

**ALTERNATIVE FREQUENCIES
FOR USE BY
PUBLIC SAFETY SYSTEMS**

**Response to Title XVII, Section 1705 of the
National Defense Authorization Act for FY2001**



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ACRONYMS AND ABBREVIATIONS

BBA-97	Balanced Budget Act of 1997
CFR	Code of Federal Regulations
DEA	Drug Enforcement Administration
DoD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOJ	Department of Justice
EMS	Emergency Medical Services
FBI	Federal Bureau of Investigation
FCC	Federal Communications Commission
FLEWUG	Federal Law Enforcement Wireless Users Group
GMF	Government Master File
GPS	Global Positioning System
IACP	International Association of Chiefs of Police
ICHIEFS	International Association of Fire Chiefs
ILS	Instrument Landing System
INS	Immigration and Naturalization Service
IRAC	Interdepartment Radio Advisory Committee
ITN	Integrated Treasury Network
IWN	Integrated Wireless Network
JWN	Justice Wireless Network
LMR	Land Mobile Radio
MoA	Memorandum of Agreement
MoU	Memorandum of Understanding
MHz	MegaHertz
NDAA-2000	National Defense Authorization Act For Fiscal Year 2000
NDAA-2001	National Defense Authorization Act For Fiscal Year 2001
NDRS	National Distress and Response System
NDRSMP	National Distress and Response System Modernization Project
NIJ	National Institute of Justice
NTIA	National Telecommunications and Information Administration
OBRA-93	Omnibus Budget Reconciliation Act of 1993
PSWAC	Public Safety Wireless Advisory Committee
PSWN	Public Safety Wireless Network
USCS	United States Customs Service
USDA	United States Department of Agriculture
USCG	United States Coast Guard
USGS	United States Geological Survey
USMS	United States Marshall Service
USSS	United States Secret Service
WINS	Wireless Interoperability Network Strategy

EXECUTIVE SUMMARY

On behalf of the Secretary of Commerce, the National Telecommunications and Information Administration (NTIA) has prepared this report in response to Title XVII, Section 1705 of the National Defense Authorization Act for FY2001. It represents part of a joint submission to the Congress by NTIA and the Federal Communications Commission regarding alternative frequencies for use by state and local public safety agencies. It is submitted as a separate report, under a joint cover letter, outlining the issues involving the use of alternative frequency bands allocated for federal use. Another important part of this legislation directs the Department of Defense (DoD) to study the feasibility of sharing frequencies in the 138-144 MHz band with non-federal public safety agencies.¹

This report discusses frequency bands considered as alternative frequencies to the 138-144 MHz band and defines this in terms of comparable spectrum. Based on the analysis in this report of the Federal Government frequency bands between 100-1000 MHz, only the 162-174 MHz and 406.1-420 MHz federally allocated bands satisfy the criteria of comparable spectrum and can be considered alternative frequencies.

This report outlines federal agency use of the 162-174 MHz and 406.1-420 MHz bands, concentrating on departments and agencies with primary public safety missions. Since these missions continue to expand and the use of these bands continues to grow, NTIA and the federal agencies have developed policies, rules and plans to alleviate spectrum congestion. This was done by mandating spectrum efficient technology, encouraging the development of consolidated integrated networks, enhancing the utility of this spectrum by setting transmitter and receiver performance standards, and encouraging the use of trunking technology.

The impact of reducing the spectrum resources available to federal public safety agencies is addressed. The rapid expansion in the use of these bands to accommodate growth of voice and data systems within federal agencies places a greater urgency on these agencies to use these bands in the most efficient ways possible. The continued competition for limited spectrum resources underscores the fundamental need for federal public safety agencies to use spectrum more efficiently. Loss of additional spectrum would dramatically affect the ability of federal public safety agencies to perform their primary function of protection of life and property.

This report outlines current federal efforts to enhance interoperability among federal, state, and local public safety agencies. NTIA has recognized the importance of these efforts and is actively involved in developing strategies and providing policy guidance to enhance their effectiveness. Many sharing and interoperability agreements already exist among these agencies. NTIA is convinced that these partnerships are the key to improved interoperability.

¹ The DoD has initiated an engineering study in the 138-144 MHz band.

In summary, NTIA has concluded that additional frequencies in the 162-174 MHz and 406.1-420 MHz bands, other than the 40 federal, state, and local public safety interoperability 12.5 kHz channels recently provided for in these bands, cannot be provided without jeopardizing the crucial missions of federal public safety agencies. The Public Safety Wireless Advisory Committee (PSWAC) Final Report identified the need for an additional 2.5 MHz of spectrum for federal, state and local interoperability. The 40 channels NTIA designated for federal, state and local incident response and law enforcement interoperability represents 0.5 MHz of the 2.5 MHz of this spectrum. NTIA will continue to work with federal, state, and local public safety agencies and organizations in developing plans and strategies to ensure that these agencies, at all levels of government, can perform their mission critical functions without the encumbrances and barriers of the past.

SECTION 1

INTRODUCTION

BACKGROUND

The National Telecommunications and Information Administration (NTIA), an agency of the U.S. Department of Commerce, is responsible for administering spectrum assigned for federal agency use. The NTIA establishes policies concerning frequency assignment, allocation and use, and provides the various federal departments and agencies with guidance to ensure that their conduct of telecommunications activities is consistent with these policies.² The NTIA also serves under the Executive Branch as the President's principal adviser on telecommunication policies pertaining to the Nation's economic and technological advancements and to the regulation of the telecommunications industry.³ NTIA develops executive branch positions to ensure that policy is effectively presented to federal agencies, the Federal Communications Commission (FCC), Congress, and the public.

Because of the events of September 11, 2001, the need to protect the citizens of the United States has been at the forefront of attention from the Congress, the Executive Branch, and regulators. A critical component of any successful means of protection and the necessary emergency response and rescue operation is the ability of public safety agencies to communicate with one another with modern, robust communications systems with adequate radio spectrum resources. During joint law enforcement and incident response operations, it may be necessary for public safety officials from one jurisdiction (e.g., a federal agent) to communicate with public safety officials from a different jurisdiction (e.g., local police) responding to an incident. The inability to communicate with each other in this situation occurs when one jurisdiction is operating their radio equipment on a different frequency than the other jurisdiction, or with systems of different technologies (i.e., conventional, trunking, analog, and digital systems). Lessons learned over the years, and more recently, point to this critical need for interoperability in order to communicate effectively. The inability of federal, state, and local law enforcement, fire, emergency medical services (EMS) and other public safety providers to communicate during the Oklahoma City Federal Building bombing response in 1995 was a prime example.⁴

² NTIA, *Manual of Regulations and Procedures for Federal Radio Frequency Management*, U.S. Department of Commerce, National Telecommunications and Information Administration, Jan. 2000 Edition [hereinafter "NTIA Manual"].

³ National Telecommunications and Information Administration Act, Pub. L. No. 102-523, 106 Stat. 3533 (1992) (codified at 47 U.S.C. 901-904).

⁴ Public Safety Wireless Network (PSWN) Program, *Public Safety Radio Spectrum: A Vital Resource for Saving Lives and Protecting Property* (Oct. 2000).

Long before these tragic events, numerous professional organizations such as the International Association of Chiefs of Police (IACP), International Association of Fire Chiefs (ICHIEFS) (formerly IAFC), and the Association of Public Safety Communications Officials International-Inc. (APCO), have led the effort to obtain additional spectrum specifically for public safety services. On March 22, 1995, a House Appropriations Subcommittee proposed the establishment of a joint advisory committee on public safety telecommunications issues. The result was the establishment of the Public Safety Wireless Advisory Committee (PSWAC), a joint effort sponsored by the NTIA and the FCC. The PSWAC was tasked with providing advice on current and future wireless communications requirements of public safety agencies through the year 2010. The culmination of the PSWAC process was a final report to the NTIA and FCC.⁵

As a direct result of the PSWAC effort, Congress directed the reallocation of 24 megahertz (MHz) of spectrum in the 700 MHz band allocated for broadcast television (former channels 60-69) for public safety service use. This action has gone a long way to meet the needs of the state and local public safety agencies. PSWAC also identified an immediate need for 2.5 MHz of spectrum for interoperability. The state and local public safety user community has been petitioning the FCC for additional spectrum, particularly in the spectrum below 512 MHz, where the majority of state and local public safety systems operate.

The efforts by the public safety community to gain additional spectrum below 512 MHz prompted Congress to include language in Section 1705 of the National Defense Authorization Act for Fiscal Year 2001, (NDAA-2001).⁶ The statute requires the Department of Defense (DoD) to study the potential for sharing the 138-144 MHz band with state and local public safety agencies. Specifically, the law requires the Secretary of Defense, in consultation with the Attorney General and the Secretary of Commerce, to conduct an engineering study to identify: (1) any portion of the 138-144 MHz band that the Department of Defense can share in various geographic regions with public safety radio services; (2) any measures required to prevent harmful interference between Department of Defense systems and the public safety systems proposed for operation on those frequencies; and (3) a reasonable schedule for implementation of such sharing of frequencies. The results of this study will be submitted to Congress in a separate report.

⁵ *Final Report of the Public Safety Wireless Advisory Committee to the Federal Communications Commission and the National Telecommunications Administration Vol. 1* (Sept. 1996) [hereinafter "PSWAC Final Report, Vol 1"]. PSWAC was an NTIA and FCC jointly sponsored Federal Advisory Committee. It was established in response to provisions of Title VI of the Omnibus Budget Reconciliation Act of 1993 directing the FCC and the NTIA to coordinate more closely with the public safety community in planning future spectrum needs of the federal, state and local public safety agencies.

⁶ National Defense Authorization Act, Fiscal Year 2001, Pub. L. No. 106-398, § 1705, 114 Stat. 1654, 1654A-366 (2000). An excerpt of the language of the public law is included in Appendix A.

In addition to the 138-144 MHz DoD sharing study, Section 1705 of the NDAA-2001 directs the Secretary of Commerce and the Chairman of the FCC to jointly submit a report to Congress on alternative frequencies available for use by public safety systems no later than January 1, 2002.⁷ This document constitutes the Secretary's portion of that report.

OBJECTIVE

The objective of this report is to review federally allocated spectrum and determine the potential for identifying alternative frequencies for use by state and local public safety services, in accordance with NDAA-2001.

APPROACH

NTIA used the following approach:

1. Briefed the Interdepartment Radio Advisory Committee (IRAC)⁸ prior to the start of this report.
2. Solicited input and advice on spectrum usage and agency impact from the IRAC.
3. Obtained information from a variety of sources to assist in identifying potential spectrum alternatives that could be used by public safety services. Sources included, but were not limited to, the following NTIA published reports:

National Land Mobile Spectrum Requirements -
U.S. Department of Commerce/NTIA, January 1994

Preliminary Spectrum Reallocation Report -
U.S. Department of Commerce /NTIA, February 1995

Land Mobile Spectrum Planning Options -
U.S. Department of Commerce/NTIA, October 1995

*Final Report of the Public Safety Wireless Advisory Committee to the
FCC and NTIA, Volume 1 and 2-*
Public Safety Wireless Advisory Committee (PSWAC), September 1996

⁷ *Id.*, Section 1705(c) *Report*. It is assumed that the phrase "public safety systems" refers to state and local (i.e., non-Federal Government) systems.

⁸ The IRAC, consisting of representatives of 20 federal agencies, serves in an advisory capacity to the Assistant Secretary of Commerce for Communications and Information. The IRAC, in existence since 1922, assists the Assistant Secretary in the discharge of her responsibilities pertaining to use of the electromagnetic spectrum.

Spectrum Reallocation Report - Response to Title III of the Balanced Budget Act of 1997-

U.S. Department of Commerce/NTIA, February 1998

Assessment of Electromagnetic Spectrum Reallocation-

U.S. Department of Commerce/NTIA, January 2001

U.S. National Spectrum Requirements - Projections and Trends-

U.S. Department of Commerce/NTIA, March 1995

Particular attention was given to past NTIA reports that dealt with reallocations of Federal Government spectrum to the private sector. The intent was not to duplicate those efforts, but utilize the extensive research that was conducted for those reports. Relevant public documents, such as FCC filings, and open literature articles, were also used as appropriate. Federal agency mission requirements and the criticality of access to spectrum resources to perform their missions was documented.

4. Coordinated with the pertinent/affected federal agencies and also worked with members of the IRAC committees by providing status reports and affording them the opportunity to provide additional input or suggestions as the report developed.

