

1.2 *Tables A-1.1 through A-1.7 show the assignment of frequencies for each of the seven major uses described in the report utilizing Implementation Option #1: Interoperability Implementation Utilizing Existing Bands.*

1.2.1 Figure A-1 is an example of how these matrices could be applied in responding to a major wildland fire in Southern California (typical of those studied in this Report).

1.3 *Tables A-2.1 through A-2.7 show the assignment of frequencies for each of the seven major uses described in the report utilizing Implementation Option #2: Interoperability Implementation Utilizing A Minimum of Interoperability Links in Existing Bands With A Majority of Interoperability Links in a Separate "Public Safety Interoperability Band".*

APPENDIX A
Interoperability Link Implementation Option Matrices

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	1R	X	X	X	X	X	X	X
150-174	1R* (1a)	X	X	X	X	X	X	X
220-222	1R* (1b)	X (1b)	X (1b)	X (1b)				
406-420	1R* (1c)	X	X	X	X			X
450-470	1R* (1d)	X	X	X	X	X	X	X
806-824	1R* (1e)		X	X	X	X	X	X

Table A-1.1: National Calling

- (1a) Two frequencies from NTIA 10 frequency interoperability reserve
- (1b) Channel 161 - Restricted to use by Urban Search & Rescue/Disaster Medical Assistance Teams nationwide
- (1c) Two frequencies from recommended NTIA 10 frequency interoperability reserve
- (1d) 460/465.525 MHz
- (1e) Channel 601

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	N/A	1R	1R	1R	X (2a)	X (2a)		
150-174	N/A	1R* (2b)	1R	1R	X (2a)	X (2a)		
220-222	N/A							
406-420	N/A	1R			X (2a)	X (2a)		
450-470	N/A	1R	1R	1R	X (2a)	X (2a)		
806-824	N/A	1R	1R	1R	X (2a)	X (2a)		

Table A-1.2: Emergency Only, Service Dependent

- (2a) For Cons and Gen Govt criminal justice, EMS & fire functions may use the systems of corresponding services
- (2b) 155.475 MHz, plus one frequency from NTIA 10 frequency interoperability reserve

APPENDIX A
Interoperability Link Implementation Option Matrices

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	N/A	1R+(3a)	1R	1R+(3b)	X (2a)	X (2a)		
150-174	N/A	1R	1R	1R* (3c)	X (2a)	X (2a)		
220-222	N/A							
406-420	N/A	1R* (3d)		1R* (3d)	X (2a)	X (2a)		
450-470	N/A	1R	1R* (3e)		X (2a)	X (2a)		
806-824	N/A	1R	1R	1R	X (2a)	X (2a)		

Table A-1.3: Day-to-Day, Service Dependent

- (3a) 45.86 MHz
- (3b) 45.88 MHz
- (3c) 154.280 MHz, plus one frequency from NTIA 10 frequency interoperability reserve
- (3d) Four frequencies from recommended NTIA 10 frequency interoperability reserve
- (3e) 460/465.550 MHz

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	2R	X	X	X	X	X	X	X (4a)
150-174	4R+ (4b)	X	X	X	X	X	X	X (4a)
220-222	1R* (4c)	X	X	X				
406-420	4R	X	X	X	X	X	X	X (4a)
450-470	4R	X	X	X	X	X	X	X (4a)
806-824	4R* (4d)	X	X	X	X	X	X	X (4a)

Table A-1.4: Tactical, Service Independent

- (4a) If permitted by State/Regional Plan
- (4b) One half of requirement for each repeater pair met from NTIA 10 frequency interoperability reserve (total of 4 frequencies required)
- (4c) Channel 170
- (4d) Channels 639, 677, 715, 753

APPENDIX A
Interoperability Link Implementation Option Matrices

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	2S+ (5a)	X	X	X	X	X	X	
150-174	16S+ (5b)	X	X	X	X	X	X	
220-222								
406-420	4S+ (5c)	X	X	X	X	X	X	
450-470	6S	X	X	X	X	X	X	
806-824	6S	X	X	X	X	X	X	

Table A-1.5: Tactical, Service Independent

- (5a) 39.46 MHz
- (5b) Remaining two frequencies from NTIA 10 frequency interoperability reserve; it is suggested that the remaining frequencies come from the pool maintained for the NIFC caches.
- (5c) Remaining four frequencies from recommended NTIA 10 frequency interoperability reserve

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	N/A	1S	1S	1S	1S	1S	1S	1S
150-174	N/A	1S	1S* (6a)	2S* (6b)	1S	1S	1S	1S
220-222	N/A							
406-420	N/A	1S				1S		
450-470	N/A	1S	1S	1S	1S	1S	1S	1S
806-824	N/A	1S	1S	1S	1S	1S	1S	1S

Table A-1.6: Tactical, Service Dependent

- (6a) 155.340 MHz
- (6b) 154.265 and 154.295 MHz

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
220-222	N/A		9S* (7a)	9S* (7b)				

Table A-1.7: Urban Search & Rescue/Disaster Medical Assistance Teams (7c)

- (7a) DMAT Channels 162, 164, 168
- (7b) USART Channels 163, 165, 167, 169
- (7c) Based on the individual incident, these channels can be used simplex or paired for repeater operation.

