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Technical Report

Project MESA;
Statement of Requirements

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Contents

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Foreword

This Technical Specification (TS) has been produced by the Public Safety Partnership Project (Project MESA).

The present document includes a general outline of the public safety community's technological needs for the transport and distribution of rate-intensive data, digital video, infrared video and digital voice for both service-specific and general applications. The present document was developed as part of a global effort to create uniform specifications and eventually a suite of open standards that could be used for the creation of the next generation of wireless equipment that will be needed to achieve the objectives of the public safety community. This effort is intended to, among other things, support the efforts of the member countries of the Public Safety Partnership Project (PSPP), Project MESA (Mobility Emergency Safety Applications) in meeting their own public safety and public service requirements. See also annex A, clause A.1, Implementation of Interoperable Technology.

The convergence of voice and data services is revolutionizing the commercial transport of information, both wired and wireless. To date, this convergence has had minimal impact on the dedicated two-way radio systems employed by most public safety agencies. The Project MESA Statement of Requirements anticipates that convergence will be a natural progression within the public safety community as new rate-intensive technologies are implemented. See also annex A, clause A.2, Impact of PSWAC's Four General Requirements on US Public Safety agencies.

The initial gross data rates identified in the present document are for the next generation of public safety wireless technologies. However, all of these requirements identified herein are also intended to clearly chart the migration path from today's analogue systems to the next two generations of wireless, high-speed, digital transport system specifications and standards.

Consistent with the public safety users' missions, it is also expected that the Project MESA SoR will emphasize transparent and seamless applications, including multiple levels of security and encryptions. These applications should be available on an individual or system-wide basis.

The Project MESA Statement of Requirements is intended to describe a functional and technical specification and standards platform that can be installed as either a private system owned by the government or a governmental/commercial partnership that provides priority service to public safety agencies and possibly secondary service to other commercial clients.

For the purpose of the present document, public safety includes all criminal justice services, emergency management, emergency medical services (EMS), fire, land management, natural resource management (See also annex A, clause A.16, Network or System Messaging, B), military, transportation, wildlife management, and other similar governmental functions that have a need for aeronautical and terrestrial, high-speed, broadband, digital, mobile wireless communications. See also annex A, clause A.3, Project MESA Use of PSWAC Recommendations.

Finally, it is important to note that the basic service and operational premises embodied in the Project MESA Statement of Requirements are predicated on full compliance with the European Human Rights legislation and/or other citizen's rights as may be defined in that document and/or by the United States Constitution and all other laws, rules and/or regulations that may be subordinate to either of those documents.

Introduction

The users of professional wireless telecommunications equipment within the Sector of Public Protection and Disaster Relief (PPDR) have developed this Statement of Requirements (SoR) document. It describes the services and applications, which a future advanced wireless telecommunications system should be able to support in order to realize the most effective operational environment for the Sector.

Emphasis has been placed on those applications, which current applied technology cannot carry out to the full, but which have been identified by the users and their agencies to be key requirements.

This document is unique in the sense that it represents the first trans-Atlantic consolidated view expressed directly by the professional users of advanced wireless telecommunication equipment.

Within Partnership Project MESA this document will be updated at regular intervals. This represents the focal source of information for Project MESA's Industry members in their work on Research and Development pointing forward towards the realization of revolutionary new and globally applicable communications standards.

This document is not specifically written to be studied end-to-end, rather it represents a unique source of information in the aim of understanding the often very difficult and dangerous working environments, which the user community is facing, such that Industry can provide the most effective and accurate technical solutions.

Finally, it represents the establishment of a clear understanding that the advanced needs of the PPDR Sector should be based on a high mobility broadband wireless network that allows the provision of dynamic bandwidth, offering self-healing characteristics and secure network access. The Project MESA Statement of Requirements (SoR) also reflects the vision of a mobile broadband-shared network that can be simultaneously accessed by multiple users, with multiple applications in a specified geographical area fully independent from availability of public networks and supply of electrical power.

1 Scope

The present document describes a functional and technical specification and standards platform that can be installed as either a private system owned by government or a governmental/commercial partnership that provides priority service to public safety agencies and possibly secondary service to other commercial clients.

It is envisaged that the Project MESA specifications will define robust management and control systems to ensure secure and reliable operational capabilities for the public safety and public security users worldwide.

The present document reflects the requirements of public service and public safety agencies to have priority service and system restoration, extremely reliable service, and ubiquitous coverage within a user's defined service area.

2 References

Void

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following applies.

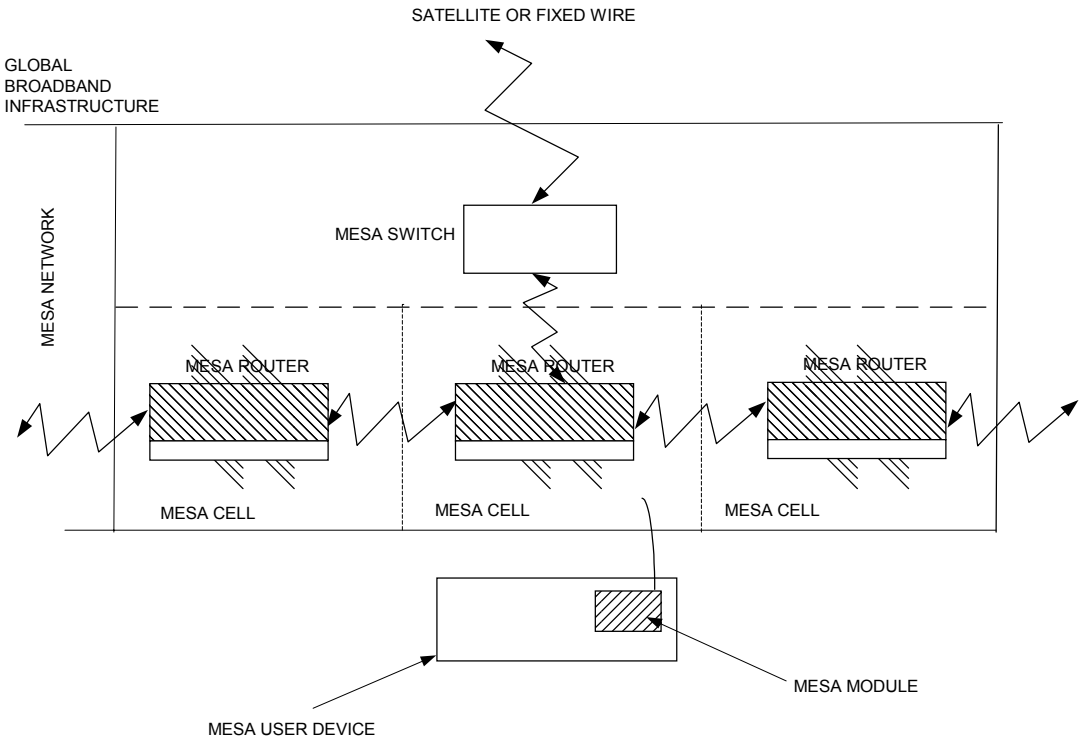

Figure 1

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply.

AFIS	Automated Fingerprint Information System
CDMV	Canadian Department of Motor Vehicles
COMPUSEC	Computer Security
COMSEC	Communications Security
DGLS	Differential Global Location System
EMS	Emergency Medical Services
HF	High Frequency
FBI	Federal Bureau of Investigation
FIFO	First-in, first-out
GLS	Global Location System
IAFIS	Integrated Automated Fingerprint Identification System
IDWCS	Integrated Digital Wireless Communications System
IEEE	Institute of Electrical and Electronics Engineers
INFOSEC	Information Systems Security
ISDN	Integrated Services Digital Network
ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation System
ITU	International Telecommunications Union
NCIC	National Crime Information Center (US)
NLETS	National Law Enforcement Telecommunications System (US)
OTAR	Over-the-air-rekeying
PASS	Personal Alert Safety Systems.
PSPP	Public Safety Partnership Project
PSWAC	Public Safety Wireless Advisory Committee (US)
RCC	Rescue Coordination Centers
RF	Radio Frequency
SAR	Search and Rescue
SENTRY	(the Federal Bureau of Prisons' "SENTRY" database) (US)
SoR	Statement of Requirements
SSG	Service Specification Group
TETRA	Terrestrial Trunked Radio
TRANSEC	Transmission Security

4 The general mission statements and the technology needs of each type of public safety discipline and its users

4.1 Introduction

This section of the Project MESA SoR is intended to describe the overall requirements of most public safety agencies in Europe and North America.

The SSG members believe the Project MESA specifications and standards created from the present document should include, but not be limited to, the following security and public safety services provided throughout the world. Those services titles and descriptions are used to ensure the various publics' safe use of land, sea, public waterways, (See also annex A, clause A.13, Administrative Control and Other Related Transportation and Public Safety Telemetry) and air and ground transportation systems will be met. Most, if not all of these services, are in some way managed and controlled as a part of the public's capital resources.

These services are listed below (the list is not exhaustive) complete with their "Mission Statements" relative to the Project MESA's SoR.

NOTE: This partial list of system and user applications has been included in the Project MESA SoR to establish a base line for the proposed universal specifications and standardized technology. Some of the items referenced in this Project MESA SoR were taken from other reports and studies done by groups outside the Project MESA process. For example, some of these items were taken directly from the *Operational Requirements Subcommittee Report* (Volume II, Appendix A) of the Public Safety Wireless Advisory Committee (PSWAC). By agreement of the Project MESA Service Specification Group's (SSG's) Vice-chairs and Chair, further refinements of the Project MESA SoR will continue to take place within the original Project 25/34 process, supplanted by direct input and final approval from the Project MESA SSG. The output of all work done by the P34 Steering Committee will be forwarded to the Project MESA SSG for their final approval, disapproval, comments, or recommendations as appropriate. Using the Project 34 process in this manner was agreed to in order to leverage user input while taking advantage of an existing process so as to maximize the benefits, reduce the number of meetings that would need to be held and expedite the work effort in order to ensure a rapid completion of the project.

4.2 General statement of Project MESA's SoR for security services applications and requirements:

All public safety services disciplines that are participating in Project MESA have indicated some need for the following services. This type of wireless communications support is crucial to ensure quality services can be provided to the constituents they serve. The technology requirements included in the present document will create a safer working environment for the world's professionals who perform all the critical public safety and public service missions.

4.3 Criminal Justice providers

Reducing crime and its impact on the health and welfare of families continues to be a top priority of public safety and public security agencies throughout the world. In recent years, the most successful anti-crime weapon in the criminal justice arsenal has been the implementation of community-based policing in communities previously served by patrol-based service. The heart of a community-based program is getting officers out of cars and into the community, whether on foot, bicycle or horseback. Community-based policing programs put an extraordinary demand on public safety communications systems because they require portable coverage throughout the community. See also annex A, clause A.4, Impact of Additional Officers in the Field. This issue covers International and national law enforcement and security functions (see also annex A, clause A.7, Use of Project MESA Specifications and Standards in Deployment of ITS and Other Related Public Safety Telecommunications Systems and Networks, E) and Courts and judicial law enforcement

4.4 Automated criminal history and law enforcement records systems and providers

Specifications and standards that comply with Project MESA should provide the technology and applications platforms necessary to access new telecommunications and automation tools and/or expand access to existing law enforcement information systems. See also annex A, clause A.5, Law Enforcement and Criminal Justice Data Systems.

To be compliant with the Project MESA SoR, the specifications and standards should provide transparent, high-speed access to a myriad of public safety files which include, but are not limited to, files on stolen articles, stolen firearms, stolen automobiles, trucks, tracks and industrial machinery.

Specifications and standards that comply with the Project MESA SoR should define and specify high-speed transmission of suspect fingerprints, photos, mug shots, iris scans, stolen property descriptions, and criminal histories files.

Specifications and standards that comply with the Project MESA SoR should define and specify the transporting of two-way, slow scan video.

Specifications and standards that comply with the Project MESA SoR should define and specify the operating on a non-interference basis with all other public safety and emergency service equipment.

Specifications and standards that comply with the Project MESA SoR should define and specify the transporting of real-time video between:

- multiple MESA user devices;
- multiple MESA user devices and MESA routers/MESA switches.

4.5 Emergency management or disaster recovery agencies

The communications system requirements for emergency management and disaster services are characterized by a very low usage pattern during routine operations and extremely high-usage patterns during major disasters or events. Thus, radio systems designed and used by emergency management agencies appear to be virtually unused on a day-to-day basis, yet when a major event occurs, these same systems are often inadequate for meeting the needs of all the emergency responders. Although individual communications systems can perform properly, major incident needs will still not be met due to interoperability issues and individual channel loading.

4.6 Special Operations needs

A special operation includes response functions to an event requiring specialized training for safe and effective operations. This includes hazardous materials leak/spill remediation, mountain rescue and associated technical rescue, collapse search and rescue, swift water rescue, blue water rescue, trench and confined space rescue, and heavy rescue. The situations encountered by users in these fields are varied, and often require work to be completed using protective clothing, which severely restricts mobility, and equipment use in hazardous or harsh environments.

4.7 Health Services

4.7.1 Emergency Medical Services (EMS)

The mission of the Emergency Medical Services (EMS) is to provide critical invasive and supportive care of sick and injured citizens and the ability to transfer the people in a safe and controlled environment. Doctors, Paramedics, Medical Technicians, Nurses or Volunteers can supply these services. They usually will also provide mobile units such as Ambulances and other motorised vehicles such as aircraft helicopters and other vehicles. The need for communications services for EMS providers inside and outside of the vehicles is vital in their work due to the fact they are nearly always in mobile resources that work in a wide variety of rural and metropolitan areas.