5. Coordinated with the FCC Wireless Telecommunications Bureau and Office of Engineering and Technology. The statute requires NTIA and the FCC to jointly submit the report to Congress. The approach taken was for NTIA and the FCC to study and examine only spectrum under their respective regulatory authority. That is, the NTIA report considered alternative frequencies that could be used by public safety systems from the federally-allocated frequency bands, which included both federally exclusive and shared allocations, while the FCC report considered the non-federal frequency bands.

SECTION 2

IDENTIFICATION OF FREQUENCY BANDS TO BE CONSIDERED FOR ALTERNATIVE FREQUENCIES

INTRODUCTION

As discussed in Section 1, the NDAA-2001 directs the Secretary of Commerce and the Chairman of the FCC to jointly submit a report to Congress on alternative frequencies that could be made available for use by public safety systems. For purposes of this report, NTIA considered “alternative frequencies” to be those frequencies comparable to the 138-144 MHz band. The criteria used in this report to determine such comparability are: 1) the proximity of Federal Government bands to current state and local public safety bands;⁹ 2) compatibility of the technical characteristics of the Federal Government bands; 3) the feasibility of using Federal Government bands; and 4) public benefits of the systems currently operating in the Federal Government bands.

SELECTION OF FEDERAL GOVERNMENT FREQUENCY BANDS TO BE CONSIDERED FOR ALTERNATIVE FREQUENCIES

State and Local Public Safety Spectrum Allocations Above 100 MHz

An overview of the current state and local public safety frequency bands above 100 MHz is provided in Table 2-1.

NTIA focused this report on spectrum above 100 MHz since spectrum congestion experienced by state and local public safety voice communication systems occurs above 100 MHz. In addition, as shown below, all of the current frequency bands for state and local public safety use are below 1000 MHz. Since the criteria used in this report is to identify alternative frequencies in proximity to the current frequency allocations for state and local public safety agencies, Federal Government spectrum above 1000 MHz will not be considered. This will limit consideration to federally-allocated frequency bands above 100 MHz and below 1000 MHz.

⁹ Federal Government frequency bands that are in close proximity will have similar propagation characteristics and will reduce the costs associated with modifying the existing state and local public safety equipment.

**Table 2-1
Overview of State and Local
Public Safety Frequency Bands Above 100 MHz**

Frequency Band (MHz)
150-162
173.2-173.4
220-222 ^a
450-470
470-512
764-776 and 794-806
806-821 and 851-866
821-824 and 866-869

^a A portion of this band is allocated for Federal Government use.

Federal Government Frequency Allocations

Table 2-2 provides an overview of the frequency bands between 100 MHz and 1000 MHz that are allocated to the Federal Government on a primary basis. These bands will be examined to determine if spectrum can be identified for alternative frequencies for state and local public safety use.

**Table 2-2
Overview of Federal Government Frequency Allocations
in the 100 - 1000 MHz Frequency Range**

Frequency Band (MHz)	Primary Allocation(s)
108-117.975 ^a	Aeronautical Radionavigation
117.975-137 ^a	Aeronautical Mobile (Route)
137-138 ^a	Space Operation (space-to-Earth); Meteorological Satellite (space-to-Earth); Space Research (space-to-Earth); Mobile-Satellite (space-to-Earth)
148-149.9 ^a	Fixed; Mobile; Mobile-Satellite (Earth-to-space)
149.9-150.05 ^a	Mobile-Satellite (Earth-to-space); Radionavigation-Satellite
150.05-150.8	Fixed; Mobile
157.0375-157.1875	Maritime Mobile
162.0125-173.2 ^c	Fixed; Mobile
173.4-174 ^c	Fixed; Mobile
220-222 ^a	Fixed; Land Mobile
225-399.9 ^b	Fixed; Mobile; Mobile-Satellite; Aeronautical Radionavigation
399.9-401 ^a	Radionavigation Satellite; Standard Frequency and Time Signal Satellite; Mobile-Satellite (Earth-to-space); Meteorological Aids; Meteorological Satellite (space-to-Earth); Space Research (space-to-Earth); Mobile-Satellite (space-to-Earth); Space Operation (space-to-Earth)
401-402 ^a	Meteorological Aids (radiosonde); Space Operations (space-to-earth); Earth Exploration-Satellite (earth-to-space); Meteorological-Satellite (earth-to-space)
402-403 ^a	Meteorological Aids (radiosonde)
403-406 ^a	Meteorological Aids (radiosonde); Earth Exploration Satellite; Meteorological Satellite
406-406.1 ^a	Mobile-Satellite (Earth-to-space)
406.1-420 ^d	Fixed; Mobile; Radio Astronomy; Space Research (space-to-space)
420-450	Radiolocation
608-614 ^a	Land Mobile; Radio Astronomy
902-928	Radiolocation
932-935/941-944 ^a	Fixed
960-1215 ^a	Aeronautical Radionavigation; Radionavigation Satellite (space-to-Earth)

^a Allocated for shared government (i.e., Federal)/non-government use.

^b The 328.6-335.4 MHz portion of this band is used for the glide slope application of the ILS.

^c Hereinafter, these bands will collectively be referred to as the “162-174 MHz band”.

^d The radio astronomy service is a shared government/non-government allocation in the 406.1-410 MHz portion of this band.

ANALYSIS OF FEDERAL GOVERNMENT FREQUENCY BANDS

NTIA determined the bands to be considered for alternative frequencies for use by state and local public safety systems through an elimination process using the criteria identified earlier. The discussion is structured around five categories representing the functions supported in the bands used by the Federal Government identified in Table 2-2:

- Aviation Communications and Radionavigation
- Fixed and Mobile Communications
- Space and Environmental Sciences
- National Security
- Satellite Communications

Aviation Communications and Radionavigation. Safe travel in the air is vitally dependent upon interference-free use of the radio frequency spectrum for both aeronautical communications and radionavigation services. The frequency bands 108-118 MHz, 118-137 MHz, 328.6-335.4 MHz, and 960-1215 MHz are allocated to the aeronautical radionavigation, aeronautical mobile (route), and radionavigation satellite services. These bands support a variety of civil, non-federal, and DoD provided aeronautical safety functions. These are shared government/non-government bands.

The 108-118 MHz band is used by the Instrument Landing System (ILS), VHF Omnidirectional Range, and Local Area Augmentation Systems for GPS, which are used extensively by civil and federal aircraft. The estimated number of ILS sites is projected at 1,020 in the year 2005.¹⁰

The 118-137 MHz band is used for air traffic control communications. The Federal Aviation Administration (FAA) operates over 3,000 radio stations in this band to serve all elements of air traffic services, weather alerting, landing and take-off, en route control, and emergency communications.¹¹ In addition, on an “as required” basis, FAA provides radio frequency support for the aeronautical communications needs of public safety agencies such as Treasury, Customs, and Forestry for law enforcement and firefighting requirements. To meet the growing demands for aeronautical voice communications in this band, new technology is planned to be implemented (e.g., time division multiple access) that will increase the spectrum efficiency of systems using this band.

¹⁰ National Telecommunications and Information Administration, U.S. Department of Commerce, NTIA Special Publication 94-31, *U.S. National Spectrum Requirements: Projections and Trends* (Mar. 1995) at 111 [hereinafter “NTIA Special Publication 94-31”].

¹¹ National Telecommunications and Information Administration, U.S. Department of Commerce, NTIA Special Publication 94-27, *Preliminary Spectrum Reallocation Report* (Feb. 1994) at 4-21 [hereinafter “NTIA Special Publication 94-27”].

The 960-1215 MHz band is used by a wide variety of aeronautical radionavigation systems including: Distance Measuring Equipment; the Tactical Air Navigation system; the Air Traffic Control Radar Beacon System; and the Universal Access Transceiver. In addition, the band is authorized for use by DoD's Joint Tactical Information Distribution System on a non-harmful interference basis. At the 2000 World Radio Conference, a new allocation was added to the 1164-1215 MHz portion of the band for a new GPS signal, GPS L5, to be used by international civil aviation. The FAA provides management of this band, as well as the other bands designated for the Aeronautical Assignment Group.¹²

The technical characteristics of the equipment used in these bands and the international standardized nature of the systems operated in these bands is not consistent with the equipment used by state and local public safety agencies. Due to the critical nature of the aeronautical safety services provided in these bands, and the airborne nature of their use, sharing would not be possible and, therefore, the 108-118 MHz, 118-137 MHz, 328.6-335.4 MHz, and 960-1215 MHz bands were not considered to be possible alternative frequencies for use by state and local public safety systems.

Fixed and Mobile Communications. The 157.0375-157.1875 MHz band is allocated to the Federal Government for maritime mobile operations. The primary use of this band is for the United States Coast Guard (USCG) ship-to-shore radio communications for safety and distress response functions, marine safety broadcasts, and command and control of USCG vessels. This band is also used for communications with the general maritime community. The band is divided into six channels. Two of these channels have specialized use associated with non-government maritime mobile operations. The frequencies in this band are international maritime mobile channels, and are controlled by various international rules and regulations.¹³ For these reasons, this band was not considered to be a possible alternative frequency band for state and local public safety systems for interoperability with Federal Government public safety systems.

The Federal Government non-tactical land mobile operations are accommodated in the 162-174 MHz and 406.1-420 MHz bands. These bands are the most widely used by the federal agencies. Forty-eight federal agencies are authorized to operate in the 162-174 MHz band and 47 agencies in the 406.1-420 MHz band.¹⁴ These bands are in close proximity to spectrum currently allocated for state and local public safety agencies. Thus, the radiowave propagation characteristics and system coverage will be essentially the same. The federal systems in these bands use a wide range of equipment types in a variety of geographic environments for voice and data communications. Common types of equipment include base and repeater stations, mobile

¹² The Aeronautical Assignment Group (AAG), chaired by the FAA, is responsible for engineering AAG frequency assignments and determining whether or not applications for frequency assignment action should be approved by NTIA.

¹³ International Telecommunications Union, Appendix S 18.

¹⁴ NTIA Special Publication 94-27 at 14.

stations, and hand-held portable stations. In nearly all cases, the equipment used by the federal agencies is the same type of “off-the-shelf” equipment used by state and local public safety agencies.¹⁵ Therefore, state and local public safety systems could use these bands with minimal modification to their existing equipment. Based on these factors, the 162-174 MHz and 406.1-420 MHz bands were considered to be possible alternative frequencies for use by state and local public safety systems.

The 220-222 MHz band is allocated for fixed and land mobile services, with a requirement for 5 kHz channelization. There are 200 frequency pairs for shared federal and non-federal operations. However, only 10 channels are for exclusive Federal Government use. The complete channeling plan is described in the NTIA Manual.¹⁶ Currently, the only technology that has been identified to satisfy the 5 kHz channelization requirement is amplitude companded single-sideband, an analog modulation scheme.¹⁷ Although this band is in close proximity to current state and local public safety allocations, there is a significant difference in the technical standards for the equipment. State and local public safety equipment is currently based on 25 kHz channelization primarily employing analog modulation with voluntary migration to 12.5 kHz and eventually 6.25 kHz channel bandwidths utilizing digital modulation. The channelization and modulation schemes employed by the state and local public safety equipment are incompatible with those used in the 220-222 MHz band. Furthermore, most of the non-federal channels in this band have been licensed through competitive bidding. Based on these factors, the 220-222 MHz band was not considered to be a possible alternative frequency band for use by state and local public safety systems.

The 932-935 MHz and 941-944 MHz bands are allocated to the Federal Government and non-federal users for the fixed services on a co-equal shared basis.¹⁸ These bands are an important resource to satisfy low-capacity Federal Government fixed communications systems. Most of the Federal Government applications that use these bands are located in areas where commercial communications service is either unavailable or cost prohibitive. Satisfying these low-capacity communication requirements in higher frequency bands will generally result in less efficient use of the spectrum because of the non-availability of suitable low-capacity radio equipment.¹⁹ The equipment that uses these bands typically transmits on a frequency in one band

¹⁵ *Id.* at D-2.

¹⁶ NTIA Manual, Section 4.3.15 at 4-198.

¹⁷ Institute for Telecommunication Sciences, National Telecommunications and Information Administration, U.S. Department of Commerce, NTIA Report 94-311, *A Survey of Relative Spectrum Efficiency of Mobile Voice Communication Systems* (July 1994) at 31.

¹⁸ National Telecommunications and Information Administration, U.S. Department of Commerce, NTIA Special Publication 98-36, *Spectrum Reallocation Report Response to Title III of the Balanced Budget Act of 1997* (Feb. 1998) at 3-21 [hereinafter “NTIA Special Publication 98-36”].

