury or death.

4.3.3.2.3 Robotics support. In extremely hazardous situations, fire suppression may only be accomplished with remote suppression equipment supported by robotics. The operation of this equipment will be heavily dependent upon wireless data connectivity.

4.3.3.2.4 Interoperability Data. The Interoperability subcommittee report examines the need for data interoperability in detail; however, this communication need must be stressed and catalogued as an operational requirement. Large fire incidents require the aid of a multitude of public safety and public service agencies to effectively save lives and protect property. Incident intelligence is greatly enhanced by the ability to send and display information formatted as text and graphics. It is impossible to effect efficient command and control without the ability to communicate with assisting and cooperating agencies on major incidents.

4.3.3.3 Video/Imagery Requirements. The basic requirement for video/ imagery is immediate, clear wireless transfer of video/ imagery for all fire personnel upon all demands, major and minor, created by fire-related emergencies. Video/imagery capture and display systems must be capable of transceiving incident specific replications and should accommodate video and imagery from all available sources including privately owned and agency controlled. For example, automatic aid agreements with commercial broadcast agencies would often provide quality video/ imagery of incident scenes for command personnel, either directly or through retransmission.

4.3.3.3.1 Incident Video/Imagery. A need exists for real time transmission of fire incident scenes from the scene location to the incident command post and also to remotely located emergency operations centers.

4.3.3.3.2 Aerial Observation Video/Imagery. A need exists for the transmission of video/imagery from airborne platforms to the incident command post.

4.3.3.3.3 Robotics Video/Imagery. In extremely hazardous situations, fire suppression may only be accomplished with remote suppression equipment supported by robotics. The operation of this equipment will be heavily dependent upon wireless connectivity and the ability to guide these devices via video support.

4.3.3.3.4 Interoperability Video/Imagery. Video/imagery interoperability need must be stressed and catalogued as an operational requirement. Large fire incidents require the aid of a multitude of public safety and public service agencies to effectively save lives and protect property. Additionally, video and imagery is gathered from multiple sources, both public and private, during major incidents. The ability to utilize video and imagery from multiple sources, as well as the ability to share this information among assisting and cooperating agencies, will greatly enhance incident operations.

#### 4.3.4 Emergency Medical Services (EMS)

4.3.4.1 Voice Requirements. The basic requirement for voice is immediate, clear voice communications for all EMS personnel upon all demands, major and minor, created by

situations requiring the intervention of EMS personnel. EMS personnel require the ability to communicate by voice with like personnel and units, base station hospitals and doctors, regional transportation coordination centers, airborne medical evacuation resources, fire service and law enforcement resources, infectious disease centers, poison control centers, and many more. Adequate voice communication paths must be provided for safe, efficient, and effective operations at all emergency medical incidents. These communication paths must be immediately available and expandable to accommodate the rapid change from day-to-day operations to multi-casualty disaster requirements.

4.3.4.1.1 Patient Care Voice. This voice communication requirement exists at the actual patient care level of an incident. This vital link provides interface between doctors and EMS personnel and fosters proper and efficient treatment for the sick and injured. Separate patient care voice paths are required for each EMS/hospital team. It is common for multiple EMS units to require immediate interface with the same or multiple base hospitals simultaneously. Seconds, not minutes, make the difference between full recovery, debilitating injury, or death. Rapid, efficient intervention supported by EMS personnel/base hospital interface plays a critical role in determining the outcome. Numbers of required patient care voice paths will vary in accordance with civilian population and EMS provider area call volume; however, our mobile society transports large numbers of potential victims via highway, rail, and air into sparsely populated areas on a routine basis.

4.3.4.1.2 Scene Control Voice. Scene control voice communication requirements exist at every EMS incident regardless of size or complexity. These voice paths are required to ensure safe working environments, the timely and accurate placement of transportation units, the immediate request for assistance and additional equipment, and overall scene coordination. The required number of scene control voice paths vary with the size and complexity of the incident. A typical multi-casualty incident will require distinct scene control voice paths to support incident command, triage, treatment, and transportation.