APPENDIX A
Interoperability Link Implementation Option Matrices

THIS PAGE RESERVED FOR FIGURE A-1

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

APPENDIX A
Interoperability Link Implementation Option Matrices

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	1R	X	X	X	X	X	X	X
150-174	1R* (1a)	X	X	X	X	X	X	X
406-420	1R* (1b)	X	X	X	X	X	X	X
450-470	1R* (1c)	X	X	X	X	X	X	X
806-824	1R* (1d)	X	X	X	X	X	X	X
New Band	1R	X	X	X	X	X	X	X

Table A-2.1: National Calling

- (1a) Two frequencies from NTIA 10 frequency interoperability reserve
- (1b) Two frequencies from recommended NTIA 10 frequency interoperability reserve
- (1c) 460/465.525 MHz
- (1d) Channel 601

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	N/A							
150-174	N/A							
406-420	N/A							
450-470	N/A							
806-824	N/A							
New Band	N/A	1R	1R	1R	1R	1R	1R	1R

Table A-2.2: Emergency Only, Service Dependent

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	N/A							
150-174	N/A							
406-420	N/A							
450-470	N/A							
806-824	N/A							
New Band	N/A	2R	2R	2R	2R	2R	2R	1R

Table A-2.3: Day-to-Day, Service Dependent

APPENDIX A
Interoperability Link Implementation Option Matrices

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	2R	X	X	X	X	X	X	X (4a)
150-174	4R + (4b)	X	X	X	X	X	X	X (4a)
406-420	2R + (4c)	X	X	X	X	X	X	X (4a)
450-470	4R + (4d)	X	X	X	X	X	X	X (4a)
806-824	4R* (4e)	X	X	X	X	X	X	X (4a)
New Band	10R	X	X	X	X	X	X	X (4a)

Table A-2.4: Tactical, Service Independent

- (4a) If permitted by State/Regional Plan
- (4b) Seven frequencies from NTIA 10 frequency interoperability reserve, 1 additional frequency required
- (4c) Two frequencies from recommended NTIA 10 frequency interoperability reserve, 2 additional required
- (4d) 460/465.550 MHz
- (4e) Channels 639, 677, 715, 753

<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	N/A							
150-174	N/A							
406-420	N/A							
450-470	N/A							
806-824	N/A							
New Band	30S	X	X	X	X	X	X	

Table A-2.5: Tactical, Service Independent

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<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
42-50	N/A	1S* (6a)	1S	1S* (6b)				
150-174	N/A	2S* (6c)	1S* (6d)	2S* (6e)				
406-420	N/A	3S* (6f)	1S* (6f)	2S* (6f)				
450-470	N/A	1S	1S	1S				
806-824	N/A	1S	1S	1S				
New Band	N/A	8S	6S	12S	4S	4S	4S	2S

Table A-2.6: Tactical, Service Dependent

- (6a) 45.86 MHz
- (6b) 45.88 MHz
- (6c) 155.475 MHz plus remaining frequency from NTIA 10 frequency interoperability reserve
- (6d) 155.340 MHz
- (6e) 154.265 and 154.295 MHz
- (6f) Remaining six frequencies from recommended NTIA 10 frequency interoperability pool

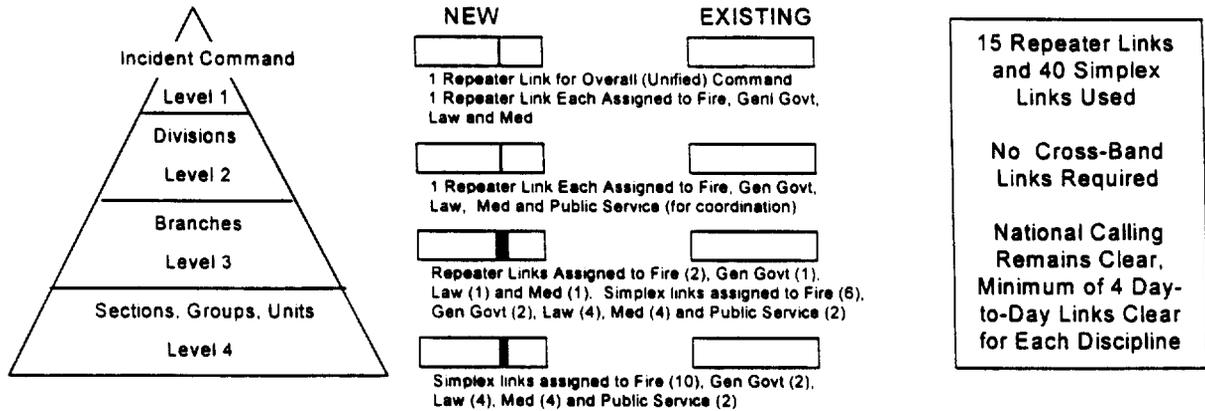
<i>Band</i>	<i>Shared</i>	<i>Crim Just</i>	<i>EMS</i>	<i>Fire</i>	<i>For Cons</i>	<i>Gen Govt</i>	<i>Hwy Main</i>	<i>Pub Serv</i>
New Band	N/A		6S* (7a)	6S* (7a)				