¹⁹ *Id.* at 3-22.

with a corresponding receive frequency in the other band or a paired channel. This means that one cannot consider spectrum in one band without impacting the other band. Moreover, the lower frequency band is located 63 MHz from the highest state and local public safety frequency band (866-869 MHz), which means that the existing public safety equipment would require modification. Based on these factors, and extensive non-Federal Government use, the 932-935 MHz and 941-944 MHz bands were not considered to be possible alternative frequencies for use by state and local public safety systems.

Space and Environmental Sciences. As shown in Table 2-2, the 137-138 MHz and 399.9-401 MHz bands have many different radio services allocated in a small amount of bandwidth (e.g., 1 MHz or less). In order to accommodate these diverse radio services, new sharing techniques had to be employed. For example, in the 137-138 MHz band, co-frequency sharing in the same geographic area with the mobile-satellite systems was not possible; consequently, a time sharing approach had to be employed. Moreover, in both of these bands, there are allocations for satellite downlinks, which would make sharing with ground based public safety systems difficult. Although close in proximity to the spectrum allocations for state and local public safety, sharing with the many different radio services is not a viable option. Therefore, these bands were not considered to be possible alternative frequencies for use by state and local public safety systems.

The 401-402 MHz, 402-403 MHz and 403-406 MHz bands are allocated on a world-wide basis for the meteorological aids service. In addition, the 402-403 MHz band is also allocated to Earth Exploration Satellites and Meteorological Satellites. The equipment employed in these bands provides many of the observations and weather reports, issues forecasts and warns of weather and flood conditions affecting national safety and the economy. The data collected by the equipment used in these bands is shared among federal agencies, state, and local governments, academic research programs, and private weather-forecasting firms. Because of the national and agency specific meteorological functions and requirements, the Federal Government is the largest user of meteorological aids equipment in these bands.²⁰ The current frequency allocations for meteorological aids are adequate for the foreseeable future. As new meteorological aids systems are introduced, all attempts will be made to field these systems in the existing allocations.²¹ In view of the importance of these bands for weather prediction as well as the services already provided to the public by the systems operating in these bands, sharing with public safety would not be possible.²² Therefore, these bands were not considered to be possible alternative frequencies for use by state and local public safety systems.

²⁰ NTIA Special Publication 94-31 at 173.

²¹ *Id.* at 176.

²² NTIA Special Publication 98-36 at 3-21.

The 608-614 MHz band is allocated for land mobile (medical telemetry and telecommand operations only) and radio astronomy observations.²³ Federal and university radio astronomy research activities are interrelated and complementary. While using a portion of this band could satisfy the alternative frequency requirements, it would come at the expense of domestic and international radio astronomy research, depriving the public of new scientific discoveries. Because of the importance of the frequencies allocated on an exclusive basis for radio astronomy observations and the extreme sensitivity of the receivers, loss of a portion of the band or sharing the band with public safety systems would have a significant detrimental effect on national radio astronomy operations. For this reason, the 608-614 MHz band was not considered to be a possible alternative frequency band for state and local public safety systems.

National Security. The Army, Navy, and Air Force heavily use the 150.05-150.8 MHz band to support air-to-ground, air-to-air, and air-ground-air tactical communications. As a result of the large line-of-sight distances from aircraft, the emissions from airborne tactical radios could make co-channel sharing with land-based receivers difficult over large geographic areas of the country. Following September 11, military use of these tactical radios is expected to increase. Furthermore, use of the 150.05-150.8 MHz band is subject to coordination/agreement with both Canada and Mexico. Based on these factors, this band was not considered to contain possible alternative frequencies for state and local public safety systems.

The 225-399.9 MHz band consists of several band segments that are used by the DoD in support of its national security mission. Tactical fixed and mobile communications are performed in the 225-328.6 MHz and 335-399.9 MHz portions of the band. The systems operating in these band segments support wartime functions; however, extensive peacetime training and alert exercises are conducted to maintain combat readiness.²⁴ Military mobile satellite operations are conducted in the 235-322 MHz and 335.4-399.9 MHz segments of the band. Military satellite communications are essential to link the activities of ground, air, surface, and subsurface mobile platforms.²⁵ The communications functions performed in the 225-399.9 MHz band are critical to DoD operations and this band is the single most critical spectrum resource of the tactical military forces.²⁶ The 225-399.9 MHz band is in close proximity to public safety allocations and has similar technical characteristics. However, based on the extensive use and the importance of this band for military preparedness in defense of the Nation, the 225-399.9 MHz band was not considered to a possible alternative frequency band for state and local public safety systems.

²³ There are only five frequency bands below 5 GHz that are allocated for radio astronomy on an exclusive basis.

²⁴ NTIA Special Publication 98-36 at 2-5.

²⁵ *Id.*

²⁶ *Id.* at 2-6.

The 399.9-401 MHz segment of the band is allocated to the radionavigation satellite and mobile satellite services. Federal Government use of this band segment is limited to federal earth stations operating with non-Federal Government satellites. Therefore, this band was not considered a possible alternative frequency band for use by state and local public safety systems.

The 420-450 MHz band is occupied by military land-based, airborne, and shipborne long-range search and surveillance radar systems used for national defense. The DoD has spectrum requirements for the radars that operate in this frequency band.²⁷ The high power associated with these long-range radars will make sharing with in-band public safety systems impractical. Therefore, the 420-450 MHz band was not considered to be a possible alternative frequency band for use by state and local public safety systems.

The 902-928 MHz band spectrum management structure is extremely complex as shown in Figure 2-1.²⁸ The 902-928 MHz band is allocated for primary use by the Federal Government for radiolocation, (shipborne air search radar systems), and by users of industrial, scientific, and medical (ISM) devices. Use of the spectrum by Federal Government fixed and mobile and automatic vehicle monitoring (AVM) systems is secondary to both of these uses. The remaining users of the 902-928 MHz band, licensed amateur radio operators and unlicensed devices operating under FCC Part 15 rules, operate on a secondary basis to all other uses, including AVM. Despite this complex spectrum allocation structure, this band effectively supports a number of critical federal requirements and a wide array of consumer and commercial applications.

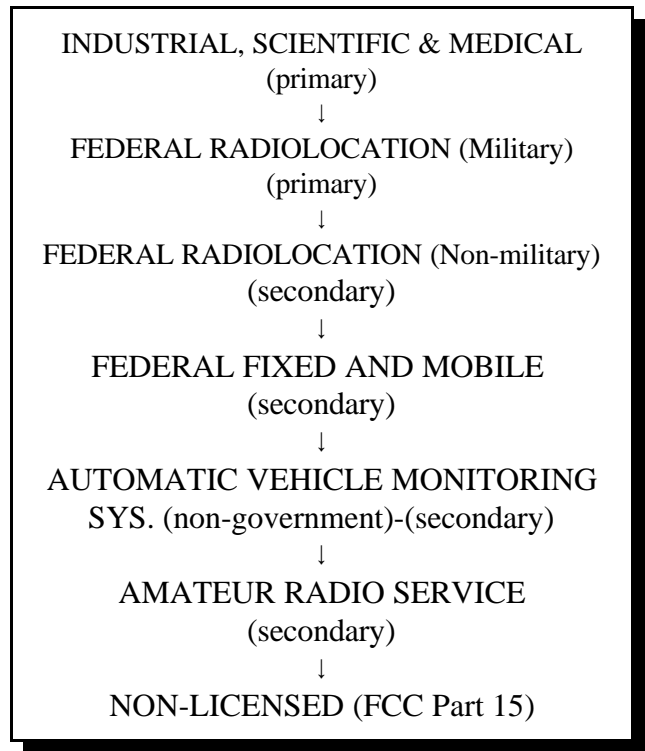


Figure 2-1. Allocation Hierarchy of the 902-928 MHz Band

As a result of the large number of diverse users that operate in this band, use by public safety is not seen as a viable option. The spectrum congestion seen by these overlapping radio services will probably be the greatest in

²⁷ NTIA Special Publication 94-31 at 126.

²⁸ NTIA Special Publication 94-27 at 4-8.

urban areas where the public safety spectrum is most needed. Based on these factors, the 902-928 MHz band was not considered to contain possible alternative frequencies for state and local public safety systems.

Satellite Communications. The 148-149.9 MHz band is used by many federal agencies including law enforcement, transportation, natural resource protection, emergency response, utility operation, and for tactical aviation communications. Satellite uplink operations in this band are authorized for the National Aeronautical and Space Administration (NASA), Department of Energy (DOE), National Science Foundation (NSF), and Department of State. This band is also essential to the support of the Civil Air Patrol and the United States Coast Guard (USCG) for search and rescue operations. Based on the current use of this band by the Federal Government, this band was not considered to be possible alternative frequencies for state and local public safety systems.

The 149.5-150.05 MHz band is one of the few internationally allocated bands to the mobile satellite service (MSS) (earth-to-space). Federal Government use of this band is limited to earth stations operating with non-government satellites.²⁹ Consequently, this band was not considered to be possible alternative frequencies for state and local public safety systems.

The 406-406.1 MHz band is allocated to the mobile satellite service and is used for the Emergency Position Indicating Radio Beacon (EPIRB). The 406-406.1 MHz EPIRB signal frequency has been designated internationally for distress use only. The International Cospas-Sarsat Program announced it will terminate satellite processing of distress signals from 121.5 MHz and 243 MHz emergency beacons. Mariners, aviators, and other persons will have to switch to emergency beacons operating at 406 MHz in order to be detected by satellites. The Emergency Locating Transmitters (ELT) for aircraft also operate in this band. Based on the exclusive use of this band for EPIRB and ELT operations, this band was not considered to contain possible alternative frequencies for state and local public safety systems.

Analysis Summary. As a result of this analysis, Federal Government frequency bands that will be considered for identifying alternative frequencies for use by state and local public safety systems are the 162-174 MHz and 406.1-420 MHz bands.

FEDERAL GOVERNMENT FREQUENCY BANDS SELECTED FOR CONSIDERATION

Based on the foregoing analysis, NTIA considered the 162-174 MHz and 406.1-420 MHz bands for state and local public safety use. As shown in Table 2-1, these bands also meet the established criteria of close proximity to current non-federal public safety frequency bands.

²⁹ NTIA Special Publication 98-36 at 2-9.

The Public Safety Wireless Network (PSWN) Program performed a study addressing the current wireless communications environment of state and local fire and EMS services.³⁰ The study identified that 70 percent of the state and local fire and EMS services operated on at least one channel in the 150.8-162 MHz band. Of the remaining 30 percent, 31 percent used the 450-512 MHz band. In a similar study conducted by the National Institute of Justice (NIJ) on state and local law enforcement agencies, more than 70 percent currently use the 150.8-162 MHz band and just less than 40 percent use the 450-512 MHz band.³¹ Based on these two studies, the majority of state and local public safety agencies extensively use the 150.8-162 MHz and 450-512 MHz bands or a combination of both.

SUMMARY

The results of the PSWN and NIJ studies are consistent with the selection of the 162-174 MHz and 406.1-420 MHz as the bands to be considered for identifying alternative frequencies for state and local public safety use. The bands primarily used by state and local public safety systems are comparable to the Federal Government bands selected for consideration for identification of alternative frequencies. The Federal Government bands identified are primarily used by Federal Government Public Safety for voice communications and are allocated for fixed and mobile usage, which is generally consistent with the state and local use. The propagation characteristics are identical and equipment used by both federal and state and local agencies are similar. For these reasons, this report will concentrate on the Federal Government bands of 162-174 MHz and 406.1-420 MHz for identifying alternative frequencies for state and local public safety use. The feasibility of using these bands and the impact to public benefits will be discussed later in the report.

³⁰ Public Safety Wireless Network (PSWN) Program, *PSWN Program Analysis of Fire and EMS Communications Interoperability* (Apr. 1999) at 15. The PSWN is a federal program jointly sponsored by the Department of Justice and the Department of the Treasury created to study, develop strategies, and provide direct assistance in improving interoperability among federal, state, and local public safety agencies. Detailed information on the PSWN Program can be found on its Web site (www.pswn.gov).

³¹ National Institute of Justice, *State and Local Law Enforcement Wireless Communications and Interoperability: A Quantitative Analysis* (Jan. 1998) at 27. The percentages do not add up to 100 percent because agencies could report more than one type of channel usage.