4.3.4.1.3 Interoperability Voice. The Interoperability subcommittee report examines the need for interoperability voice in detail; however, this communication need must be stressed and catalogued as an operational requirement. EMS personnel require the ability to communicate by voice with base station hospitals and doctors, regional transportation coordination centers, airborne medical evacuation resources, fire service and law enforcement resources, infectious disease centers, poison control centers, and many more. Adequate voice communication paths must be provided for safe, efficient, and effective operations at all emergency medical incidents.

4.3.4.2 Data Requirements. The basic need for data is immediate, clear multiplex wireless transfer and display of data (text and graphics) for all EMS personnel upon all demands, major and minor, created by EMS-related emergencies. The ability to transmit, receive, and display data will greatly enhance and support the overall mission of EMS. The advantage of digital text and graphic data in conjunction with voice is accuracy and storage for future recall. Text can be recalled unlimited times to assure correct interpretation of the information. In addition, digital information can be stored and integrated into other data for

the purposes of incident reporting and documentation. Data transmission requires less air time than voice, allowing increased availability of voice communication paths.

4.3.4.2.1 Mobile Data Computer/Terminal applications. A need exists for communications support of wireless mobile and portable computer systems capable of transceiving incident and patient specific data and intelligence. Support for these systems should accommodate transmission of text such as secure and unsecure individual and group messaging, multilayered geographic information data (GIS), as well as real time data such as automatic vehicle and personnel location.

4.3.4.2.2 Patient Care Data. A need exists for the wireless transfer of patient vitals and diagnostic data. Advanced diagnostic tools such as twelve lead EKG, EEG, ultra-sound, and MRI will transfer life saving information between field units and base hospitals.

4.3.4.2.3 Automatic Location Information. A need exists for automatic communication of location information generated to report accurate location of vehicles and personnel into a synthesized computer command and control system. This system should also accommodate associated data such as emergency situation alert function, personnel vitals, and equipment status and needs.

4.3.4.2.4 Interoperability Data. The Interoperability subcommittee report examines the need for data interoperability in detail; however, this communication need must be stressed and catalogued as an operational requirement. EMS incidents require the aid of a multitude of public safety and public service agencies. Data must be shared to effectively care for the sick and injured.

4.3.4.3 Video/Imagery Requirements. The basic requirement for video/imagery is immediate, clear wireless transfer of video/ imagery for all EMS/hospital personnel upon all demands, major and minor, created by EMS-related emergencies. Video/imagery capture and display systems must be capable of transferring patient specific replications from units in the field to diagnostic patient care centers. The ability for doctors to view the actual patient in conjunction with voice and data assessment information will greatly enhance patient care and survivability.

4.3.4.3.1 Patient Care Video/Imagery. Video/imagery capture and display systems must be capable of transferring patient specific replications from units in the field to diagnostic patient care centers. The ability for doctors to view the actual patient in conjunction with voice and data assessment information will greatly enhance patient care and survivability.

4.3.4.3.2 Interoperability Video/Imagery. The Interoperability subcommittee report examines the need for data interoperability in detail; however, this communication need must be stressed and catalogued as an operational requirement. EMS incidents require the aid of a multitude of public safety and public service agencies. Video/ Imagery must be shared to effectively care for the sick and injured.

#### 4.3.5 Hazardous Material Teams (Haz Mat)

4.3.5.1 Voice Requirements. The basic requirement for voice is immediate, clear voice communications for all hazardous materials team personnel upon all demands, major and minor, created by situations requiring the intervention of Haz Mat personnel. Haz Mat personnel require the ability to communicate by voice with a large variety of public safety and public service organizations to effectively contain and safely control hazardous material incidents. Adequate voice communication paths must be provided for safe, efficient, and effective operations at all hazardous materials incidents. These communication paths must be immediately available and expandable to accommodate the rapid changes that occur on incidents of this nature.

