Where a dedicated channel is not available for communications with Public Service entities, a radio from a pool of Public Safety radio equipment should be assigned to the Public Service entity for the duration of the incident.

A common platform for data communications and associated data bases should be established for the purposes of communicating with Public Service entities. This will primarily involve development of infrastructure gateways.

12.3.7.9 Federal Government

Overview of Requirements & Methodologies

Much of the Federal Government agencies' communications interoperability needs are similar to those already addressed. In many cases the requirement itself is very similar to the state and local entities, but the fact that the coverage area expands beyond the typical state or local jurisdiction(s) creates some unique problems.

The Department of Energy (DOE) has some unique interoperability requirements as discussed previously. The U.S. Coast Guard (USCG), the primary federal agency with maritime authority, has unique interoperability requirements while performing its four main missions; maritime law enforcement, maritime safety, environmental protection and national security. The USCG must maintain interoperability with the maritime public, as well as both law enforcement and emergency response agencies.

Federal law enforcement personnel often depend on state and local law enforcement for support, and also coordinate their operations with other sate and local agencies. Most federal agencies operate their own systems, on the federal government frequency bands, and rely on additional radios, on applicable sate/local frequencies, to satisfy the interoperability capability. In cases where the local law enforcement entities operate in an adjacent band (such as 150-164 MHz) to the federal government band (such as 162-174 MHz), there are mutual aid agreements negotiated to utilize one or more of the local law enforcement channels for interoperability.

Federal law enforcement agencies often install multiple radios in field units or provide the users with multiple portable radios to provide interoperability with other agencies. For example, the Justice and Treasury Departments combined have expended over $10M to provide radios for interoperability with other federal, state and local agencies.

Day-to-day Interoperability

The day-to-day requirements vary among the various federal agencies, but are similar to the requirements of the law enforcement and search and rescue activities previously defined.

Although gateways and manual interconnects are used to some extent, they are rarely used due to the time involved for set-up and the coverage limitation.

Mutual Aid Requirements

Most of the mutual aid requirements for the federal government are similar to those previously outlined for criminal justice and emergency response agencies.

Task Force Requirements

Federal government agencies are significantly involved task force operations throughout the country. These task forces typically include personnel from federal, state and local law enforcement entities.

In most cases, the lead agency of the task force distributes radios to the task force members to ensure interoperability.

Conclusions and Recommendations

For the most part, the interoperability requirements of the federal government users are similar to that of their state/local counterparts. Some of the problems are compounded due to the geographic coverage required.

12.3.8 The National Public Safety Wireless Network Initiative

12.3.8.1 Background

Vice-President Gore, in his program for a National Information Infrastructure[10], called for development of a national law enforcement and public safety wireless network. This network would provide the backbone and distribution medium(s) for voice and for advanced technology between information processing centers/repositories and field personnel at all layers of government.

On April 20, 1994, the Federal Law Enforcement Wireless Users Group (FLEWUG), co-chaired by the Justice and Treasury Departments, was formally chartered and tasked with research and planning for such a network. The FLEWUG plays an important function within the National Performance Review's charter to Reengineer Through the Use of Information Technology. Its mission is clearly stated in the NPR Information Technology IT-04 Vision Statement:

> "To provide law enforcement and public safety an integrated wireless/wireline network that meets the functional requirements of the user community. As envisioned, the network will incorporate spectrally efficient technologies, support interoperability, and be secure. Network planning and development will be sensitive to individual agency issues such as priorities and privacy, will provide virtual autonomy and non-interfering operations, and will include flexibility to expand and extend capabilities. Cooperative

[10] NTIA Docket 930940-3240: Federal Register, Vol 58, No. 181, September 21, 1993, pg 49035

and coordinated system development efforts between multiple agencies will relieve the effects of diminishing resources such as funding and radio spectrum and will result in numerous cost and quality of service advantages."

In April, 1996, the US Justice Department formally authorized and funded the FLEWUG Program Management Office (PMO). The purpose of the PMO is to organize, direct and manage the multitude of tasks that must be completed.. the PMO will receive guidance and direction from the FLEWUG in coordination with participating state and local partners. The PMO will establish project teams made up of experts drawn from government, industry and academia to address specific items of interest. Such teams will be assembled on an as-needed basis and dismissed when their work is completed.[11]

APCO, the National Association of State Telecommunications Directors (NASTD) and several federal agencies, through the Project 25 series, have offered to develop a public safety standard for the advanced technology transport portion of this network. Planning for this standards process has already begun.

12.3.8.2 The Need

There is perhaps no better way to exemplify the need for the PSWN than to examine the growth in automated inquiries to state and federal databases by law enforcement agencies for wanted person and motor vehicle license inquiries. APCO submitted a White Paper to the FCC in 1994[12] which showed the steady increase in inquiries for the states of California, Florida, Illinois, New York and Texas over the years 1991-1993. The number of transactions per officer for these states, largely conducted by voice over standard mobile radio networks, was contrasted with the number of transactions per officer for the Los Angeles County Sheriff's Department which uses an advanced mobile data terminal (MDT) system. The use of automated systems in the field increased the number of transactions per officer by up to six times the overall average. The data collected by APCO has been updated below to include information for 1994. *It is critical to note that none of these transactions represent the new fingerprint and mugshot technologies supported by NCIC-2000.*

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11 The Public Safety Wireless Network of the Future Draft 2nd Edition: FLEWUG, October, 1995, pg 10.

12 The Impact of Advanced Technologies on Public Safety Spectrum Requirements - A White Paper: APCO, August 1994, pp. 9-13.