SECTION 3

FEDERAL OPERATIONS IN THE 162-174 MHz AND 406.1-420 MHz BANDS

INTRODUCTION

The 162-174 MHz and 406.1-420 MHz bands are the two most heavily used bands by the Federal Government. More than 40 percent of all federal agency frequency assignments in the Government Master File (GMF) are in these two bands.³² They are the primary public safety bands of the Federal Government. These bands, like the state and local 150-174 MHz and 450-512 MHz bands, have the highest concentration of government users of all government bands below 512 MHz. The 162-174 MHz band is authorized for use by federal non-military agencies on a primary basis and is utilized for mobile and fixed services. The 406.1-420 MHz band is divided into two sub bands: the 406.1-410 MHz and 410-420 MHz bands. The 406.1-410 MHz band is allocated to fixed, mobile and federal and non-federal radio astronomy services on a primary basis. The 410-420 MHz band is allocated exclusively to the Federal Government fixed and mobile services on a primary basis. In addition, the 406.1-420 MHz band is the primary band for Federal Government trunked radio systems. It is also important to note that all Federal Government mobile bands are allocated on a co-primary basis with the fixed service, and these bands are used for fixed systems in addition to mobile systems, including fixed point-to-point, fixed point-to-multipoint, aeronautical mobile and maritime mobile systems.³³ Thus, federal public safety mobile operations are shared with other Federal Government services in these bands.

The Federal Government public safety agencies have similar operational needs as state and local agencies in that they both have requirements for basic voice and data communications, as well as video and high-speed data requirements. Federal public safety agency responsibilities encompass law enforcement, transportation, natural resources, emergency and disaster, and medical and administrative duties. While many of these responsibilities are similar to those of state and local public safety agencies, there are some additional responsibilities that are unique to federal agencies. Among these responsibilities are: protecting the President, other high-level officials, and foreign dignitaries; promoting public safety and efficiency in traveling via air, water, and land; interdicting entry of illegal persons and substances into the United States; establishing communications between disaster areas and relief forces; ensuring the swift search for and rescue of human life; protecting the national forests, parks and farmlands; and ensuring the security of energy generation and distribution networks. In addition, federal emergency response and public safety organizations conduct large scale exercises to prepare for and respond to a wide variety of emergencies and disasters, such as hurricanes, earthquakes, and chemical and nuclear power plant accidents. Furthermore, with the recent terrorist attacks on the United States, federal public

³² The GMF is a complete listing of Federal Government frequency assignments and associated technical characteristics.

³³ PSWAC Final Report, Vol 1 at 16.

safety communications will be needed for both prevention and response to crises. Since these types of operations are often highly mobile, spectrum allocated to the mobile service is necessary to support these communications needs. Although most operations are conducted within the mobile service, public safety agencies also use fixed point-to-point and point-to-multipoint systems under the fixed service allocations. An additional requirement of federal public safety agencies is that operations are supported nationwide.³⁴

FEDERAL PUBLIC SAFETY AGENCY PLANS IN THE 162-174 MHz AND 406.1-420 MHz BANDS

The following paragraphs provide a summary of the comments submitted by the federal public safety agencies discussing their current and future plans for using the 162-172 MHz and 406.1-420 MHz bands. A detailed description of the federal public safety agency comments is provided in Appendix B.

Department of Justice

The Department of Justice (DOJ) has a primary mission to “enforce the law and defend the interests of the United States according to the law, provide federal leadership in preventing and controlling crime, seek just punishment for those guilty of unlawful behavior, administer and enforce the Nation’s immigration laws fairly and effectively and ensure fair and impartial administration of justice for all Americans.”³⁵ Wireless communications are critical to meet these mission requirements. DOJ uses both the 162-174 MHz and 406.1-420 MHz bands extensively for its operations. The 162-174 MHz band is its primary band for land mobile radio (LMR) use to successfully meet its growing mission requirements. The Justice Wireless Network (JWN) initiative will consolidate all of the DOJ bureaus into a single LMR communications system. This new digital narrowband system, which utilizes both the 162-174 MHz and 406.1-420 MHz bands, is being developed to increase spectrum efficiency, improve interoperability among all bureaus within DOJ as well as other federal law enforcement agencies, and maximize efficiencies and savings through shared communications systems. The JWN will consolidate the communications needs of the Office of the Attorney General, Federal Bureau of Investigation (FBI), Drug Enforcement Administration (DEA), Immigration and Naturalization Service (INS), U.S. Marshals Service (USMS), and Bureau of Prisons (BOP).

Department of the Treasury

The Department of the Treasury (Treasury) has a primary mission to promote prosperous and stable American and world economies, manage the government’s finances, safeguard our

³⁴ PSWAC Final Report Vol 1, Sec. 4.1.6. at 29.

³⁵ Letter from Merri Jo Gamble, U.S. Department of Justice, Justice Management Division, Wireless Management Office, to William D. Speights, Public Safety Program, National Telecommunications and Information Administration (Oct. 30, 2001) at 1 [hereinafter "Justice Letter"].

financial systems, protect our Nation's leaders, and pursue a safe and drug-free America.³⁶ Wireless communications are critical to meet these mission requirements. For example, the U.S. Secret Service (USSS) provides protection for the President, Vice President, and political leaders of the United States, as well as protection to visiting foreign dignitaries. Treasury uses both the 162-174 MHz and 406.1-420 MHz bands for 95 percent of its law enforcement and protection operations. The vast majority (more than 80 percent) of this equipment operates in the 162-174 MHz band. The Integrated Treasury Network (ITN) is a consolidated Treasury Wireless LMR architecture that will satisfy Treasury's mission requirements, maximize resource sharing, and employ a complementary mix of infrastructure alternatives. The ITN will provide increased interoperability and comply with the NTIA narrowband (12.5 KHz) requirement. The Treasury Strategic Plan calls for using the 162-174 MHz band to satisfy nationwide or wide-area requirements and the 406.1-420 MHz band to satisfy local area or campus communications requirements.³⁷ Treasury believes that the ITN will provide cost efficiencies and strong benefits for its users.³⁸ In addition, the ITN will be based on narrowband digital technology standards and meet Treasury's communications requirements through consolidation. The design also allows for interconnection with the JWN and other Federal Government, state and local public safety agencies. The ITN will consolidate the communications needs of the USSS, U.S. Customs Service (USCS); Bureau of Alcohol, Tobacco, and Firearms; and the Internal Revenue Service into one network.

United States Coast Guard

The USCG has a significant presence in the 162-174 MHz and 406.1-420 MHz bands. This allows the USCG to interoperate with other federal agencies during joint operations involving: search and rescue, counter-narcotics, immigration, and general law enforcement operations. These ongoing operations involve the DEA, USCS, INS, Border Patrol, and others using LMR applications as well as aeronautical and maritime applications. In addition to federal interoperability requirements, the USCG has numerous Memoranda of Understanding (MoU) and Memoranda of Agreement (MoA) in place for interoperability with state and local public safety agencies.

One of the most important USCG systems used in their public safety role is the National Distress and Response System (NDRS), which consists of approximately 300 antenna sites with analog transceivers controlled by 46 regional communication centers. Much of the equipment was initially installed in the 1970s and is no longer commercially available or supportable. The life expectancy of the electronic equipment installed during this period was 15 years. Equipment that failed over the past 30 years was replaced with a mixture of older and newer equipment resulting

³⁶ Letter from James E. Downes, Department of the Treasury, Assistant Director, Wireless Program Management Office, to William D. Speights, Public Safety Program, National Telecommunications and Information Administration (Oct. 5, 2001) at 1 [hereinafter "Treasury Letter"].

³⁷ *Id.*

³⁸ *Id.*

in a system of non-standard electronics. The National Distress and Response System Modernization Project (NDRSMP) plans to replace the antiquated NDRS communications system with enhanced functionality.³⁹ These functions include Maritime Safety, Maritime Law Enforcement, and Nationwide and Marine Environmental Protection missions. The NDRSMP will provide communications between USCG facilities (e.g., Groups, Sections, Air Stations, Port Security Units, cutters, boats, aircraft, and selected vehicles). The USCG is entering the second phase of the NDRSMP. The project will cost an estimated \$525 million, is being developed and implemented in two phases, and is designed to meet USCG needs for safety of life at sea and coastal law enforcement protection. The design includes a new focus on enhanced interoperability with the various federal, state and local public safety agencies that are their partners in public safety.

Other Federal Public Safety Agencies

Numerous other federal public safety agencies are actively initiating communications system replacement programs and are currently maintaining significant systems and infrastructure in the 162-174 MHz and 406.1-420 MHz bands. The Department of Agriculture (USDA) has various radio communication requirements.⁴⁰ The USDA includes the Forest Service, which is involved in recreational management, law enforcement, fire fighting, incident support, and aviation services. USDA also has an Office of Inspector General; Animal, Plant and Health Inspection Service; and Food Safety and Inspection Service. All of these divisions have their own unique radio communications needs. The Department of the Interior (DOI)⁴¹ has radio communications requirements in support of the National Park Service, Bureau of Land Management, Fish and Wildlife Service, Bureau of Indian Affairs, Bureau of Reclamation, and the U.S. Geological Survey. The DOE⁴² has an important role in the protection of the Nation's electrical resources at the various DOE conventional and nuclear power generating stations. DOE also operates the Nuclear Emergency Search Teams that respond to national and international incidents that involve numerous federal, state, and local public safety agencies. The Transportation Safeguards Division provides communications nationally for escort teams, which require real time response communications with local public safety agencies. Most of DOE's communications needs center around DOE sites and laboratories. The DOE also partners with

³⁹ United States Coast Guard *National Distress and Response System Modernization Project* at <http://www.uscg.mil/hq/g-a/ndrsmp>.

⁴⁰ Letter from Marvin T. Storey, Telecommunications Manager, Wireless Programs Policy & Planning, U.S. Department of Agriculture, to William D. Speights, Public Safety Program, National Telecommunications and Information Administration (Oct. 30, 2001) at 1 [hereinafter "Agriculture Letter"].

⁴¹ National Telecommunications and Information Administration, U.S. Department of Commerce, NTIA Special Publication 01-44, *Assessment of Electromagnetic Spectrum Reallocation - Response to Title X of the National Defense Authorization Act for FY 2000* (Jan. 2001) at 4-40 [hereinafter "NTIA Special Publication 01-44"].

⁴² *Id.*

the FBI to counter emerging threats to national security and public safety. The Federal Protection Service, under the General Services Administration, is responsible for the protection of federal properties. Again, each of these divisions or bureaus have their own communications needs to support their unique mission requirements.

Each of these agencies plays a vital role in public safety/law enforcement, be it by patrolling campgrounds located on federal lands, monitoring the processing of food consumed by Americans, or monitoring environmental operations. The continued integrity of the 162-174 MHz and 406.1-420 MHz bands is vital to the ability of these Departments and agencies to perform mission critical functions.

SPECTRUM EFFICIENT TECHNOLOGIES IN THE 162-174 MHz AND 406.1-420 MHz BANDS

There is a growing demand for access to the 162-174 MHz and 406.1-420 MHz bands. The NTIA and the federal public safety agencies realize that the primary way to satisfy the growing demand for spectrum in these bands is to employ more spectrum efficient technologies. The areas in which the Federal Government is implementing spectrum efficient technologies include: migration to narrowband technology, integrated wireless networks, receiver performance standards, and trunking technology.

Migration to Narrowband Technology

In 1992, Congress passed the Telecommunications Authorization Act of 1992.⁴³ Title I of this Act required NTIA to develop and implement a plan to make federal LMR systems use more spectrum efficient technologies. A report summarizing the plan and its implementation schedule was prepared and submitted to Congress as required by the legislation.⁴⁴ As part of this plan, NTIA selected a 12.5 kHz channel width for re-channeling (or re-farming) the federal fixed and mobile bands.⁴⁵ The reduction in channel width from 25 kHz to 12.5 kHz will effectively double the number of available channels in the 162-174 MHz and 406.1-420 MHz bands.⁴⁶

Federal public safety agencies have also engaged in a long-term standards development process known as Project 25 or TIA102. A collective effort by industry, the Telecommunications Industry Association (TIA, an ANSI accredited standards developing body) and individual members of state and local public safety agencies has resulted in the development of an extensive

⁴³ Telecommunications Authorization Act of 1992, Pub. L. No. 102-538, 106 Stat. 3533 (1992).

⁴⁴ National Telecommunications and Information Administration, U.S. Department of Commerce, NTIA Report 93-300, *Land Mobile Spectrum Efficiency* (Oct. 1993) at 1.

⁴⁵ *Id.* at 8.