Information required by EMS providers include:

- Patient Information
- Medical Information
- Resource Information
- Incident Information
- Geographical Information

Emergency systems must be able to inter-operate to provide a broad scope of services to all emergency medical staff to allow them to integrate with other agency systems. The broadening scope of services and advances in the medical field displays significant growth from the historic perspective of just giving first aid. The EMS of today requires sufficient bandwidth to allow for full colour video with simultaneous sound to be sent from the patient directly to the hospital or receiving centres whilst on the move. Bio-medical information needs to be transmitted with guaranteed accuracy. This is vital, for example, in the transmission of 12 lead ECG in the case of Myocardial Infarctions. Accurate medical information is also required to be transmitted to the medical persons to enable them to give the best possible patient care. The safety and security of EMS staff is also paramount and individual locaters for both the resources and the staff would be vital.

The ability to send and receive relevant information concerning several patients at the same time from the same scene without interference or corruption is also required. The systems must also be capable of working beside sensitive medical equipment without interfering with the operations of that equipment.

4.7.2 Disaster Medicine

Disaster Medicine is provision of triage, primary aid, transportation and secondary care in major incidents.

The requirements in Disaster Medicine are in principle similar to those outlined in the above section on EMS. The main difference lies in the scaling, and in the fact that whereas experience is continuously gained in EMS, Disaster Medicine is infrequently practiced by each individual service. It is important that the activities and procedures are based on the more regularly performed tasks.

The procedures and protocols for exchanging information related to major incidents should be as similar to those used in the day-to-day services as possible. MESA will have to be able to cope with the substantially increased demands on communication seen in major disasters.

4.8 Fire Services

With variations from region to region and country to country, the primary areas of responsibility of the fire services include:

- Structure Fire-fighting and fire safety
- Wildland Firefighting
- life saving through search and rescue
- rendering humanitarian services
- management of hazardous materials and protecting the environment
- salvage and damage control
- safety management within an inner cordon
- mass decontamination

Responsibility may also include incidents at on ships and at sea beyond the local authority or international borders.

Firefighters often work in severe environmental conditions with both high humidity and extremely high temperatures that can exceed 538°C/1 000°F, it is essential that their communications equipment function in the same environment. In addition, equipment is frequently subjected to high levels of shock and vibration.

Firefighters that deal with wild land fires require reliable communication services over very large geographic areas from body-worn MESA user devices. These fires can occur on barren flat lands or extremely rough, mountainous terrain, which often leaves the firefighters isolated with their only link to safety their communications link. That link has to be supported with long life and easy replaceable battery packs.

The focal points for the next generation of on-site wireless monitoring and control systems for fire-fighting are personnel safety and enhanced operational control, “The IP-Firefighter”.

To accomplish this objective an IP network like an IPv6 based mobile wireless broadband network is carried to site, typically by the operational control vehicle. The uplink to the dispatching center from the mobile network is situation dependent, either a narrowband wireless link or a narrow or wide band satellite link. This link, which may not be part of Project MESA development, would provide wide-area transport.

The mobile network supports conferencing facilities, using ITU H.323 or similar protocols. In addition to conferencing, the mobile network is the transportation media for the on-site operational monitoring and control system.

The reason for the application of IPv6 is to be able to assign firefighters, vehicles and individual pieces of equipment a fixed network address. As the communication units enter the network coverage area, the units will automatically register with the network and announce their availability and capability to the network area controller, typically situated in the operational control vehicle.

The area controller uses the network to access a variety of data including:

Structure Data – Building floor plans, hazards, fire hydrant locations, fire control equipment locations, pre-fire plan information, occupant information, etc.

Equipment Data – main and pump water pressures, valve settings, engine temperatures, fuel levels, etc.

Environmental Data - wind speed and direction, external temperature and acidity level (pH) in the direct environment of the firefighters, chemical levels, pictures from IR/Visible light switchable video cameras, etc.

Personnel Data - in-building position in 3D with a 1 meter (3 feet) accuracy, breathing air tank levels, accountability monitoring, distress buttons and vital signs. Some of these functions are also known as Personal Alert Safety Systems (PASS)[1].

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[1] Reference NFPA 1982 Standard on Personal Alert Safety Systems

Vital signs are obtained from a harness worn by the firefighters. The harness will measure and communicate vital signs such as respiratory rate, blood pressure, heart rate, pulse rate, body and body surface temperature, dual axes accelerometers (if the firefighter has not moved for a number of seconds, he may be unconscious).

The network conferencing facilities should enable:

- Two-way full duplex intercom-like audio conference among all firefighters in each workgroup and on-site operational control
- Video streaming from selected firefighters to local operational control with remote control of video source selection by operational control

The on-site operational monitoring and control should encompass the following abilities:

•Ability to act as conference master

- Select camera views (IR/Visible light)
- Manage group audio communications
- Patch through to dispatch center and outside world

•Personnel safety monitoring

- Location of personnel

Alarms on

- Firefighter distress button
- Evacuation signal sent from operational control
- Low breathing air levels
- Abnormal breathing air consumption rate
- Minimum breathing air levels to exit hazard area
- Lack of movement
- Body temperature too high
- Other abnormal vital signs
- Untenable environment in area of firefighter

•Equipment monitoring

- Location of equipment

Alarms on

- Low fuel levels
- Lack of water pressure
- Temperature too high
- Acidity too high/low
- Wind shifts
- Other abnormal equipment and environmental conditions

•Equipment control

- Valve settings
- Pump pressure settings
- Engine start/shutdown
- Ladder control

Intelligent alarms should be used to minimize constant reporting of normal situations. When a situation is detected that is an exception to normal operation, all necessary personnel should be notified, but the system should allow for other activities to continue without interruption or distraction. It should be noted that the accurate in-building personnel location in 3D and firefighter monitoring is of outmost importance. It is the intent of Project MESA to provide Public Safety personnel in potentially hazardous situations the very best protection technology can offer.

4.9 Coast Guard Services (and related public safety functions)

Coast Guard Services may include, but not be limited to, search and rescue (at sea and other waterways), protection of coastal waters, criminal interdiction, illegal immigration, disaster and humanitarian assistance in areas of operation. Coast Guard functions may vary with Administrations, but core functions and requirements are generally common globally.

4.10 Search and Rescue Activities

During a search or a rescue operation access to geographic information, information on resource locations, and locations searched is crucial. Search and rescue operations may require coordinated operations among diverse agencies, and interoperability between agencies is important to the success of this function.

Command and control information is necessary to ensure the safety of the personnel and the success of the activities. Operations may be conducted in adverse weather conditions, and equipment must be resistant to these conditions.

4.10.1 Search Activities

Search activities involve the use of resources and skills to locate people who are lost or who are believed to be lost on land or sea. These activities may take place over large geographical areas and may cross national boundaries.

During an incident, searchers must have access to geographic information, information on resource locations, and locations searched. In addition, command and control information is necessary for the search management to ensure the safety of the searchers and the success of the search. Searches may be conducted in adverse weather conditions, and equipment must be resistant to these conditions.

4.10.2 Rescue Activities

Rescue activities are the use of resources and skills to extricate people in distress on land or water. The rescue process includes the retrieval of the people, and may also include triage, first aid, transport and secondary treatment. Medical activities related to rescue are covered within clause 4.7: Health Services.

4.11 Airport Security (and related public safety functions)

Airport security should include capability to communicate by secure radio with "Airport Management" and "Control Tower" operations. They need to have wireless communications with other public safety organizations, and access to local and international databases for individual profiling of known criminals. Airport security will need to work in clear voice and encrypted communication.

4.12 Humanitarian Assistance

Humanitarian Assistance is a special case of 4.5 Emergency management or disaster recovery, 4.11 Search and Rescue Services, as well as other related types of public safety discipline. The main characteristics, which directly affect and possibly limit the roles for advanced telecommunications technologies in Humanitarian Assistance, include

- The provision of assistance by institutions and organizations from several countries, resulting in the need to consider special regulatory aspects;
- The provision of assistance outside the normal areas of operation of the participating services, resulting in the need for the deployment of complete, autonomous, and inter-operable systems;
- The provision of assistance in a usually dangerous and potentially hostile environment, resulting in the need for full interoperability of personal communications, indispensable for the safety and security of relief personnel of a wide variety of providers, including emergency services, military units, national and international as well as non-governmental organizations;
- The deployment of large-scale assistance upon short notice, typically hours or days, but for an extended period, possibly months or years rather than days, resulting in the double requirement of rapid deployment and economical and operational appropriateness over a longer period;
- The provision of assistance taking into consideration the continuum from relief to rehabilitation, resulting in the need for technologies which can be expected to remain sustainable within the socio-economic environment of the country or region where the assistance is being provided.

4.13 Hazardous Materials (HAZMAT) and related public safety services

Hazardous Materials incidents can be complex, and may involve activities of many different public safety organizations. Specific requirements not detailed in this clause are listed in clauses 4.3 Criminal Justice providers, 4.7 Health Services, 4.8 Fire Services, 4.12 Humanitarian Assistance and other relevant clauses.

Hazardous materials incident activities can be classified into four areas and, along with the activities, are described below.

4.13.1 Coordination and Management

Command and control

Resource information

Safety and accountability information and control

4.13.2 Analysis and Material Classification

Geographic and Population Information

Metrology (weather)

Environmental impact

Detection and analysis

Research / databases

4.13.3 Handling

Containment

Fire fighting

Evacuation and assistance

Decontamination

Treatment

Evidence collection

4.13.4 Cleanup and Rectification

Cleanup

Forensic and Criminal Investigation4.14 Correctional institutions

Specifications and standards that comply with the Project MESA SoR should be written to ensure the long-term needs of prisons and other correctional institutions are met. Those needs include the transmission of digital voice, data, video, infrared video, still photos, alarm and control, files, identification characteristics and other capabilities identified elsewhere in the present document.

4.15 Correctional enforcement and probation officers

The specifications and standards that comply with the Project MESA SoR should be written to ensure correctional and parole officers have access to the full range of public safety services and applications as may be deemed appropriate by the local controlling agencies.

Those specifications and standards that are created as a result of Project MESA should ultimately describe technologies that can be implemented on both a local, institutional or as needed on a wide area basis, up to and including nation-wide networks.

4.16 Planning precepts for responding to large public safety events or emergencies

The Project MESA SoR does not look at large-scale events as being an anomaly. True, major earthquakes do not occur that often, nor do hurricanes or floods. However, when considered on a worldwide basis, they occur more often than we would like to think. Furthermore, few years pass without numerous major forest or wild land fires occurring in the United States, Australia, South America, and/or parts of Europe.

The reality of responding to large-scale events is that they happen throughout the year at unpredictable locations and at unpredictable times. Public safety agencies should be prepared to respond to these events when they occur with the support of effective and efficient communications tools to aid in their response. The Project MESA SoR outlines some of the more urgently needed tools that will help achieve that objective. In addition, while the unpredictability of these events makes it impractical to have adequate wireless communications facilities in all places where these events may occur, we can identify and protect blocks of frequencies worldwide where such facilities can be rapidly implemented.

4.17 General governmental and/or government administration needs

The needs of the General Government users are diverse in nature since they perform a myriad of public service tasks to carry out their respective missions. The term "General Government" includes any national governmental agency, territory, possession, precinct, district, state, county, city, town, village, or similar governmental entity, including an authority. The need is for them to have the essential communications tools necessary to fulfill their official governmental responsibilities. The technological requirements included in the Project MESA SoR will greatly assist General Government services providers in their efforts to offer effective water, sewage, electrical, public parks, schools, pest abatement and control, building code enforcement, planning and zoning and enforcement, and public health services.

The Project MESA SoR focuses on the needs of large urban regions since they tend to have wide ranges of representative user, user requirements and technology uses. While less populated rural areas may have some of the same requirements as densely populated areas, they will often occur on a more fragmented basis. However, the needs of suburban and rural areas are not forgotten and are also taken into account in the Project MESA SoR to ensure it is a representative reflection of the majority of the public safety users needs.

4.18 Land and natural resource management

The agencies at local, state and national governmental levels that are charged with the oversight of a nation's environmental, land, forestry and conservation, and agricultural development all fall into this very unique but broad-based public safety category. Their responsibilities include the management of forests, riparian wetlands, national and global environmental monitoring and policing, management and control of parks and public lands, and various other environmental and agricultural resources that have been set aside for the common good of the general public. Frequently, these governmental agencies are also responsible for the protection of large tracts of private land from fire.

Their responsibilities often include Land & Natural Resource Management and their mission is to serve the public through activities directed to conserve, improve, and protect natural resources and their environmental quality. Needs are based on the performance of official duties. This group of public safety professionals requires telecommunications technology that will allow them to communicate over a wide area, using a myriad of technological and application platforms. These technologies and applications would include, but not be limited to, secure information, voice, video and infrared video, high-speed data, still photos, enhanced patient and firefighter bio-telemetry information.

To accomplish these objectives, the specifications and standards should define technology that is capable of transmitting and receiving in extremely harsh conditions. While their mission is to protect and manage the finite and fragile public resources associated with forest, wildlife, fish, recreational areas, and other renewable and non-renewable public resources, they also ensure the public lands are protected for generations to come. Their daily activities include, but are not limited to, fire control and/or suppression; maintenance of air & water quality; identification and removal of hazardous toxic waste; management of mineral leases; management of mine reclamation; management of solid waste removal and storage; management and protection of reclamation projects; wetland protection; environmental impact analyses of projects that are scheduled to be built on government lands; management of government-controlled fish & wildlife management; and protection and management of natural stream flow.

Many large-scale wildland fire activities require large-scale logistics support at the event. These events can be similar to putting an army into the field because they involve multiple layers of organizations, and they require supplies and personnel support. In one North American county, wildland fires are typically attacked by two, twelve-hour shifts of fire-fighters. Near the close of the present shift, there is a very voluminous list of supplies and personnel that will be needed on the next shift that should be relayed from the field to the support center. This can involve hundreds of items that can take up to an hour of air time using current wireless technologies as the transmission medium. In addition, there are frequently multiple levels of air support providing both intelligence and direct action related to the fire. This intelligence includes weather conditions as well as the status of the perimeter and personality of the fire itself.