Figure 1
Wanted Persons Transactions by State (to State Files)
(Millions)

Year	CA	FL	IL	NY	TX
1991	N/A	7.30	19.43	9.83	12.19
1992	N/A	8.70	22.29	10.82	17.53
1993					
1994					

California data not available for 1991 and 1993

Figure 1 shows the actual numbers of transactions related to Wanted Persons inquiries for 5 of the most populous states for the period 1991-1994. Figure 2 shows similar data for in-state Criminal History transactions. Each transaction includes an inquiry and its associated response(s). If more than one match results from an inquiry, there may be more than one response. With NCIC-2000, Wanted Person and Criminal History transactions will be made by a fingerprint inquiry with a potential mugshot response.

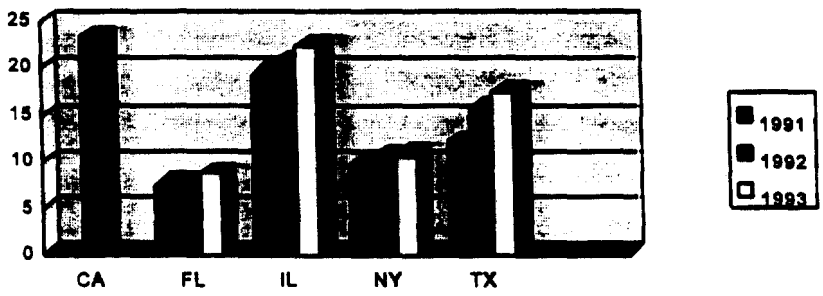
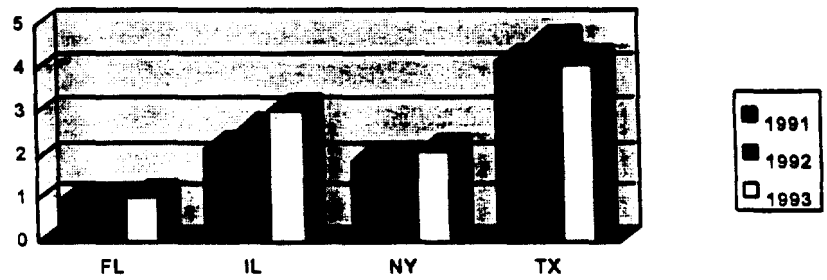


Figure 2
Criminal History Transactions by State (to State Files)
(Millions)

Year	CA	FL	IL	NY	TX
1991	N/A	1.00	2.21	1.90	4.20
1993	N/A	1.00	3.06	2.31	4.47

California data not available for 1991 and 1993



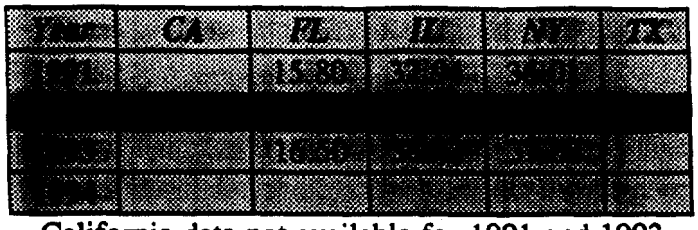
The other transaction set that will likely produce a data file response is related to motor vehicle inquiries. In this case, a name or operator's license number may result in a photograph being sent from the motor vehicle file to the officer's vehicle. Figure 3 shows the number of transactions for 4 major states. Again, a transaction includes an inquiry and related response(s).

Many states are now automating the collection of operator license photographs. California, for example, no longer takes film photographs. At application or renewal time, the Department of Motor Vehicles (DMV) captures the image on a computer at the DMV field office. It is then transferred to Sacramento where it is stored electronically after the new license document is produced. The National Law Enforcement Telecommunications System (NLETS), a system separate from the FBI's NCIC network, links the criminal justice computers in the 50 states. NLETS recently completed standards to allow the interchange of these operator license photographs. The intent of these standards is the eventual delivery of the photo from any state database to a data terminal carried by a field officer anywhere in the country.

Figure 3

Motor Vehicle Transactions by State (to State Files)

(Millions)



California data not available for 1991 and 1993
Texas data not available

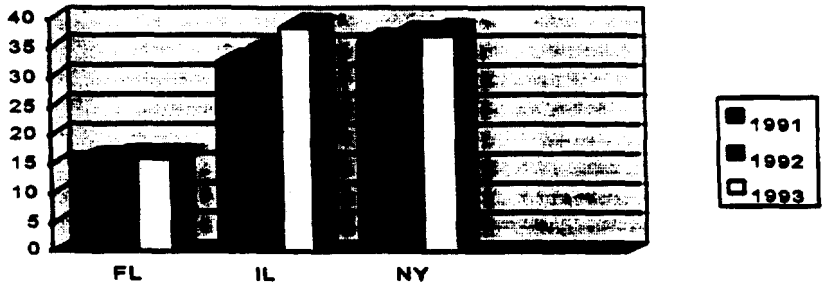
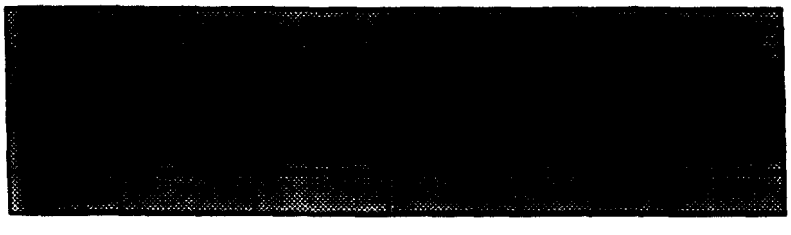


Figure 4 shows the number of sworn officers by state for these same states. Unfortunately, multi-year statistics were only available for Florida and Texas. However, it can readily be seen that, even with fiscal restraint in most states, the number of law enforcement officers continues to grow. The added 16% from the Crime Bill has dramatically impacted these numbers since 1994.

