

Service (SERS). Commenter has/is serving as a voluntary frequency/CTCSS/DCS GMRS coordinator for the Washington, D.C. Metropolitan area. It is with having the above extensive expertise in dealing with personal, business, medical and emergency/public assistance communications matters that this Commenter is qualified to make the following Comments.

### III.

### COMMENTS

6. Pursuant to the PSWAC Charter, the scope of activity and objectives of this Committee is to “provide advise and recommendations to the Chairman, Federal Communications Commission (FCC) and the Administrator, National Telecommunications and Information Administration (NTIA) on operational, technical, and spectrum requirements of Federal, state, and local public safety entities through the year 2010.”<sup>2/</sup> It is to further “[a]dvise the NTIA and FCC on options to provide for greater interoperability among Federal, State, and local public safety entities.”<sup>3/</sup>

7. On December 15, 1995, the PSWAC Steering Committee approved the ISC document entitled “Definition of Public Safety/Public Services”.<sup>4/</sup> In defining Public Safety/Public Services, the ISC has restricted the definition of Public Safety Services to those services only “rendered by or through Federal, State, or Local government entities” (Emphasis added) and Public Safety Services Provider/Support Provider to only those entities that are “properly authorized by the appropriate (Public Safety) governmental authority”<sup>5/</sup> (Emphasis added). These restrictive definitions fail to take into account recent Commission proceedings that further define Public Safety Services/Support Providers as those provided by entities not related to or requiring Public-Safety governmental authority authorization.

8. The issue of defining who is a “public safety authority”<sup>6/</sup> or public “safety-of-life” entity<sup>7/</sup> has been debated within Commission proceedings since 1987. It began with GN Docket No. 87-112 and has recently been concluded with the adoption of the Emergency Medical Radio Service (EMRS) Memorandum Opinion and Order in PR Docket No. 91-72 (EMRS M,O&O) on January 18, 1996.

9. Shortly after the adoption of the Report and Order in GN Docket Nos. 84-1231, 84-1233, and 84-1234<sup>8/</sup> which allocated the 821-824/866-869 MHz bands to Public Safety, the Commission adopted a Notice of Proposed Rule Making, GN Docket No. 87-112, to establish

service rules and technical standards for the use of these newly allocated bands (821 MHz Notice). In the 821 MHz Notice, the Commission proposed to define “public safety authorities” as being those entities licensed in the Public Safety Radio Services (PSRS) under 47 CFR Part 90, Subpart B and SERS under 47 CFR Part 90, Subpart C. After the extensive review of comments and replies regarding this issue, the Commission concluded that their proposed defining of “public safety authorities” as meaning PSRS and SERS eligibles was correct, sighting that PSRS and SERS are “both involved with public safety”, and issued the Report and Order in GN Docket No. 87-112 (821 MHz Order) adopting this definition.<sup>9/</sup>

10. Also in 1987, the Commission adopted a Notice of Proposed Rule Making, GN Docket No. 87-14, to reallocate the 220-222 MHz band from secondary ARS to primary narrowband commercial and public safety use.<sup>10/</sup> Shortly after the adoption of the Report and Order in GN Docket No. 87-14 reallocating this band<sup>11/</sup>, the Commission adopted a Notice of Proposed Rule Making, PR Docket No. 89-552, to provide for the use of this new band.<sup>12/</sup>

11. In the Report and Order to GN Docket No. 89-552, the Commission adopted a band plan for 220-222 MHz which included a 10 channel Public Safety/Mutual Aid set aside, but allowing only those public safety entities eligible under 47 CFR Part 90, Subpart B access to these frequencies.<sup>13/</sup> In response to a Petition for Reconsideration questioning the exclusion of select 47 CFR Part 90, Subpart C SERS eligibles from these new 220-222 MHz Public Safety/Mutual Aid channels<sup>14/</sup> (220 MHz Reconsideration), the Commission adopted a Memorandum Opinion and Order in PR Docket No. 89-552<sup>15/</sup> (220 MHz M,O&O) electing to defer this issue to a then recently enacted Notice of Proposed Rule Making, PR Docket No. 91-72, to create a new EMRS.<sup>16/</sup>

12. Upon adoption of the Report and Order in PR Docket No. 91-72 (EMRS Order), the Commission inadvertently omitted addressing the deferred 220 MHz Reconsideration issue, as noted in paragraph 11 *supra*, as stated would be done pursuant to the 220 MHz M,O&O. Upon release of the EMRS Order, a further Petition for Reconsideration<sup>17/</sup> (EMRS Reconsideration) was filed again raising the same issue addressed in the 220 MHz Reconsideration.

13. In comments filed in response to the EMRS Reconsideration, the International Municipal Signal Association/International Association of Fire Chiefs, Inc. (IMSA/IAFC) claimed that the purpose of the EMRS proceeding was to “disentangle emergency medical

communications from other SERS eligibles”, to “provide “Public Safety” recognition to this user community in recognition of its function and communications needs,” and to apparently “cure” a definable injustice to EMRS (47 CFR Part 90, Subpart B) eligibles.<sup>18/</sup> Upon adopting the EMRS Order, it was perceived that the Commission had appropriately redefined Public Safety authorities/safety-of-life eligibles as 47 CFR Part 90, Subpart B entities only and essentially deleting all non-EMRS SERS (47 CFR Part 90, Subpart C) entities from 821 MHz Order definition.