Table A-2.7: Urban Search & Rescue/Disaster Medical Assistance Teams

- (7a) Based on the individual incident, DMAT channels can be used simplex or paired for repeater operation.
- (7b) Based on the individual incident, USART channels can be used simplex or paired for repeater operation.

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Interoperability for A Major Wildland Fire



Command Level 1: Nat Tac #R1 serves as Unified Command Net for all disciplines. Nat Tac #R2 is used for Fire Command, Nat Tac #R3 is used for Genl Govt Command, Nat Tac #R4 is used for Law Command, Nat Tac #R5 is used for Med Command.

Divisions Level #2: Nat Tac #R6 is used for Fire, Nat Tac #R7 is used for Gen Govt, Nat Tac #R8 is used for Law, Nat Tac #R9 is used for Med. SD/D-D Rpt is assigned to Public Service for coord.

Branches Level #3: Nat Tac #R10 and For Conv SD/D-D #R1 is used for Fire, GG SD/D-D #R1 is used for Genl Govt, Law SD/D-D #R1 is used for Law, Med SD/D-D #R1 is used for Med. Nat Tac #S1 - S6 assigned to Fire, Nat Tac #S7 and S-8 assigned to Genl Govt, Nat Tac #S9 - S12 assigned to Law, Nat Tac #S13 - S15 assigned to Med, Nat Tac #17 - S18 assigned to Pub Serv.

Section/Group/Unit Level #4: Nat Tac #S19 - S24 & Fire SD/Tac #S1 - #S4 for Fire, Nat Tac #S25 - S26 for Genl Govt, Nat Tac #S27 - 28 & Law SD/Tac #S1 - S2 assigned to Law, Nat Tac #S29 - S30 & Med SD/Tac #S1 - S2 assigned to Med, Pub Serv SD/Tac #S1 - S2 assigned to Pub Serv.

This diagram depicts a typical assignment of Future Mutual Aid Spectrum Resources to a Major Wildland Fire Incident in Southern California

Interoperability Links Applied to A Major Incident Using Incident Command System Protocols

Figure A-2

APPENDIX B
CURRENT INTEROPERABILITY FREQUENCIES
FCC Part 90 (State/Local Government)

A review of FCC Rules and Regulations indicates that the following intersystem/mutual aid operations are permitted. Only the standard channels (prior to refarming) are listed. Citations are from Pike and Fischer, Inc. Communications Regulation on CD ROM (2-96).

B-1. FCC Part 90, Subpart B - Public Safety Radio Services:

1.1 FCC 90.19 Police Radio Service:

39.46 and 45.86 MHz:

90.19(e)(11) This frequency is reserved for assignment to stations for inter-system operations only: provided, however, that licensees holding a valid authorization to use this frequency for local base or mobile operations as of June 1, 1956, may continue to be authorized for such use.

155.475 MHz:

90.19(e)(14) This frequency is available nationwide for use in police emergency communications networks operated under statewide law enforcement emergency communications plans. Operations authorized on this frequency which are not in accordance with this limitation may continue until January 1, 1985.

1.2 FCC 90.21 Fire Radio Service:

45.88, 154.265, 154.280 and 154.295 MHz:

90.21(c)(2) This frequency is reserved for assignment to stations in this service for intersystem operations only and these operations must be primarily base-mobile communications.

1.3 FCC 90.27 Emergency Medical Radio Service:

155.340 MHz:

90.27(c)(5) This frequency may be designated by common consent as an inter-system mutual assistance frequency under an area-wide medical communications plan.

460/465.525 and 460/465.550 MHz:

90.27(c)(10) This frequency is shared with the Police and Fire Radio Services. This frequency may be designated by common consent for intra-system and

inter-system mutual assistance purposes and is subject to the coordination requirements specified in §90.175 of this part.

1.4 FCC Part 90, Subpart C - Special Emergency Radio Service:

The following note should be removed from FCC rules as a result of the removal of 155.340 MHz from the Special Emergency Radio Service:

90.53(d)(3) The frequency 155.340 MHz may be assigned as an additional frequency when it is designated as a mutual assistance frequency as provided in §90.53(b)(10).