4.3.5.1.1 Tactical Voice. Tactical voice communication requirements exist at the actual situation or containment level of an incident. Tactical assignments and functional groups vary significantly on hazardous materials incidents. Haz Mat incidents may be static or dynamic. They may involve fire and explosions. Oceans, lakes, and waterways may be affected; and toxic gas clouds many times complicate the task of containment and civilian safety. Each of these concerns must be addressed and attacked by specialized task groups. Separate tactical voice paths are required for each strike team, task force, or functional group. The total number of tactical voice paths will vary in accordance with the size and nature of the incident, as well as the number and variety of units required for containment and control.

4.3.5.1.2 Command Voice. Command and Control voice communication requirements exist at each successive level of command above the tactical levels. The location and anticipated dynamic consequence of hazardous material incidents dictate command responsibility. This command responsibility may be placed upon officials from fire agencies, law enforcement, the Coast Guard, Fish and Game, AQMD, etc. Generally, separate command voice paths will be required for each leader in the chain of command upon which all leaders immediately subordinate will operate. The total number of command voice paths will vary in accordance with the size and nature of the incident. Standard operating procedures for the Incident Command System dictate that a five to one ratio of subordinates to commander is ideal. Large incidents require multiple command voice paths. The potential for disaster implied by these incidents dictates that the voice communication conduit from command to subordinate to tactical levels of operation be solid, reliable, and secure.

4.3.5.1.3 Interoperability Voice. The Interoperability subcommittee report examines the need for interoperability voice in detail; however, this communication need must be stressed and catalogued as an operational requirement. Haz Mat personnel require the ability to communicate by voice with a wide variety of assisting and cooperating agencies such as fire, law enforcement, health departments, the Coast Guard, Department of Defense state and federal forestry, fish and game, flood control, AQMD, highways and transportation, toxic substance and poison control centers, agriculture, railroads, Chem. Trek, EMS, utility providers, and state and federal disaster warning centers. Adequate voice communication paths must be provided for safe, efficient, and effective operations at all hazardous material incidents.

4.3.5.2 Data Requirements. The basic need for data is immediate, clear multiplex wireless transfer and display of data (text and graphics) for all Haz Mat personnel upon all demands, major and minor, created by Haz Mat-related emergencies. The ability to transmit, receive, and display intelligent data will greatly enhance and support the overall mission of Haz Mat teams. The advantage of digital text and graphic data in conjunction with voice is accuracy and storage for future recall. Text can be recalled unlimited times to assure correct interpretation of the information. In addition, digital information can be stored and integrated into other data for the purposes of incident reporting and documentation. Data transmission requires less air time than voice, allowing increased availability of voice communication paths.

4.3.5.2.1 Mobile Data Computer / Terminal applications. A need exists for communications support of wireless mobile and portable computer systems capable of transceiving incident-specific data and intelligence. Support for these systems should accommodate transmission of text, such as secure and unsecure individual and group messaging, multilayered geographic information data (GIS), as well as real time data, such as automatic vehicle and personnel location, as well as weather and atmospheric conditions.

4.3.5.2.2 Automatic Location Information. A need exists for automatic communication of location information generated to report accurate location of vehicles and personnel into a synthesized computer command and control system. This system should also accommodate associated data such as emergency situation alert function, personnel vitals, and equipment status and needs. Automatic location information will accomplish several goals in the mission of life and property protection: Emergency responders dispatched with regard to actual incident proximity will trim precious life and property saving response times; incident commanders will accurately assign and monitor units/ personnel to accomplish strategic efficiency; and Haz Mat personnel will report emergency situation location by the push of a button, speeding help their way and reducing the likelihood of injury or death.

4.3.5.2.3 Robotics support. In extremely hazardous situations, hazardous material containment may only be accomplished with remote equipment supported by robotics. The operation of this equipment will be heavily dependent upon wireless data connectivity.