14. In reply to IMSA/IAFC’s comments, this Commenter presented substantiative supportive arguments that non-EMRS eligible SERS entities, under 47 CFR Part 90 Subpart C [§§ 90.35 (physicians/hospitals), 90.37 (rescue organizations), 90.41 (disaster relief organizations), and 90.45 (beach patrols)], during emergencies and disasters do “perform the exact function and have interoperability communications needs equal to their EMRS counterparts.”<sup>19/</sup> In the EARS M,O&O, the Commission agreed with this Commenter’s assertions and appropriately amended 47 CFR 90.720 to reflect their inclusion because of the correct assessment that it would “serve the public interest by enhancing interoperability between many types of emergency providers in safety-of-life situations.”<sup>20/</sup>

#### IV.

#### CONCLUSION

15. With adoption of the EMRS M,O&O, the Commission has essentially refined the 821 MHz Order definition of Public Safety authorities/safety-of-life entities to now mean those eligible under 47 CFR Part 90 Subpart B (PSRS) and Subpart C (SERS under §§ 90.35, 90.37, 90.41 and 90.45). Nowhere in the Commission’s rules is it required that these entities be properly authorized by an appropriate governmental authority, whose primary mission is in providing public safety services, prior to performing their duties.

16. The PSWAC ISC definition of Public Safety Services is too restrictive. It fails to recognize that Public Safety/Safety-of-Life services are provided by entities not related to, or requiring prior specific authorization from, a governmental authority whose primary mission is in providing public safety services.

17. The PSWAC ISC definition also goes counter to the PSWAC Charter. The PSWAC Charter mandates the maximizing of interoperability between Federal, state, and local public safety entities. By defining Public Safety Services/Providers as those only related to

or authorized by a Public Safety governmental entity, interoperability communications becomes significantly restricted, hampers the prompt rendition and delivery of medical/emergency services and is therefore not in the public interest.

18. It is strongly recommended that the PSWAC ISC definition be modified to better conform with the PSWAC Charter and the Commission's definition of who constitutes a Public Safety/Safety-of-Life authority/entity by the removal from the definitions any reference to the requirement that such entities be "properly authorized by the appropriate governmental authority" whose primary mission is providing/to support public safety services (Attachment B). Only in this manner can the

PSWAC Charter mandate of maximizing interoperability communications between the many types of emergency providers in safety-of-life situations be achieved.

Respectfully submitted,

Dr. Michael C. Trahos, D.O., NCE, CET

**FOOTNOTES**

- 1/ DEFINITION OF PUBLIC SAFETY/PUBLIC SERVICES, PSWAC/ISC 95-12-051/3 12/14/95, ISC revised and approved 12/14/95, Steering Committee approved 12/15/95.
- 2/ CHARTER, Public Safety Wireless Advisory Committee, June 26, 1995, Section B.
- 3/ Ibid.
- 4/ DEFINITION OF PUBLIC SAFETY/PUBLIC SERVICES, PSWAC/ISC 95-12-051/3, December 14, 1995.
- 5/ Ibid.
- 6/ NOTICE OF PROPOSED RULE MAKING, GN Docket No. 87-112, 2 FCC Rcd at 2869, at paragraph 6.
- 7/ MEMORANDUM OPINION AND ORDER, PR Docket No. 91-72, FCC 96-11, at paragraph 19.
- 8/ REPORT AND ORDER, GN Docket Nos. 84-1231, 84-1233 & 84-1234, 2 FCC Rcd 1825 (1986).
- 9/ REPORT AND ORDER, GN Docket No. 87-112, FCC 87-359, at paragraphs 12 and 13.
- 10/ NOTICE OF PROPOSED RULE MAKING, GN Docket No. 87-14, FCC 87-45, at paragraph 10.
- 11/ REPORT AND ORDER, GN Docket No. 87-14, FCC 88-266, at paragraph 43.
- 12/ NOTICE OF PROPOSED RULE MAKING, PR Docket 89-552, FCC 89-327, in general.
- 13/ REPORT AND ORDER, PR Docket No. 89-552, FCC 91-74, at paragraph 24 - 28.
- 14/ PETITION FOR RECONSIDERATION, PR Docket No. 89-552, Dr. Michael S. Trahos, May 15, 1991; PUBLIC NOTICE, Report No. 1848, June 5, 1991.
- 15/ MEMORANDUM OPINION AND ORDER, PR Docket No. 89-552, FCC 92-261, at paragraph 38.

- <sup>16/</sup> NOTICE OR PROPOSED RULE MAKING, PR Docket No. 91-72, 6 FCC Rcd 2017 (1991).
- <sup>17/</sup> PETITION FOR RECONSIDERATION, PR Docket No. 91-72, Dr. Michael C. Trahos, April 2, 1993; PUBLIC NOTICE, Report No. 1936, April 27, 1993.
- <sup>18/</sup> REPLY, PR Docket No. 91-72, IMSA/IAFC, June 4, 1993, at page 16.
- <sup>19/</sup> REPLY COMMENTS, PR Docket No. 91-71, Dr. Michael C. Trahos, June 14, 1993.
- <sup>20/</sup> MEMORANDUM OPINION AND ORDER, PR Docket No. 91-72, FCC 96-11, at paragraph 23.

VI.

ATTACHMENT A

PSWAC/ISC 95-12-051/3 (12/14/95)  
Revised and approved by ISC (12/14/95)  
Approved by Steering Committee (12/15/95)

**DEFINITION OF PUBLIC SAFETY/PUBLIC SERVICES**

**Public Safety:** The public's right, exercised through Federal, State or Local government as prescribed by law, to protect and preserve life, property, and natural resources and to serve the public welfare.