B-2. FCC Part 90, Subpart T - 220 - 222 MHz

2.1 FCC 90.715(a) Frequencies available to Public Safety eligibles [in part]:

Channel	161	220.8025 MHz
	162	220.8075
	163	220.8125
	164	220.8175
	165	220.8225
	166	220.8275
	167	220.8325
	168	220.8375
	169	220.8425
	170	220.8475

2.2 FCC 90.720 Channels available for public safety/mutual aid.

(a) Part 90 licensees whose licenses reflect a two-letter radio service code beginning with the letter "P" (except for "PS") are authorized by this rule to use mobile and/or portable units on Channels 161-170 throughout the United States, its territories, and possessions to transmit: (1) communications relating to the immediate safety of life or (2) communications to facilitate interoperability between public safety entities.

(b) Any entity eligible to obtain a license under Subpart B of this part is also eligible to obtain a license for base/mobile operations on Channels 161-170. Base/mobile or base/portable communications on these channels that do not relate to the immediate safety of life or to communications interoperability between public safety entities may only be conducted on a secondary, non-interference basis to such communications.

B-3. FCC Part 90, Subpart S - 800 MHz:**3.1 FCC 90.613(a) Frequencies available to eligibles [in part]:**

Channel	601	866.0125 MHz
	639	866.5125
	677	867.0125
	715	867.5125
	753	868.0125

3.2 FCC 90.617(a)(1) General Geographic Requirements:

Channel numbers 601-830 are also available to eligible applicants in the Public Safety Category in areas farther than 110 km (68.4 mi) from the U.S./Mexican border, and 140 km (87.0 mi) from the U.S./Canadian border. The assignment of these channels will be done in accordance with the policies defined in the Report and Order of Gen. Docket No. 87-112. (See §§90.16 and 90.34.) The following channels are available only for mutual aid purposes as defined in Gen. Docket No. 87-112: 601, 639, 677, 715, 753.

3.3 FCC 90.619 Frequencies available in the U.S./Mexico & U.S./Canada border areas:**(a) U.S./Mexico border area:**

(2) Certain channels in the 821-824/866-869 MHz band are also available to eligible applicants in the Public Safety Category in areas within 110 kilometers (68.4 miles) of the U.S./Mexico border. These channels will be assigned according to the policies defined in the Report and Order of Gen. Docket No. 87-112 (see §§90.16 and 90.34). The following channels are available only for mutual aid purposes as defined in Gen. Docket No. 87-112: Channels 601, 639, 677, 715, and 753.

(b) U.S./Canada border area:

Specific provisions for use of the 821-824/866-869 MHz bands in the U.S./Canada border area are contained in paragraph (c) of this section

(c) Use of frequencies in the 821-824/866-869 MHz band (Channels 601-830) in the U.S./Canada border area. The following criteria shall govern the assignment of frequency pairs (channels) in the 821-824/866-869 MHz band for stations located in the U.S./Canada border area. They are available for assignments for conventional or trunked systems in accordance with applicable sections of this subpart and the Report and Order in Gen. Docket No. 87-112. They are not available for intercategory sharing.

(1) Channels 601-830, as listed in §90.613 Table of 806-824/851-869 MHz Channel Designations, are available to eligible applicants in the Public Safety Category for use in the U.S./Canada border area as shown in Table 25. Additionally, Channels 601, 639, 677, 715 and 753 are available in all regions only for mutual aid purposes as defined in Gen. Docket No. 87-112.

APPENDIX C

PSWAC/ISC 96-04-024/2
Revised 5/21/96

Metropolitan Washington Area Interoperability

**A Case Study Of The Spectrum Required To Facilitate Effective
Inter-Jurisdiction and Inter-Agency Operations That Provide
Public Safety Services During Major Emergency Events.**

Prepared by: **The Interoperability Subcommittee of the Public Safety Wireless
Advisory Committee (PSWAC) and The Metropolitan Washington
Council Of Governments.**

I. FORWARD

The Interoperability Sub Committee (ISC) of the Public Safety Wireless Advisory Committee (PSWAC) requested the assistance of the Metropolitan Washington Council of Governments (COG) to determine the spectrum requirements for wireless communications to successfully handle a disaster like the crash of Air Florida Flight 90 in today's environment. The request was officially made to the Police Chiefs Committee at their February 28, 1996 meeting. There were 40 representatives in attendance. The committee unanimously approved the request. Fire Service participation was accomplished by fax on February 28 by inviting COG's Fire Chiefs to send their communications representatives to the special meeting. A special joint meeting of the Police and Fire/EMS communications committees was called for March 8, 1996 to address the request. A follow up meeting was held on April 2, 1996 to review and edit a draft report covering the analysis, conclusions and recommendations. This final report is included in the ISC final report to the Advisory Committee and will be considered for adoption by the Police and Fire Chiefs Committees of the Council of Governments.