4.3.5.2.4 Interoperability Data. The Interoperability subcommittee report examines the need for data interoperability in detail; however, this communication need must be stressed and catalogued as an operational requirement. Hazardous material incidents require the aid of a multitude of public safety and public service agencies to effectively save lives and protect property. Incident intelligence is greatly enhanced by the ability to send and display information formatted as text and graphics. It is impossible to effect efficient command and control without the ability to communicate with assisting and cooperating agencies on Haz Mat incidents.

4.3.5.3 Video/Imagery Requirements. The basic requirement for video/imagery is immediate, clear wireless transfer of video/imagery for all Haz Mat personnel upon all demands, major and minor, created by Haz Mat-related emergencies. Video/imagery capture and display systems must be capable of transceiving incident specific replications and should accommodate video and imagery from all available sources including privately owned and

agency controlled. For example, automatic aid agreements with commercial broadcast agencies would often provide quality video/ imagery of incident scenes for command personnel, either directly or through retransmission.

4.3.5.3.1 Incident Video/Imagery. A need exists for the real time transmission of Haz Mat incident scenes from the scene location to the incident command post and also to remotely located emergency operations centers.

4.3.5.3.2 Aerial Observation Video/Imagery. A need exists for the transmission of video/imagery and multi-spectral toxic cloud replication from airborne platforms to the incident command post.

4.3.5.3.3 Robotics Video/Imagery. In extremely hazardous situations, hazardous material containment may only be accomplished with remote equipment supported by robotics. The operation of this equipment will be heavily dependent upon wireless connectivity and the ability to guide these devices via video support.

4.3.5.3.4 Interoperability Video/Imagery. The Interoperability subcommittee report examines the need for video/imagery interoperability in detail; however, this communication need must be stressed and catalogued as an operational requirement. Hazardous material incidents require the aid of a multitude of public safety and public service agencies to effectively save lives and protect property. Additionally, video and imagery is gathered from multiple sources, both public and private, during major incidents. The ability to utilize video and imagery from multiple sources, as well as the ability to share this information among assisting and cooperating agencies, will greatly enhance incident operations.

#### 4.3.6 Urban Search and Rescue/Technical Search and Rescue (USAR/TSAR)

4.3.6.1 Voice Requirements. The basic requirement for voice is immediate, clear voice communications for all USAR/TSAR team personnel upon all demands, major and minor, created by situations requiring the intervention of USAR/TSAR personnel. USAR/TSAR personnel require the ability to communicate by voice in specialized environments, such as confined spaces created by collapsed structures or trenches, and difficult terrain dictated by steep and broken topography found in mountain and canyon rescues. To effectively conduct operations under these demanding situations, adequate voice communication paths must be provided to foster safety and efficiency. These communication paths must be immediately available and expandable to accommodate the precise coordination required by incidents of this nature.

4.3.6.1.1 Tactical Voice. Tactical voice communication requirements exist at the actual situation or rescue level of an incident. Tactical assignments and functional groups vary significantly on USAR/TSAR incidents. USAR/TSAR incidents present rescuers with a variety of exacting operational concerns. Each of these concerns must be addressed and attacked by specialized task groups. Separate tactical voice paths are required for each strike team, task force, or functional group. The total number of tactical voice paths will vary in

accordance with the size and nature of the incident, as well as the number and variety of units required to safely effect the rescue.

4.3.6.1.2 **Command Voice.** Command and Control voice communication requirements exist at each successive level of command above the tactical levels. Generally, separate command voice paths will be required for each leader in the chain of command upon which all leaders immediately subordinate will operate. The total number of command voice paths will vary in accordance with the size and nature of the incident. Standard operating procedures for the Incident Command System dictate that a five to one ratio of subordinates to commander is ideal. Large incidents require multiple command voice paths. Rapid intervention is the key to success on incidents of this nature. Successful operations depend upon immediate voice communications from command to subordinate to tactical levels of operation. This conduit must be solid, reliable, secure and immediately available.