Figure 4

Number of Sworn Officers (Local/Sheriff/State/Special)

(Source: US DOJ Bureau of Justice Statistics)



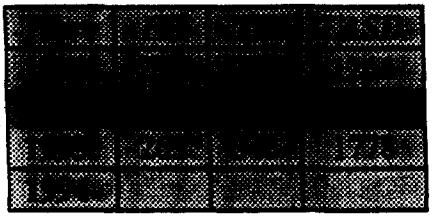
Perhaps no agency in the United States makes as much use of MDTs as the Los Angeles County Sheriff's Department (LASD). MDTs are an integral part of the Sheriff's new multi-million dollar UHF radio system. The system became fully operational in May,

1990. Using 8 duplex radio channels, the MDT system processed 10.3 million transactions in 1991, 12.8 million in 1992, and 13.2 million in 1993.

Figure 5 shows a comparison of the number of transactions per officer for LASD as compared to Florida and Texas, the other two states that provided sufficient data for comparison. *It should be noted that these computations are based on the total LASD sworn compliment; in reality over 25% of LASD 's staff is assigned to custody facilities where they do not use MDTs.*

Figure 5

Annual Transactions Per Sworn Officer



It can be readily seen from these figures that the number of transactions from agencies that make extensive use of MDTs can be up to 6 or more times higher than the overall state averages.

The advent of Community Based Policing (CBP) in the early 1990's is now being credited with the sometimes dramatic reduction in violent crime starting in 1993. Importantly, CBP involves getting officers out of their vehicles and directly in touch with more of the population. CBP is, therefore, placing increased demands on public safety communications systems to provide personal based, rather than vehicle based, communications. The widespread use of notebook and, more recently, palmtop personal computers is rapidly driving these personal communications requirements beyond voice to high speed data and eventually full NCIC-2000 capabilities. In fact, the Communications Committee of the International Association of Chief's of Police has estimated that as much as 75% of the state/local government field patrol force could be equipped with such palmtop devices by 2010 if the equipment is available and inexpensive and the infrastructure is available to support the application. This market penetration is based on the similarly rapid introduction of personal portable radios into the field force beginning in the early 1970's. The FBI today issues notebook computers to each of its new agents as they graduate from the FBI Academy. This phenomenon will not be limited to law enforcement, but will similarly impact fire and emergency medical services, and general government applications, particularly as government manpower levels continue to be reduced and the workforce is required to work smarter" to provide a similar level and quality of service.

It has been estimated that, if developed individually on an agency-by-agency basis, up to 400 additional mobile data networks could be required in Southern California to support

the needs of the various public safety agencies as we move into the 21st century. With the need for high speed data and associated wideband RF channels for carriage, the spectrum demands for these individual networks would be phenomenal. Similar requirements can be expected in other metropolitan areas of the United States.

More importantly, the development of individual uncoordinated networks will leave data interoperability in the same state as voice interoperability is today.

> Data interoperability for criminal justice users will allow investigators and field agents to travel anywhere in the country and still access not only federal and state criminal justice systems, but also the systems of her/his own agency.
>
> Data interoperability will allow agencies responding to large-scale mutual aid events such as wildland fires to transmit staffing, equipment and related logistics information to distant Emergency Operations Centers and receive specific incident briefing and assignment data potentially long before arriving at the scene, potentially saving hours of initial downtime at incident staging areas.
>
> Data interoperability provides the potential for Internet-like communications between any terminal or group of terminals, provided the addresses of the terminal(s) are known and such access is permitted by administrative authorities and policy.

12.3.8.3 The Network

The PSWN has often been described as public safety's wireless lane on the information super highway. As envisioned, it could be a cellular-like network in major metropolitan areas moving to wide-area systems supported by high level sights in rural areas. Minimum raw data rates of 64 kbps will be required to support public safety's future data and voice requirements. Depending upon the individual application, maximum data rates could reach a requirement of 384 kbps.

The network would be designed for the transparent and secure transport of transactions nationwide between terminals and between terminals and hosts. Additional terminal-level encryption would be provided for users requiring higher levels of security than that provided by the network.

User terminals would be based on an open architecture design allowing an array of off-the-shelf devices to be connected to the network using a standard interface card such as a PCMCIA card or external RF modem readily available today.

> By selecting appropriate spectrum for the RF subsystem, it is hoped that technology developed for the emerging PCS industry can be readily transferred and applied to the PSWN.

Because of the mobile nature of this service, the current belief is that spectrum below 2 GHz will be required to provide satisfactory coverage. The 1710-1755 MHz band and potential new spectrum below 800 MHz are being considered.

The network is envisioned to be government owned RF nodes using a standardized open architecture interface allowing multiple vendors to supply both sides of the link, thus providing multiple sourcing and competitive procurement.

It is anticipated that interconnections between wireless nodes will be made using several different mediums, Government-owned microwave and fiber backbones will play a significant role, particularly in more rural areas. Commercial networks will undoubtedly provide the large share of links, particularly in metropolitan areas.

In order for commercial carriers to be considered for the RF backbone to meet procurement requirements of many state and local governments, the following conditions may have to be met:

- At least two carriers (although not necessarily the same two carriers) must be available in all parts of the country;

- Carriers would have to provide coverage to rural areas of the country where there may be little or no demand for commercial services;

- Carriers would have to provide sufficient coverage to meet potentially high demands of public safety users in areas where commercial demand may be very low (areas of depressed income, for example).

- Priority access is required at all times, especially during periods of network blockage.

- Any participating carrier would have to subscribe to the open architecture required by the network;

- Carriers would have to provide for seamless handoff of in-progress transmissions from units leaving one service area and entering that of another ;

- Participating carriers would all have to be linked to the network;

- Participating carriers would have to operate in the same band using some network management technique that would make "channel" selection transparent to the user;

- Local laws in some states may not allow the transport of criminal history information over public access networks.