The Air Florida or the Fourteenth Street Bridge disaster occurred on January 13, 1982. This disaster represented many challenges to the in-place command and control and communications capabilities of the responding public safety agencies. The resulting overload condition severely hampered the responding agencies and prevented these agencies from providing their best service to those in need. One outcome of this disaster was formulation and adoption of The Greater Metropolitan Washington Area Police and Fire/Rescue Services Mutual Aid Operational Plan. This Mutual Aid Plan was adopted in December 1983 and was revised in September 1990. This Mutual Aid Plan incorporates the Incident Command System (ICS) developed by the US Fire Administration, the Federal Emergency Management Agency (FEMA), and the National Fire Protection Association (NFPA).

This paper will consider the original disaster looking for short comings in communications which hampered response and assistance. The report will then address the current communications capability in supporting the Mutual Aid Plan. Again the report will address the issues and problems in communications reported by the responders to recent disasters. The report also addresses the users' response to the question: "*If the Air Florida disaster occurred today what communications are required to make your Mutual Aid Plan viable? And, looking to the year 2010 what future communications needs do you anticipate to enhance interoperability and improve response and service in disaster incidents?*".

The following is a list of individuals who participated in the development of the case study:

METROPOLITAN WASHINGTON COG PARTICIPANTS **TABLE 1**

NAME	ORGANIZATION/AGENCY
Steve Souder	Arlington County (VA) ECC
Ralph C. Henderson	Defense Protective Service
Austin Story	Montgomery County Police - ECC
Elwood R. Ey III	Montgomery County Fire/Rescue ECC
Mark Deputy	Montgomery County Fire/Rescue ECC
Bruce R. Blair	Montgomery County Police
Ken Boyles	Central Intelligence Agency
Tyrone Dindal	Central Intelligence Agency
John Kurtin	Central Intelligence Agency
Paul A. Nichols	Fairfax County Fire/Rescue
Curt Andrich	Fairfax County Police
Bruce Henry	Virginia State Police
Mike Gallant	U.S. Park Police
Phil Kramer	U.S. Park Police
Henry Wood	Prince William Public Safety Center
Steve Marzolf	Prince William Public Safety Center
Gary E. DeBruler	MDW Provost Marshal Office US Army
Douglas R. Champaigne	MDW Provost Marshall Office US Army
Michael Gills	COG Public Safety
Joe Zelinka	COG Public Safety
Andrew L. Jackson, Jr.	DC Fire/EMS/Comm. Div
M. R. Oluwa	DC Fire/EMS /Comm Div
Paul Basak	U.S. Capitol Police
Harold Pickering	DC Fire/EMS Department
Joseph Lundholm	Montgomery County Police Dept. (Vol)

II. THE INCIDENT

On January 13, 1982 at approximately 3:45 in the afternoon Air Florida Flight 90 took off from Washington National airport and moments later crashed into commuter traffic on the northbound span of the Fourteenth Street Bridge. After striking the bridge, the 737 jetliner broke in two pieces and fell into the ice covered Potomac river near the Virginia side and quickly sank below the icy surface.

This tragic occurrence instantaneously created a multi-sector emergency response situation encompassing two geographic areas, both requiring emergency rescue and medical services. Each site represented a different set of circumstances that would require a different combination of equipment and personnel to be assembled from the resources available to the federal, state and local agencies in the surrounding area.

Helicopter, boats, life rafts and divers were needed to attempt a rescue of the aircraft passengers and crew members in the Potomac river. Rescue workers armed with tow trucks, hydraulic jacks, acetylene torches and related equipment were needed to rescue passengers from the crushed automobile wreckage on the bridge. Both sites needed emergency medical

services to stabilize and transport the rescued to nearby hospitals. Both sites needed a law enforcement response to assist in rescue efforts and provide traffic and crowd control.

The two sector aircraft and motor vehicle rescue operation quickly escalated to a multiple incident rescue operation a half hour later when a Metro subway train derailed in an underground tunnel near the Smithsonian station of the Metro subway rail system. Here, another group of rescue workers similar to those deployed on the bridge were needed to rescue passengers of the subway train wreckage.

To further complicate matters, massive traffic jams would impede the progress of the responding emergency personnel as they traveled toward the sites of the emergencies. The diminished road conditions coupled with the early release of Federal employees, due to the day-long snowstorm, produced traffic nightmares and grid-lock throughout the area.

Public Safety Notification and Response

Public safety officials were notified of the air crash through two different means. The United States Park Police Communications Center received the initial call from a commuter on a mobile phone who advised that there was a plane crash in the Gravelly Point area (just north of the airport) of the Virginia shoreline of the Potomac River. The Park Police Communications Center called the control tower at National Airport and the FAA advised that they had no knowledge of an airplane crash. The District of Columbia Fire Department received notification from a commuter calling through the IMTS mobile telephone operator. The IMTS mobile operator connected him directly to the DC Fire Communications Center. The majority of the public safety agencies received notification when the FAA at National Airport broadcast an alert on the Washington Area Warning and Alerting System (WAWAS), a wireline network connected to the public safety agencies in the region sponsored by the Federal Emergency Management Agency (FEMA).