4.3.6.1.3 **Interoperability Voice.** The Interoperability subcommittee report examines the need for interoperability voice in detail; however, this communication need must be stressed and catalogued as an operational requirement. USAR/TSAR personnel require the ability to communicate by voice with a wide variety of assisting and cooperating agencies, such as fire, law enforcement, building departments, Haz Mat, public works, flood control, highways and transportation, EMS, utility providers, and engineering entities, etc. Adequate voice communication paths must be provided for safe, efficient, and effective operations at all USAR/TSAR incidents.

4.3.6.2 **Data Requirements.** The basic need for data is immediate, clear multiplex wireless transfer and display of data (text and graphics) for all USAR/TSAR personnel upon all demands, major and minor, created by USAR/TSAR related emergencies. The ability to transmit, receive and display intelligent data will greatly enhance and support the overall mission of USAR/TSAR teams. The advantage of digital text and graphic data in conjunction with voice is accuracy and storage for future recall. Text can be recalled unlimited times to assure correct interpretation of the information. In addition, digital information can be stored and integrated into other data for the purposes of incident reporting and documentation. Data transmission requires less air time than voice, allowing increased availability of voice communication paths.

4.3.6.2.1 **Mobile Data Computer/Terminal applications.** A need exists for communications support of wireless mobile and portable computer systems capable of transceiving incident specific data and intelligence. Support for these systems should accommodate transmission of text, such as secure and unsecure individual and group messaging, multilayered geographic information data (GIS), as well as real time data, such as automatic vehicle and personnel location, as well as weather, atmospheric, and seismic conditions.

4.3.6.2.2 **Automatic Location Information.** A need exists for automatic communication of location information generated to report accurate location of vehicles and personnel into a synthesized computer command and control system. This system should also accommodate associated data, such as emergency situation alert function, personnel vitals, and equipment

status and needs. Automatic location information will accomplish several goals in the mission of life and property protection: Emergency responders dispatched with regard to actual incident proximity will trim precious life and property saving response times; incident commanders will accurately assign and monitor units/personnel to accomplish strategic efficiency; and USAR/TSAR personnel will report emergency situation location by the push of a button, speeding help their way and reducing the likelihood of injury or death.

4.3.6.2.3 Robotics support. In extremely hazardous situations, such as confined space rescues, many tasks may only be accomplished with remote equipment supported by robotics. The operation of this equipment will be heavily dependent upon wireless data connectivity.

4.3.6.2.4 Interoperability Data. The Interoperability subcommittee report examines the need for data interoperability in detail; however, this communication need must be stressed and catalogued as an operational requirement. USAR/TSAR incidents require the aid of a multitude of public safety and public service agencies to effectively save lives and protect property. Incident intelligence is greatly enhanced by the ability to send and display information, such as building floor plans formatted as text and graphics. It is impossible to effect efficient command and control without the ability to communicate with assisting and cooperating agencies on USAR/TSAR incidents.

4.3.6.3 Video/Imagery Requirements. The basic requirement for video/imagery is immediate, clear wireless transfer of video/imagery for all USAR/TSAR personnel upon all demands, major and minor, created by USAR/TSAR related emergencies. Video/imagery capture and display systems must be capable of transceiving incident specific replications and should accommodate video and imagery from all available sources including privately owned and agency controlled. For example, automatic aid agreements with commercial broadcast agencies would often provide quality video/imagery of incident scenes for command personnel, either directly or through retransmission.

4.3.6.3.1 Incident Video/Imagery. A need exists for the real time transmission of USAR/TSAR incident scenes from the scene location to the incident command post and also to remotely located emergency operations centers.

4.3.6.3.2 Aerial Observation Video/Imagery. A need exists for the transmission of video/imagery, and multi-spectral intelligence from airborne platforms to the incident command post.

4.3.6.3.3 Robotics Video/Imagery. In extremely hazardous situations, rescues may only be accomplished with remote equipment supported by robotics. The operation of this equipment will be heavily dependent upon wireless connectivity and the ability to guide these devices via video support.