**Public Safety Services:** Those services rendered by or through Federal, State, or Local government entities in support of public safety duties.

**Public Safety Services Provider:** Governmental and public entities or those non-governmental, private organizations, which are properly authorized by the appropriate governmental authority whose primary mission is providing public safety services.

**Public Safety Support Provider:** Governmental and public entities or those non-governmental, private organizations which provide essential public services that are properly authorized by the appropriate governmental authority whose mission is to support public safety services. This support may be provided either directly to the public or in support of public safety services providers.

**Public Services:** Those services provided by non-public safety entities that furnish, maintain, and protect the nation's basic infrastructures which are required to promote the public's safety and welfare.

VII.

**ATTACHMENT B**  
**PROPOSED****DEFINITION OF PUBLIC SAFETY/PUBLIC SERVICES**

**Public Safety:** The public's right, exercised through Federal, State or Local government as prescribed by law, to protect and preserve life, property, and natural resources and to serve the public welfare.

**Public Safety Services:** Those services tendered by or through Federal, State, or Local entities in support of public safety duties.

**Public Safety Services Provider:** Governmental and public entities or those non-governmental, private individuals or organizations, which are providing public services.

**Public Safety Support Provider:** Governmental and public entities or those non-governmental, private individuals or organizations which provide essential public services to support public safety services. This support may be provided either directly to the public or in support of public safety services providers.

**Public Services:** Those services provided by non-public safety entities that furnish, maintain, and protect the nation's basic infrastructure which are required to promote the public's safety and welfare.

## VIII.

**ATTACHMENT C**  
**CHARTER****A. Committee's Official Designation**

Public Safety Wireless Advisory Committee.

The establishment of this Committee is in response to the provisions of Title VI of the Omnibus Budget Reconciliation Act of 1993 and, more specifically, to reflect the desires of the House Appropriations Committee's Subcommittee on Commerce, Justice, and State, the Judiciary and Related Agencies that the FCC and NTIA coordinate closely with the public safety community in planning for future spectrum needs.

**B. Committee's Objectives and Scope of Activity**

The function of the Advisory Committee is to provide advice and recommendations to the Chairman, Federal Communications Commission (FCC) and the Administrator, National Telecommunications and Information Administration (NTIA) on operational, technical, and spectrum requirements of Federal, state, and local public safety entities through the year 2010. In addition, it will serve to advise the FCC and NTIA of opportunities for improved spectrum utilization and efficiency and facilitate a negotiated rulemaking at the FCC regarding public safety spectrum, and the development and implementation of plans at NTIA regarding Federal public safety spectrum policy. Membership for the Committee will be solicited from public safety organizations, entities and manufacturers and members will serve as representatives of organizations and not as experts serving in an individual capacity. The Advisory Committee will:

- Advise the FCC and NTIA of specific operational wireless needs of the community including improvement of basic voice, data and E911 services, and the implementation of new wide-area, broadband telecommunications technologies for transmission of mugshots, fingerprints, video, and other high speed data.
- Advise the NTIA and FCC on options to provide for greater interoperability among Federal, state, and local public safety entities.
- Advise the FCC and NTIA on options to accommodate growth of basic and emerging services, including bandwidth vs. functional requirement trade-offs, technical options, and other options.
- Advise the NTIA and FCC on the total spectrum requirements for the operational needs referred to above including frequency band options, shared/joint spectrum use options, and other options.

C. Period of Time Necessary for the Committee to Carry Out its Purposes

The Committee will submit a report to the FCC and NTIA within the scope outlined in Part B above within 12 months of the first formal meeting. All business of the Committee will be completed within a two-year period.

D. Officials to Whom the Committee Resorts

Chairman, FCC  
Administrator, NTIA

E. Agencies Responsible for Providing Necessary Support to the Committee

The Federal Communications Commission

The National Telecommunications and Information Administration

F. Description of Duties for Which Committee is Responsible

The duties of the Committee will be to gather information and prepare technical analyses and recommendations concerning the matters listed in Part B above and provide them to the FCC and NTIA. The committee will function solely as an advisory body under the Federal Advisory Committee Act, 5 U.S.C. App2.

G. Estimated Annual Operating Costs in FTEs and Dollar

The estimated annual staff time is two FTEs for FCC and two FTEs for NTIA. The estimated annual operating costs for support services provided to the Committee are \$25,000.00, to be shared equally by NTIA and FCC.

H. Estimated Number and Frequency of Meetings

The Committee is expected to meet at least two times per year, and at such other intervals as the Committee decides.

I. Termination Date

The Committee would terminate no later than June 26, 1997.

J. Date Charter is Filed

June 26, 1995.

ATTACHMENT 3

PSWAC/ISC 95-10-030/2

**Public Safety  
Wireless Advisory Committee**

**Interoperability  
Subcommittee**

**Interoperability  
White Paper**

11 December, 1995

ericssonz

## **Introduction**

The Public Safety Wireless Advisory Committee (PSWAC) was formed on July 28, 1995, "to provide advice and recommendations to the Chairman, Federal Communications Commission (FCC) and the Administrator, National Telecommunications and Information Administration (NTIA) on operational, technical, and spectrum requirements of Federal, state, and local public safety entities through the year 2010. In addition, it will serve to advise the FCC and NTIA of opportunities for improved spectrum utilization and efficiency and facilitate a negotiated rulemaking at the FCC regarding public safety spectrum, and the development and implementation of plans at NTIA regarding Federal public safety spectrum policy."<sup>1</sup> A key activity of PSWAC is to "advise the NTIA and FCC on options to provide for greater interoperability among Federal, state, and local public safety entities."<sup>1</sup>

Indeed, interoperability is a formidable problem. It is a problem that is often associated with risk of life during natural disasters and national emergencies. The loss of a single life resulting from two different public safety agencies' communications equipment inability to communicate is unacceptable! However, equally unacceptable is selecting an interoperability solution that cannot be implemented because it ignores practical considerations such as affordability.