⁴⁶ After Jan. 1, 2005, all systems in the 162-174 MHz band must conform to this standard. After Jan. 1, 2008, all systems in the 406.1-420 MHz band must conform to this standard.

set of standards for digital public safety wireless communications.⁴⁷ Phase 1 of Project 25 specifies a 12.5 kHz channel width consistent with NTIA's narrowband mandate. Phase 2 of Project 25 provides a migration path to a narrower channel width of 6.25 kHz (or equivalent) as technology permits. The technology readiness obstacles currently associated with Project 25 Phase 2 include battery size and weight and oscillator stability.⁴⁸ Also, based on information from manufacturers, the 6.25 kHz Phase 2 option is likely to be delayed several years due to technical problems with encryption techniques in very narrow bandwidths. The federal public safety agencies' pursuit of more spectrum efficient technologies is a necessary tool to satisfy the growing demands for wireless communications within the Federal Government.

Integrated Wireless Networks

To increase spectrum efficiency and maximize the limited spectrum resources available to federal public safety agencies, Treasury and DOJ are each developing Integrated Wireless Networks (IWNs) to address the needs of the numerous bureaus and agencies within their departments. Treasury's network, which is in the design stage, is referred to as the ITN. The estimated cost of the ITN is \$500 million.⁴⁹ The DOJ is in the process of developing the JWN, with an estimated completion cost of \$1 billion.⁵⁰ Both the ITN and JWN require that the limited spectrum resources in the 162-174 MHz and 406.1-420 MHz be used efficiently. Moreover, continued access to these bands is vital to the design and success of these networks.

The ITN and JWN will provide nationwide coverage through hybrid LMR systems, which will consist of both trunked and conventional digital narrowband equipment. The ITN will be based on digital technical standards that maximize the use of the available spectrum. The JWN is planned to increase spectrum efficiency and maximize efficiencies through shared infrastructure, digital technology, and common procurement strategies.⁵¹ With limited spectrum resources in the 162-174 MHz and 406.1-420 MHz bands, more federal public safety agencies are looking at IWNs to maximize the use of spectrum resources to meet the increasing spectrum demands of their agencies.

⁴⁷ The standards are published in the Telecommunications Industry Association/Electronics Industries Alliance (TIA/EIA), and the standards suite is referred to as TIA/EIA-102. These standards are developed through an American Standards Institute (ANSI)-accredited process.

⁴⁸ Public Safety National Coordination Committee, *Recommendations to the Federal Communications Commission for Technical and Operational Standards for Use of the 764-776 MHz and 794-806 MHz Public Safety Band Pending Development of Final Rules* (Feb. 25, 2000) at Appendix G4.

⁴⁹ NTIA Special Publication 01-44 at 4-40.

⁵⁰ *Id.* at 4-36.

⁵¹ *Id.*

Receiver Performance Standards

NTIA and the federal public safety agencies have long been advocates of technical standards for receivers to minimize interference and increase overall spectrum efficiency. State and local public safety entities are also recognizing the importance of establishing receiver standards to minimize interference.⁵² As the demand for wireless services continues to grow, straining the limited spectrum resources that are available, it is becoming increasingly important to manage the resource by considering the total system performance. Thus, both the transmitter and receiver performance characteristics must be considered for maximum spectrum efficiency. In the 162-174 MHz and 406.1-420 MHz bands, NTIA has adopted receiver performance standards (in addition to transmitter performance standards) that include: intermodulation rejection, adjacent channel selectivity, and spurious response attenuation.⁵³ NTIA and the federal public safety agencies believe that receiver performance standards are necessary to reduce interference from adjacent channel transmitters. This will allow transmitters and receivers to operate closer to each other in the spectrum, improve performance, and increase the overall efficiency of these bands.

Trunking Technology

The use of trunking technology as a means of increasing the efficiency and utility of spectrum resources is growing rapidly within both the 162-174 MHz and 406.1-420 MHz bands. Federal agencies use trunked systems for limited areas with a high concentration of use and for campus environments, such as federal prisons, hospitals, laboratories, and training facilities. The DoD has the largest number of trunked systems operating and planned within the 406.1-420 MHz band. DoD uses these systems to satisfy the important needs of national security, training, administration, and emergency preparedness at its various facilities. The planned federal IWNs will also use trunked systems in their designs to satisfy some of their requirements, especially in large cities. Trunking technology allows all agencies to more efficiently use the limited spectrum resources.

SUMMARY

The 162-174 MHz and 406.1-420 MHz bands are the most heavily used Federal Government frequency bands. Every federal public safety agency requires access to these bands for communication systems to meet their mission critical requirements. NTIA and the federal public safety agencies recognized the increased demand for access to these bands and took measures to implement spectrum efficient technologies. The migration to narrowband technology (or equivalent) will make more channels available and satisfy the need for additional spectrum in the near future. Integrated Wireless Networks, such as the ITN and JWN, will also utilize the limited spectrum resources in the 162-174 MHz and 406.1-420 MHz bands more efficiently. The

⁵² Comments of the Association of Public Safety Communications Officials, International-Inc., Fourth Notice of Proposed Rulemaking, WT 98-86 (Sept. 25) at 15; Comments of the Public Safety National Coordination Committee, Fourth Notice of Proposed Rulemaking, WT 98-86 (Sept. 25) at 13.

⁵³ NTIA Manual, Section 5.3.5.2.B at 5-18.

receiver performance standards adopted by NTIA are necessary to mitigate the potential for interference and more effectively manage the limited spectrum resources in the 162-174 MHz and 406.1-420 MHz bands and further enhance their utility.

SECTION 4

IMPLICATIONS OF REDUCING THE SPECTRUM AVAILABLE TO FEDERAL PUBLIC SAFETY AGENCIES

INTRODUCTION

The importance of radio communications to the federal public safety community cannot be overstated. In a large-scale disaster such as an earthquake, forest fire, or flood, numerous agencies from federal, state, and local governments and thousands of individuals come together to provide emergency medical assistance, fire suppression, rescue operations, infrastructure repair, crowd control and security, and food and shelter, and to begin the process of rebuilding. At a time when other means of communications are likely to be inoperable, public safety radio systems must provide reliable, instantaneous, and interference-free communications between the responders and their agencies. As discussed in the previous sections, the predominant bands used to support federal law enforcement and public safety communications are the 162-174 MHz and 406.1-420 MHz bands.

Federal public safety operations have evolved over the years to be critically dependent on the use of the radio frequency spectrum as a reliable and effective means for satisfying critical communications requirements. Since these types of operations are often highly mobile in nature, spectrum allocated to the land mobile service is necessary to support these communication needs. Since mobility is a critical factor, the location of these frequencies in the radio frequency spectrum is important. Spectrum below 1 GHz is needed because atmospheric and foliage penetration losses are relatively low, components are small, and efficient antennas can be used for hand-held operations. The lower atmospheric losses that exist in this region of the spectrum are necessary for the wide area communication systems that are required to support nationwide federal public safety operations.

IMPACT OF REDUCING THE SPECTRUM AVAILABLE FOR FEDERAL PUBLIC SAFETY COMMUNICATIONS

In accordance with the requirements Title VI of the Omnibus Budget Reconciliation Act of 1993 (OBRA-93) and Title III of the Balanced Budget Reconciliation Act of 1997 (BBA-97), NTIA identified a total of 255 MHz of federal spectrum for reallocation to the private sector.⁵⁴ As part of the response to OBRA-93 and BBA-97, NTIA performed analyses examining the feasibility of reallocating spectrum allocated to the federal land mobile service.

⁵⁴ In accordance with Section 1062 of the National Defense Authorization Act of Fiscal Year 2000, the President reclaimed 8 MHz reducing the total reallocated spectrum to 247 MHz. *See* National Defense Authorization Act for Fiscal Year 2000, Pub. L. No. 106-65, § 1062, 113 Stat. 512, 767-769 (1999) (Codified at 47 U.S.C. § 921 note).

The OBRA-93 analysis confirmed that the 162-174 MHz and 406.1-420 MHz bands were the most heavily used bands by the Federal Government.⁵⁵ The analysis determined that the reallocation of any portion of this spectrum would result in a loss of federal investment and an increase in spectrum congestion in the remaining portions of the bands. Moreover, the resulting interference from increased spectrum congestion would have a degrading effect on the quality of service of federal public safety communications. It was concluded that because of the extremely high federal investment in LMR systems in these bands, the absence of comparable spectrum, and the critical use in supporting federal public safety missions, reallocation was not considered to be a viable option.⁵⁶

The BBA-97 analysis further confirmed that federal public safety agencies rely heavily on the 162-174 MHz and 406.1-420 MHz bands to support their missions.⁵⁷ It was concluded that because of the critical public safety and law enforcement functions performed in these bands and the benefits such functions provided to the public, reallocation of these bands for non-federal use was not considered to be a viable option.⁵⁸

In response to Section 1062 of the National Defense Authorization Act for Fiscal Year 2000, NTIA provided an assessment of the electromagnetic spectrum reallocation from the Federal Government to the private-sector in accordance with the requirements of OBRA-93 and BBA-97.⁵⁹ The NTIA assessment concluded that nearly every major federal department or agency includes a federal public safety function, with the Departments of Justice, Treasury, Defense, Agriculture, Interior, Energy, and the Federal Emergency Management Agency having particularly important roles as a result of their mandated missions.⁶⁰ Most of the radio communications requirements supporting these federal public safety agencies are concentrated primarily in the 162-174 MHz and 406.1-420 MHz bands. This assessment stated that frequency assignments in the 162-174 MHz band were increasing at a rate of nearly 8 percent per year, while assignments in the 406.1-420 MHz band were increasing at a rate of nearly 12 percent per year.⁶¹ These trends clearly showed that federal public safety communication requirements and their reliance on land

⁵⁵ National Telecommunications and Information Administration, U.S. Department of Commerce, NTIA Special Publication 94-27, *Preliminary Spectrum Reallocation Report* (Feb. 1994) at 4-22.

⁵⁶ *Id.* at 4-23.

⁵⁷ National Telecommunications and Information Administration, U.S. Department of Commerce, NTIA Special Publication 98-36, *Spectrum Reallocation Report - Response to Title III of The Balanced Budget Act of 1997* (Feb. 1998) at 2-12.

⁵⁸ *Id.* at 2-13.

⁵⁹ National Defense Authorization Act for Fiscal Year 2000, *Supra* note 53.

⁶⁰ NTIA Special Publication 01-44 at x.

⁶¹ *Id.* at 4-36

mobile communications systems were steadily increasing. Any loss of access to these frequency bands would be particularly harmful to federal public safety communications, since there are no suitable alternative replacement bands available.⁶²

As part of the PSWAC final report, an analysis was performed to determine the spectrum requirements of federal, state, and local public safety agencies.⁶³ The PSWAC concluded that the existing Federal Government spectrum allocations will satisfy federal public safety spectrum requirements through the year 2010 provided:

- a) there is no reduction in the spectrum allocations for public safety;
- b) spectrum efficient technologies become available; and
- c) funds are available to implement spectrum efficient technologies.⁶⁴

The PSWAC conclusion is consistent with the conclusions reached in the NTIA OBRA-93 and BBA-97 analyses. All of the analyses conclude that the current frequency allocations for public safety systems cannot be reduced without jeopardizing the ability to perform the mission critical functions of the federal public safety agencies.

FEDERAL AGENCY COMMENTS ON REDUCING SPECTRUM RESOURCES FOR PUBLIC SAFETY COMMUNICATIONS

Several of the major federal public safety agencies have provided specific comments on the impact of reductions in the spectrum resources necessary to support their missions.

Department of the Treasury

Treasury stated that reallocating any portion of either the 162-174 MHz or 406.1-420 MHz land mobile bands would have a devastating effect on its bureaus and negatively impact its ability to carry out critical spectrum dependent missions and should be avoided at all costs.⁶⁵ Treasury further stated that the 162-174 MHz band is also being used to replace systems that had to be relocated due to the loss of the 216-220 MHz and 1710-1755 MHz bands in compliance with OBRA-93 and BBA-97.

⁶² *Id.* at 4-37.

⁶³ *Final Report of the Public Safety Wireless Advisory Committee to the Federal Communications Commission and the National Telecommunications Administration, Volume 2* (July 1996) Appendices at B. [hereinafter "PSWAC Final Report Vol 2"]

⁶⁴ *Id.* at 643.

⁶⁵ Treasury Letter at 1.