TABLE 2 lists the agencies that responded and their role in the emergency operations. It also shows the frequency band each agency was operating on at the time of the Fourteenth Street Bridge disaster. Helicopters were provided by the US Park Police. Divers were provided by Fairfax County, Virginia as well as the District of Columbia Harbor Patrol.

FOURTEENTH STREET BRIDGE RESPONDERS / ROLES TABLE 2

Agency/Jurisdiction	Role Of Agency/Jurisdiction
Arlington County, VA Police	Traffic Control
Arlington County, VA Fire / EMS	Emergency Medical / Rescue
District Of Columbia Fire / EMS	Emergency Medical / Rescue
District Of Columbia Police	Traffic Control/ Rescue
Fairfax County, VA Fire / EMS	Emergency Medical / Rescue
Federal Protective Service	Support (as requested)
Montgomery County, MD Fire / EMS	Emergency Medical
National Airport Fire	Rescue
National Airport Police	Traffic Control
Prince George's County, MD Fire / EMS	Emergency Medical / Rescue
RACES*	Comm Links (i.e., to morgue)
Red Cross	Support
U.S. Army MASH unit	M.A.S.H. Operations
United States Coast Guard	Rescue / Recovery
United States Navy	Recovery
United States Park Police	Traffic/Rescue
US Federal Aviation Administration	Notification / Alert
Virginia Department Of Transportation	Traffic Control Support
Virginia State Police	Traffic Control
WMATA Police	Traffic

* Radio Amateur Civil Emergency Service

There were three basic types of problems encountered by responders to the Fourteenth Street Bridge disaster; 1) situational problems, 2) organizational problems and 3) communications problems.

Situational Problems:

Multiple Incidents. The Metro subway train crash siphoned off personnel and communications resources.

Traffic Gridlock. Bad weather and heavy traffic from early release of federal employees produced impeding traffic conditions.

Multiple Geographic Sectors. The fact that responders were needed on the bridge and at the river bank divided available personnel and created an increase in communications traffic.

Notification Delay. The driving snowstorm produced very low visibility at the time of the incident. This limited the number of people who could have witnessed and reported the incident to those in very close proximity of the accident. Most witnesses were in their cars and unable to report since cellular telephone service hadn't been implemented yet.

Organizational Problems:

Lack Of Command & Control. At the time of the Fourteenth Street Bridge disaster there was not a formal Incident Command Structure (ICS) system in place. Command and Control protocol was inadequate. Likewise, communicating protocols and channel utilization procedures were inadequate.

Undetermined Controlling Jurisdiction. The fact that the incident involved both the bridge and the river made it difficult to determine jurisdictional authority.

Communications Problems:

At the time of the Fourteenth Street Bridge disaster there were two mutual aid channels available to public safety agencies, one for fire and one for police. The Fire Mutual Aid Radio System (FMARS) channel operated on 154.280 MHz and was used for base-to-base, base-to-mobile and mobile-to-mobile communications. The Police Mutual Aid Radio System (PMARS) channel operated half-duplex on 458.550/453.550 MHz, available for base-to-base communications through a manual patch at the communications center. Interoperable communications during an incident like the Fourteenth Street Bridge disaster are conducted on the FMARS channel. The PMARS channel is used primarily for inter-jurisdictional vehicle pursuits and is spectrally inefficient in that it ties up three voice channels when in use.

The communications problems agencies encountered during the Fourteenth Street Bridge rescue operation principally centered around an inability to utilize the mutual aid channels. This was generally caused by either radio incompatibility or severe overloading of the single available mutual aid channel. Some agencies did not have the capability to access the mutual channels at all because their radios operated outside the frequency band of the FMARS channel. Even those agencies that operated radios compatible with the mutual aid channel sometimes could not communicate effectively because the single mutual aid channel was severely overloaded.

It should be pointed out that there is a peculiar irony in what has just been said. Some agencies could not access the already overloaded mutual aid channel. If these agencies were somehow able to access the mutual aid channel the result would likely have been an even more overloaded mutual aid channel.

Some of the specific communications problems encountered are listed below:

Inadequately Informed Responders. Due to lack of early situation reports and congested radio communications channels, responders were not informed about what to expect, where to go, etc., as they responded to the scene.

Functional Contention On Channels. Fire/EMS personnel had to compete for airtime with traffic and routing communications that were being carried out on the only common channel.

Telephone Overload. A heavy increase in wireline telephone calls blocked wireline telephone circuits. This further complicated communications because the telephone was a primary link between communications centers due to the congestion of the single mutual aid channel.

Dispatcher Overload. Use of only a single mutual aid channel resulted in too many communications to a single dispatch point and overload. Lack of channels did not allow distribution of communications.

Manual Patching. Some responders with radios that operated in a frequency band incompatible with the mutual aid channel were required to patch through the dispatcher to communicate with others on the mutual aid channel. This is a highly undesirable solution because it is extremely cumbersome and ties up the channel that is patched to the mutual aid channel.