The vast cornucopia of user needs and potential technological solutions quickly becomes overwhelming. The objective of this white paper is to review the fundamental user requirements for interoperability, identify candidate technical solutions, and recommend solutions that satisfy user needs for interoperability.

## **Interoperability Definition**

James E. Downes, Department of Treasury, chairman of the Interoperability Subcommittee provided two definitions of interoperability from the Federal Law Enforcement Wireless Users Group (FLEWUG) and FED-STD-1037B.<sup>2</sup> For the purpose of this white paper the following definitions are provided:

**Interoperability** - The ability of two or more public safety communications systems to interact with one another and exchange information according to a prescribed manner in order to achieve predictable results.

**Public Safety** - Individuals in Federal and non-Federal public safety agencies "generally made up of law enforcement/police services, fire and rescue services, emergency medical services, and emergency management services."

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<sup>1</sup> Charter Section of Handout at Public Safety Wireless Advisory Committee Round Table in Washington, DC on July 28, 1995

<sup>2</sup> PSWAC/ISC 95-09-003 dated September 28, 1995

### Interoperability Missions

John Powell, representing the Association of Public Safety Communications Officials (APCO), described three types of public safety interoperability to AFCEA on September 19, 1995. (See Appendix A.) APCO's three types of public safety interoperability missions and examples are summarized in the following table:

Mission	Mutual Aid	Day-to-Day	Task Force
<b>Definition (Requirements)</b>	Involves many agencies Little planning Small tactical talk groups Many incidents out of infrastructure coverage	Areas of concurrent jurisdiction Routine traffic Minimize dispatcher-to-dispatcher interaction	Layers of government (federal, state & local) Prior planning • Covert • Short range Roaming in and out of infrastructure coverage
<b>Examples</b>	Oklahoma City Amtrak Crash • Air Florida Crash • Hurricane Hugo • Wildland Fires • Polly Klaas	Polly Klaas  Urban Automobile Accident involving Police, Fire & EMS	Waco, Texas • World Leader Visit

It should be noted that John Powell's conclusion that "infrastructure based interoperability is not efficient because it makes continuous use of an extra RF channel by each participant on a different band or system"<sup>3</sup> is incorrect. Powell's argument contains two fallacies: 1) unless the two agencies of concurrent jurisdiction have a shared system (identical operating frequencies), an additional channel with the associated base station equipment is always required to provide interoperability, and 2) in the 866-869 MHz NSPSAC channels, agencies that are geographically adjacent are rarely (if ever) given the same frequency. Thus, different/additional frequencies are always required. The situation is also the same even when two agencies operate on systems that have identical protocols.

In order to ensure interoperability during a natural disaster, the following categories of radio users should be included:

1. **Military** - Military forces shall be considered a public safety agency when they assist state and local governments with emergency management activities related to natural disasters or during periods of civil unrest.
2. **Utility Companies** - Certain utility companies require interoperability with public safety agencies especially during natural disasters or during periods of civil unrest when gas lines, water lines, or electrical distribution pose a threat to the life and safety of individuals.

<sup>3</sup> Handout at September 19, 1995 AFCEA presentation.

3. **Special Mobile Radio Services (SMRS)** - Government agencies may mandate the use of SMRS resources during natural disasters to provide radio services and coverage in situations where otherwise the public safety communications infrastructure is jeopardized.
4. **Third Party Provided Services** - Some public safety users pay a third party for the communications services and therefore the communications system is not licensed in a public safety band. Consideration should be given to spectrum policy issues for these users.
5. **Others** - Interoperability with civil defense, railroads, flood control, public transportation, and district attorney offices should be an important consideration.

It should be noted that not all agencies have the same interoperability needs. For example, it is highly unlikely that volunteer firemen would be involved in many of the task force scenarios. However, the few task force scenarios that might involve volunteer firemen would have different interoperability requirements than a mutual aid scenario. An example of this is the Oklahoma City bombing disaster. Appendix C contains some excerpts of recent APCO Bulletin articles on the Oklahoma City bombing disaster. It suggests that communications architecture resembled a military-style hierarchy of communications links as represented in Figure 2.

The communications link between "Command & Control" and the first line of group leaders is separate from each agency's group communications link. In fact, separation of communication links is highly desirable because the vital "Command & Control" communications link would not want to be busy with group traffic. Capacity of any conventional communications link has a practical limit of approximately 50 users. Disaster relief also involves the Federal Emergency Management Agency (FEMA), whose role is to provide federal assistance and resources to state and local efforts.<sup>4</sup>

While some of these agencies are considered to be part of "public service" (instead of "public safety"), they are still critical user agencies who are called on during an emergency situation, and who require interoperability.