Treasury further maintains that any loss of spectrum in the 162-174 MHz band will have a detrimental effect on its strategic and capital planning efforts to provide secure, effective, and efficient communications to support the Department.⁶⁶

Treasury's nationwide build-out of the ITN in the 162-174 MHz band is dependent on continued access to the spectrum. Treasury stated that the explosion of wireless systems among federal public safety agencies, especially in large metropolitan areas where there is spectrum congestion, makes obtaining frequency clearance increasingly difficult with the current spectrum allotments.⁶⁷ A reduction of the available spectrum would make it impossible, endangering the lives of federal law enforcement agents and officers.⁶⁸ Treasury concludes that it is absolutely essential that sufficient spectrum in both the 162-174 MHz and 406.1-420 MHz bands be available to support the Department's communication systems and maximize agent and officer safety, protect the Nation's leaders and successfully accomplish Treasury's diverse missions throughout the United States and its possessions.⁶⁹

Department of Justice

The DOJ stated that the proliferation of land mobile systems in the 162-174 MHz and 406.1-420 MHz LMR bands does not permit additional sharing without the loss of communications on the part of the Department and other agencies that already occupy the spectrum.⁷⁰ Similar to the concerns raised by Treasury, the loss of spectrum in either band will also impact the implementation and effectiveness of the DOJ's JWN. DOJ points out that the increasing demand for spectrum is an ongoing challenge that the Department faces within its own system architecture. To lose access to any portion of the spectrum in the 162-174 MHz and 406.1-420 MHz bands that it currently has access to would severely impact an already spectrally constrained DOJ communications architecture.⁷¹

Department of the Interior

The DOI stated that it requires accessible land mobile spectrum in the 162-174 MHz and 406.1-420 MHz bands because of the amount of public safety activities coinciding with the bureau missions.⁷² The DOI has analyzed its LMR systems in terms of priority, location, cost, and redundancy. This analysis identified cost savings to make maximum use of infrastructure resources

⁶⁶ NTIA Special Publication 01-44 at 4-41.

⁶⁷ Treasury Letter at 1.

⁶⁸ *Id.*

⁶⁹ *Id.*

⁷⁰ Justice Letter at 1.

⁷¹ *Id.*

⁷² NTIA Special Publication 01-44 at 4-41.

available to all bureaus in the narrowband transition process. DOI believes that the investment of time and money to plan and engineer this effort will be wasted if the current LMR spectrum resources are reduced. DOI concludes that any loss of spectrum in the 162-174 MHz and 406.1-420 MHz bands will increase cost, disrupt current public safety communications efforts, and severely limit the ability of the Department to execute daily operational missions.⁷³

Department of Agriculture

The USDA utilizes the 162-174 MHz and 406.1-420 MHz bands for short-range communications at fire camps and at operation bases at other incidents where wireline or microwave is not cost effective. Spectrum congestion is not the primary concern in these remote areas; it is the question of alternative spectrum if the current spectrum resource is reduced. USDA concludes that if spectrum access is reduced in the 162-174 MHz and 406.1-420 MHz bands, there are no suitable alternative bands that can be used to support its communications requirements.⁷⁴

TRENDS IN FEDERAL PUBLIC SAFETY SPECTRUM USAGE

The number of frequency assignments in the 162-174 MHz and 406.1-420 MHz bands are steadily increasing, reflecting the increase of missions in support of the public. Since there are limited land mobile spectrum allocations, federal public safety agencies must employ new technologies to satisfy future spectrum requirements. Currently, significant effort is being focused in these bands to increase their spectral efficiency and capacity in an effort to satisfy the increasing user demand. As discussed in Section 3, two of the more important technology trends are narrowbanding and integrated wireless networks. Migration to more spectral efficient narrowband radios employing digital modulation and implementing integrated communications networks to increase spectrum efficiency is necessary if federal public safety agencies are to continue to meet their mission requirements using the available limited spectrum resources.

SUMMARY

Federal public safety requirements for use of the 162-174 MHz and 406.1-420 MHz bands are steadily increasing, as discussed earlier in this section. With this rapid expansion of spectrum use and the growing competition for scarce spectrum resources, the current frequency allocations for public safety LMR communications systems cannot be reduced without jeopardizing the ability to accommodate future spectrum requirements necessary to perform the mission critical functions of the federal public safety agencies.

⁷³ *Id.* at 4-43.

⁷⁴ Agriculture Letter at 1.

SECTION 5

CURRENT FEDERAL INTEROPERABILITY EFFORTS

INTRODUCTION

Due to the use of dissimilar communications networks or different frequencies, most agencies from different jurisdictions cannot communicate directly with others. First responders may have equipment that operates in the same frequency bands. However, if the systems used have different receiver standards, modulation techniques, and/or encryption schemes, they will continue to have difficulty inter-operating. In order to carry out joint operations, agencies often are required to exchange personnel or radios just so they can communicate.

Interoperability simply refers to the ability of public safety personnel to communicate by radio with staff from other agencies, on demand and in real time. There are three distinct types of interoperability: day-to-day, mutual aid, and task force. Day-to-day interoperability involves typical exchanges of information and coordination during routine public safety operations. Interoperability is required, for example, when firefighters from adjoining counties join forces to fight a fire or when regional law enforcement agencies must work together during a high speed pursuit. Mutual Aid interoperability involves the immediate need for assistance in response to large scale emergencies. The initiation of mutual aid assistance requests are generally covered by local or regional Mutual Aid Agreements, MoUs or MoAs. Task Force interoperability involves all agencies, federal, state and local, coming together for extended periods of time in response to large scale incidents such as criminal apprehensions, rescue operations, and large scale narcotics operations.

For many years, federal agencies have shared spectrum and systems to meet the operational needs of public safety. Hundreds of agreements and MoUs have been entered into among federal, state and local public safety agencies to allow sharing of resources including spectrum, radio systems, dispatch facilities, real estate, and communications towers for the purpose of interoperability.⁷⁵ The NTIA Rules and Regulations⁷⁶ and the FCC Rules⁷⁷ both allow and encourage this type of sharing arrangement. Much of it occurs at a local level, without national intervention, except for the recording of such agreements. This process has worked well for many years and continues to function today. For most requirements, this sort of arrangement is all that is needed for intercommunication or interoperability.

⁷⁵ An S160 annotation to an assignment indicates a particular frequency is used for interoperability purposes. It is made pursuant to Section 7.12 of the NTIA Manual and is coordinated in accordance with Section 8.3.3.

⁷⁶ NTIA Manual, Section 8.3.3 at 8-40.

⁷⁷ *Part 300, Code of Federal Regulations, Title 47 Telecommunications, Part 2, § 2.103 at 373.*

NTIA PUBLIC SAFETY PROGRAM

Since the publication of the PSWAC Final Report, NTIA and federal public safety agencies have agreed that more needs to be done to improve federal, state and local interoperability. With that goal in mind, NTIA established a Public Safety Program to address the long-range spectrum requirements of federal public safety agencies, to develop a strategy to provide sufficient spectrum for growth of the current services, advanced technology, and interoperability, and to develop and implement a plan to meet these requirements. In its public policy role as advisor to the Administration for telecommunications issues, and specifically for public safety issues, NTIA expanded its involvement in public safety issues. Through this program, NTIA has strived to ensure adequate access to spectrum for public safety communications for the safe, effective, and efficient protection of life and property, to increase opportunities for sharing and interoperability among federal, state, and local entities, and to provide leadership and a federal liaison with various public safety groups. In its role as technology advocate, NTIA is actively involved in technology issues. It ensures that domestic and international technical standards are introduced to promote the application of advanced technology, enhance interoperability, and provide spectrum savings while preserving mission effectiveness. NTIA is also responsible for increasing government, industry, and public sector awareness of Administration policies and objectives. In addition, NTIA explored, through several single and multi-agency initiatives, methods for providing funding assistance to state and local agencies for planning and implementing interoperable public safety communications systems.⁷⁸ NTIA will continue to explore options for funding these initiatives.

FEDERAL INTERAGENCY PUBLIC SAFETY PROGRAMS AND WORKING GROUPS

One of the primary efforts of NTIA in promoting the advancement and enhancing the importance of public safety communications issues involves direct leadership, policy, and technical support to the PSWN Program and the Federal Law Enforcement Wireless Users Group (FLEWUG).⁷⁹ In its first phase, the PSWN program performed detailed studies of public safety issues dealing with the primary topics of spectrum, interoperability, funding, case studies, advanced technology, and federal, state and local partnerships. The PSWN is governed by the Executive Committee, made up of leaders of the public safety community who provide advice and guidance to the program. NTIA is an active member of the PSWN Executive Committee and the various working groups and task forces of the program. In this way, NTIA can best assist the public safety community by providing technical expertise and public policy guidance.

⁷⁸ Department of Justice, The Department of the Treasury, Department of Commerce and The Federal Law Enforcement Wireless Users Group, *Funding of Public Safety Wireless Communications Systems, Report of the Interagency Working Group* (June 1998).

⁷⁹ The FLEWUG is an interagency working group formed to address the common issues and technical solutions of federal public safety agencies. The PSWN program provides resources for the FLEWUG.

In coordination with NTIA and the primary federal public safety agencies, the PSWN Program is working with the public safety community to develop practical solutions and to lay a foundation for improving interoperability at all levels of government. At the end of its first phase of operation, the PSWN published its Wireless Interoperability Network Strategy (WINS).⁸⁰ The WINS provides state and local agencies a snapshot of PSWN information resources, the current state of interoperability efforts throughout the Nation, and alternative solutions to support agencies with different performance, security, and reliability requirements. The second phase of the PSWN program consists of direct interoperability assistance services to state and local public safety agencies to help them address and resolve interoperability issues. PSWN will assist state and local agencies in the development of interoperability solutions that best fit their operational environment. Current PSWN projects that NTIA is supporting are shown in Appendix C.

An example of a pilot interoperability program is the ongoing sharing effort between the Department of the Army and the State of Wisconsin. The Department of the Army, in coordination with NTIA, signed an MoA with the Wisconsin Department of Transportation (WDOT) to establish a shared (federal, state and local) Pilot Trunked Radio System utilizing Federal Government allocated frequencies.⁸¹ The purpose of the pilot system is to enhance interoperability between federal, state and local entities within the state. The pilot is a four site, narrowband system with WDOT providing the equipment and sites and the Department of the Army providing the spectrum resources.

Lastly, in an effort to address the common issues and potential solutions to the needs of the public safety community at all levels of government, NTIA and the FCC formed a Joint Public Safety Working Group immediately after the PSWAC report was published. The dialog established during those meetings was an important step in addressing vital issues at all levels of government. The re-establishment of this group is appropriate and currently under consideration.

ONGOING REGULATORY EFFORTS

One of the most effective means of jump-starting the interoperability of federal, state, and local public safety agencies is to provide a spectrum resource for the sole purpose of interoperability. NTIA, in coordination with federal public safety agencies within the FLEWUG and the IRAC, developed a plan to designate 40 channels in the two primary Federal Government public safety bands (162-174 MHz and 406.1-420 MHz) for the purpose of Interagency Law Enforcement and Incident Response Operations.⁸² The PSWAC Final Report identified the need

⁸⁰ *Public Safety Wireless Interoperability National Strategy* at <http://www.pswn.gov/pswins.htm>.

⁸¹ Memorandum of Agreement Between Assistant Secretary of Defense for Command, Control, Communications and Intelligence and Secretary, Wisconsin Department of Transportation (Mar. 1998) at 1.

⁸² NTIA Manual, Section 4.3.16 at 4-201. These are narrowband (12.5 kHz) channels.

for an additional 2.5 MHz of spectrum for federal, state and local interoperability.⁸³ The 40 channels NTIA designated for federal, state and local incident response and law enforcement interoperability represents 0.5 MHz of the 2.5 MHz of this spectrum.

INTERAGENCY COMMITTEES

On October 28, 1997, the IRAC established ad hoc committee 214. The objective of this ad hoc committee is to address the numerous issues dealing with public safety telecommunications and develop recommended plans, policies, procedures, and regulations for the improvement of interoperability among federal, state, and local public safety agencies. The committee is currently working with the FCC and FLEWUG in developing guidelines for making usage of the law enforcement and incident response interoperability frequencies more efficient and timely.

SUMMARY

NTIA and the federal public safety agencies have recognized the importance of interoperability at all levels of government and have been working to develop policies, interoperability channeling plans, rules, strategies, and pilot programs to enhance and improve interoperability. Significant gains have been made, but more work must be done. NTIA will continue to work with the FCC and public safety organizations to insure interoperability needs of the public safety community are addressed.

⁸³ PSWAC Final Report Vol 1 at 3.