4.3.6.3.4 Interoperability Video/Imagery. The Interoperability subcommittee report examines the need for video/imagery interoperability in detail, but this communication need must be stressed and catalogued as an operational requirement. USAR/TSAR incidents require the aid of a multitude of public safety agencies and pure communication requirements

exist at the actual situation or rescue level of an incident. Tactical assignments and functional groups vary significantly on Swift Water Rescue incidents. Swift Water Rescue incidents present rescuers with a variety of exacting operational concerns over a vast geographic area. Each of these concerns must be addressed and attacked by specialized task groups. Task groups consist of land based resources, watercraft resources, airborne resources, and swimmer insertion teams. Separate tactical voice paths are required for each functional group. The total number of tactical voice paths will vary in accordance with the size and nature of the incident as well as the number and variety of units required to safely effect the rescue.

#### 4.3.7 Swift Water Rescue

4.3.7.1 Voice Requirements. The basic requirement for voice is immediate, clear voice communications for all Swift Water Rescue personnel upon all demands, major and minor, created by situations requiring the intervention of water rescue personnel. Swift Water Rescue personnel require the ability to communicate by voice in specialized dynamic environments, as well as in routine patrol and rescue situations. To effectively conduct operations under these demanding situations, adequate voice communication paths must be provided to foster safety and efficiency. Paths are required to support water course surveillance, recreational user observation and other routine duties, as well as dynamic demands required in expanded incident situations. These communication paths must be immediately available and expandable.

4.3.7.1.1 Tactical Voice. Tactical Voice. Tactical voice communication requirements exist at the actual situation or rescue level of an incident. Tactical assignments and functional groups vary significantly on incidents requiring intervention by Swift Water Rescue personnel. Swift Water Rescue personnel task groups consist of land-based resources, watercraft resources, airborne resources, and swimmers. Each of these functional groups and tactical assignments must be addressed and supported by voice communication paths. Clear and distinct tactical voice communication paths must be immediately available for assignment to specific water emergency incidents. Swift Water Rescue personnel handle a multitude of incidents ranging from routine single victim water rescues to multi-casualty incidents, vessel grounding, and downed aircraft. Adequate tactical voice communication paths are required to support multiple incidents simultaneously.

4.3.7.1.2 Command Voice. Command and Control voice communication requirements exist at each successive level of command above the tactical levels. Generally, separate command voice paths will be required for each leader in the chain of command upon which all leaders immediately subordinate will operate. The total number of command voice paths will vary in accordance with the size and nature of the incident. Standard operating procedures for the Incident Command System dictate that a five to one ratio of subordinates to commander is ideal. Large incidents require multiple command voice paths. Rapid intervention is the key to success on incidents of this nature. Successful operations depend upon immediate voice communications from command to subordinate to tactical levels of operation. This conduit must be solid, reliable, secure and immediately available.

4.3.7.1.3 Interoperability Voice. The Interoperability subcommittee report examines the need for interoperability voice in detail, but this communication need must be stressed and catalogued as an operational requirement. Swift Water Rescues, as a rule, involve multiple jurisdictions due to the dynamic nature and paths of the involved waterways. Swift Water Rescue personnel require the ability to communicate by voice with a wide variety of assisting and cooperating agencies, such as fire, law enforcement, lifeguards, Coast Guard, public works, flood control, highways and transportation, EMS, etc. Adequate voice communication paths must be provided for safe, efficient, and effective operations at all Swift Water Rescue incidents.

4.3.7.2 Data Requirements. The basic need for data is immediate, clear multiplex wireless transfer and display of data (text and graphics) for all Swift Water Rescue personnel upon all demands, major and minor, created by Swift Water related emergencies. The ability to transmit, receive, and display intelligent data will greatly enhance and support the overall mission of Swift Water Rescue teams. The advantage of digital text and graphic data in conjunction with voice is accuracy and storage for future recall. Text can be recalled unlimited times to assure correct interpretation of the information. In addition, digital information can be stored and integrated into other data for the purposes of incident reporting and documentation. Data transmission requires less air time than voice, allowing increased availability of voice communication paths.