12.3.9 POLICIES AND PROCEDURES

12.3.9.1 Overview of the Incident Command System

The Incident Command System (ICS) (reference Appendix D) has been developed to provide a common system which public safety agencies can utilize for response to local or wide area emergencies.

The basic organizational structure of the ICS is based upon reviews of large incident responses in the past; organization needs were subsequently identified. Incident related management organizations in the past were organized informally as needs were identified. Under ICS the organization is pre-identified and is applicable to both small day-to-day situations as well as very large and complex incidents.

ICS Structure

Incident Commander and Command Staff

Operations Section

Planning Section

Logistics Section

Finance Section

12.3.9.2 Laws Impacting Use of ICS

- California Code of Regulations, Title 19, Division 2

  - Standardized Emergency Management System (SEMS) Defined

  - §2443 Compliance required for Reimbursement

12.3.9.3 Impact of Policies and Procedures on Specific Services

Public Transportation

- Mass Transportation Providers need to be on the same spectrum bands as public safety entities in their respective jurisdictional areas.

- Policies relating to the implementation of common infrastructures in "harsh" environments (underground tunnels, remote areas, forests, deserts etc...) where

other public safety entities do not generally operate must address the financial impact of systems implementation.

- Procedures for Interoperability must be especially insightful as to the potential for large scale public safety consequences in high density urban mass transportation systems.

12.3.10 Conclusions

- The grade of service (GOS) for interoperability paths can be no less than that for operational paths as detailed in Appendix A of the Operational Requirements Report. Interoperability is often used under circumstances that are less tolerant of error than during normal operations.

- Day-to-day interoperability includes both monitoring another agency's traffic for informational purposes, and response to a particular incident. In the latter case, the simple fact that multiple agencies are involved means that the risks associated with these incidents are probably higher than those involved with routine intra-agency operations. This interoperability can include coordinated use of cross-jurisdiction frequencies, use of structured interagency networks, and gateways between systems.

- Mutual aid interoperability, at least during initial stages of an incident, implies an emergency or disaster situation is imminent or has occurred. The quantity of traffic is often at its peak and personnel are usually under a high degree of stress. As incidents progress, particularly for long term disasters, personnel become fatigued and are more prone to making errors; their attention span is shortened and transmissions may be missed. Personnel operating in the field may be in high noise environments performing crowd control, rescue operations or fighting fires.

- Task force operations often involve providing for close-in protection of undercover operatives, coordination of personnel involved in narcotic raids, and related incidents with life-threatening potential.

12.3.11 Recommendations

12.3.11.1 Additional Channels

- Appendix A contains recommendations for the number of simultaneous interoperability links required by user service category for two options. The first option is to implement interoperability within existing public safety bands. The second option is to implement interoperability at the minimum level within current public safety bands, while providing the majority interoperability spectrum within a new "Public Safety Interoperability Band" in spectrum below 512 MHz.

- Aggregate numbers for the first option (using existing bands) indicate a total need for 51 repeatered voice links and 83 simplex voice links within current bands, plus 2 independent high speed data and 2 independent full motion video links. It is believed that existing designated interoperability frequencies can be used for 17.5 of the repeatered and 28 of the simplex voice links. The high speed data and full motion video links must be provided within new spectrum.

- Aggregate numbers for the second option (new interoperability band) indicate a total need for 21 repeatered voice links and 20 simplex voice links within current bands. It is believed that existing designated interoperability frequencies can be used for 13.5 of the repeatered and 13 of the simplex voice links. 31 repeatered voice, 70 simplex voice, 2 independent high speed data and 2 independent full motion video links must be provided in the new Public Safety Spectrum.

- To implement interoperability using the first option (exclusively within existing bands), the aggregate numbers indicate a requirement for the following quantities of links:

Voice

A total of 49 repeatered and 52 simplex voice interoperability links are required. Some of these requirements are met by existing Intersystem links, as described in Appendix B.

In the major bands establish the following repeatered links:

- A service independent National Calling link as described in Section 7.5.7 in each of the 42-50, 150-174, 406-420, 450-470 and 806-824 MHz bands (total of 5 links).

- One service dependent emergency-only link in the 42-50, 150-174, 450-470 and 806-824 MHz bands for each of the fire, emergency medical and law enforcement services (total of 12 links).

- One service dependent day-to-day interoperability link each for fire and law enforcement services in the 42-50, 150-174, 450-470 and 806-824 MHz bands (total of 12 links).

- Four service independent tactical links as described previously in each of the 150-174, 406-420, 450-470 and 806-824 MHz bands (total of 20 links).

In the major bands establish the following simplex links:

- A total of 24 general access tactical links whose use is according to a priority system in each of the following bands: 42-50 MHz (2 links), 150-174 MHz (16 links), 450-470 MHz (6 links), 806-824 MHz (6 links).

- One day-to-day interoperability link each for fire, emergency medical, general government law enforcement and public service in the 42-50, 150-174, 450-470 and 806-824 MHz bands (total of 20 links).

High speed data

High speed data links must be supported within the Public Safety Wireless Network as described in Section 6 both as an operational requirement and for interoperability.

In addition to the voice requirements listed above, spectrum must be dedicated nationwide in one of the bands above 150 MHz for two independent duplex links for high speed data. These links must be able to operate co-site without mutual interference.

Full motion video

Spectrum must be dedicated nationwide for two independent video links each with sufficient bandwidth to support full motion video. These links must be able to operate co-site without mutual interference.

Interoperability frequencies must be carefully chosen by the FCC/NTIA to minimize mutual interference between mutual aid channels when they are used co-site. For example, receiver desensitization can occur when a strong signal is present near the receiving frequency of a radio. Furthermore, the use of 25 kHz bandwidth equipment on 15 kHz channel centers in the 150-162 MHz band. Last, the lack of standard pairing of mobile relay frequencies in this same band can lead to a distant base station causing interference to an adjacent mutual aid channel.