Varied and wide area responses, including those using air support, require dynamic frequency assignments for all operational categories, which are allocated through well-coordinated procedures. Land & Natural Resource Management systems require areas of operation covering entire regions and sometimes nations.

4.19 Transportation's organizational mandates and missions

Organizations at local, wide area, and national government levels, charged with the planning, construction, management and maintenance of many forms of transportation systems, fall in this public safety category. Their mission may include the construction and management of complex transportation systems responding to events such as snowstorms, mudslides, flooding, earthquakes, and hazardous material spills in order to allow other public safety providers and the general public safe passage on the world's transportation infrastructures. The use of a fast, efficient telecommunications infrastructure is critical to their mission.

The mission of public safety transportation providers is to serve the public by establishing, operating, and maintaining a high quality, cost-effective road and highway transportation system that emphasizes safety and vehicular traffic and passenger throughput.

4.20 Intelligent Transportation Systems (ITS)

Many of these public and public safety transportation organizations require what is commonly designated as Intelligent Transportation System (ITS). These systems range from public dissemination of information to monitoring transportation corridors and transport vehicles regarding weight, height, and fuel permits. Innovative applications planned within these services are critical to public safety providers.

ITS services and applications will represent a broad range of applications that will enhance the performance of public transportation systems and improve the ability of other public safety providers to achieve their mission. The Project MESA SoR's operational requirements for an ITS system are derived from a number of transportation-related sources and may or may not represent the transportation communities' complete needs as they know them. More importantly, the services and applications defined in the Project MESA SoR are intended to enhance, not replace, the existing wireline, fiber optic or microwave infrastructures used to provide the traveling public with an ITS system.

5 Introduction and general technology - requirements

The objective of Project MESA Statement of Requirements is to establish a suite of specifications and then standards that are created from the user's perspective. The present document will provide a profile of the operational and functional requirements of new aeronautical and terrestrial-based digital, wireless, broadband systems. The Project MESA radio specifications and the standards that will eventually be derived from those specifications will be created to accommodate the transmission and reception of voice, high-speed data, full-motion video, and infrared video and numerous other applications. Given the obvious fact that some of the technological requirements and applications will apply to all of the services and some will only apply to a select number of services, the present document has been written to encompass all of the requirements. Therefore, it should be understood that poor planning and lack of interoperability and the lack of a specific service designation in the SoR itself does not imply or intend to imply that service does not have that specific technological requirement(s). Some of the primary attributes of a Project MESA network(s) would include, but not be limited to, the following:

5.1 Needs

Satisfies the current and identified long-term needs and requirements of national and local public safety, public service, and public security communities from throughout the world.

5.2 Improvements in spectrum efficiencies

Affords immediate significant and evolutionary improvements in radio bandwidth and spectrum efficiency through the cooperative use of a broadband specification and standards that will ensure full utilization of all the bandwidth allocated.

5.3 Life-cycle procurements

Promotes global competition in the participant's life-cycle procurements of technology platforms and systems.

5.4 Security requirements

Permits effective, efficient, reliable and, as may be required, secure (authenticated and/or encrypted) intra- and interagency communications (interoperability). The basic security platforms should be capable of being expanded and enhanced to meet each nation's individual requirements without degradation to overall system performance.

5.5 Economical and ergonomically friendly design

Provides ergonomically designed human-engineered "user friendly" equipment that will meet the needs of the majority of the Project MESA users. The proposed Project MESA specifications and standards should also be written to ensure the hardware created from those specifications and standards is capable of meeting the specific environmental and

operational requirements of various disciplines represented by Project MESA users, as may be articulated in the present document or any of its subordinate documents or annexes. Hardware and software developed for use in MESA should comply with relevant regulations concerning users with special needs.

5.6 Digital migration in place

The technical specifications created for this SoR may establish, where practical, a tactical communications architecture that provides for a digital "migration-path" from existing public safety analogue and digital systems and platforms. While full, direct backward compatibility may not be achievable or even desirable, linkage with those existing platforms, such as TETRA and Project 25, may be. It is desirable that this migration path and coexistence include current systems and known and defined standards that may be developed between now and the time Project MESA technologies become available.

5.7 Consistent with existing standards

Any new Project MESA specifications and standards that are developed from those existing specifications and standards should be consistent with creating full and complete interoperability with technologies built to the Project MESA specifications. Of equal importance is the need for any future Project MESA specification to provide a clear and well-defined link back to existing public safety standards as may be embodied in TETRA, Project 25 Phase I and Phase II and other national and international standards that may be germane, but have not yet been specifically identified by the users.

5.8 Compatible for multiple international standards

Project MESA specifications and standards should provide a technology architecture that is transparent to the applications the technology is intended to carry. It is understood under that definition that the specifications and standards created for Project MESA will be capable of transporting multiple international standards-based data protocols.

5.9 Full two-way communication

Specifications and standards written to meet the needs of Project MESA SoR should allow for full two-way communication at all times at a gross channel data rate in excess of 2 megabits per second.

5.10 Multiple levels of security

All specifications and standards written to comply with the Project MESA SoR should allow for multiple levels and jurisdictionally specific types of security.

5.11 Multiple levels of availability of service

All specifications and standards written to comply with the Project MESA SoR should allow for multiple levels and geographical and service-specific system availability to the end public safety user.

5.12 End-to-end network integrity

All specifications and standards written to comply with the Project MESA SoR should ensure the full integrity of any public safety system or network cannot be compromised or jeopardized.

5.13 High-speed, error-free service

Specifications and standards written to comply with the Project MESA SoR should be predicated on a network design that is capable of the rapid transmission of all potential data applications, through very harsh operating environments, with a minimum of data or transmission errors.

5.14 System and network access

Specifications and standards written to comply with the Project MESA SoR should ensure system and network switching technology built from those specifications or standards is capable of switching and transferring multiple applications, from multiple MESA user devices through multiple system components, to one or more authorized hosts or network servers.

5.15 Compliant with the need of the participating nations

Specifications and standards written to comply with the Project MESA SoR will also be written to comply with the specific baseline requirement of the national governments that are active within the Project MESA process. Those requirements will be articulated within the body of the SoR or any of its subordinate annexes or related documents and may, as appropriate, be identified as a specific need of a specific nation, government, governmental agency or organization.

6 General, functional and operational

6.1 Requirements of the Project MESA SoR

The Project MESA specifications and standards that are developed in response to the present document are intended to provide the baseline technology requirements that will allow for the creation of universal specifications and standards. Those specifications and standards will be created to accommodate the implementation of local, wide-area, national, and international high-speed public safety data networks. Whether the networks are implemented as a series of individual networks or as one or more local or wide area networks is outside the scope of this process. It is critical, however, that the specifications and standards created from the present document meet the primary needs of public safety users.

The following represents an overview and the general requirements of Project MESA's SoR for wireless terrestrials, extraterrestrial, mobile, portable, and aeronautical radios to be used for the transmission of broadband high-speed data, video and voice services as described:

a) Project MESA SoR Requirements

- The Project MESA SoR assumes the requirements contained herein may need modification as the wireless specifications and standards evolve and develop to accommodate new technologies.

b) Accommodation of Multiple Agency Networks

The Project MESA SoR for wireless specifications and future standards should accommodate the creation of a new multiple-agency, multiple-function, multiple-services, mobile computer telecommunications system and associated network(s).

c) Cooperative Participation

It is understood by the Project MESA users and members of its Service Specification Group (SSG) that certain technological and operational compromises may be required to fully complete the wireless specifications and standards as envisioned in the present document. Each of those potential compromises will be addressed on a case-by-case basis.

6.2 Interface requirements

It is anticipated that the new Project MESA SoR and wireless specifications and standards will provide for a direct interface to various local, wide area, and national data platforms and applications; it is not expected that the specifications and standards will deal with network or protocol issues beyond the point of interface from the wireless network to other networks, with the exception of defining a standard for the exchange of information on emergency incidents. Another possible exception might be where we are defining a standard for the exchange of information on emergency incidents.

NOTE: A proposal for a common language for public safety communications across networks is for further study.

6.3 Transparent interfaces

The proposed Project MESA wireless specifications and standards are intended to provide interfaces that are transparent to both the wireless network and the network being interfaced.

6.4 End-to-end transmit time

The proposed Project MESA wireless network(s) end-to-end transit time should be less than 400 milliseconds. Actual transit time may vary based on size and design of network.

NOTE: 400 milliseconds in alignment with ITU Recommendations for Satellite.

6.5 Interface protocol requirements

Specifications and standards that are written to comply with the Project MESA SoR specifications could apply IEEE 802 series protocols, including 802.3 10BaseT and 100BaseT for interfacing with external systems. From this it implicitly follows that any protocol conversion to e.g. ATM, DS-1 and DS-3, OC-1 and OC-3, Frame Relay, ISDN, SONET, SATCOM will occur on the 802-side, i.e. externally to the MESA network.

6.6 Dynamic partitioning

The specifications and standards that are written to comply with the Project MESA SoR should provide for the capability of dynamic partitioning of the network or networks. This dynamic allocation of network bandwidth will be predicated on a predefined hierarchal structure and a users priority of service.

EDITORS NOTE: NEEDS CLARIFICATION at MESA#5

6.7 High-speed simultaneous network or system access

The specifications and standards that are written to comply with the Project MESA SoR should also provide for high-speed simultaneous access to multiple networks or host computers by a single MESA user device, as well as simultaneous access from multiple MESA user devices to a single host.

NOTE: Simultaneous access would be used for updating the same file that is located on multiple hosts. Authorization to each host would be required.

6.8 Network pre-emption

The specifications and standards that are created to comply with the Project MESA SoR should support prioritization of access and routing, and allow for dynamic or forced pre-emption. It is noted that ruthless pre-emption of non-public safety users on shared commercial/government systems is a policy issue that should be addressed as these systems are being planned.

NOTE: Ruthless pre-emption is defined as the immediate disconnection of a low priority user when a completely busy system is needed for high priority use.

6.9 First-In, first-Out (FIFO)

Specifications and standards written to comply with the Project MESA SoR should ensure a system design that allows for access on a "first-in - first-out" (FIFO) basis within each priority class.

6.10 Transparent transfer

Specifications and standards written to comply with the Project MESA SoR should allow for the seamless transfer of MESA user devices moving between MESA cells, and/or predefined system architecture, regardless of the MESA network services being utilized.

6.11 Over-the-air-rekeying (OTAR)

The specifications and standards that are written to comply with the Project MESA SoR are required to include multiple levels of encryption, based either on a consensus suite of standards or each nation's individual need.

Requires Further Study: **Care should be taken to separate the mechanism of over the air re-keying from encryption key management functions. Key management is a security operation that includes many variables that will vary by user organizations and needs to be an integral part in the use of the OTAR feature set.**

6.12 Automated information requirements

The specifications and standards that are written to comply with the Project MESA SoR should accommodate access to each nation's specific automated security requirements.

6.13 Blocking unauthorized access

The specifications and standards written to comply with the Project MESA SoR should include the ability to block access by unauthorized users.

6.14 MESA network component identification

The specifications and standards that are written to comply with the Project MESA SoR should include the capability to automatically identify all appropriate MESA switches, MESA routers and MESA user devices with each transmission within a network or a group of networks.

6.15 Optional site-by-site implementation and management

The specifications and standards that are written to comply with the Project MESA SoR should allow for the user(s) implementing and managing network components on a site-by-site basis. Obviously, if part of a total network or system, all-individual components have to be implemented and managed within a hierarchal structure and managed accordingly.

6.16 Dynamic remote partitioning

The specifications and standards written to comply with the Project MESA SoR should include the capability of remotely partitioning the network, system or an individual site bandwidth.

6.17 System and/or network transaction audit trail

The specifications and standards written to comply with the Project MESA SoR should allow the network manager(s) the option of creating an audit trail of all transactions that take place over their site, network or system. Access to this information has to be protected by authorization codes.

6.18 Ability to provide statistical reports

The specification and standards written to comply with the Project MESA SoR should include all necessary systems or network management software to allow for the users to easily access operational and performance management information. This information should be formatted to allow for the creation of statistical reports on usage, traffic patterns, and performance of the networks or systems and their MESA switches, MESA routers and MESA user devices. Access to all management systems will require appropriate security authorization.

6.19 Agency-by-agency and site-by-site reports

The specification and standards written to comply with the Project MESA SoR should include a management system that allows for traffic, usage, and performance reports to be generated on an agency-by-agency and/or site-by-site basis.

6.20 Dynamic transfer rates and bandwidth allocation

The technology selected to comply with the Project MESA SoR should allow for a dynamic information transfer rate by means of adaptive radio frequency modulation and error detection and correction coding. The specifications and standards that are written to accomplish this feature should also include the use of adaptive channel radio frequency bandwidth allocation.

6.21 Degradation and redundancy

The specifications and standards that are written to comply with the Project MESA SoR should include the capability of providing "graceful system or network degradation" and/or complete redundancy when required.

6.22 Duty cycle requirements

The specifications and standards written to comply with the Project MESA SoR should include all the technology requirements that ensure the equipment used in the system or network are capable of, and rated for, a 100% duty cycle.

6.23 Pre-testing technology proposals

Any new technologies proposed to be used in response to the Project MESA SoR should be bench tested before their inclusion in a final specifications or standard. In addition, to be compliant with the SoR, and at the discretion of the SSG and Steering Committee (SC), it may be necessary to conduct actual field tests of a prototype technology.

6.24 Compliances with national and international rules, regulations and standards

All specifications and standards that are written to comply with the Project MESA SoR should meet or exceed all applicable national minimum performance standards, regulations, rules or other criteria as may be in place or scheduled to be in place when the documents are completed.

6.25 High-speed access to national data basis

The specifications and standards that are written to comply with the Project MESA SoR should provide high-speed access to each user's specified applications and files.