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<sup>4</sup> Federal Response Plan (For Public Law 93-288, as Amended), Basic Plan Paragraph II. A. 1. Page 4

Figure 2  
Command & Control Hierarchy  
Oklahoma City Example

**NOTE:** *The electronic version of this figure was unavailable at the time this report was prepared. Readers can find the full text of this figure in FCC WT Docket No. 96-86.*

It should be noted that there is a distinction between interoperability and interconnectivity: "Interoperability allows diverse systems operating on different frequencies to communicate with each other so users do not have to account for differences in products or services. Interoperability implies compatibility among systems at specified levels of interaction, including physical. This compatibility is achieved through specifications for the interfaces between systems."<sup>5</sup> Interconnectivity is the technology required to provide interoperability; however, interoperability has many issues beyond technical interconnection.

**Interoperability Today**

John Powell's interoperability presentation to AFCEA on September 19, 1995 (see Appendix A), also describes today's solutions to interoperability. Solutions to the three types of public safety interoperability missions are summarized in the following table:

Mission	Mutual Aid	Day-to-Day	Task Force
<b>Definition (Requirements)</b>	Involves many agencies Little planning Small tactical talk groups Many incidents out of infrastructure coverage	Areas of concurrent jurisdiction Routine traffic Minimize dispatcher-to-dispatcher interaction	Layers of government (federal, state & local) Prior planning • Covert • Short range Roaming in and out of infrastructure coverage
<b>Examples</b>	Oklahoma City Amtrak Crash • Air Florida Crash • Hurricane Hugo • Wildland Fires • Polly Klaas	Polly Klaas  Urban Automobile Accident involving Police, Fire & EMS	Waco, Texas World Leader Visit
<b>Today's Solution</b>	Portable-to-Portable Direct Talk	Multiple Radios for Different Bands Difficult Infrastructure Gateways	Portable-to-Portable Hand Out Unique Radio Equipment

<sup>5</sup> "In Pursuit of an Optimum: A Conceptual Model for Examining Public Sector Policy Support of Interoperability," Lori Annette Perine, National Institute of Standards and Technology, August 1995.

For the mutual-aid scenario, a portable-to-portable direct-talk solution is entirely acceptable. The problem is that public safety communications operate on different, rather than contiguous frequency bands. Therefore, there is no guarantee that two different public safety agencies operate on the same frequency channels; this prohibits mutual aid operation. For the day-to-day scenario, the lack of common operating frequencies and incompatible communications infrastructure is solved by either 1) carrying multiple radios that are compatible with all the communications equipment in the jurisdiction of interest, or 2) provide "gateways" based on common channels to the communications infrastructure. For the task force scenario, unique covert requirements are provided by handing out unique radios.

The Polly Klaas case was used as an example of John Powell's "Day-to-Day" public safety interoperability mission. John Powell defines the "Day-to-Day" interoperability mission as "areas of concurrent jurisdiction" while the Polly Klaas case clearly illustrates the failure of two *adjacent* counties to interoperate. A better example of interoperability in areas of concurrent jurisdiction would be an automobile accident where police, fire, and EMS agencies respond jointly. Interoperability in areas of concurrent jurisdiction is typically solved by the different agencies operating on a shared public safety radio system. The movement from agency specific conventional systems to shared trunked systems is prevalent today. For example, in Manatee, Florida, 30-40 public safety agencies operate on one system. Thus, the Polly Klaas example is more suitably classified under a Mutual Aid mission.

The real tragedy in the Polly Klaas case in terms of radio equipment was that the technology allowed the systems to interoperate between adjacent counties, however, interoperation was not part of routine procedures. Through the use of infrastructure gateways, different radio systems could have communicated. The point should be made that while technology is available for communication between dissimilar systems, not all agencies will want to interoperate. Stated another way, if a new common mutual aid channel is available in all new public safety radios, an agency may choose not to scan and monitor the new mutual aid channel. This amplifies a possible scenario in which new common mutual aid channels become available for new public safety radios. Following this logic, if an agency chooses not to scan and monitor the new mutual aid channel, then interoperability will not be achieved. Therefore, a mandated interoperability solution is impractical due to the diverse operations of public safety users.

### **User Requirements**

The system must provide for interoperability of communications between local, state and federal public safety agencies.

"Interoperability" is defined as the ability of two or more public safety communications systems to interact with one another and exchange information according to a prescribed manner in order to achieve predictable results.

The system must provide interoperability to licensees with minimal cost impact. The interoperability benefit of a solution must be balanced with the cost of implementation.

1. All radios must be capable of accessing current mutual aid channels designated within its frequency band of operation.

The imbedded base of equipment must be capable of interfacing with any newly-developed interoperability solution. Maximum reuse of existing equipment is critical because it speeds the realization of true interoperability and protects existing public safety investments.

Any interoperability solution must have a migration plan to meet all applicable FCC and NTIA rules and regulations.

2. Mobiles and portables must be able to communicate even when operating outside existing infrastructure.
3. Any advanced technology chosen for an interoperability solution should be public domain in order to allow multi-source, competitive procurements.

The primary control of the systems should remain with each distinct licensee.

Equipment size should be less than or equal to existing public safety equipment. All systems should provide simple and user-friendly functionality.

4. Portable radios shall be capable of operation for at least 8 hours on a 10-10-80 duty cycle or 16 hours on a 5-5-90 duty cycle.

### User Desires

Of course, there are unyielding requirements needed to provide interoperability. Users, however, also have specific needs and desires for their systems. The following list showcases these user desires.