- The most critical Interoperability requirement is for direct unit-to-unit communications. Normally, a common over-the-air interface must be used for direct unit-to-unit communications. On April 12, 1996, the Interoperability Subcommittee adopted a resolution to establish a baseline technology for interoperability. The text of that resolution is included in the main Interoperability Subcommittee Report.

- Interoperability will use the following functions if they are supported on the equipment and infrastructure (as applicable). Again, these imply that a common over-the-air interface be used for direct unit-to-unit communications. Where equipment is in use that does not support these features, communications must not be substantially impaired by these features.

Emergency Signal: Personnel who need emergency assistance must be able to activate an alarm that sends an automatic distress notice to other personnel in the field who are involved in the incident on that communications path and optionally to a central monitoring point.

Unit ID: when a transmitter is keyed, a unique identifier must be sent to other personnel in the field who are involved in the incident on that communications path and optionally to a central monitoring point.

12.3.11.2 Establish Standards Committee

While the Minimum Baseline for Interoperability presented in Section 11.2.3 will suffice for some time, perhaps as long as 2010, the time will come when most, if not all, users in a given area will be using a digital voice communications platform and will not want to give up the capabilities provided by that platform when switching to analog FM for direct unit-to-unit communications. Therefore, it is recommended that, after the PSWAC process is completed, the FCC and NTIA together establish a working group compromised of experts representing government, industry, and federal, state and local government users similar to, but smaller than the PSWAC effort, to address base line technology for interoperability. It is further recommended that another PSWAC should be convened within ten (10) years to evaluate technology development and the effect that actions stemming from this PSWAC have had on meeting the needs of public safety's spectrum and interoperability problems.

Considering the evolution to digital technology, we should not limit future interoperability to an analog baseline. Just as the AMPS cellular standard (which clearly goes far beyond simple analog FM) provides North America-wide cellular interoperability, there is clearly a future need for digital interoperability standards for public safety communications. It is imperative that this baseline be addressed and established within the next two years, to allow the public safety community to develop implementation and migration plans accordingly.

Any group selected for the purpose of such an evaluation should be composed of experts representing industry and users. The selection methodology must be weighted towards the needs of the end user. There has been significant discussion regarding the use of an accredited standards making entity in the development of digital baseline standards. The consensus of the working group is that such a requirement would be overly restrictive.

The Telecommunications Industry Association (TIA), the ANSI-accredited SDO for the telecommunications industry has stated: "...not all documents called *standards* are issued by American National Standards Institute (ANSI)-accredited Standards Developing Organizations (SDO). The ATM Forum is issuing standards for Asynchronous Transfer Mode (ATM) systems and the ATM Forum is not ANSI-accredited. The Internet Society also issues publicly available specifications[13]."

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[13] Letter from Matthew J. Flannigan, TIA President, to Dennis Connors, Ericsson Inc., dated April 12, 1995.

Vice President Albert Gore has stated "All parties should participate in the development of private-sector, voluntary, consensus standards through the existing international organizations, such as the International Telecommunications Union, the International Standards Organization and the Internet Society. The creation of truly global networks will require a high degree of interconnection and interoperability[14].

Indeed, the two technology developments arguably having the largest impact on American society during the past decade were not developed through an accredited SDO, but rather are proprietary: the IBM-PC bus architecture and the Microsoft Disk Operating System (DOS) Windows software. It is interesting to note that the primary competition to these, Apple with its closely held proprietary hardware and software platforms, is currently experiencing significant financial problems.

It is therefore recommended that any digital baseline standards for interoperability be open standards developed/adopted in an open and fair process. Clear user concerns in selecting any baseline standard include the issues of graceful migration and competitive procurement.

While it is desirable that interoperability technologies be in the public domain, several key issues surface with respect to technology development and its associated Intellectual Property Rights (IPR). These include:

- Heavy research & development (R&D) expenditures are normally made in those areas which appear to be promising for future applications; most resulting technology is patented, with resulting IPR belonging to the developer. As a result, many promising technologies often have associated IPR.

- There is clearly a possibility that the benefits resulting from use of proprietary technologies could result in a solution whose value (in speed, performance, elegance of implementation, overall cost, etc) clearly outweigh the associated costs of the IPR. A detailed cost-benefit analysis may need to be performed as part of the process of selecting one proposal over another, whether or not one or more of the offerings are in the public domain.

- Limiting the consideration in choosing a technology to public domain offerings will potentially eliminate solutions which, in the overall picture, could provide the greatest benefit.

- Providing a platform for holders of IPR to propose their proprietary developments for use by the general community at fair and reasonable terms may bring technology into the open market that would otherwise be held only by the IPR developer with all of the benefits from the sale of that technology enuring exclusively to the IPR holder.

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[14] Vice-President Albert Gore's keynote address to the G7 meeting in Brussels, Belgium, discussing the Global Information Infrastructure, February 26,1995.

12.3.11.3 Establish Standard Identifiers

Standard nomenclatures and identifiers for channels/talk groups must be mandated by the FCC and NTIA for use on all equipment, to include approved identifiers to be displayed for interoperability channels/talk groups on equipment with varying numbers of characters in the channel/talk group display window.

It is recommended that manufacturers provide software that only permits FCC/NTIA approved identifiers to be programmed into radios for national interoperability channels/talkgroups.

12.3.11.4 National Calling Channel

A National Calling Channel" and one or more "Tactical Channels" must be established in **EACH** of the public safety frequency bands. Use of these channels should be similar to that currently designated in the NPSPAC plan (47 CFR 90.16 and 90.34).

The National Calling Channel in each band should:

- Be clear nationwide (ideally North America-wide as in the NPSPAC band) and restricted to this use.

- Be available for use by ANY public safety user at ANY level of government and should also be available for use by private companies which provide public safety services (such as a private ambulance company).