7 Technology and applications

7.1 Requirements of the users

This partial list of system and user applications has been included in the Project MESA SoR to establish a baseline for the Project MESA specifications and standards. The material in the present document is not intended to be restrictive or to preclude other applications or needs. Further refinements will take place within the Project MESA process as the specifications are developed. Therefore, it should be understood that Project MESA specifications and standards should be designed to accommodate, but not be limited to, the following types of applications:

a) Transfer of multiple digital applications

- The wireless specifications and standards written to comply with these standards should be designed to transfer digital voice, data, video and infrared video, and other digital data applications at high data rates, between and among MESA user devices and external network components.

b) Use of existing protocols

- The Project MESA SoR requires wireless specifications and standards that are written to ensure the end products from those documents will be digital, wireless technologies that are based, wherever possible, on existing protocols. That equipment has to be capable of employing both information-rate arbitration and adaptation techniques to permit seamless transport of digital information between and amongst systems. It is necessary that the proposed seamless technology specification and standards be able to allow the transport of digital information between different transport technologies as well as different systems.

c) In building and portable service

- The Project MESA SoR for wireless specifications and standards should be driven by the objective of being able to provide a complete suite of wide area "in vehicle" and portable "in building" services. These standards and specifications should employ an assortment of technologies and platforms, including: wide area synchronized, simulcast, wide area multicast, distributed satellite receiver voting, macro cell and micro cell technologies.

d) Regional and national interoperability

- The Project MESA SoR requires that any specification and standards created from the present document should ensure local, region-wide and/or nationwide interoperability between any applicable network elements.

e) Interoperability between MESA user devices

- Any wireless specification or standard that complies with the Project MESA SoR should ensure local, region-wide and/or nationwide interoperability between and among individual MESA user devices that may be traveling outside of their home operational infrastructure. (It is assumed that prior protocol and registration agreements would generally be in place to accommodate the above-described roaming.) An emphasis should be placed on ad hoc registration to allow foreign MESA user devices to be registered when the (otherwise) required infrastructure is not available. This becomes critical when assisting at the scene of a disaster where much of the infrastructure is unavailable.

7.2 Use of standardized technology

Specifications and standards created from the Project MESA SoR should use standardized technology.

7.3 Use of open architectures

The Project MESA SoR expects the specifications and standards that are created from this process will include the adoption of an Open System Architecture and design approach, which employs "best practices" for implementation where standards are not yet established.

7.4 Migration

The specifications and standards that are compliant with the Project MESA SoR should embody network strategies that encourage a transparent migration path, which includes the widespread use of mobile terminals, notebook computers, hand-held computers and PDAs or their future technological replacements. To be compliant with the SoR, these terminal devices would need to be able to intercommunicate on a transparent basis on both the new wireless network and existing Wide Area Networks or Local Area Networks, be they public or private. They should also be able to interface with public and private microwave networks, fiber optic networks, and other common carrier services.

7.5 Service platform

Specifications and standards created from the Project MESA SoR should accommodate both on-net and off-net services and applications now used or projected to be used by public safety users.

7.6 Priority services

Specifications and standards created from the Project MESA SoR should be written to ensure public safety users can have both levels of priority services and the highest level of priority service.

7.7 Traffic (data) distribution

Specifications and standards that are written to comply with the Project MESA SoR should allow for both point-to-point and point-to-multipoint transmission and transfer of the users defined data.

NOTE: Unless otherwise specified, the term data includes all potential data formats, including but not limited to, voice, slow-scan video, full motion video, data files, fingerprints, mug shots, etc.

7.8 Network and data base interconnectivity

Specifications and standards created to be compliant with the Project MESA SoR should embody the concept of connecting to, or interconnecting with, all known or specified local, regional, national and/or international public safety databases, applications, files, or related electronic technology services that allow the users to meet the requirements of the SoR.

7.9 Dynamic network optimization

Specifications and standards that are created to be compliant with the Project MESA SoR should provide for and allow dynamic network optimization.

7.10 Frequency neutral technology

Specifications and standards that comply with the Project MESA SoR shall be frequency neutral, thereby allowing standardized technology to be used in any authorized and available spectrum consistent with the required channel bandwidth.

7.11 Adequate interference protection

Specifications and standards that are compliant with the Project MESA SoR shall be developed to ensure an adequate level of interference protection to and from adjacent systems and/or channels. Adequate interference protection is defined as that which is sufficient to permit operation of a system within the specified interference-limits as defined in the final Project MESA specifications and standards. Compliance with the Project MESA specification and standards implies a requirement for full compliance with all appropriate Rules and Regulations as may be specified by international standards or treaties, national laws, rules, regulations, or ordinances that were created to ensure spectrum harmony and a minimum level of interference among the users of the spectrums in question.

7.12 Regulatory compliance

Specifications and standards that comply with the Project MESA SoR will be written to ensure full compliance with existing European and North American, or other national's or international's, regulatory rules and regulations.

7.13 Environmentally safe

Specifications and standards created from the Project MESA SoR should be virtually free from technology that is capable of generating harmful non-ionizing radiation and primary and secondary RF emissions that would have a negative impact on the tools used by public safety providers that would include, but not be limited to, computers, cell phones, emergency medical monitors, breathalyzers and radar guns.

7.14 Non-public use of Project MESA specifications and standards

While the wireless User Requirements referred to in the present document are written for the specific use of meeting the needs of local, regional, national and/or international public safety agencies, public security agencies, and other public safety services providers, there is nothing within these requirements, or intended by these requirements, that precludes any or all of the specifications or standards from being used in other general land mobile radio applications.

7.15 Compliance with Project MESA SoR

The suite of wireless specifications and standards developed from the Project MESA SoR should include the full consideration and acceptance of the present document and any additional requirements as may be stipulated by an appropriate national, regional, or local public safety or public security services body who actively participates in the Project MESA process. Inclusion or exclusion of these requirements will be based on the consensus of the Service Specifications Group participants. Every effort will be made to ensure all comments, opinions, white papers, or correspondence received from others, who may or may not be a part of the process, are considered by the active participants

7.16 Open interfaces

Any specification or standard that meets the needs of the Project MESA SoR should provide clearly definable open interface from the Project MESA wireless RF platform to other voice and data applications outside its RF systems and networks.

NOTE: Data includes video, telemeter, voice, photos and all other Project MESA service applications.

7.17 Related documents, standards, policies or requirements

The specifications and standards created from the Project MESA SoR are intended to embody the work previously done by other national and international agencies, groups of agencies or standards bodies as much as may be practical. Although all of these documents may not be directly related to the actual technical specifications or standards created from the Project MESA SoR, they may all relate to the type of data files and applications that may be accessed by the wireless network and systems that are created as a result of the Project MESA specifications and standards. To ensure clarity in the SoR, ancillary and supportive applications documentation will be created. This material does not and should not imply, nor is it intended to suggest, that the proposed specifications should comply with all the material contained therein. In fact, some of this material may have already been superseded and/or is in direct conflict with the stated purpose of the present document. However, for the purpose of the present document, these references will provide the creators of the specification and standards a snapshot of the networks, application and technologies with which the wireless Project MESA network will need to interface.

7.18 Network transmission requirements

The technology selected and the specifications and standards created to meet the needs of the public safety community and the Project MESA SoR should be capable of supporting information transfer rate-intensive applications, such as the rapid transmission of digital photos taken at the scene of a public safety incident. This transmission of public safety data should take place almost instantaneously.

7.19 Split screen data requirements

The Project MESA wireless specification and standards that are compliant with the present document will be created to include technology that will accommodate the simultaneous transmission and reception of split screen data to/from a mobile, portable or fixed terminal unit at a very high data transfer rate.

7.20 Location Determination

Specifications and standards developed to meet the needs of Project MESA should include technology specifications and standards that would provide geographical position-locating capability inside of a building.

NOTE: A number of the services covered by the MESA effort share the common denominator of having to deploy their personnel into situations, which are potentially life threatening. A number of these situations occur inside buildings, and the knowledge of the physical location (in 3D) of the individuals will be extremely instrumental in risk reduction. However, current satellite-based location systems are not always operational inside buildings. The lack of service today does not eliminate the need for this type of service or application and future Project MESA specification and standards should be written to recognize that requirement.

7.21 Delayed transmission and remote stops

The specifications and standards written to comply with the Project MESA SoR should be capable of delayed transmission and/or remote store and forward when required and authorized.

7.22 Network and unit response time

The specifications and standards written to comply with the Project MESA SoR should support full two-way operation to accommodate the implementation of "smart" systems that automatically update fields in files being transmitted from MESA user devices with known information.

8 The use of technologies and the compatibility requirement for the various applications

A second component of land transportation is public mass transit (i.e., trains, ferries, light-rail systems, monorail systems, air transport and buses), which transports hundreds of thousands of passengers each day. These organizations have direct responsibility for the safety and general welfare of their passengers during the time the transportation service is taking place. Emergency mass transportation incidents can arise as a result of human error, equipment failure, terrorism, and environmental factors, such as weather conditions and natural disasters. Operational needs to address these issues are incorporated in the Project MESA SoR, which provides the users' perspective of the types of applications, services and technologies they believe will be needed to continue to improve both the performance and safety of these types of transportation.

8.1 Data to be transported

- The Project MESA specifications and standards should comply with the SoR's basic requirement for immediate, error-free transfer and display of all forms of data, including but not limited to, text, voice, video, infrared video, photos, detailed graphical information, such as maps, engineering plans or drawings, and

fingerprints, active files, reports, and all other applications as may otherwise be specified in the present document.

8.2 General

- General Specifications and standards that are compliant with the present document will reflect the fact that a need exists for real-time support of wireless mobile and portable computer systems. The interface for this kind of service should be capable of transmitting and receiving routine data queries and responses, electronic mail, location data and other graphics. It should also be capable of transmitting and receiving incident-specific data, intelligence, and command and control information. The Project MESA SoR assumes the rapid market penetration of portable two-way radios into law enforcement and other public safety communities will continue and further perpetuate the need for a very high-speed data transmission and retrieval system.

- Project MESA's specifications and standards should provide a flexible platform that allows field computers to remotely access automated information systems and files. Field computers, as defined in the present document, may be used for dispatch or field support to perform real-time changes to host system data files and/or access active host files.

- Subscriber radio and computer equipment referenced in the present document may be vehicle-mounted or a hand-held portable unit.

- The specifications and standards that are written to comply with the Project MESA SoR should include the capabilities to minimize RF network data and message routing, and transport time is targeted to be no more than 400 milliseconds.

NOTE: 400 milliseconds in alignment with ITU Recommendations for Satellite. The SoR recognizes Network Time Delay may be impacted by other factors, such as final system design and size of network.

8.3 Electronic messaging

- Specifications and standards written to be compliant with the Project MESA SoR should include MESA user devices with status and control features and functions and should also be able to provide essential user-defined status messaging on a optional basis.

- The specifications and standards that are written to comply with the Project MESA SoR should support technology that will allow the field MESA user device to access and transmit information that is magnetically stored on an individual’s driver's license or other type of personal identification card. Although these specifications and standards are intended to allow for the transmission and reception of data from these cards, they are not at this time intended to include the specifications and standards for the card readers themselves. - It is expected that the specifications and standards created to comply with the Project MESA SoR also include the appropriate technical requirements to ensure system and network users have the ability to transmit real-time telemetry information from field locations (fixed, mobile, or portable) to fixed, or in some cases, mobile or portable control points. This telemetry information may be used to monitor the functions of a system, site, or device. These monitoring functions may also incorporate personal paging devices used to provide administrative and emergency alerts for field personnel. Implicit in these requirements is the requirement to allow messaging to be inputted into the network or system from MESA user devices. The input from those devices may be transmitted to a single MESA user device**,** multiple MESA user devices, a single MESA router, multiple MESA routers or any combination of the above.

- Public safety specifications and standards that are created to be compliant with the present document should also include the ability to provide end-to-end system or network encrypted messing.

- The specifications and standards that are compliant with Project MESA should include the capability to provide field personnel access to a simple service-wide or system-wide "panic button" that will activate a general alarm, which may be received by a predefined table of MESA devices. All such alarms will take priority over all other voice or data traffic on a Project MESA compliant system or network.

- Project MESA-compliant specifications and standards should also support a broadband telecommunications technology that provides the capability to change signs and public information systems. Authorized agents should have the ability to dynamically change visible street signs/bulletin boards and/or other electronic media devices that will alert the public to potential hazards, dangers or delays.

- The specifications and standards written to comply with the Project MESA SoR should allow for the remote transmission of and access to an agency or agencies' standard uniform crime reports.

- The specifications and standards written to comply with the Project MESA SoR should allow for the ability for authorized personnel to remotely transmit and/or receive information on public safety traffic reports. These reports may include both text, video, and complex diagrams.

- The specifications and standards that are written to comply with the present document should support the transparent, secure, wireless access (authenticated and encrypted) to information systems [such as driver's license and vehicle registration files that are maintained at the local, regional or national Department of Motor Vehicles (DMV)].

- The specifications and standards written to comply with the Project MESA SoR should allow for the remote transmission of and access to criminal justice command and control information. Access to this information will be based on a prior authorization table established at the host processor. (Scope and content of Command and Control files is not intended to be a component of the Project MESA specifications and standards.)

- The specifications and standards written to comply with the Project MESA SoR should be able to provide access to the following types of files:

    a. Computerized criminal history files

    b. Disposition reporting systems individual wants and warrant files

    c. International, national, regional, and local criminal case history tracking files

    d. Court/law enforcement and prosecutor case management files

    e. Defendant voluntary assessment files

    f. Correctional tracking files

    g. Probation tracking files

    h. Capital Resource Inventory Files

    i. Maps

    j. Plans

    k. Charts

    l. Graphic depictions

    m. Administrative reports

    n. Statistical reports and complex spread sheets

    o. Complex engineering data

    p. Complex mathematical calculations

- The specifications and standards written to comply with the Project MESA SoR will support the transmission of secure (authenticated and encrypted) access to the following types of files:

    a. International, national, regional, and local offender file

    b. International, national, regional, and local victim file

    c. Non-offender files as may be appropriate

    d. Incident/complaint file as may be appropriate

    e. International, national, regional, and local witness file

    f. International, national, regional, and local apprehension file

g. Agency case files as appropriate

h. Agency and court disposition of charges files

8.4 Encryption

- Specifications and standards that are compliant with the Project MESA SoR will include a high level of security that will fulfill public safety future needs and requirements. Those needs and requirements will include the extensive use of wireless data and voice systems. These systems should be capable of being encrypted for the extremely secure transmission of all voice and data traffic.