1. There is a desire to minimize dispatcher-to-dispatcher interaction.

### Potential Interoperability Solutions

This paper addresses three possible solutions for achieving public safety interoperability: 1) move the operational frequency of all public service radios to a new common band, 2) establish new nationwide mutual aid channels within a common band, 3) utilize infrastructure gateways and cross band repeaters.

## **1. Move All Public Safety Communications to a New Band**

### *1.1 Overview*

Moving all public safety communications to a new band is the optimal technical solution; however, many barriers must be overcome before this becomes possible. While the Spectrum Subcommittee is actively working to identify spectrum, a frequency band adjacent to an existing public safety band would be optimal (e.g., 380-400 MHz new public safety band, 406-420 MHz federal public safety and 450-470 MHz non-federal public safety). This new common UHF band would have a subset of channels set aside for nationwide mutual aid use. It has been suggested that five mutual aid channels might be sufficient although ten mutual aid channels might better serve to meet interoperability requirements.<sup>6</sup> However, this approach could accommodate any number of mutual aid channels.

### *1.2 Technical Approach*

The advantages of this approach is that the radio terminal products (portables and mobiles) would operate in a single band avoiding the additional cost inherent in multi-band radio. Thus, a new common band radio could be programmed to scan and operate on *any* channel in the new common band. This approach would solve all of the user requirements defined in this paper.

### *1.3 Cost Analysis*

The cost of this approach could be minimal. The average life of a public safety communications system is approximately 15 years. This means that most of the current installed base will be obsolete by the PSWAC timeline of 2010. From a practical viewpoint, it may take longer than 15 years to migrate all public safety agencies to a new band since many agencies continue to use their communication equipment long after the average life (some agencies use systems as long as 30 years). Other challenging aspects of this plan are identifying 1) who will pay to clear a band that has billions of dollars of imbedded equipment, 2) who will administer a grant program transferring the monies raised by the auctions to public safety agencies, 3) where will the imbedded base of incumbents be relocated, 4) how will this be financially justified to Congress when other services will contribute auction monies to the U.S. Treasury, and 5) how will all public safety officials be convinced to join this migration.

## **2. Establish New Universal Mutual Aid Channels**

### *2.1 Overview*

This option assumes that public safety agencies would continue to operate on their current licenses and that new universal mutual channels be established. New universal mutual aid

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<sup>6</sup> Letter to FCC from Michael R. Granados, Sr., chairman IAFC Communications Committee dated September 2, 1995.

channels would allow any public safety agency needing interoperability a standard methodology for achieving this need. The command and control hierarchy of communications could be improved by scanning the new universal mutual aid band. The new universal mutual aid band *could operate on a new LMR Emergency Band, utilize existing cellular (PCS/ADC) networks, or could utilize Satellite systems.*

## 2.2 Technical Approaches

The *new LMR Emergency Band* approach has the advantage of supporting direct talk. Public Safety agencies arriving on the scene of a disaster could talk to one another immediately. In-building coverage could be excellent and wide-area coverage could be extended by providing gateways into existing infrastructure networks. There may be a significant economic impact to the establishment of the *new LMR Emergency Band* depending on the approach used to access it.

The new universal mutual aid band could utilize *existing PCS/ADC networks*. This approach has this advantage: there is a significant commercial investment of infrastructure and services that could be utilized with little additional investment by the public safety community. This approach would utilize established commercial standards. Economical benefits include the use of extensive existing infrastructure, leveraging the benefits of a larger scale industry, and increased competition through cellular manufacturers. The disadvantages include slow access time, terrestrial infrastructure (vulnerable to natural disasters) that may not survive, coverage in rural area may be unacceptable, direct talk is not available, and interconnect-like services sometimes make group calls difficult.

The use of *Satellite Systems* to provide a new mutual aid band has a tremendous benefit in wide-area coverage. However, because of power limitations associated with in-building coverage, satellites may be unacceptable without the use of a terrestrial-based repeater. In addition, access time may be long, direct talk is not available, and interconnect-like services tend to make group calls difficult. Economical benefits of using existing satellite systems would be diminished over time by the usage fees for existing satellite systems.

Access to new common mutual aid channels could be accomplished by either using a *multi-band radio* or a *second dedicated emergency radio*. This approach could be implemented as soon as an agency begins to purchase new radio terminals that have a capability of accessing the new mutual aid channels.

A *multi-band radio* would transmit and receive on its normal operating frequency band and provide operation on mutual aid channels that are perhaps in another frequency band. This approach would add a separate transmit/receive (T/R) module to every public safety radio. This essentially adds another radio to the chassis of a public safety radio. The additional radio would share power, displays, keypad, and perhaps even the antenna. The advantage of this approach is that users could continue to operate on their existing communications systems. The disadvantages are that a new multi-band radio will be significantly more expensive, larger, and have shorter battery life than existing public safety equipment.

Instead of placing the burden of incorporating a second T/R module in every public safety radio, this approach would have a second *dedicated radio* specifically used for interoperability. Although this approach (multiple radio category) is not preferred by some users, it is very cost effective. A second dedicated radio would provide a method for agencies and specific users who need interoperability. It would be expected that every public safety agency would have a number of these new dedicated emergency radios. However, this approach would not require an agency to procure new expensive multi-band radios when the agency may not have a high need for interoperability.

### **3. Utilize Gateways & Cross-Band Repeaters**

One of today's solutions for interoperability is to modify existing infrastructure. This option would require that each of the fragmented public safety bands of operation establish nationwide mutual aid channels and gateways and then integrate these mutual aid channels into existing public safety infrastructure. All 800 MHz trunked public safety systems use this technique to accommodate interoperability with nationwide mutual aid channels.