- Be used in the non-encrypted mode only.

- Be restricted to the use of clear text voice only. The use of 10-codes and other short-cuts may result in a garbled message.

- Be monitored by dispatch centers to allow "visiting" units needing to report an emergency or obtain emergency information a means of contacting a local agency. The use of a regional planning process to designate a "monitoring" agency in each area is desirable.

- Be limited to very short transmissions. For longer messages, participants should be instructed to change channels to one of the "National Tactical Channels" or some other channel for the exchange of information. This will allow the dispatch facility to routinely monitor only one channel which normally is quiet (i.e. dispatchers are less likely to mute the channel as a means off-loading extraneous radio traffic).

- Not be used by "visiting" units for non-emergency traffic. The "monitoring" agency should not be asked to be a "message center" for "visiting" units. Messages related to the reporting of emergencies by "visiting" units or

messages related to directing a "visiting" unit to respond to an emergency are appropriate. Messages related to administrative matters are not appropriate.

12.3.11.5 Tactical Channels

The Tactical Channels in each band should:

- Include a very limited number of channels (similar to the four channels provided in the NPSPAC band) to which visiting units might be instructed to change for the exchange of information. The number of channels should be limited as a matter equipage of the "visiting" mobile/portable unit (encouraging the equipping of all mobile/portable units with these channels---asking that all of the 100± "mutual aid" channels be "equipped" in each unit may be a negative factor.)

- Be clear nationwide and designated for this use.

- Be used for the lengthy exchange of information.

- Have a common nomenclature (reference .Section

- Be available for use by ALL public safety agencies at ALL levels of government and by those private companies performing a public safety service under contract to a government agency so long as the government agency holds the license. It may be desirable for repeater stations to be under the control of the "monitoring" agency and their use subject to assignment by the "monitoring" agency.

- Be restricted to "visiting" units with use by "local" units restricted to the need to communicate with "visiting" units. Agencies should not be allowed to use these channels for their own tactical operations within their jurisdiction (they should either obtain their own tactical channels for this function or, possibly, use one of the other 100± mutual aid channels being discussed.) However, agencies conducting tactical operations outside of their jurisdiction might be allowed to use these channels as a means of minimizing disruption to local agency operations. For instance, a dignitary protection unit covering a governor should operate on their own channels when the governor is within the state but might be allowed to use these "National Tactical Channels" when the governor is traveling outside the state.

- Be in the non-encrypted mode unless prior permission had been obtained from the "monitoring" agency. Encryption may be needed by the "visiting" unit for any number of reasons (for instance, the dignitary protection unit in the example above may need to operate in the encrypted mode to provide an appropriate level of security). It may be desirable for the "monitoring agency"

to establish a method by which the encrypted visiting user can be contacted (possibly by having the "visiting" unit scan the National Calling Channel).

As with other mutual aid frequencies, it is important to consider placement within each band. There have been significant problems when mutual aid channels have been placed side-by-side or next to other statewide or nationwide assignments due to adjacent channel interference which can render such channels unusable when operating within close proximity to each other.

Some of the Interagency Frequencies identified in Appendix B may be candidates for this use. However, many of these have already been designated for specific purposes in state and regional plans. Caution is urged; a great deal of research must be done prior to making any reassignment of the Interagency Frequencies.

12.3.11.6 Establish ICS (Incident Command System)

Appropriate regulatory agencies (including the Congress and state legislatures) must enact legislation requiring use of the Incident Command System for multi-agency incidents.

It is essential that plain voice and plain text be used, particularly for mutual aid interoperability.

A national method for certifying Communications Unit Leaders (CUL) must be developed and implemented. A trained CUL to manage communications at major incidents must be mandated.

Certification and regular training on the ICS must be mandated for all public safety field personnel.

12.3.12 REGULATORY ISSUES

12.3.12.1 Administration and Planning

The examination of incidents and deliberations within Working Group 3 have clearly shown that the implementation of interoperability, particularly for mutual aid operations, is now, and by its very nature must remain, a state/regional controlled function.

Most mutual aid planning is conducted at the state level. While the Federal Emergency Management Agency (FEMA) has significant responsibility at the national level to coordinate and provide for disaster response and relief, in any major incident the bulk of the response and responders are provided from state and local resources.

FEMA was specifically invited to participate in the deliberations of the PSWAC and chose not to participate. The lack of participation by FEMA is an indication to this Working Group that they are willing to abide by the decisions of the federal, state

and local government and various non-government participants who prepared and reviewed this effort.

Radio coverage plays a significant role in the development, operation and effectiveness of interoperability plans. Because radio waves do not recognize jurisdictional or political boundaries, it is critical that development of interoperability plans include those agencies, organizations and political entities which are within typical radio coverage areas, even if those involve multiple states.

The federal agencies are not restricted by state boundaries. However, a significant amount of their interoperability communications requirements, and virtually all of that requirement with state/local government entities, takes place on a state or regional basis. This is particularly true for day-to-day federal/state/local and for task-force interoperability. There is, however, the need for some spectrum to be reserved specifically for federal agency interoperability.

There is clearly a need for a number of radio frequencies to be assigned on a national basis for use as previously described in Section 12.3.11.

It is strongly recommended that these frequencies to be administered on a national basis by an organization established for that purpose whose membership, while limited to the fewest numbers possible, is representative of the broad user categories at the federal, state and local governmental level, with advisory participation, as deemed appropriate, by non-governmental organizations which provide support services to government.

The designation of these national interoperability frequencies must take place in conjunction with the designation of all recommended interoperability frequencies and the general ground rules for their implementation, operation and administration needs to be in place prior to state/regional groups developing plans to implement and administer the remaining interoperability frequencies.