4.3.7.2.1 Mobile Data Computer/Terminal applications. A need exists for communications support of wireless mobile and portable computer systems capable of transceiving incident specific data and intelligence. Support for these systems should accommodate transmission of text such as secure and unsecure individual and group messaging, multilayered geographic information data (GIS), as well as real time data such as automatic vehicle and personnel location, as well as weather and atmospheric conditions.

4.3.7.2.2 Automatic Location Information. A need exists for automatic communication of location information generated to report accurate location of vehicles, personnel, and victims into a synthesized computer command and control system. This system should also accommodate associated data such as emergency situation alert function, personnel vitals, and equipment status and needs. Automatic location information will accomplish several goals in the mission of life and property protection: Emergency responders dispatched with regard to actual incident proximity will trim precious life and property saving response times; incident commanders will accurately assign and monitor units/ personnel to accomplish strategic efficiency; victim location may be accurately tracked to support proper placement of resources; and Swift Water Rescue personnel will report emergency situation location by the push of a button, speeding help their way and reducing the likelihood of injury or death.

4.3.7.2.3 Interoperability Data. The Interoperability subcommittee report examines the need for data interoperability in detail, but this communication need must be stressed and catalogued as an operational requirement. Swift Water Rescue incidents require the aid of a multitude of public safety and public service agencies over a multi-jurisdictional operational area. It is impossible to effect efficient command and control without the ability to communicate with assisting and cooperating agencies on Swift Water Rescue incidents.

**4.3.7.3 Video/Imagery Requirements.** The basic requirement for video/imagery is immediate, clear wireless transfer of video/imagery for all Swift Water Rescue personnel upon all demands, major and minor, created by Swift Water Rescue-related emergencies. Video/imagery capture and display systems must be capable of transceiving incident specific replications and should accommodate video and imagery from all available sources including privately owned and agency controlled. For example, automatic aid agreements with commercial broadcast agencies would often provide quality video/imagery of incident scenes for command personnel, either directly or through retransmission.

**4.3.7.3.1 Incident Video/Imagery.** A need exists for the real time transmission of Swift Water Rescue incident scenes from the scene location to the incident command post and also to remotely located emergency operations centers.

**4.3.7.3.2 Aerial Observation Video/Imagery.** A need exists for the transmission of video/imagery and multi-spectral intelligence from airborne platforms to the incident command post.

**4.3.7.3.3 Interoperability Video/Imagery.** The Interoperability subcommittee report examines the need for video/imagery interoperability in detail, but this communication need must be stressed and catalogued as an operational requirement. Swift Water Rescue incidents require the aid of a multitude of public safety and public service agencies to effectively save lives. Additionally, video and imagery is gathered from multiple sources, both public and private, during Swift Water Rescue incidents. The ability to utilize video and imagery from multiple sources as well as the ability to share this information among assisting and cooperating agencies will greatly enhance incident operations.

#### **4.3.8 Lifeguards/Water Safety Personnel.**

**4.3.8.1 Voice Requirements.** The basic requirement for voice is immediate, clear voice communications for all Lifeguards/Water Safety personnel upon all demands, major and minor, created by situations requiring the intervention of Lifeguards/ Water Safety personnel. Lifeguards/Water Safety personnel require the ability to communicate by voice in specialized dynamic environments, as well as in routine patrol and rescue situations. To effectively conduct operations under these demanding situations, adequate voice communication paths must be provided to foster safety and efficiency. Paths are required to support beach management, swimmer surveillance, and other routine duties, as well as dynamic demands required in expanded incident situations. These communication paths must be immediately available and expandable.

**4.3.8.1.1 Tactical Voice.** Tactical voice communication requirements exist at the actual situation or rescue level of an incident. Tactical assignments and functional groups vary significantly on incidents requiring intervention by Lifeguard/Water Safety personnel. Lifeguard/Water Safety personnel task groups consist of land-based resources, watercraft resources, airborne resources, and swimmers. Each of these functional groups and tactical assignments must be addressed and supported by voice communication paths. Clear and distinct tactical voice communication paths must be immediately available for assignment to