- The specifications and standards written to comply with the Project MESA SoR should include the optional capabilities for robust MESA user device and network security as outlined elsewhere in the present document.

- The specifications and standards that are written to comply with the Project MESA SoR should include the option of having fully encrypted systems and networks. Fully encrypted systems and networks would include all associated control channels and the use of password access codes if applicable.

- The countries that are participating in the Project MESA SoR process believe that future information technology requirements mandate a high level of security for a majority of their governmental and public safety functions. Specifications and standards that are written to comply with the present document should include the capability to provide wireless, multimedia data systems using multiple types of encryption. In order to maximize the effectiveness of agents and officers in the field, a mobile office environment utilizing cryptographically protected wireless voice and data communications should be developed. (The term data includes all forms of data including video and telemetry.)

- The specifications and standards written to comply with the Project MESA SoR should support transparent, secure (authenticated and encrypted) access to national governmental files.

- Both network and application encryption shall be compliant with regional legislation covering lawful interception/CALEA.

8.5 Office of the future

- Project MESA specifications and standards will be written to maximize the effectiveness of personnel in the field by creating the equivalent of a mobile office. The field environment of the office will be highly dependent on high-speed, wireless technology that allows field personnel full access to both host and on-board applications and transport facilities as stipulated within the present document. As noted previously, this mobile office will provide instantaneous voice, data, video, and infrared video access to an individual public safety officer's agency's data bank and personnel, and other authorized public safety data repositories and personnel. It will allow or provide for access to other agencies in the same public safety discipline or public safety personnel in different disciplines.

- The specifications and standards written to comply with the Project MESA SoR should allow field MESA user devices to access one of many host processors at a very high data rate.

- The specifications and standards created from the Project MESA SoR should create the foundation for a paperless operational environment through the use of high-speed, wireless, digital data links to and from field units. The paperless environment envisioned by the SoR includes the routing, distribution and deployment of public safety capital resources, including manpower, materials, equipment and inventory.

- The specifications and standards written to comply with the Project MESA SoR should allow for the remote transmission of and access to all authorized criminal justice incident reports.

8.6 Transparent network and system access

- Project MESA specifications and standards that are created from the present document will also provide transparent access to other public and private systems and networks.

- The specifications and standards written to comply with the Project MESA SoR should support the capability to implement direct user point-of-entry systems.
- The specifications and standards written to comply with the Project MESA SoR should allow for high-speed access to public safety and general government client server networks.
- Specifications and standards created to comply with the Project MESA SoR should meet the needs of land, air, ground, and water transportation systems as may be outlined in the present document or any of its annexes.
- Specifications and standards that are created to comply with the Project MESA SoR should include the necessary technology platforms that allow for the following maritime services:
    a. Transmission of short-range aids to navigation
    b. Receipt and acquisition of vessel position, identification, and sailing intentions
    c. Data dissemination with respect to ice conditions and/or port status.
- ITS and other public safety providers share a common interest in the safety of the motoring public. Each of them requires a comprehensive telecommunications system or network to accomplish their individual mission. Specifications and standards that are compliant with the Project MESA SoR should include the capabilities to achieve each of these requirements as they are identified in the present document, its annexes and attachments, as well as any other requirements that may be added later.
- Specifications and standards that comply with the Project MESA SoR will accommodate telecommunications links for point-to-point and point-to-multipoint control of systems and subsystems. Public safety features of the Intelligent Transportation Systems network include the following:
    a. Emergency vehicle location tracking
    b. Emergency vehicle route guidance
    c. Emergency vehicle signal priority
    d. Driver and personal security
    e. Automatic collision notification
    f. In-route driver information
    g. In-vehicle signing
    h. Incident detection and management
    i. Probe data for traffic control
    j. Transit management
    k. Priority treatment for transit
    l. Public travel security
    m. Automated roadside inspections
    n. Weight in motion
    o. Automated vehicle classification
    p. International border crossings
    q. Electronic clearance
    r. On-board safety monitoring
    s. Hazardous materials incident response

t. Collision avoidance

u. Intersection collision avoidance

v. Safety readiness

w. Crash-restraint deployment

x. Automated highway system check-in

y. Highway-rail intersection safety

8.7 Transmission of complex files

- Project MESA specifications and standards will include the capability to send wireless transmissions of public and private data, such as complex spread sheets, floor plans, building plans, chemical test data, engineering data, environmental data, hazardous material data, fingerprints, iris scans and many other applications too numerous to mention. This information will be transmitted to and from firefighters, law enforcement officers, emergency health providers, and hazardous material teams, and other public safety emergency and operational personnel. To comply with the SoR, the specifications and standards should be written to allow for these transmissions from one or more units in the field to one or more base or fixed stations or other subscriber units.

- The specifications and standards written to comply with the Project MESA SoR should support the capability to transmit electronic images from any MESA user device to any other MESA user device and/or a fixed base location. These images include suspect mug shots, photographs of missing persons, crime scene photos, Department of Motor Vehicle (DMV) license photos, photographs of articles of evidence, aerial photos of disaster scenes for damage assessment, photos of medical patient for remote diagnosis/triage, aerial and infrared photos of fire scenes, and related photos of importance to government officials using the high-speed data network.

- The specifications and standards written to comply with the Project MESA SoR should support the capability to transmit graphical depictions of fires, accident scenes, natural disasters, chemical spills, structural data and other complex graphical information from any MESA user device to any other MESA user device and/or a fixed base location.

- The technology specifications and standards that are compliant with the Project MESA SoR will include the capability for public entities to transmit and receive still, full-motion and slow scan images to manage and maintain the oversight and security of their assets and capital resources. The technology built to comply with the present document should allow for the transmission of complex building and structural plans, electrical schematics, heating and ventilation system plans, water, sewage, and gas pipe routings, plus showing all entrances and exits as well as the location of any hazardous materials. Specifications and standards that comply with the present document will allow the user to accurately identify and locate their capital resource and other inventories using Differential Global Location System (DGLS). Accuracy for all of these requirements depends on the availability of DGLS in any given area since DGLS is provided by many means, including transmission over dedicated public safety frequencies.

- The specifications and standards that are written to comply with the Project MESA SoR should include the capability to rapidly transmit 10-point fingerprints from the officer in the field to one or more base units and the capability to rapidly transmit 10-point fingerprints from specified base units to one or more MESA user devices in the field.

- All specifications and standards that are written to comply with the Project MESA SoR should be able to transmit real-time iris scans from the officer or official in the field to one or more control points or MESA user devices.

8.8 System integrations and interoperability

- Specifications and standards that are written for Major Incident Management should be compliant with the Project MESA SoR and include the capability to provide transparent integration and interoperability with a multitude of public safety and public service agencies. To comply with the SoR, specifications and standards should provide disaster management and control capabilities. Those capabilities will be used to greatly enhance the ability of the user to send and display information formatted as text and graphics. Any command and control specifications and standards that do not include the ability to communicate with and assist cooperating agencies during the management of a disaster would be unacceptable. Specifically, a standard for the exchange of information on emergency incidents should be established.

- The specifications and standards written to comply with the Project MESA SoR should include the inherent ability to install a high level of redundancy throughout the system or network platform to ensure a non-interruptible operational capability during a man-caused or natural disaster.

- The specifications and standards written to comply with the Project MESA SoR will include adequate network and system security to protect the network or subscriber units from unwanted intruders, while allowing for the authorized and authenticated transparent access of Emergency Management personnel to other public safety network and system services.

- The specifications and standards that are written to be compliant with the Project MESA SoR should be able to function during a major incident and be capable of interconnecting one or more public safety providers for different services. This point-to-point or point to multiple points interconnection should be able to take place either on a subscriber to subscriber or subscriber to fixed base or fixed base to fixed base or any combination of the above. With major incidents, multiple agencies often need to be able to monitor another agency's video transmissions, but the ability to access public safety video should be based on a "need-to-know" or incident management basis. Specifications and standards written to meet this requirement should include adequate encryption and authentication to ensure the level of security that may be required by the end user (s).

8.9 Transmission of user and patient monitoring telemeter

- Project MESA's specifications and standards that comply with the present document need to allow for the capability of remotely transmitting and receiving data for applications relating to patient care and other biomedical activities, including patient monitoring. Those may include, but not be limited to, the real time transfer of patient vitals signs and diagnostic data as well as the output of advanced diagnostic tools such as twelve lead Electro Cardio-Graphic (EKG/ECG), Magnetic Resonance Imaging (MRI), ultra-sound reading and visual displays and other life-saving technology outputs and applications. Those transmissions should be capable of being sent from any field unit to any other field unit or to any base(s) units within the network or system.

8.10 Other public safety telemetry applications

- The Project MESA SoR envisions specifications and standards that will accommodate the transmission of telemetry generated by the real-time monitoring of environmental changes, such as seismic movements, water levels in dams, water flow in rivers, tide levels, wind levels, weather station, snow level, rainfall and snow melt runoff, road surface temperature, bridge conditions, ice and salt surface conditions, air quality, water quality, well contamination, structural integrity, chemical integrity, heat levels, cooling levels and many other telemetry application now in use or projected to be in use by the time the Project MESA specifications or standards are scheduled for completion.

- The specification and standards created to be compliant with the Project MESA SoR should also provide an interface to wildlife, sealife, and fish monitoring devices and networks.

- Other forms of telemetry that have to be transmitted on a compliant system or network would include weather-related data, such as wind, rain, lightning, dust movement, barometric pressure, humidity, vegetation moisture content, and soil moisture content.

- The specifications and standards that are compliant with the Project MESA SoR should provide for the transmission of search and rescue incident information from ground, water or airborne platforms to the incident command post and to rescue personnel on the ground.

- The specifications and standards that are compliant with Project MESA should also be written to accommodate train to train-signaling and telemetry.-

- The specifications and standards that are written to comply with the Project MESA SoR should provide for the capability of transmitting real-time information from remote heat, movement, audio sensors, and infrared video, and video scanners.

- The specifications and standards that are created to comply with the Project MESA SoR will be written to ensure the technology built to those standards is capable of transferring data obtained from the tracking of specific animals or herds of animals back to a centralized location. It should be emphasized that this tracking will be part of an identification process of present and future migratory patterns that may be influenced by changes in environmental habitats. This data may then be analyzed either in the field in mobile laboratories or transmitted to one or more base units. This technology requirement is critical to wildlife management personnel in their efforts to project the survivability of a specific specie or species. The use of technology will help scientist and wildlife professional better understand what environmental and habitat conditions are needed to ensure the survival of a particular specie of wildlife.

8.11 Transmission of geographical location data

- The specifications and standards created from the Project MESA SoR should also ensure the public safety officer in the field has instant access to Global Location System data and network or system clocking, automatic vehicle locations systems, person or equipment location data and any other transportation and communications technology that will improve resource management. They should also be written to include the ability to conduct various forms of remote monitoring, including, but not limited to, audio, video, infrared video, telemetry, tracking or movement, flow, heat, force, chemical makeup, and other critical public safety-related data monitoring functions. One of those monitoring functions is to detect the location of and forward automatic distress signals from various public safety disciplines.

- The specifications and standards written to comply with the Project MESA SoR should support the transmission of a combination of Global (geographical) Location (GLS) information and graphical and topographical maps to identify specific locations of public safety concern.

- Specifications and standards that are written to be compliant with the Project MESA SoR should ensure public safety users can allocate bandwidth on demand for vehicle tracking systems and other critical applications.

- The specifications and standards that are created to comply with the Project MESA SoR should embody technology, which enables the system to determine the position of MESA user devices inside buildings.

- For the purpose of the Project MESA SoR, the term vehicles will include, but not be limited to, trucks, cars, trains, boats, motorcycles, airplanes and other modes of transportation as may be appropriate.

8.12 ITS video requirements

- Video requirements for transportation management may include real-time situation updates from on-scene units to command centers. Multiple agencies may need to have the capability of monitoring another agency's video transmissions; however, this capability should be controlled through a need-to-know or incident-management process. Service may be encrypted and require authentication.

8.13 Transmission of full-motion video

- The specifications and standards written to be compliant with the Project MESA SoR should provide for the capability of all public safety services to fully use full-motion video in either a fixed and/or mobile situation. Full-motion video applications will include, but not be limited to, the following:

  a. Vehicle pursuits

  b. On-site undercover surveillance

  c. Medical didactic

d. Fire management

e. Hazardous material spill management (HAZMAT)

f. Natural disaster site control

g. On-scene criminal investigations

h. On-scene accident investigations

i. On-scene public disturbance control

j. On-scene bomb render safe or disruption procedures

- The specifications and standards written to comply with the Project MESA SoR should include the capability of transmitting full-motion or still-image sequences from any MESA user device to any other MESA user device and/or MESA routers/MESA switches.
- The specifications and standards written to be compliant with the Project MESA SoR should provide for the capability of transmitting full-motion video from a MESA user device to one or more MESA user devices. The same unit should be capable of receiving video from another MESA user device.
- The specifications and standards written to be compliant with the Project MESA SoR should provide for the capability of transmitting full video from a fixed station in the system or network to one or more other fixed stations in the system or network. The same fixed station should be capable of receiving full-motion video from other fixed stations in the system or network.
- The specifications and standards written to comply with this Project MESA SoR should provide for the use of airborne video platforms. Those airborne video links should be capable of interconnecting with one or more MESA user devices, one or more MESA routers, or any combination of the above.