12.3.12.2 Specific Regulatory Changes

It is critical that the FCC and NTIA rapidly initiate the regulatory changes to support the interoperability platform described in this report. In particular, the changes to support the following interoperability provisions need to be provided:

Interoperability Communication Plans (ICPs) shall be established at the State and/or multi-state Regional level (where radio coverage and significant local demographics include more than one state), so that operational procedures can be developed which meet local needs as well as provide the nationwide uniformity of use required to ensure that resources from distant jurisdictions can effectively and efficiently participate in mutual aid events. Examples of multi-state regional areas include the New York City, Chicago and Washington, DC greater metropolitan areas.

In order to establish general uniformity of use, regulations should he established by the FCC and NTIA to formally certify State or Regional Interoperability Communications Planning Organizations and their areas of jurisdiction. These Planning Organizations shall each be charged with developing an ICP which establishes, in accordance with FCC/NTIA regulations, the operational procedures for use of each of the FCC/NTIA designated interoperability links, and such other links as may be deemed appropriate within that state/region. Regional ICPs shall coordinate with State ICPs. Each State or Regional ICP shall include within its plan organizational rules of procedure, which shall include the eligibility criteria and method by which members of the organization are installed so as to maintain an approximately even balance amongst the user service categories of Criminal Justice (including, corrections, courts and law enforcement), Emergency Medical, Fire, and General Government, and include federal, state, and local government representation. Each Planning Organization shall include liaison with the Public Service sector. Members of each such State or Regional Planning Organization shall be reported to the FCC/NTIA and be formally acknowledged. A mechanism shall be established by FCC/NTIA to reimburse the reasonable operating expenses of these Planning Organizations. Adjacent Planning Organizations shall coordinate with each other. At least one meeting of all Planning Organizations shall be held each year, coincident with a meeting of a national organization representative of the eligibles, for the purpose of coordination, discussion and recommendation for correction of any relevant issues.

Regulations should be established by the FCC and NTIA, assigning the specific interoperability frequencies and, where a frequency's use is service dependent, stipulate the relevant condition and eligibility criteria. Except for the National Calling Channels, the regulations should permit state/regional ICPs to allow for temporary exception to the normal use of a link when exigent circumstances indicate such a need.

Fixed base stations operating on ICP frequencies shall only be licensed to state and federal governmental entities, conditioned upon operation in accordance with the appropriate ICP. Other governmental and public service entities may own and/or operate such equipment for the purposes and uses identified in the FCC/NTIA Regulations and the appropriate ICP. The ICP shall require such other entities to discharge the licensee's responsibilities under FCC/NTIA regulations for fixed station operation, maintenance, and record keeping as appropriate, by the use of a written agreement.

Mobile and Control Stations may be used by public safety eligibles, either under a formal license, or without licensing by the FCC or NTIA as long as the equipment is type accepted for use on the intended interoperability links, and is operated in full conformance with FCC/NTIA regulations and the applicable ICP. Public service mobiles may be operated on appropriate interoperability links by written agreement with the licensed state entity, in full conformance with the FCC/NTIA regulations and as provided in the appropriate ICP.

12.3.12.3 Summary of FCC-Related Issues

- Need to provide for joint licensing with federal agencies.
- Reallocation of 220-222 MHz for USART use.

12.3.12.4 Summary of NTIA-Related Issues

- Need to provide for joint, co-equal assignments with state/local agencies.
- Recommendation to implement sufficient interoperability frequencies in the 402-420 MHz band to support federal agency requirements.

12.4 Working Group #4 Report (Define Public Safety/Public Service)

Working Group #4 was assigned the difficult task to develop a definition of Public Safety/Public Services. The product of this group's work is reflected in Section 3.1 of this report. The definitions were approved by the Steering Committee on December 15, 1995.

12.5 Working Group #5 Report (Identify Existing Interoperability Requirements)

Working Group #5 was formed to identify the existing interoperability requirements within the public safety community. This working group worked closely with Working Group #3 in identifying the inventory reflected in Section 5 of this report.
Section 6 is the product of this working group's endeavors.

12.6 Working Group #6 Report (Develop DRAFT ISC Report)

Working Group #6 was established to develop the DRAFT Report for the Interoperability Subcommittee. This group worked closely with and then merged with Working Group #2. The entire report is the product of this working group's work.

12.7 Working Group #7 Report (Provide Cost/Benefit Analyses)

There is no report available from Working Group #8 at this time, due to the time constraints of this report. Working Group #8 will likely submit a supplemental report which will be reflected in Section 8 of this report.

12.8 Working Group #8 Report (Address Regulatory Issues/Mandates)

12.8.1 Purpose

Working Group #8 was assigned the task of identifying and recommending changes to statutes or regulations that would facilitate interoperability. The focus of the working group was to be on more fundamental changes. For example, a recommendation by the ISC that a

specific frequency be used as an interoperability channel would require a change in FCC regulations. However, such a change lies in the day to day activities of the FCC and requires no special analysis.

12.8.2 Federal/Local Coordination

A repeated theme in discussions at the ISC were problems with coordination and Interoperability between federal and local officials. These problems appear, in significant part, to flow from or be exacerbated by the split in spectrum authority under the Communications Act between the president and the FCC.

Typically, a local user operating on a federal frequency is given secondary status — which puts their investment at additional risk. Similarly, federal users are restricted from being authorized to operate on FCC controlled frequencies except for limited communications with FCC licensees.

Consider a hypothetical example which illustrates elements of this problem. Suppose that a large western state builds a statewide mobile system. Some federal law enforcement agencies could (technically speaking) operate on this system and forego the expense of building their own statewide infrastructure. Clearly, interoperation between such federal users and local users using the statewide system would be greatly facilitated in these circumstances. However, under current rules, the state authorities cannot accept federal agencies as "tenants" on such systems.