Gateways achieve interoperability by incorporating a base station to translate dissimilar radio equipment into base-band analog voice and retransmit on the operating frequency and protocol of the home system. Gateways provide a system solution to interoperability yet require over-building the existing infrastructure. Gateways would probably be required to establish new universal mutual aid channels. This would provide interoperability over a large area but would not address the direct-talk requirement.

A FEMA vehicle equipped with cross-band repeaters could be an acceptable alternative for a direct-talk requirement. With as few as 100 FEMA vehicles, access to any disaster scene could be as little as 2 hours. A FEMA vehicle with cross-band repeaters could translate a fixed number of operating frequencies in all public safety operating bands, thus providing interoperability with the installed base of user equipment.

### **Economic Impact**

The interoperability solution needs to address all users, a large portion of which are small users. For non-federal public safety users, 10.9% (673,584) are volunteer firemen which equals 83% of all licensed fire transmitters. Also, 50% of all police departments have less than 10 officers. In fact "an examination of the present use by public safety reveals that the majority of licensees, particularly below 800 MHz, are individual agencies, utilizing one or two channels, often with a loading of less than 35 mobiles. (In fact, FCC records indicate of the Part 90 public safety licenses, more than 80% fall in this category.)"<sup>7</sup>

Intellectual Property Rights, or "IPRs," could potentially be a huge barrier to establishing an interoperability standard. An interoperability solution should be public domain. If

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<sup>7</sup> APCO Bulletin May 1994, TDMA-FDMA and Spectrum Efficiency by Art McDole, page 47

manufacturers want to build a public safety radio with FCC/NTIA mandated mutual aid channels, they should be able to do so without obtaining an IPR license from another manufacturer.

### **Cost - Benefit Analysis**

These three potential interoperability solutions are analyzed for estimated cost to the user community over a 15 year timeframe (PSWAC timeline is 2010). It should be noted that these are cost estimates and therefore are projections rather than hard numbers. These cost estimates are provided so that the different solutions can be compared on a relative basis.

#### **1. Moving All Public Safety to a New Band**

Assuming that the average communications equipment life is 15 years, the cost of procuring a communications system would be no additional burden to the user community. With an installed base estimated at \$30 billion (non-federal \$25 billion and federal \$5 billion), the cost to the user community is estimated at \$3 billion. Auctioning of spectrum vacated by public safety to help pay for this cost, however, is not taken into account in this projection.

#### **2. PCS/ADC Mutual Aid Channel with Dual Band Radios**

The estimated cost of adding one new mutual aid channel to the existing infrastructure is \$10,000 per base station x 230,000 Non-Federal licensed sites, or \$2.3 billion. In addition, the air time is estimated at \$.23 per minute x 100 minutes per year x 15 years x 6.2 million radio, or \$2.1 billion. The PCS/ADC capability is estimated to increase the cost of each public safety radio by \$200 x 6.2 million radios, or \$1.2 billion. The total estimated cost to the user community ultimately amounts to \$5.6 billion.

#### **3. Satellite Mutual Aid Channel with Dual Band Radios**

The estimated cost of adding one new mutual aid channel to the existing infrastructure is \$10,000 per base station x 230,000 Non-Federal licensed sites, or \$2.3 billion. In addition, the air time is estimated at \$.50 per minute x 100 minutes per year x 15 years x 6.2 million radios, or \$4.6 billion. However, this air time cost could be eliminated by the public safety community paying for a dedicated satellite which is estimated to cost \$1.5 billion for the payload and launch with \$10 million per year for administration, or \$150 million. Adding the satellite capability to the public safety radio is estimated to increase the cost of each public safety radio by \$300 x 6.2 million radios, or \$1.9 billion. The total estimated cost to the user community is \$5.9 billion.

#### **4. New LMR Mutual Aid Channel with Dual Band Radios**

The estimated cost of adding one new mutual aid channel to the existing infrastructure is \$10,000 per base station x 230,000 Non-Federal licensed sites, or \$2.3 billion. Adding the new LMR mutual aid channel capability to the public safety radio is estimated to increase the

cost of each public safety radio by \$150 x 6.2 million radios, or \$.9 billion. The total estimated cost to the user community is \$3.2 billion.

### **5. Dedicated Emergency Radio**

Estimated cost of adding one new mutual aid channel to the existing infrastructure is \$10,000 per base station x 230,000 Non-Federal licensed sites, or \$2.3 billion. Assuming that only half of the existing public safety users would need an emergency radio, the cost of a separate emergency radio is estimated at \$350 per radio x 3.1 million radio, or \$1.0 billion. The total estimated cost to the user community is \$3.3 billion.

### **6. Infrastructure Gateways & FEMA Cross-Band Repeaters**

Estimated cost of adding one new mutual aid channel to the existing infrastructure is \$10,000 per base station x 230,000 Non-Federal licensed sites, or \$2.3 billion. No modifications to the radio terminal products are required. Assuming 100 FEMA vehicles (2 for each state) outfitted with 10 cross-band repeaters, the cost would be \$10,000 per cross-band repeater x 10 per vehicle x 100 vehicles, or \$10 million. The total estimated cost to the user community is \$2.3 billion.