Helicopter Communications. The lone helicopter involved in the initial rescue operations was equipped with a synthesized aircraft radio capable of "dialing up" on other agencies frequencies. The hindrance to interoperability was not hardware based but administrative procedures. At the time many agencies did not want any "outside" agencies operating on their systems. Discussions in the Council of Governments Police Communications subcommittee following the Air Florida incident highlighted concerns over the use of the FMARS channel and that helicopters operating in support of one jurisdiction on a medical evacuation were causing interference to ground units responding to other calls. The thrust of the discussions by some of the participants was that aero use of the FMARS channel be limited to ground use and in effect no airborne operation was authorized. It should be noted that much of the resistance has disappeared and there is now more interaction between helicopters and ground stations.

Hospital Communications. Due to inadequate radio communications, hospitals were not kept informed as to the number of casualties that would be transported to them and when they would arrive. Transporters were unsure of hospital capacities and therefore unsure of how to distribute transport of the casualties across the hospital network

TABLE 3 lists the agencies that responded and the frequency band which they operated on at that time. It clearly shows that many of the responding agencies could not communicate with other agencies at the scene because the radios they used were not compatible with the VHF FMARS mutual aid frequency.

Even in-band compatibility problems existed because crystal controlled radios with restrictive band splits were still in use during this time period. Fortunately, advances in wide band synthesizer technology have eliminated this problem.

FREQUENCY BAND OF 14th ST. BRIDGE RESPONDERS TABLE 3

Agency/Jurisdiction	Frequency Band (Mhz)
Arlington County, VA Police	450-470
Arlington County, VA Fire / EMS	150-162
District Of Columbia Fire	150-162
District Of Columbia EMS	30-50
District Of Columbia Police	450-470
Fairfax County, VA Fire / EMS	450-470
Federal Protective Service	406-420
Montgomery County, MD Fire / EMS	150-162
National Airport Fire	150-174
National Airport Police	150-174
Prince George's County, MD Fire / EMS	450-470
RACES*	140-150
Red Cross	30-50
U.S. Army MASH unit	225-400
United States Coast Guard	Maritime
United States Navy	225-400 MHz
United States Park Police	406-420 MHz
United States Park Police (helicopters)	UHF (tunable)
US Federal Aviation Administration	406-420
Virginia Department Of Transportation	30-50 MHz
Virginia State Police	150-174
WMATA Police	450-470

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III. TODAY

In the aftermath of the Air Florida disaster the Public Safety Community generated numerous incident reports, participated on review boards, received extensive media coverage and took action to correct the problems that hampered their response and rescue efforts. Using the Metropolitan Washington Council of Governments (COG) as the catalyst a Metropolitan Emergency Response Task Force was created to make recommendations to strengthen the regional response capability. A report was approved by the COG Board of Directors on June 9, 1982.

The recommendations of the Task Force were used by the Police Chiefs Committee and the Fire Chiefs Committee to develop The Greater Metropolitan Washington Area Police and Fire/Rescue Services Mutual Aid Operational Plan (The Mutual Aid Plan). The Mutual Aid Plan was adopted in December 1983 and revised in September 1990. This Mutual Aid Plan focused on correcting the command and control deficiencies encountered during the disaster. The participating Police Chiefs and Fire Chiefs developed a detailed command and control system which would enable them to manage a disaster incident. The Mutual Aid Plan is governed by existing Police and Fire/Rescue Services mutual aid agreements and provides guidance to responding agencies. The Mutual Aid Plan incorporates the Incident Command System found in the Fire Service Major Incident Model and developed by the US Fire Administration, FEMA.

The communications problems which occurred during the Air Florida disaster were also addressed and a communications plan to support the command and control system in the Mutual Aid Plan was developed within the available resources. It was apparent that radio spectrum was not available to provide the needed channels/RF communication paths to support the command and control system. Two FMARS and one PMARS frequencies are available. FMARS is in the VHF Band and PMARS is in the UHF band. Spectrum in a common band is needed to provide interoperability without a multitude of radios and an overly complex operation. In a disaster situation communications must be an extension of that used in normal operations.

In reviewing the Mutual Aid Plan (MAP) the lack of wireless communications needed to support the command and control system is quite obvious. The efficiencies and ability to quickly respond which are the results of a properly executed command and control system cannot be achieved without information passing quickly and effortlessly between the responders and those directing the resources. A mutual aid plan detailing a command and control system places a greater demand on communications. Each functional element must have internal communications to direct their activity. This is not only to effectively carryout their mission but also for the safety of their team. The incident commander must have communications with each team to coordinate the response, to direct resources, to guard the safety of all responders and to maintain the command system.