8.14 Robotics with full-motion video

- The specifications and standards written to be compliant with the Project MESA SoR should provide the capability to remotely control all features and functions of wireless robotic devices.
- The specifications and standards written to be compliant with the Project MESA SoR should provide the capability of wireless remote control of the robotics devices on-board (internal) microphones and speakers.
- The specifications and standards written to be compliant with the Project MESA SoR should provide the capability of wireless remote control of the robotic devices guidance system.
- The specifications and standards written to be compliant with the Project MESA SoR should provide the capability of wireless remote control of the robotics devices electro-mechanical arms.
- Specifications and standards written to be compliant with the Project MESA SoR should provide the capability of wireless remote control of the robotics devices electro-mechanical tilt, height, motor, and speed controls.
- The specifications and standard written to be compliant with the Project MESA SoR should provide the capability of wireless remote control of the robotics device’s electro-mechanical arms and handgrip, strength, and lift control.
- The specifications and standards written to be compliant with the Project MESA SoR should provide the capability of wireless remote control of the robotics device's chemically sniffed and analyzing computer.
- The specifications and standards written to be compliant with the Project MESA SoR should provide for the capability to remotely download and upload programming instructions to and from the robot's master control unit.
- The specifications and standards written to be compliant with the Project MESA SoR should provide for the capability to remotely transmit full-motion video, slow scan video, and infrared video from a robotic device to its control unit.

- The specifications and standards should be written to allow for all remote control equipment to be placed at least 1 000 feet from the robotic device.

- The specifications and standards written to be compliant with the Project MESA SoR should ensure the robotics' device communications link is capable of transmitting and receiving a very high-resolution video signal and/or photographic images. These services will be used to assist public safety officials in performing their assigned tasks.

- The specifications and standards that are created from the Project MESA SoR should include the capabilities necessary to penetrate difficult communications environments, such as tunnels, mine shafts, fallen buildings, intense heat, extreme cold, adverse weather and environmental conditions, and other potential search and rescue locations that are not conducive to normal commutations.

8.15 Transmission of still-photographs and images

- The specifications and standards that are created to comply with the Project MESA SoR should include the capability to rapidly transmit sequences of still photographs and other high-resolution images.

- The specifications and standards that are written to comply with the Project MESA SoR should provide the capability to transmit high-resolution copies of documents, such as drivers' licenses, passports and criminal history photographs.

Annex A (informative): National and international public service and public safety programs, standards, specifications and requirements

A.1 Implementation of interoperable technologies

The Public Safety Wireless Network (PSWN) program was established in the United States to assist its city, county, state and Federal agencies in their efforts to implement new wireless technology and improve interoperability.

A.2 Impact of PSWAC's four general requirements on Project MESA

The present document reflects many of the major recommendations of the Final Report of the US Government's Public Safety Wireless Advisory Committee (PSWAC). Within that Final Report, the four generally universal limitations of **(1)** priority access and system restoration, **(2)** reliability, **(3)** ubiquitous coverage, and **(4)** security were identified as restricting the use of commercial services for mission critical public safety wireless applications (*ibid*, Section 1.23, p 14. Additionally, *Final Report* Appendix C (Interoperability Subcommittee Report), Sections 1.2.4, 3.3 and 6.1.3 and Appendix D (Spectrum Resources Subcommittee Report), Section 7.3 provides detailed technical discussions about these limitations).

NOTE 1: The Public Safety Wireless Advisory Committee was jointly chartered on June 25, 1995, in accordance with the requirements of the Federal Advisory Committee Act by the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA) to examine the operational and spectrum needs of federal, state and local public safety agencies through the year 2010 and to make recommendations for meeting those needs. Its *Final Report* was released on September 11, 1996.

NOTE 2: Appropriate ETSI citations should be added and the document reworded as information becomes available.

A.3 Project MESA use of PSWAC recommendations

The Project MESA SoR includes requirements taken directly from the *Operational Requirements Subcommittee Report* (Volume II, Appendix A) of the Public Safety Wireless Advisory Committee (PSWAC)

A.4 Impact of additional officers in the field

This problem in the United States has been aggravated by the addition of over 100,000 new officers funded through the Violent Crime Control and Law Enforcement Act of 1994 (Public Law 03-322, commonly called the "Crime Bill"). The act requires that the new officers funded by the Violent Crime Control and Law Enforcement Act must be a community-policing officer. In the US, they are having a negative impact on already overworked communications systems.

A.5 Law enforcement and criminal justice data systems

Expansion to new high-speed wireless data systems will offer many new and expanded technological assets and tools to law enforcement agencies. These new tools will more effectively and efficiently provide information services to public safety agencies and will certainly prove to be a force multiplier in the world's war on the criminal element and organized crime in its many shapes and forms. For the first time, authorized field officers will be able to positively and rapidly confirm the identity of persons in the field by transmitting a fingerprint to local or national processing centers. The officer will be able to obtain a photograph of any person who has been catalogued by his or her own local, national or international series of criminal information and history files.

A.6 Prisons and correctional institutions

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

Correctional organizations throughout the world 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 all the other commonly recognized public safety and public service organizations. Correctional organizations provide public safety services to their clients that include law enforcement, fire services, emergency medical services, emergency management and disaster recovery services. At many institutions they may also provide some forms of highway maintenance, even though their primary mission will always be the reintegration of their client offenders into society.

A.7 Use of Project MESA specifications and standards in deployment of ITS telecommunications and other public safety related networks and systems

Effective and reliable radio communications are required for large national governmental agencies such as those found in the US federal government and its agencies, like the Department of Defense, who are required to perform congressionally mandated functions. Some of those US-mandated functions would include, but not be limited to, dealing with safety-of-life, security, and protection of US government-owned property and military bases, protection of the US President and other governmental dignitaries, enforcement of the Federal government's laws, protection of Native Americans, providing for enforcement of the United States Immigration and Nationality Act, operation of US Federal prisons, security of US coasts and harbors, protection of the United State's natural resources, maintenance and protection of US streams and inland waterways, distribution of its water and natural resources, and many other essential missions.

ITS – The Intermodal Surface Transportation Efficiency Act (ISTEA) was passed by Congress and approved by the President in December 1991. In the United States, the Federal government manages the ITS program, as discussed above.

To support the missions and responsibilities, national service and defense agencies frequently use wireless platforms, such as aeronautical and terrestrial-based mobile radio, HF, satellite, and cellular communications for clear and encrypted voice communications, paging, audio and video monitoring, alarm systems, electronic tags and tracers, technical surveillance, and limited data collection and transfer. These platforms are used both nationally and internationally, over diverse geographies, often requiring MESA user device interoperability and the ability to communicate on a priority basis at all times.

From an aeronautical and terrestrial broadband wireless perspective, there are many similarities between national government users and those of local governments. However, national security, extensive geographical coverage requirements, and privacy and security concerns are significant differences that require comment.

- National law enforcement data requirements

    1) In the United States, for example, in order to provide compliance with legislative, executive, and departmental laws, orders and regulations, all Federal use of wireless data must be protected with an appropriate level of cryptography. The wireless data requirements include such uses as mobile computing terminal applications, geographic position and automatic location data, emergency signals, transmission of reports, electronic messaging, home incarceration monitoring, and perimeter and vehicle alarms. In addition, multimedia systems employing both photographic and fingerprint transmission in conjunction with report automation must be supported. Remotely controlled radio devices are routinely used for turning on and off surveillance microphones, activating kill switches in vehicles, arming and disarming alarm and monitoring systems, and aiming video cameras. This control can be a one-time data burst or can be a continuous data stream.

2) The United States Government uses many applications with unattended electronic sensors/monitors, for border surveillance, parolee monitoring and other remote-sensing technologies will continue to evolve and will require increasingly sophisticated wireless communication paths.

As a practical matter, the present document recognizes the individual users will always have the responsibility for designing and implementing their own system or networks. However, the specifications and standards that result from the Project MESA should be considered as a baseline specification or standard that will ensure the system or network meets the users needs, in an efficient and effective manner, while providing a high-level of interoperability and competition in the marketplace.

The United State's Intermodal Surface Transportation Efficiency Act (ISTEA) was passed by the US Congress and approved by the United States' President in December 1991. It established the ITS program, which seeks to apply advanced communications and computer technologies to surface transportation systems in order to decrease traffic congestion, improve safety, reduce transportation-related environmental impacts, and increase productivity.

The United State's Intermodal Surface Transportation Efficiency Act (ISTEA) was passed by the US Congress and approved by the United States' President in December 1991. It established the ITS program, which seeks to apply advanced communications and computer technologies to surface transportation systems in order to decrease traffic congestion, improve safety, reduce transportation-related environmental impacts, and increase productivity. Public safety goals of the ISTEA legislation being addressed by ITS are reducing the frequency of accidents, reducing the severity of accidents, reducing congestion due to incidents, and enhancing traveler security.

In order to reduce the time and cost of implementing such a system, existing communications services will be used to the extent possible, provided they can meet ITS requirements. Some systems will require wireless data communications technologies (such as dedicated short-range communications using roadside readers and vehicular mounted transponders) or may require the use of collision avoidance radar. There are likely to be ITS-specific systems or applications requiring new spectrum. ITS may also require dedicated and shared use of frequencies currently allocated to public safety and other services.

Video requirements for transportation management may include real-time situation updates from on-scene units to command centers. Multiple agencies may need to have the capability of monitoring another agency's video trans-missions; however, this capability should be controlled through a need-to-know or incident management process.

A.8 Use of GLS for vehicle and personnel tracking, security, and inventory control

Public safety users need reliable vehicle tracking systems to ensure the safety of the official in the field, track their equipment assets, and to know and track the location of specific public safety officials.

A.9 Impact of recent major events on Project MESA SoR

Following the New York World Trade Center bombing, the bombing of the Oklahoma City Federal Center, Hurricane Andrews in the state of Florida, the Rodney King riot in Los Angeles, California, and Loma Prieta and Northridge, California, earthquakes, it became very clear to US public safety users that poor planning, lack of interoperability, lack of advance technology, and inadequate infrastructure created major problems with the responding agencies. In addition, major fires that occurred on public lands, such as those in Yellowstone National Park in the United States, further exposed the inability of public safety responders to combine resources and continue to communicate on a highly controlled and effective basis. Such events have served as a warning sign to public safety agencies throughout the world that there is a need for better technology, improved interoperability, comprehensive planning, and improved international standards.

The US has recently seen a wave of forest and grassland fires in both the National Park system and in Malibu, California. During these events, over 1 000 firefighters work to contain fires throughout the country. The core of this firefighter manpower is drawn from agencies and organizations throughout the nation.

Other major events, such as the Olympics, political conventions, and the "Million Man March," can occur and often do occur throughout the world. All of these types of events create an environment where Project MESA's soon to be developed standards will provide a baseline for high-speed data interoperability.

A.10 Major incident operational dynamics

The dynamics of managing a major incident means the applications for emergency management agencies will exist to a smaller degree prior to disasters and then will become critical when it becomes a disaster.

A.11 Institutional monitoring

A major role in incarceration is the ability of some organizations to monitor their clients who are sequestered in their own home or resident. Monitoring is accomplished through the use of a remote electronic monitoring devise. The use of "house arrest" has risen tremendously. Additionally, there is a mounting movement to develop systems and processes to continually monitor 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.

A.12 Environmental monitoring

The Project MESA SoR envisions specifications and standards that will accommodate the real time environmental monitoring of public resources, such as water flow and quality. Telemetry applications envisioned should provide instant information and a timely warning of severe change in conditions in order to provide the maximum allowable time for an agency to respond with men and equipment. Early warnings will allow public safety responders an opportunity to perform their mission and functions more efficiently.

A.13 Administrative control of transportation and other related public safety telemetry

Future public safety telemetry systems may also provide both an inventory of remaining infrastructure and the control of moving fixed assets, such as fire trucks, snow plows, police cars, ambulances, and many other types of equipment used in emergency response. This would also include changeable signs and traveler information radio systems, as well as weather and road condition data transfer from remote sites.

The Project MESA SoR telemetry requirements include such applications as Supervisory Control and Data Acquisition (SCADA). This kind of procedure monitors systems and provides control functions to lighting, traffic control, pumping stations and specialized equipment, such as toll collection and lane access control equipment. While the Project MESA specifications and standards are required to provide the technology to accommodate these technologies, they are not intended to replace existing infrastructure unless or until it be comes economically and operationally efficient.

Specifications and standards that are compliant with the Project MESA SoR will also include the capability to provide monitoring of highway infrastructure integrity, such as pavement temperature, salt content, water flow and height at bridges, mud flow areas, and high wind areas to provide instant information and warning, thereby freeing up personnel and equipment to perform their functions more efficiently. The monitoring of equipment and fleet productivity increases effectiveness of operations.

Project MESA specifications and standards should be written to accommodate train and train signaling telemetry. A combination of on-board train data with information provided through an Intelligent Transportation System (ITS) suited to railroad operations is paramount in the avoidance of train collisions and the improvement of system safety.

In addition to the other transportation requirements listed, mass transit requirements also relate to local operations, system safety and the protection of property owned by transit operation or authority. One-way video provides a means to remotely view specific locations or interests through either snapshot or real-time video, as necessary. For example, this feature allows crews to monitor safety within train cars in response to incidents or activation of passenger emergency alarms, plus view upcoming stations and track for safety risks. Two-way portable video is necessary on a limited basis for system or passenger safety when responding to a remote station. Field units and dispatch control points could communicate using real-time video with voice from mobile radios, hand held portables, or fixed sites.

Specifications and standards written to comply with the Project MESA SoR are required to accommodate the wireless transmission of tracking data that will be used to protect endangered and threatened species and to control specific herd or animal depletion. These wireless communication links are established by the means of a specific MESA network. The gathering of wildlife data is crucial to track and catalogue the movement of specific species under study by multiple parties. The emphasis is on the identification of present and future migratory patterns that will influence the environmental habitats and future survival of these species.