*NOTE: The electronic version of the figure in this position was unavailable at the time this report was prepared. Readers can find the full text of this figure in FCC WT Docket No. 96-86.*

### **User Data**

According to FCC data base, there are 6.15 million radios (transmitters) and 229,000 sites licensed for public safety use. There are approximately 80,000 Federal channel allocations. Both federal and non-federal public safety users operate on 9 fragmented frequency bands. See Appendix B for details.

The vast majority of the installed base of non-federal public safety radios are frequency synthesized analog radios.

The installed base of non-federal public safety communications equipment is estimated at \$25 billion and the federal public safety communications equipment is estimated at \$5 billion. The average life of a public safety radio terminal is 7 years and the life of radio infrastructure is 15 years.

### **Conclusions**

Interoperability is a problem often associated with risk of life and property during natural disasters and national emergencies. The loss of a single life resulting from two different public safety agencies' communications equipment not being capable of communicating is

unacceptable. However, equally unacceptable is to select an interoperability solution that cannot be implemented because it ignores practical considerations such as cost.

Three public safety missions have been identified to characterize interoperability: 1) Mutual Aid, 2) Day-to-Day, and 3) Task Force. Different public safety agencies have diverse interoperability needs. These requirements cover a vast range of capabilities from limited interoperability (i.e. volunteer fireman at an Amtrak accident) to encrypted covert interoperability (i.e. FBI at Waco, Texas).

Public safety users are diverse in their operational needs. From the FCC data base, there are 40,000 different public safety licensees, 6.15 million radios (transmitters) and 229,000 sites licensed for public safety use. There are approximately 80,000 Federal allocations. Both Federal and non-Federal public safety users operate on 9 non-contiguous frequency bands. The installed base of non-Federal public safety communications equipment is estimated at \$25 billion and the Federal public safety communications equipment is estimated at \$5 billion. The vast majority of the installed base of non-Federal public safety radios are frequency synthesized analog radios. The Federal users place a high value on encryption features. The lowest common denominator between existing and new public safety equipment is 25/30 KHz analog radios.

A significant consideration for all interoperability solutions must be cost. For any interoperability solution implemented nationwide, the cost will exceed several billion dollars since it is impacting an installed base of over \$30 billion.

Moving all Public Safety users to a new band appears to be optimal from a technical standpoint. This could be partially implemented by letting newly-procured public safety equipment operate in a new band. Auctioning vacated public safety spectrum could subsidize such a plan through federal grants. Shared systems (exclusive to public safety users) could be encouraged to provide a solution to day-to-day interoperability and maximize spectral use. It is desirable to locate this new public safety band contiguous to one of the nine existing public safety bands and to allocate at least 20 MHz of new spectrum for public safety.

Using satellites for mutual aid operation has a significant advantage over other potential solutions by providing wide area coverage. However, because of limited transmit power, there are concerns whether satellites can provide adequate in-building coverage.

Establishing a new common LMR mutual aid band does provide a level of interoperability. However, this is achieved at the expense of either procuring a second emergency radio or a dual band radio. Dual band technology, by its nature, will evolve slowly, reduce battery life, increase radio size and may remain cost prohibitive for many years.

The use of dedicated emergency radios appears to be a very attractive solution. Public safety agencies would only need to equip those individuals who require interoperability (i.e. the Oklahoma City bombing command and control hierarchy). The disadvantage is that some public safety users do not want to be burdened with a second radio.

The use of a mandated digital common air interface compatible with the highest tier federal encryption requirements would be achieved at the expense of the users who have limited interoperability needs and who are financially unable to procure such a high tier radio. Mandating and/or defining one interoperability solution severely penalizes users with limited resources and diverse interoperability needs.

Infrastructure-based interoperability solutions have demonstrated the capability to operate across bands and to connect dissimilar communications equipment. Establishing nationwide mutual aid channels in the nine public safety operating bands would provide an acceptable level of interoperability. FEMA vehicles equipped with a multitude of cross band repeaters could provide communications outside fixed terrestrial-based coverage areas.

### **Recommendations**

Many interoperability solutions may require over a decade to implement. Can public safety wait for an interoperability solution while human life and property are at risk? Obviously not. Therefore, it is recommended that the interoperability solution be divided into near-term and long-term solutions.

#### *Near-term Recommendation*

It is recommended 25/30 KHz analog mutual aid channels be established in each of the nine current public safety bands of operation. Interoperability can then be achieved in the near-term by reprogramming the large installed base of frequency synthesized analog radios to these new mutual aid channels. It is recommended that dedicated emergency radios be encouraged for agencies not owning frequency synthesized analog radios. It is further recommended that the agencies with the highest need for interoperability (typically the urban agencies) upgrade their infrastructure to provide cross band repeaters and gateways to provide users with interoperability in adjacent and concurrent jurisdictional areas. Alternatively, users with concurrent jurisdictional areas could investigate sharing operations on an existing trunked system. It is finally recommended that FEMA vehicles be fully equipped to provide cross band operation between these newly-established mutual aid channels for use in areas where existing infrastructure coverage is not available. These Interoperability recommendations will satisfy both the Mutual Aid and Day-to-Day public safety missions. It is recommended that the Task Force public safety mission accomplish interoperability the same way it is done today, namely, handing out mission specific radio equipment. This near-term solution could be implemented immediately.

#### *Long-term Recommendation*

*Primary* - The optimum long-term solution is to move public safety users to a new acceptable operating band adjacent to one of the existing nine public safety bands. Then 25/30 KHz analog channels would be established with at least 10 channels being allocated nationwide for mutual-aid use. The issue of auctioning vacated public safety spectrum, user incentives,