SECTION 6

SUMMARY/CONCLUSIONS

INTRODUCTION

The National Defense Authorization Act of 2001 directs Commerce and the FCC to jointly submit a report on alternative frequencies that could be made available for use by public safety systems. On behalf of Commerce, NTIA has completed its analysis of Federal Government spectrum that could constitute such alternate frequencies.

SUMMARY

NTIA's review of Federal Government spectrum has identified the following:

- The DoD has begun an engineering study to identify any potential sharing opportunities with public safety services in the 138-144 MHz band. It is premature to speculate as to the potential for sharing within this band until the engineering study is complete.
- The criteria for determining alternative frequencies to the 138-144 MHz band were: 1) the portions of the radio spectrum allocated to the Federal Government that are in close proximity to existing state and local public safety frequency allocations; 2) compatibility of the technical characteristics of the Federal Government bands; 3) the feasibility of using Federal Government bands; and 4) public benefits of the systems currently operating in the Federal Government bands. This will ensure that similar propagation characteristics exist and equipment is readily available. It was determined that the federal fixed and mobile bands of 162-174 MHz and 406.1-420 MHz meet these criteria.
- The predominant bands used to support federal law enforcement and public safety communications are 162-174 MHz and 406.1-420 MHz. Federal public safety operations have evolved over the years to be critically dependent on the use of the radio frequency spectrum as the primary, robust, reliable, and effective means of communications.
- Federal public safety requirements for use of the 162-174 MHz and 406.1-420 MHz bands are steadily increasing, reflecting the increase of mission critical functions in direct support of service to the public. Since there are limited fixed and mobile allocations, federal public safety agencies must employ new technologies to satisfy future spectrum requirements.

- Through narrowbanding efforts, the Federal Government is using the spectrum more efficiently in order to satisfy their congressionally mandated missions.
- The Treasury and Justice Departments are developing integrated communications networks that will rely heavily on the 162-174 MHz and 406.1-420 MHz bands. These integrated communications networks will employ spectrum efficient narrowband digital technology and are designed to allow for interconnection with other federal, state and local public safety agencies to enhance interoperability.
- NTIA reports in response to OBRA-93, BBA-97, and Section 1062 of the NDAA for Fiscal Year 2000, concluded that any loss of access to the 162-174 MHz or 406.1-420 MHz bands would be particularly harmful to federal public safety communications. Furthermore, the PSWAC Final Report concluded that the existing Federal Government spectrum allocations will satisfy federal public safety spectrum requirements through the year 2010, providing there are no reductions in the spectrum allocations.
- During joint law enforcement and incident response operations, the Federal Government has a need to interoperate with state and local public safety agencies. NTIA, working with the FLEWUG and the IRAC, established a policy setting aside 40 channels in the 162-174 MHz and 406.1-420 MHz bands for nationwide interoperability between federal, state and local public safety entities.
- The PSWAC Final Report identified the need for an additional 2.5 MHz of spectrum for federal, state and local interoperability. The 40 channels NTIA designated for federal, state and local incident response and law enforcement interoperability represents 0.5 MHz of the 2.5 MHz of this spectrum.
- Providing additional spectrum is not a total solution for solving the issue of interoperability. Spectrum alone will not achieve interoperability during either law enforcement or incident response operations. First responders from different jurisdictions may have equipment that operates in the same frequency bands, but will not be able to communicate with each other if the systems used are built to different technical standards (e.g., modulation, vocoders, encryption schemes).

CONCLUSIONS

The federal public safety requirements for use of the 162-174 MHz band and 406.1-420 MHz bands are steadily increasing. With this rapid expansion of spectrum usage and the growing competition for scarce spectrum resources, the current frequency allocations for federal public safety communications systems cannot be reduced without jeopardizing the ability to accommodate future spectrum requirements necessary for mission critical functions.

NTIA recognizes the importance of interoperability with state and local public safety agencies and has identified spectrum from the limited resources in the 162-174 MHz and 406.1-420 MHz bands for this purpose. NTIA will continue to work with the public safety community through such entities as the FCC, FLEWUG, ICHIEFS, IACP, PSWN, and other organizations to establish policies and programs to enhance interoperability between federal, state, and local public safety organizations.

In its role as public policy advisor on telecommunications to the President, NTIA realizes that the interests of the Nation as a whole rest in assuring that public safety agencies at all levels of government have the resources they need to do their job effectively and with great resolve. As federal spectrum manager, NTIA must provide adequate spectrum resources for the federal public safety agencies and protect the ability of these agencies to perform their primary functions of protection of life and property, just as the FCC must do for the state and local public safety agencies.

APPENDIX A

Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001

SEC. 1705. REPORT ON PROGRESS ON SPECTRUM SHARING.

(a) STUDY REQUIRED- The Secretary of Defense, in consultation with the Attorney General and the Secretary of Commerce, shall provide for the conduct of an engineering study to identify-

(1) any portion of the 138-144 megahertz band that the Department of Defense can share in various geographic regions with public safety radio services;

(2) any measures required to prevent harmful interference between Department of Defense systems and the public safety systems proposed for operation on those frequencies; and

(3) a reasonable schedule for implementation of such sharing of frequencies.

(b) SUBMISSION OF INTERIM REPORT - Within one year after the date of enactment of this Act, the Secretary of Defense shall submit to the Committee on Armed Services of the Senate and the Committee on Armed Services of the House of Representatives an interim report on the progress of the study conducted pursuant to subsection (a).

(c) REPORT - No later than January 1, 2002, the Secretary of Commerce and the Chairman of the Federal Communications Commission shall jointly submit a report to Congress on alternative frequencies available for use by public safety systems.

APPENDIX B

Federal Public Safety Agency Input

The contents of this appendix are actual inputs to this report as solicited from various federal agencies that have ongoing or pending communication systems upgrades designed to meet the narrowband mandate in the 162-174 MHz and 406.1-420 MHz bands. These inputs contain information previously published in the NTIA Special Publication 01-44, "Assessment of Electromagnetic Spectrum Reallocation, Response to Title X of the National Defense Authorization Act for FY2000," published in January 2001. The responding federal agencies reviewed and updated the information for inclusion in this report.

Department of Justice⁸⁴

The majority of spectrum use by the DOJ is primarily in the 162-174 MHz band and secondarily in the 406-420 MHz band. Both bands are allocated for exclusive government land mobile use and are critical for successfully meeting DOJ mission requirements.

In response to the NTIA narrowband mandate, and a congressional directive to consolidate all of the DOJ components into a single land mobile communications system, DOJ has undertaken a comprehensive effort to develop the Justice Wireless Network (JWN) concept. The consolidated JWN is a department-wide LMR system, which utilizes the 162-174 MHz and 406.1-420 MHz bands with current budget estimates of \$1 billion. The JWN is planned to fulfill the following goals:

- Increase spectrum efficiency
- Improve interoperability among all department components, as well as other federal law enforcement agencies
- Maximize efficiencies and savings through a shared infrastructure and common procurement strategies

DOJ engages in a wide range of operations and functions that are supported by LMR systems. The utilization of LMR is critical for meeting departmental communications and information sharing requirements. DOJ is committed to providing its agents and personnel with effective tactical communications systems that are protected from unwanted monitoring and that maximize interoperability among components. These unique and essential features require the Department to maintain some level of LMR capability to ensure agent safety and to successfully accomplish the Department mission. Congress has recognized the necessity of a tactical LMR system and validated the DOJ goal to provide compatible and secure communications among all DOJ components to support joint missions and to share infrastructure for tactical and safety of life uses. Development of the JWN concept included evaluation and application of commercial

⁸⁴ Justice Letter at 1-2.

services to the maximum extent possible. The new consolidated JWN concept includes a commercial services component for administrative uses that are not part of the cost estimate for the LMR system portion. The evaluation of commercial services revealed that the DOJ critical requirement for 24 hours a day/7 days a week priority tactical dispatch communications support could not be met by commercial services.

The DOJ mission is to “enforce the law and defend the interests of the United States according to the law, provide federal leadership in preventing and controlling crime, seek just punishment for those guilty of unlawful behavior, administer and enforce the Nation’s immigration laws fairly and effectively and ensure fair and impartial administration of justice for all Americans.” Wireless communications are critical to successfully meeting mission requirements and in many instances provide a lifeline during the conduct of these missions. The proliferation of the 162-174 MHz and 406.1-420 MHz government exclusive bands does not permit additional sharing without the express loss of communications on the part of DOJ and other agencies who already occupy this spectrum. The inability of the DOJ to achieve its mission goals by removal of the spectrum must be taken into consideration in any spectrum sharing in either the 162-172 MHz and 406.1-420 MHz government exclusive spectrum bands. The burgeoning demand for spectrum is an ongoing challenge that the DOJ faces within its own architecture. To relinquish any portion of what we currently use or to submit to sharing would severely impact an already spectrally constrained DOJ communications architecture.

Department of Agriculture (USDA)⁸⁵

The Department of Agriculture’s (USDA) radio requirements involve primarily conventional land mobile radio systems. These requirements are concentrated in three bands, 162-174 MHz, 406.1-420 MHz, and 1710-1850 MHz. There is also a small but growing requirement in the 30-50 MHz band. Several agencies within the USDA rely heavily on land mobile radio systems to accomplish their missions. The USDA has more than 70,000 radios supporting its varied missions. More than 60,000 radios, consisting of repeater stations, base stations, mobiles and portables, are in the 162-174 MHz band. These systems also support communications with the approximate 800 contracted and owned aircraft flying between 50,000 and 100,000 hours each year.

One of the two Federal Response Plan (FRP) Emergency Support Functions (ESF) where the USDA has primary responsibility is ESF-4 Firefighting. Within this function, the Forest Service provides the primary firefighting detection and suppression of wildland, rural, and urban fires resulting from or occurring coincidentally with a major disaster or emergency requiring federal response assistance. The National Interagency Fire Center (NIFC) in Boise, Idaho, maintains the National Incident Radio Support Cache and the National Fire Supplies and Equipment Cache. These caches of radios and equipment are available and regularly used in support of the FRP. The Forest Service has secondary support functions in six additional ESFs.

⁸⁵ Agriculture Letter at 1-2.

Radio communications are a mandatory requirement in each of these activities, in particular, ESF-2, where the Forest Service provides radio communications systems support of firefighters, law enforcement officers, and disaster response operations. This includes the additional radio systems required for the establishment of a Disaster Field Office (DFO) radio net.

The USDA utilizes the 406.1-420 MHz band to a lesser degree than the 162-174 MHz band however, it still plays a major part in USDA's activities. The NIFC maintains portable system caches in this band for short-range communications at fire camps and for operations bases at other incidents. Equipment in this band is also used for interconnecting repeaters, base stations, or telephone lines where wireline or microwave is not cost effective.

Forest Service. The Forest Service, in support of its mission, accounts for more than 80 percent of the Department's radio use. The Forest Service's activities include wildfire firefighting, law enforcement, search and rescue, and other normal daily administrative and operational use involving the management of 140 million acres of public land. This includes 155 national forests, wilderness areas, national grasslands, national primitive areas, national scenic and research areas, national wild and scenic rivers, national recreation areas, national game refuge and wildlife preserves, national monument areas, national historic areas, and national volcanic monument areas. There are many responsibilities included in this management that require reliable radio communications. Most of these are in rural areas.

Recreation Management: Includes over 330 million visitor days per year involving 5,885 campgrounds, 328 swimming developments, 1,222 boating sites, 250 winter sports sites, 124,600 miles of rivers, and 369,000 miles of roads.

Law Enforcement: Communications to support investigation and enforcement of wildland arson, archeological theft, timber theft, illegal drug activities, and access and control of wildfire areas. Of special interest is the "urban" environment of some national forests during recreation season. There is a substantial requirement in law enforcement support of vehicle traffic, personal property theft, and domestic violence.

Incident Support: Communications support for incidents such as wildfires, earthquakes, hurricanes, volcanic eruptions, oil spills, and nuclear disasters. In 1996 alone, over 6,000 radios were issued out at an average of seven times each.

Aviation: Communications support to coordinate aircraft operations. This includes an owned fleet of 42-fixed wing (air tankers, lead planes, air attack, smokejumper, infrared scan) and one rotary. A contracted fleet – 39 fixed wing aircraft (air tankers, air attack, smokejumper) and 505 rotary wing aircraft. Most are used in support of wildland firefighting; however, some are also used to transport personnel and equipment to support other incidents.

Office of Inspector General. Communications to support special agents conducting their investigations of violations of federal law as they pertain to the Department. They also provide protection to the Secretary of Agriculture.