The essence of the problem is that public safety radio is supported by two pools of spectrum, one controlled by the FCC and the other controlled by the NTIA. Historically these areas of spectrum were managed separately. But, the separate policies have inadvertently resulted in barriers to the efficient operation of shared systems and in barriers to Interoperability. These problems become more acute as technology improves, radio communications become more essential and large scale systems are used to gain efficiencies.

12.8.3 Shared Systems

Shared systems (i.e., large trunked systems which provide service to many governmental entities in a specific geographic area) offer a high level of built-in interoperability. They also offer greater spectrum efficiency than many smaller non-trunked systems or systems trunked on fewer channels. However, shared systems face difficulties which hinder their adoption. Probably the most significant difficulty of shared systems is that they require individual agencies to surrender some autonomy in return for the efficiencies and better coverage of the larger system.

The FCC could implement policies which facilitated the adoption of shared systems. For example, the FCC could require a showing (or statement) on license applications that no shared system can meet the agency's needs. The FCC could also implement policies which help preserve the autonomy of individual agencies and hence lower the threshold for adoption. For example, the FCC could adopt a policy that said that all communications involving safety-

of-life were to be carried at equal priorities. Thus, a "tenant" on a shared system would not need to fear that the "landlord" would get superior access to channels in a crunch time.

12.8.4 Commercial Systems

The discussions in the ISC identified significant shortcomings of the ability of commercial systems ability to meet public safety needs. The FCC could adopt policies that would remove some such shortcomings. However, many of these shortcomings flow from market forces and are not readily susceptible to regulatory cures. One such policy, which would reduce problems with access to commercial systems during times of peak usage, would be rules that provided for priority access to commercial systems by public safety users.

12.8.5 Recommendations

The FCC and NTIA should establish a task force to identify policies that would facilitate joint use of spectrum by federal and non-federal government users. This task force should also consider policies needed to facilitate the creation of shared systems that support both federal government and non-federal users.

The FCC should consider implementing incentives that facilitate the adoption and use of shared systems for public safety communications.

The FCC should adopt rules that make commercial systems more responsive to public safety needs. Most importantly, the FCC should require commercial systems to offer a priority access option to public safety users.

12.9 Working Group #9 Report (Address Commercial Services Access/Availability)

12.9.1 Introduction

This report describes the role commercial wireless services can play in public safety to compliment and interoperate with existing services, and public safety issues that impact the acceptance and proper use of commercial wireless services in that environment.

Commercial services can augment day-to-day, mutual aid and task force communications interoperability beyond use of private land mobile radio technology. In particular, administrative and logistical types of traffic can find uses within commercial services.

Public Safety Agencies can relieve some traffic congestion on crowded radio channels by allowing that appropriate traffic to be handled by commercial providers with commercial-off-the-shelf (COTS) equipment and services.

Primary public safety systems can use commercial wireless services to provide critical backup networks based on different technologies. Reliance on multiple backup technologies is important should a single source of failure affect undifferentiated private systems.

Commercial services can be used on an "as needed" basis. The technology and services can be easily acquired and used for optimum efficiency when specific needs arise. Overhead associated with ownership and ongoing maintenance of underlying infrastructure is eliminated.

Wireless commercial services are growing dramatically. For example, mobile data networks are expected to grow at an annual rate of over 38% per year, with the number of users increasing from 300,000 in 1993 to over 1,400,000 users in 1998. That rate of growth will result in lower costs and improved service, and will make commercial options in data communications increasingly attractive in the future.

12.9.2 Background

Working Group #9 was established to address Access and Availability of Commercial Services. The co-chairs of Working Group 9 established group leaders to address:

- Commercial capabilities by technology

  - Satellite
  - Paging
  - Cellular
  - PCS
  - SMR/ESMR

- Commercial applications in public safety

  - Public safety awareness of commercial wireless services
  - Commercial interoperability approaches

12.9.2.1 Public safety issues regarding the use of commercial wireless services

Commercial providers were encouraged to contribute individually and/or in conjunction with trade associations.

Input was provided in approximately 60 documents including:

- White papers
- Surveys
- Studies
- Articles

12.9.3 Possible Commercial Wireless Services Role in Public Safety

Studies show increasing interference and congestion on existing telecommunication systems used by public service organizations[15].

12.9.3.1 A Major Incident Review

12.9.3.1.1 Overview

Air Florida Flight 90 Crash

The Interoperability Subcommittee of the Public Safety Wireless Advisory Committee (PSWAC) prepared a case study of the crash of Air Florida Flight 90 on January 13, 1982 (see document # 96-04-024/2). The purpose of the case study was to identify the communications interoperability problems that occurred and determine what interoperability problems still exist today and finally, make recommendations to satisfy the existing and future interoperability needs should a similar incident occur again. This includes what role commercial wireless service providers' offerings might have played in the management of the numerous public safety efforts required to manage the incident. This contribution will identify the technological capabilities of existing cellular, paging and the emerging PCS systems in the United States.

This particular study focuses on the Air Florida airplane crash that took place on the Fourteenth Street Bridge in Washington, DC, over fourteen years ago.

According to the case study, the first notifications of the Air Florida crash were from a commuter using a mobile telephone, and separately, from the Washington National Airport over the Washington Area Warning and Alerting System, a wireline network sponsored by FEMA.

Although agencies were alerted in both instances, there was no central plan in place at the time. No one knew what agencies had received the alert, and were responding.

Today, a Mutual Aid Plan (MAP) is in place that provides an Incident Command Structure (ICS) for respondents.

Although the ICS provides a plan for command/control, there is insufficient communications capabilities to properly implement the plan to its fullest extent when an incident occurs.

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[15] Reference ISC WG 9048, Maryland Law Enforcement Telecommunications Interoperability Analysis, Focused Research International, Inc., pgs.20 & 21, ISC 96-04-02412, Metropolitan Washington Area Interoperability , Case Study