The specifications and standards requirements outlined in the Project MESA SoR ensures US firefighters will have equipment that encompasses a wide variety of scenarios, ranging from provision of full-motion real-time video from on-site personnel or robotic sensors to remote command centers, to slow-scan images for damage assessment. These video data should be accessible by a number of users under strict, need-to-know management procedures. Often a video image of current conditions is necessary to make critical decisions, like the release of water from a reservoir, in the management of natural resources.

The Project MESA SoR is written to ensure the final specifications and standards include the technology to provide hydrologic management capabilities that will allow for the transmission of still photographs on demand to various locations to facilitate decisions concerning the adjustment of water releases or the evacuation of population downstream from a flood-stage river.

Many national governments, including the US Federal government, provide an array of emergency and disaster response communications capabilities to protect the public and resources from natural and technological hazards. This involves a wide range of missions, including prevention, mitigation, preparedness, response, and recovery.

These services involve virtually every department and agency of the government. Where safety of life and property are at risk, communications systems that can operate reliably when normal systems are disrupted are essential. A significant number of these governmental emergency and disaster response communications systems are designed to interface (but are not necessarily fully interoperable) with local governments, as well as with national volunteer organizations, such as the Red Cross, amateur radio operators, and similar groups.

Many specialized emergency requirements have unique spectrum-dependent needs that should also be satisfied by the international and national dedication of radio spectrum for that purpose. As an example, the US Federal government and its Department of Defense (DOD), state, and local government search and rescue teams, deployed to the site of a national emergency or disaster, need reliable communications to locate victims in collapsed buildings, administer medical assistance and lifesaving treatment, and relocate them to safety or medical facilities.

In general, the data and video requirements of a national emergency management and disaster services are similar to those of their local counterparts. Often the data collected, analyzed, and disseminated in these services originates and terminates between national and local agencies alike.

National activities in aviation, maritime, highways, and railroads have a tremendous investment in both fixed and mobile operations. In the United States, Federal agencies and the Department of Defense surface transportation operations provide a variety of management and oversight support to coordinate activities at various highway and rail sites.

Maritime safety and waterway management agencies provide for the safe operation of a nation's navigable water resources. These public safety activities require coordination of many diverse, yet interrelated, disciplines. These regulatory activities range from the inspection of user vessels and offshore facilities to the providing or contraction for icebreaking capabilities to keep shipping routes open year-round, in order to ensure each nation's shipping lanes and ports remain open. They may also be required to provide port security, fire protection, and firefighting services.

These same entities may also be required to provide safe passage for shippers traveling through costal or inter-coastal waterways.

A.14 The use of global location system in Project MESA

Location information allows more efficient use of equipment and personnel, equipment management inventory, and location control. The ability of dispatch control point or other vehicles to monitor the location of equipment or apparatus within a defined geographical service area will improve efficiency of services provided by the governmental agency. Since some public safety field personnel and/or their clients are not assigned to vehicle-related tasks, there is a need for a personal location device to track the location of an assigned individual for general management purposes and in the event of an emergency.

These tracking devices may be incorporated within the voice communications equipment or could be a separate personal device. Public safety users also need access to the Global Location System to assist them in disaster management and recovery. Following an earthquake, flood, hurricane, or other disaster, it is not uncommon for normal landmarks to have disappeared: buildings are destroyed, streets are covered, and road signs are missing. Emergency management personnel need a means by which they can map the event so that they can better understand where the problems lie and dispatch personnel to deal with situations appropriately. Although access to the GLS signal itself does not create a path or channel requirement, use of location data at any other location requires that a communications link be established.

Public safety agencies will also use the GLS location information requested in the Project MESA SoR to more efficiently manage equipment utilization, equipment inventory, and operational and response control. The location and control of limited resources during routine and extended emergency incidents are crucial elements in being able to effectively manage a crisis and quickly mitigate the emergency.

In addition to being a telemetry function, the management of bridges, buildings, signs, road surface conditions and repair need inventory data acquisition. Road construction survey information requires differential GLS accuracy. DGLS can be provided by many means, including transmission over a Project MESA system or existing dedicated public safety frequencies.

A.15 Office of the future and general administrative applications

Project MESA system should accommodate transmission of forms and reports to central sites from mobile and remote locations. This capability will be used to transmit long data streams to and from central locations and the field in just a few seconds.

Direct point-of-entry will allow public safety and other entities direct, high-speed entry and access to critical government records from MESA user devices.

A.16 Network or system messaging

Some public safety personnel, including correctional officers, need to have access to emergency networks. Those networks should be able to send emergency assistance or distress notices that are automatically routed to the appropriate location, place(s) or unit. MESA user devices provide for the transmission of status reporting, feature and service control functions and monitoring.

A.17 Emergency or distress signals

Public safety personnel who need emergency assistance should be able to activate an alarm that sends an automatic distress notice to a central monitoring point and to other staff in the field.

A.18 Corrections and probation officers and staff's use of full motion video

Correction and probation personnel often require 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 to include constant updating of vehicle positions for dispatch and personnel 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. Many of these applications require secure transmission of the position information to protect operations from being compromised by potential adversaries.

A.19 Major incident management and control video

With major incidents, multiple agencies often need to be able to monitor another agency's video transmissions, but the ability to access public safety video should be based on a "need-to-know" or incident management basis.

A.20 Airborne command and control video

Airborne video platforms provide critical support and intelligence for major events, in particular for disaster response and management. Near-full motion and snapshot video transmissions from airborne platforms to command and control locations and supervisors on the ground are required. Airborne video is extremely important to the management of major disasters, wildfires, high-speed chases and other activities that require a broader vision.

The airborne video platform specified in the Project MESA SoR will also accommodate the need that exists for the transmission of video/imagery of multi-spectral toxic cloud replications.

A.21 Normal incident command and control video

Some incidents require real-time video. While these incidents may be infrequent in some areas and some disciplines, others have a more frequent demand for real-time video. The capability should exist for both point-to-point and broadcast use of the video. For example, full motion video should be transportable from the incident scene to an incident command post, and also to a remotely located emergency operations center. Major incidents often require monitoring of the incident from more than one location.

A.22 Traffic surveillance video

One-way video is required to view specific locations or interests through either snapshot, real-time or close to real-time accuracy, to monitor traffic flow, facilitate incident responses, and manage traffic control gates from remote sites.

A.23 Surveillance and monitoring

Law enforcement requires the ability to transmit high-resolution, limited motion video at the rate of one frame every five (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.

A.24 Law enforcement video applications

The ability to transmit full motion video from mobile video cameras directly to dispatch and other command and control installations is required. Although the 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 should support retransmission of full-motion video to mobile and remote locations, where command and control personnel and other mobile officers can monitor, make decisions, and provide assistance based on the video transmission.

A.25 Disaster relief video applications

The availability of a variety of video/imagery sources is critical to the effective management of a disaster. 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.

Video interoperability is a critical operational requirement. Disasters 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 disasters. The ability to use video and imagery from multiple sources, as well as the ability to share this information among assisting and cooperating agencies, will greatly enhance emergency management operations.

A.26 Land management and wildfire control applications for full motion video

Real-time and close to real-time incident monitoring from remote sites (including airborne) provide up-to-date information on such incidents as wild land fires, as well as crowd control in routine parks' environments. Infrared real-time mapping from airborne platforms is rapidly becoming an essential component for fighting wild land fires.

A.27 Emergency medical services video applications

Video interoperability is a critical operational requirement. Disasters require the aid of a multitude of public safety and public service agencies to effectively save lives and protect property.

A.28 The use of robotics in a hazardous materials environment

Hazardous material and explosive disposal responses can frequently benefit from use of robotic devices. These devices require full-motion video that can be transmitted over a short distance (up to 1000 meters), from the control device to the robotic devices. This application may require the use of equipment and technologies developed for explosive atmospheric conditions and/or that will not initiate the explosive device being rendered safe. Indeed the Project MESA specifications should embody equipment that will not interfere with any approved device at all, explosive or otherwise. 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 specified in the Project MESA SoR.

A.29 Lifeguard and water rescue applications for robotics

Lifeguard/water safety personnel often require the support of robotic devices in underwater search and rescue operations. Robotics is extremely important when persons, planes, and ships are submerged in water depths greater than 200 feet.

Robotics equipment becomes the preferred method of retrieval, as human divers require considerable decompression time at these depths. The use of remote control recovery vehicles eliminates the need to further risk human life to recover a dead body or salvage from ships or planes.

A.30 Search and rescue applications of robotics

Urban Search and Rescue/Technical Search and Rescue (USAR/TSAR) personnel often require the support of robotic devices in search and rescue operations when persons are trapped in collapsed buildings, mines, tunnels, etc. Robotics equipment may be the only method of locating trapped persons in areas where human rescuers are physically unable to enter because of access limitations or due to the presence of hazardous materials. The use of miniature remote control vehicles for such applications will dramatically increase in the future.

A.30.1 Robotics and video/imagery applications in search and rescue

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 using video support. As with the law enforcement application, special equipment designs may be required.

A.30.2 Transmission of still photos for public safety applications

Agencies require the ability to transmit still photographs on demand to other locations. For example, a law enforcement, parole or probation 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.

A.30.3 General encryption requirements

In order to maximize the effectiveness of agents and officers in the field, a mobile office environment using cryptographically protected wireless data communications should be developed.

A.30.4 Specific and/or unique requirements of the United States Government

This section identifies operational requirements unique to the US and its Federal government and Department of Defense (DOD) public safety/public services agencies. While these requirements are based on "American" requirements, they are no doubt very similar to services provided by other National Public Safety Organizations in Europe. The diversity and complexity of national agency missions, like those discussed above compel the use of a wide variety of telecommunications capabilities.

The Project MESA specifications and standards should embody the requirement of the US government to access information repository systems such as the United States' Department of Justice's National Crime Information Center (NCIC) 2000 and their Integrated Automated Fingerprint Identification System (IAFIS). These data systems are created to give national and local law enforcement agencies immediate access to these and other automated files.

Project MESA should provide national public safety and security agencies high-speed and wireless access to remote, wireless, video equipment that can be used in covert video monitoring, particularly in dealing with organized crime and drug interdiction.

Project MESA specifications and standards should be written to allow Federal agencies in the United States to provide service nationwide to a multitude of different public safety providers. Specifications and standards created from the Project MESA SoR should be able to provide multiple levels of services to full-time Federal public safety governmental personnel, over 300,000 postal vehicles, and the security monitoring of 180 billion pieces of mail per year. In addition, it is anticipated the equipment developed from the Project MESA SoR will monitor and accommodate the distribution of water and assist in the management of timber growth and harvest. The technology may also be used for the protection, operation, and management of our national parks, national forests, range and grasslands, as well as the wildlife that inhabit them. Beyond that, the SoR includes technology requirements that will help monitor and protect game refuges, and protected preserves or nations, such as those of our Native Americans. Finally, the technology required by the Project MESA SoR will assist the US government in managing our national finite and renewable resources, such as may be found at dams, hydroelectric plants, or in mining operations or oil fields.

The Project MESA SoR includes requirements that are crucial to assure the latest weather patterns, snow and precipitation levels, temperature and water quality are monitored in order to minimize a natural disaster due to these conditions. The emphasis is on the collection of data from remote sensors and the prediction of flooding conditions based on that data. In the United States, the Federal Hydrologic Program involves a large number of Federal agencies as well as local agencies. The network, data, and frequency assets are shared among these agencies.

The Project MESA SoR includes technical requirements that will allow the US Postal Services' wireless data transmission that is mission critical to their objective of providing continued low-cost mail service to over 95 million addresses.

The Project MESA SoR includes technical requirements that will accommodate the United States' government's requirements to gather and distribute seismic data that remains crucial to any opportunity to eventually create an early warning and detection system. Earthquake monitoring equipment will detect earth movements and motions and transmit the parameters of that movement over the wireless Project MESA network to centralized locations to be catalogued and analyzed. Eventually this data will become part of a comprehensive system that will be used to reduce potential earthquake damage, and loss of life and property.

The Project MESA specifications and standards should accommodate Type I, Type II, Type III, Triple Des and other encryption algorithms used by the US government, other national governments, and local government (if standardized and widely available). They should also accommodate Type IV cryptographic algorithms with Over-The-Air-Rekey (OTAR) consistent with the Project 25 Phase 1 standards used in the United States.

The Project MESA SoR requires the use of specific automated security applications within each nation. In the United States the requirement will be to use Information Systems Security (INFOSEC) across the network as an integral part of their enterprise solution. INFOSEC should include, but not be limited to, the following security disciplines: communications security (COMSEC), computer security (COMPUSEC), transmission security (TRANSEC), personnel security, administrative security, and operational security.

Project MESA specifications and standards should accommodate the United States to meet the needs of NCIC 2000 standards. These specifications or standards would need to meet or exceed the Federal Bureau of Investigation's (FBI) NCIC 2000 standards, and or any future modifications as may be applicable at the time the MESA wireless specifications are approved.

The United States government has a number of high-speed data applications that can and should be served by a system built to Project MESA's specifications and standards. Those include, but are not limited to, the following:

1. National and local offender file
2. National and local victim file
3. Non-offender files as may be appropriate
4. Incident/complaint file as may be appropriate
5. National and local witness file
6. National and local apprehension file
7. Agency case files as appropriate
8. Agency and court disposition of charges files

The United States government requires that all its criminal justices files, such as those embodied in the NCIC and National Law Enforcement Telecommunications System (NLETS) files, be supported by transparent, secure (authenticated and encrypted) access.