Animal Plant and Health Inspection Service. The Animal Plant and Health Inspection Service's primary activities include inspection and eradication of plant pests, animal diseases, and wildlife damage. Radio support for these activities includes air to ground, ground to ground, and telemetry. Inspection officers often work with port authorities for the inspection of cargo on international arrivals. Field veterinarians work in both local and remote sites to help diagnose animal disease in hopes of controlling or preventing disease spread.

The Food Safety and Inspection Service. Compliance and Investigation Division (CID), requires radio support for its investigations of violations involving meat, poultry, and/or egg products laws and regulations. CID interests are in the prevention of potential threats to human health and safety that could occur when clandestinely slaughtered livestock or adulterated products are placed in the human food channels.

Department of the Treasury⁸⁶

The Secretary of the Treasury, as the Chief Financial Officer of the United States, advises the President on financial and tax policy matters. The majority (approximately 60 percent) of the U.S. Department of the Treasury's responsibilities relate to promoting prosperous and stable American and world economies and managing the government's finances. The law enforcement activities of the department protect our financial systems and our Nation's leaders, and enable the pursuit of a safe and drug-free America.

Treasury agents and officers are charged with reducing the trafficking, smuggling, and use of illicit drugs; suppressing the illegal trafficking, possession, and use of firearms and explosives; and combating financial crimes and money laundering. Additionally, the bureaus are responsible for protecting our Nation's leaders and visiting foreign dignitaries; fighting violent crime; providing high quality training for law enforcement personnel; and protecting Treasury facilities and securing high-value assets.

The vast majority (almost 95 percent) of Treasury's law enforcement and protection operations is conducted on communications systems using the two federal land mobile bands, (162-174 MHz and 406.1-420 MHz). The majority (more than 80 percent) of this equipment operate in the 162-174 MHz band. The Treasury Strategic Plan calls for using the 162-174 MHz band to satisfy nationwide or wide-area requirements and the 406.1-420 MHz band to satisfy local area or campus communications requirements.

⁸⁶ Treasury Letter at 1-2.

Treasury's Wireless LMR Vision. A consolidated Treasury Wireless LMR architecture, known as the Integrated Treasury Network (ITN), that satisfies bureau mission requirements, maximizes resource sharing, employs a complementary mix of infrastructure alternatives, provides interoperability, and complies with federal requirements and initiatives.

The ITN will provide Treasury bureaus nationwide coverage through a LMR system that will consist of both trunked and conventional VHF digital narrowband equipment. The ITN will provide over-the-air-rekeying and over-the-air-programming capabilities to Treasury agents and officers thereby saving time and manpower costs. Total estimated cost to study, design, build-out, operate, and maintain the ITN through 2005 is about \$486 million.

Treasury believes that the ITN will provide cost efficiencies and high benefit for Treasury users. Additionally, the ITN will be based on digital technical standards that address common bureau requirements and realize management and resource efficiencies through consolidation, sharing, centralization, and targeted use of commercial services. The ITN provides the flexibility to support bureau unique mission-critical law enforcement and protective requirements. It not only accommodates increased interoperability among Treasury bureaus, but also allows for interconnection with the Justice Wireless Network (JWN) and other Federal Government and state and local public safety entities. Implementation of the ITN began in Fiscal Year 2001 and, pending availability of funds, Treasury plans to have the ITN fully implemented by December 31, 2004, to successfully meet NTIA's narrowband mandate. Additionally, Treasury has negotiated with vendors to provide not only LMR systems, but body-worn transmitters and receivers, tactical receivers, vehicle and package tracking transmitters and receivers, and video control equipment in the 162-174 MHz band. The majority of the equipment will be synthesized, allowing limited frequency flexibility. Use of this equipment is not limited to specific regions or areas, but will be utilized anywhere in the United States and possessions.

The department's nationwide build-out of the ITN in the 162-174 MHz band and use of the 406.1-420 MHz at various sites throughout the Nation is dependent on use of the spectrum. The explosion of wireless systems among the federal agencies, especially in large metropolitan areas, makes obtaining frequency clearance increasingly difficult, which endangers the lives of federal law enforcement agents and officers. It is absolutely essential that sufficient spectrum in both 162-174 MHz and 406.1-420 MHz bands be available to support the department's systems and maximize agent and officer safety, protect the Nation's leaders, and successfully accomplish Treasury's varied missions throughout the United States and possessions.

APPENDIX C

Current PSWN Interoperability Pilot and Demonstration Programs

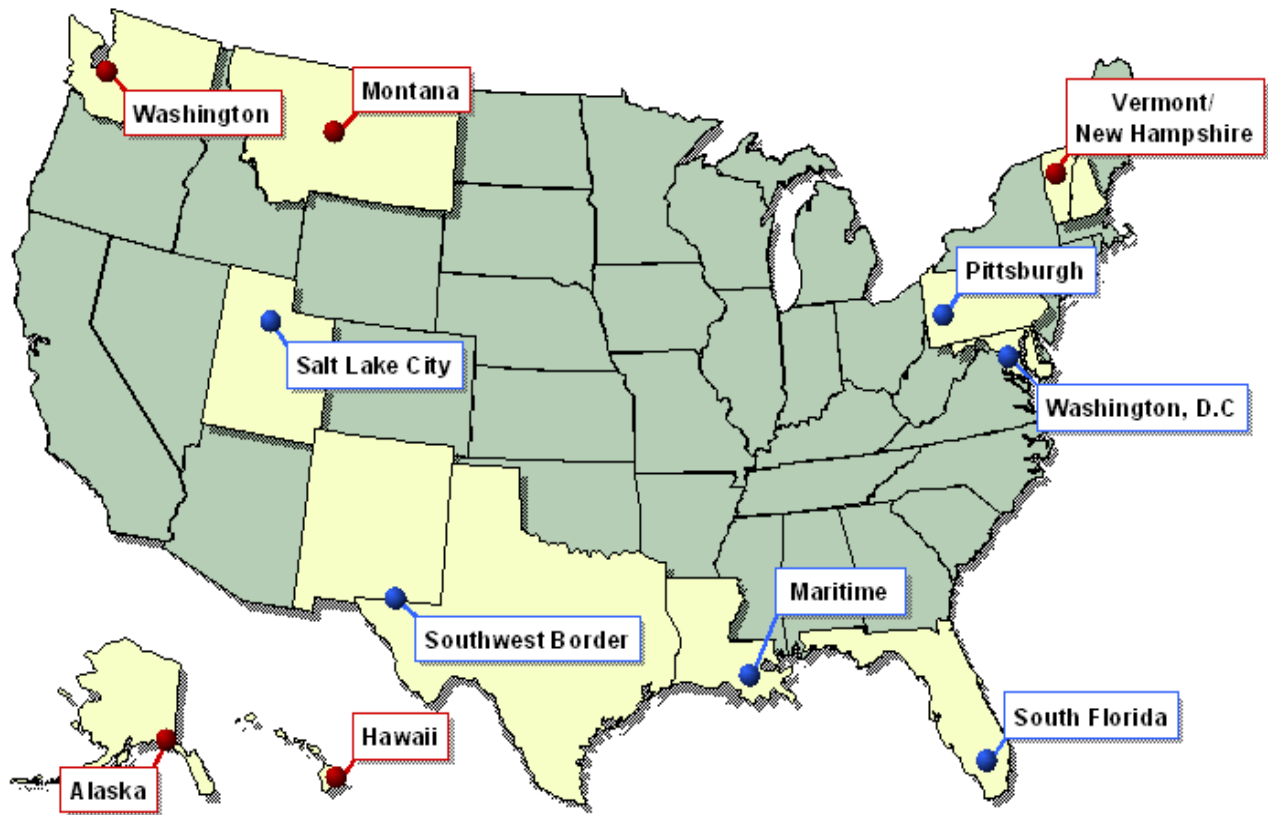


Figure C-1. PSWN Pilots

Source: PSWN Web site (www.pswn.gov)

PSWN INTEROPERABILITY PILOT AND DEMONSTRATION PROGRAM DESCRIPTIONS⁸⁷

SOUTHWEST BORDER PILOT

This pilot provides a unique solution for interoperability between proprietary trunked systems. The PSWN Program is implementing a fixed site talk group-to-talk group or conventional channel-to-talk group interoperability link that will allow subscriber units in each city to talk to subscriber units in the other. This pilot is being conducted in Las Cruces, New Mexico and El Paso, Texas.

SOUTH FLORIDA PILOT

This pilot demonstrates quick system implementation of a discrete, short-term interoperability solution for local, state and federal users in different frequency bands. A fixed solution and a mobile solution are being implemented. The fixed solution uses leased circuits and a shared channel to link designated dispatch consoles and agencies together for interoperability. The mobile component uses a package designed to provide interoperability beyond current coverage areas by applying a modular interface system that can be mounted on a mobile platform.

SALT LAKE CITY PILOT

As the host of the 2002 Winter Olympics Games, Salt Lake City is seeking enhanced functionality for current systems through comprehensive radio coverage and seamless interoperability with minimal dispatcher intervention. A cross-system interconnect solution is being implemented, allowing for wide-area interoperability between local, state and federal public safety entities, virtually eliminating jurisdictional obstacles to interoperability.

WASHINGTON, D.C., AREA PILOT

This pilot involves providing interoperability in the Washington, D.C., area. The solution implements tri-band repeater stacks at six traffic choke points around the D.C. area "Beltway" and ties those repeaters into an interconnected network of local 800 MHz systems. The pilot involves a large federal presence and addresses the challenges of bringing together many different radio networks and systems operating in different bands.

⁸⁷ Public Safety Wireless Network Program/Federal Law Enforcement Wireless Users Group *PSWN Program & FLEWUG Status Report* (Jan.-Jun. 2001) at 18-22.

NEW ORLEANS MARITIME CASE STUDY

This program is examining several options as part of the pilot, including developing a regional maritime wireless interoperability strategy, implementing a VHF-to-800 MHz link, implementing a console-to-console link, conducting a mobile command post upgrade, and developing a regional maritime wireless data strategy.

MONTANA STATE INTEROPERABILITY ASSISTANCE

This project encourages resource sharing and promotes interoperability among several Montana-based public safety agencies from different levels of government. The project collocates several public safety agencies' equipment at a single site. The successful techniques used in this project can be applied to other sites throughout the state.

VERMONT/NEW HAMPSHIRE STATE INTEROPERABILITY ASSISTANCE

This project involves providing support to public safety representatives in Vermont and New Hampshire in the design and implementation of a cross-border interoperability solution. The proposed solution involves installing radios with microwave interconnects in Vermont to achieve interoperability with New Hampshire.

METRO WASHINGTON, D.C., FIRE PROJECT

The PSWN Program worked with the D.C. Fire Department to develop an interoperability solution that allows an incident commander to use a switching device to connect radio systems operating on three different frequency bands. The switch will allow neighboring fire departments to interoperate when responding to fires or emergencies in the subway's underground tunnels.

BLAINE, WASHINGTON

The U.S. Border Patrol in Blaine currently provides dispatch and communications service for the Blaine, Lynden, and Sumas Police Departments on a wideband communications system. When the Border Patrol transfers to the JWN system, the local police departments will lose their dispatch functionality. The PSWN Program assessed the impact of the narrowband conversion on local police departments and considered solutions that will allow the U.S. Border Patrol to continue providing dispatch services to local agencies.

RAINBOW COMMUNICATIONS SYSTEM

The Rainbow Communications System, located in Hawaii, is a unique example of a shared system used by state and federal public safety agencies and serves as a critical communications infrastructure for these agencies. PSWN conducted an analysis to determine several viable alternatives for replacing the current system, including a privately owned system, commercial services, and a hybrid of both.

PITTSBURGH AREA PILOT⁸⁸

The PSWN Program is working with federal agencies to implement a shared federal system for the Pittsburgh area. This will be a trunked narrowband 162-174 MHz system that will fully comply with the current narrowband digital standard, TIA 102 (Project 25).

STATE OF ALASKA PILOT PROGRAM

The State of Alaska has requested assistance from PSWN to help them in developing the business case, management structure and technical support for a statewide shared public safety system. The system will be jointly sponsored by the State Department of Public Safety and the U.S. Air Force. A pilot system consisting of nine sites in the Northern Zone close to Fairbanks will be developed first as a proof of concept. PSWN will continue to provide direct assistance to the state in developing the concept of a shared federal, state and local infrastructure. To date, this assistance consists of organizational support, funding assistance, strategy and operations development, and systems planning assistance.

⁸⁸ Public Safety Wireless Network Program/Federal Law Enforcement Wireless Users Group, *PSWN Program & FLEWUG Status Report* (Jul.-Dec. 1999) at 12.