The Mutual Aid Plan (MAP) has been employed numerous times in the past 12 years when the area public safety agencies were called on to respond to emergency incidents. Two of these incidents are listed below to illustrate the problems associated with communications to support the Mutual Aid Plan. In the March 28 meeting the participants were asked to provide the communications difficulties they have experienced in responding to other disaster situations.

1. Responding agencies in a disaster incident have equipment and systems operating in different bands. Additional equipment must be deployed at the scene to provide the interoperability to support the Mutual Aid Plan. Confusion and delays in implementing the Mutual Aid Plan are a result.
2. As response builds and tactical teams deployed the current designated mutual aid channels quickly become overloaded. Communications is disrupted as responders contend for the channels. Arriving responders communicating on the mutual aid channels disrupt communications within the tactical teams. The arriving responders are not efficiently and effectively assigned to an essential task. Delays are critical in the initial response.
3. The Incident Commander becomes an island if not kept abreast of the activity at the scene. The command and control system begins to unravel. Dispatchers become overloaded and unable to effectively control communications activity. Alternate means of communications are put in place such as runners, using channels from the agency's system where the incident occurred, etc. All of these stop gap measures reduce the effectiveness of the responders. Also, the agency who's channels are redirected to the incident may be at risk in meeting it's communications needs.

4. Should other mutual aid communications needs arise in the vicinity they would not be able to be met as mutual aid channels are not available. Should a second disaster occur no planned communications would be available to provide interoperability.

5. In past incidents, the use of mobile data and mobile computing to assist with command, control, database access, and secure communications has been extremely limited. The planned implementation of mobile computing and Automatic Vehicle Location systems, coupled with Geographic Information Systems, will increase the ability of incident managers to effectively control field resources. This will go a long way to help overcome the deficiencies noted above. Standards and application conventions will allow automated command and control systems to effectively replace the grease pencil acetate ICS documentation used today, thus ensuring functional and jurisdictional interoperability.

COLONIAL PIPELINE SPILL

1. INCIDENT: MARCH 28, 1993
 - A. Colonial Pipeline Oil Spill at 1830 Town Center Parkway Fairfax County Fire and Rescue Dispatch Time 0910 hours
 - B. Colonial's thirty-six inch main transmission line broke, spewing #2 fuel oil about fifty feet into the air. Colonial initiated shut-down at approximately 0848 hours, immediately upon pressure drop.
 - C. Colonial personnel maintain 24 hour presence at the pipeline rupture area until the backfill operation is completed.
 - D. Colonial estimates that 407,436 gallons were spilled into the environment.
 - E. The main plume is being contained at the confluence of Sugarland Run and the Potomac by booms with product and containment water being recovered. Isolated sheen pockets have been noticed as far south on the Potomac as Quantico, Virginia.
2. INITIAL STRATEGIC OBJECTIVES
 1. Protect Public Water Systems
 - containment booms, Water Plant shutdown, product recovery and Government mobilization
 2. Protect Wetlands
 - animal rescue and shoreline assessment
 3. Protect Health and Safety Over Entire Spill Route
 - safety plan, atmospheric monitoring and drinking well water testing
 4. Protect Health and Safety in the Immediate Area
 - work area isolation
 - pipe removed
 - product removal
3. RESPONDING ORGANIZATIONS
 1. Fairfax County Fire and Rescue Department
 2. Fairfax County Police Department
 3. Fairfax County Health Department
 4. Fairfax County Animal Control
 5. Fairfax County Water Authority
 6. Fairfax County Department of Public Works

7. Fairfax County Attorney's Office
8. Herndon Police Department
9. Herndon Department of Public Works
10. Herndon Sewer and Water
11. Herndon Engineer
12. Loudoun County Fire and Rescue Department
13. Loudoun County Sheriff's Department
14. Loudoun County Animal Control
15. Loudoun County Health Department
16. Virginia Department of Waste Management
17. Virginia Department of Transportation
18. Virginia Department of Health
19. Virginia State Water Control Board
20. Virginia Department of Emergency Services
21. Virginia Department of Air Pollution
22. Maryland Department of Environment
23. Washington Suburban Sanitary Commission
24. City of Rockville, MD
25. D.C. Office of Emergency Preparedness
26. National Transportation Safety Board
27. U.S. Coast Guard
28. U.S. Environmental Protection Agency
29. DOT Office of Pipeline Safety
30. U.S. Navy
31. Department of Interior
32. U.S. Fish and Wildlife
33. Colonial Pipeline
34. Colonial Pipeline Contractors
35. Tri State Bird Rescue and Research
36. Virginia Power
37. Reston Hospital Center
38. Bell Atlantic
39. C & P Telephone
40. National Oceanic and Atmospheric Administration

4. COMMUNICATIONS

- A. Not enough communication with the forward command post. First morning overflights are important, conveying information from these overflights is imperative.
- B. Issues with safety at the forward command area. Could not locate person in charge during early phase. Area seemed out of control initially.
- C. More county communications required. Need photo identifications established early. Traffic control should be established immediately if