The following is a representative list of some of the applications files that will need to be accessible and secured in a Project MESA system that is fully compliant with the SoR:

1. Wanted persons files
2. United States Secret Service Protective Service files
3. Foreign fugitive files
4. Unidentified person files
5. License plate files
6. Vehicle files
7. Boat files
8. Vehicle/boat parts files
9. Stolen article files
10. Gun files and stolen gun files
11. Stolen and fraudulent securities files
12. Originating Agency Identifier (OAI) files
13. Interstate Identification Index (III) files
14. Convicted person and/or supervised release files
15. All available electronic image files

16. All authorized logically linked NCIC 2000 files
17. The existing and proposed "Enhanced" name and personal information files
18. The proposed improved NCIC identification files
19. Files available through the NCIC 2000
20. Files available through the Canadian Police Information Center Systems and the Canadian Department of Motor Vehicle (CDMV) databases
21. Access to Federal Corrections Systems (SENTRY) database files that are proposed under NCI 2000
22. Access to the proposed NCIC 2000 "Search and Reporting" systems
23. Access to the proposed NCIC 2000 on-line manuals and training programs

The United States government requires remote; secure (authenticated and encrypted) updates of files kept for national criminal information files, such as those contained in the United State's Uniform Crime Information systems.

The United States government requires the ability to access the national law enforcement files, like the FBI's NCIC 2000 image files, directly from MESA user devices in the field. This access should be provided on a secure (authenticated and encrypted) high-speed wireless link that is interconnected to the national law enforcement files, like the FBI's NCIC 2000 image files.

The United States government requires secure access to its Automated Fingerprint Information System (AFIS) and the new 10-point fingerprint files. In addition, access to automated files containing palm prints is also required.

Annex B (informative): Known North American Federal, state and country requirements

- The Federal Bureau of Investigation (FBI) National Crime Information Center (NCIC) 2000 System Requirements
- The FBI's Integrated Automated Fingerprint Identification System (IAFIS) System Requirements Definitions
- The FBI's IAFIS concepts of operations
- The FBI's Integrated Digital Wireless Communications System (IDWCS) Performance Specification
- The FBI's Technology Planning Guide
- The National Incident-Based Reporting System Requirements for use of the handbooks for Uniform Crime Reporting, Volumes 1 through 4
- The Federal Data Collection Guidelines, Volume 1
- The Federal Data Submission Specifications, Volume 2
- The Federal Manual on Approaches to Implementing an Incident-Based
- Reporting System, Volume 3
- Federal Guidelines on Error Message Manual, Volume 4
- Federal Guideline Hate Crime Data Collection
- OMB Circular A130 as it applies to interoperability requirements between Federal and state governments for Automated Information System security
- The Immigration and Naturalization Service's ENFORCE concept of operations
- The *Final Report* of the Public Safety Wireless Advisory Committee

Annex C (Informative): Law enforcement scenario – Court House Murder

An explosion took place in the Virginia federal court's parking lot in proximity to I-95 interstate highway. A white female having no ID is a victim of a car bomb explosion as she inserted key into vehicle's door lock. The explosion also caused some collateral damage as well as potential structural damage to court house building and significant public distress in the immediate area.

Numerous calls were received by the local 911 PSAP which then initiated first response of municipal police, fire, and EMS. Initial on scene units found a significant explosion scene with several ongoing fires and many "walking wounded" wandering through the incident scene. Police and Fire initiated a command post across from the incident location. Police units established critical perimeter for public safety entry only and also began initiation of a secondary perimeter using current GIS mapping. EMS set up an initial triage contiguous to the police and fire command post. Initial injured were assessed and information forwarded to area transport hospitals via MESA devices that were tracking hospital capacities, services available and patient transports.

Concurrently, an initial incident scene search was underway at the explosion site with PD, FD, and EMS. EMS determined the victim to be deceased and FD determined the explosion created significant damage thus making the scene unsafe. Also, other vehicles in the immediate scene were damaged and leaking fuel and several small fires were in progress. Encrypted MESA real time video feeds were being transmitted from scene to the command post. MESA personnel location technology was in use providing 2D/3D location, biotelemetry of FD/PD personnel to their command staffs as well as monitoring of immediate air quality in proximity to the explosion site. Upon completion of the first search, the scene was declared unsafe and messages sent to all on scene personnel to remain outside of the critical perimeter until the scene was cleared by the bomb squad.

Once the second perimeter was established police command manipulated the DOT's traffic signals and traffic electronic signs to minimize or eliminate additional vehicle traffic. Streets & Public works were notified via MESA technology to provide barricades at the outer perimeter for police units at specific locations. Notifications for criminal investigators, ATF, and federal law enforcement were made. Bomb squad units were also notified to respond to clear the scene for any secondary devices. Police helicopter with video feeds was above providing video to incident command post.

The bomb squad then uses MESA enabled robotics to ensure that no other explosion devices are present. The clearance information that was broadcast to all on scene personnel via MESA ALERT messaging, a crime scene perimeter was established to account for personnel entering/exiting the scene. Posted officers using an accountability system collected this data from the MESA devices of each person entering and exiting. Crime scene diagrams were constructed of the scene with exact placement of evidence being provided with MESA devices and applications. Criminal investigators began to collect scene evidence and conduct interviews of identified witnesses. Court house security personnel provided a MESA interface to the building security video system to enable access to the parking garage cameras. Investigators used MESA subscriber devices to collect digital pictures and video evidence from the crime scene as well as the victim fingerprints using a field device.

The fingerprint collection provided the victim's information/data identifying her to be a Federal judge for state of Virginia. Initial analysis of security video provided several license plate numbers and several potential suspects that were in or around the area. The security video also confirmed that no other persons were in the immediate blast zone although collateral damage and injuries did occur from flying debris.

Attempt to locate (ATL) information was compiled at the command post and sent to all on scene MESA law enforcement devices and to the local PSAP who in turn forwarded information through various criminal law enforcement networks [2] to other local, county, state and federal law enforcement.

Additional criminal investigation of security camera video indicates a prime suspect vehicle captured in the video of white Volvo leaving the complex at approximate time of incident. Cameras show a partial license plate of vehicle from Texas. Additional ATL's are posted to the immediate area and forwarded to law enforcement networks.

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[2] Law enforcement database systems such as the National Crime Information Centre (NCIC) and the State of Virginia Crime Information Centre (VCIN) and Criminal Records Office in England.

Criminal investigators query a MESA enabled tollway tolltag/video collection monitor which indicates that a vehicle matching the description with a partial Texas license passed the toll gate subsequent to the incident. Further information from the toll collection point indicates that tolltag usage and those records provided an address.

Maps and GIS information (roadway data) of surrounding area was obtained via MESA LAN/WAN connections to local and state networks and was sent to the incident investigative commander. Concurrently, partial plate searches are ongoing through Texas DOT DMV databases. A positive hit is made which provides additional demographic data and subsequent searches through Texas and NCIC indicate criminal history and further suspect information which yields finger prints, photo, and suspect name.

Camera surveillance of incident scene is now being transmitted back to local police headquarters and incident command post since a federal judge was involved. Police helicopter video live coverage of area is also being sent to both locations. Police headquarters PIO is editing video for release to the media.

With known information on victim to be a federal court judge, FBI and federal marshal's conduct concurrent investigations. Federal ATF is conducting explosive analysis with local municipal police to determine construction of bomb material. MESA wireless connections facilitate federal ATF databases queries for information on material possibly used, purchasers, and locations of sale.

Positive identification of suspect is made and law enforcement initiates tactical surveillance activities at suspect's last known address. On scene law enforcement agents query local tax and water database records using MESA devices with wireless connections to existing LAN/WAN connections to confirm ownership information. Incident perimeter is established, tactical operations command post and full tactical response is initiated, as suspect vehicle is located at scene by initial surveillance units. Location is then placed under full video surveillance for tactical approach and placement. On scene tactical, surveillance, and counter surveillance officers are deployed by the tactical commander using MESA devices and GIS mapping with positional data for each officer being transmitted and received by the tactical team and commander. The tactical commander places specific deployment locations on the map displays to provide directional guidance to deploying officers.

Deployed infrared and normal video indicate movement and location of the suspect in the house. This information is correlated with building floor plans obtained by the tactical commander and the suspect's position is then indicated on the floor plan transmitted to the entry team. The entry team makes entry and takes the suspect into custody and removes him from the residence. Upon entry, tactical officers notice bomb making materials and what appears to be active devices in the residence. The incident commander alerts all on scene personnel with MESA messaging capabilities and require all to move back from the residence. Additional infrared scans of the residence are made to ensure no additional human heat signatures.

Arresting officers use a MESA handheld device to take a biometric fingerprint sample from the suspect to confirm identity.

Bomb squad arrives on scene and uses a MESA robot to clear the residence and remove active devices which were being placed by the suspect to kill or injury law enforcement upon entry. Incident commander generates cancellations for law enforcement networks and transmits them to the various networks through the MESA connected devices.

Annex D (Informative): Law enforcement Scenario - U.S. State & Urban Police Response to Earthquake Damage

This scenario begins after a magnitude 8.2 earthquake has damaged many buildings in a large metropolitan area. Urban Police responds to a cell phone 911 calls & observes that a Federal building is near collapse, while an adjacent ten story office building has also sustained damage but appears to be structurally sound. Fire rescue & EMS are called to the scene. All patients that could self-extricate, or be easily extricated have been removed from the rubble and transported for treatment. The local jurisdiction is overwhelmed with rescue and EMS Units & has requested assistance from several specialized urban search and rescue (US&R[3]) teams. One of these teams from the State Police has arrived and has been assigned to search and rescue and traffic control (side access control included) of victims in a partially collapsed parking garage. A Disaster Medical Assistance Team (DMAT[4]) is setting up a treatment centre and a US&R Incident Support Team (IST[5]) is also in the area.

Upon arrival, the State Police Search & rescue team splits up with one half of the team (Team A) began surveying the garage for structural integrity and for likely victim locations. They also set up a base of operations in a park across the street. The other half of the SPD Search & Rescue Team (Team B) went to the Federal building to determine the integrity of the structure, calling in the building engineers to provide blueprints & building drawing. The law enforcement coordinator directs a team for traffic and crowd control. The team's communications specialists set up an Internet satellite link and connect it to a Project MESA network node. This node will allow various voice, video, and data to be transmitted to similarly equipped units, including the IST and the DMAT.

Structural specialists begin the structural survey of the garage using handheld computers to sketch the structure perimeter and noting entrances and areas of structural concern. At the same time a group of engineers from the city & federal office of the Dept. of Commerce begin looking over the drawing & blueprints for the federal building. Data collected indicated that the building was on the verge of collapse within twenty-four hours. This information is relayed to all public safety units via the MESA terminal to the command post established at the park & given to the communications specialist. This information is then transmitted through integrated MESA terminals to the team incident commander who can make entry plans from this data. Using this data the incident commander establishes the hazard zone for tracking entry into the garage & the collapsing building.

The structural specialists find that one outside wall of the parking garage has fallen away and the concrete T-bars of the parking garage and have detached from the outside wall, collapsing. The engineering team at the federal building found that gas main on the north side of the building was ruptured & on the threshold of exploding. The Urban Police are directed to cordon off a four block square area and begin necessary evacuations. The structural specialists set up two thodolites[6] to monitor any movement of the federal building. These units contain video cameras that transmit images via an integrated MESA terminal to the base of operations, where the specialists can safely monitor the structure. Once a preliminary structural assessment is complete, the incident commander assigns the search teams to enter the structure to search for victims. The teams are assisted by hazardous materials specialists, which detect any nuclear, biological, or chemical hazards to the rescue personnel. A search of the appropriate data bases allow for an inventory of the building contents to be reviewed, examined and results transmitted to all officials involved.

Two search teams that will enter the garage area & federal building turn on their personal safety systems that include an activity monitor and location tracking system. As the teams enter the hazard zone, they check in with the safety officer who notes their entry using a MESA-equipped terminal. This information is used at the base of operation to track all personnel inside the hazard zone.

As the search teams search, they note the presence or absence of victims on their MESA terminals and the data is echoed on the floor plan of the structure at the base of operations. As the teams move through the garage, the locations of all team members are logged for use if a member becomes lost or incapacitated.

The hazardous materials specialists plug their hand-held monitoring equipment into a MESA terminal, which relays any detection information to the safety officer's terminal at the incident command centre established at the park location.

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3 A US&R team is a self-contained heavy structural rescue team with search, rescue, medical, and technical support capabilities.

4 A DMAT is a mobile field hospital staffed and equipped to treat large numbers of injured.

5 The IST supports US&R teams with tasking, materiel, and coordination.

6 A thodolite is a surveying instrument that may be used to measure and monitor movement of an object.

As Search Team 2 proceeds into the parking garage, the hazardous materials specialists detect a potentially dangerous level of gasoline vapour in the air. The safety officer's terminal indicates the danger and he decides that this route into the garage is too hazardous and orders the team out of the garage, and to find another entrance. Before the team exits, they leave a combustible gas indicator with an integrated MESA terminal. This terminal will continuously monitor the air and, if an explosive condition is detected, will send an evacuation signal to all personnel in the structure.

Search Team 2 uses their MESA wireless intercom system to coordinate their search and the search team leader uses narrowband FM radio to report their progress to the incident commander. Team 2 locates several victims trapped in vehicles under the concrete T-bar sections and notes the locations on their MESA terminal. The incident commander calls for a rescue team to go to the garage to assist in the rescue operation. Rescue Team 1 begins work on extrication of the victims. As the rescue team accesses each patient, medical specialists treat the patient as much as possible in the confined space.

The medical team managers use the MESA terminal at the base of operations to inform the IST and the DMAT of the number of victims, the severity of their injuries and the estimated time of their extrication. When it is decided that one of the victims requires a leg amputation to extricate the victim, the medical specialists consult with the medical team managers using voice and video exchange using MESA equipment.

The incident commander, safety officer and law enforcement coordinator use data on the total time each team has been in the structure to rotate teams for rest and rehabilitation. Eventually, all victims in the garage are extricated, stabilized, and transported to the DMAT. The incident commander then contacts the incident support team for resupply of expended equipment and materiel, and for the team's next assignment.

History

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