Office of Management and Budget

Commercial Spectrum Enhancement Act

Report to Congress on Agency Plans for Spectrum Relocation Funds

February 16, 2007

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INTRODUCTION

On December 23, 2004, President Bush signed into law the Commercial Spectrum Enhancement Act (CSEA, Title II of P.L. 108-494) that created the Spectrum Relocation Fund (SRF) to provide a centralized and streamlined funding mechanism through which Federal agencies can recover the costs associated with relocating their radio communications systems from certain spectrum bands, which were authorized to be auctioned for commercial purposes. The CSEA appropriated such sums as are required for relocation costs, which are financed by auction proceeds.

On September 18, 2006, the Federal Communications Commission (FCC) concluded an auction of licenses for Advanced Wireless Services (AWS), on radio spectrum in the 1710 megahertz (MHz) to 1755 MHz band that is currently used by Federal agencies, which was paired with the 2110 MHz to 2155 MHz band in the auction. The 1710 MHz to 1755 MHz band of spectrum was reallocated to AWS under the provisions of the CSEA, including the use of the SRF to facilitate relocation of Federal communications systems, while the 2110 MHz to 2155 MHz band was reallocated to AWS by the FCC and does not require relocation of Federal systems. The AWS auction raised $13.7 billion in net winning bids, and will facilitate the provision of innovative new wireless services to the commercial market.

In accordance with the CSEA, a portion of the auction proceeds associated with the 1710 MHz to 1755 MHz band will be used to facilitate relocation of Federal communications systems. On December 27, 2005, the National Telecommunications and Information Administration (NTIA) of the Department of Commerce, on behalf of the Federal agencies, and after review by the Office of Management and Budget (OMB), provided the FCC and Congress with the estimated costs and timelines for relocating Federal agencies from the 1710 MHz to 1755 MHz spectrum band. The estimate of total relocation costs at that time was $936 million, and timelines varied by agency. Since the time of that estimate, several agencies have refined their relocation plans, and the aggregate cost of relocation activities is now estimated at $1.009 billion. Other refinements are under review by the agencies and OMB; Congress will be notified, as required by the CSEA, if there are additional resource requirements.

In accordance with Section 204 of the CSEA, the transfer of funds from the SRF to agencies for relocation activities will proceed after the Director of OMB, in consultation with NTIA, has determined the cost and timelines of relocation activities. In addition, the CSEA required that transfers may not be made until 30 days after the Director of OMB has notified the Committees on Appropriations and

Energy and Commerce of the House of Representatives, the Committees on Appropriations and Commerce, Science, and Transportation of the Senate, and the Comptroller General of how the SRF will be used to pay relocation costs, and the timeline for such relocation.[1]

In consultation with NTIA, the Director of OMB has determined that the costs and timelines for relocation of Federal communications systems from the 1710 MHz to 1755 MHz spectrum band as indicated in Table 1 below are appropriate. This report is submitted pursuant to the Congressional notification provision of the CSEA.

[1] Section 204 of P.L. 108-494, the Commercial Spectrum Enhancement Act, which created a new Section 118 of the National Telecommunications and Information Administration Organization Act. See 47 U.S.C. 928(d)(2).

Table 1 - Spectrum Relocation Transfer Amounts and Project Timelines

AGENCY	BUREAU	AMOUNT [1]	TIMELINE [2]
Agriculture	Forest Service	$21,578,486	36
DOD	Air Force	$106,753,481	48
DOD	Army	$15,933,043	36
DOD	Navy	$134,465,000	36
DOD	RDT&E / O&M (Defense-wide support)	$98,200,000	72
	Subtotal	$355,351,524	
DOE	Bonneville Power Administration	$48,627,399	72
DOE	Southwestern Power Administration	$8,091,360	24
DOE	Western Area Power Administration	$108,202,200	36
DOE	National Nuclear Security Administration	$10,900,000	24
DOE	Departmental Administration (DOE-wide support)	$1,000,000	72
	Subtotal	$176,820,959	
DHS	Customs and Border Protection	$74,349,990	12
DHS	Immigration and Customs Enforcement	$3,559,281	12
DHS	Secret Service	$105,800	12
DHS	Chief Information Officer (DHS-wide support)	$11,979,761	12
	Subtotal	$89,994,832	
HUD	Inspector General	$21,115	24
DOI	Bureau of Reclamation	$4,550,000	36
DOI	Geological Survey	$6,158,949	36
DOI	National Park Service	$14,703,000	36
	Subtotal	$25,411,949	
DOJ	Alcohol, Tobacco, and Firearms	$48,024,000	36
DOJ	Drug Enforcement Agency	$74,772,000	36
DOJ	Federal Bureau of Investigation	$139,225,000	36
DOJ	Chief Information Officer (DOJ-wide support)	$800,000	36
	Subtotal	$262,821,000	
DOT	Federal Aviation Administration	$58,062,020	48
Treasury	Internal Revenue Service	$4,409,000	28
Treasury	Inspector General for Tax Administration	$892,000	28
	Subtotal	$5,301,000	
NASA	NASA	$740,000	24
TVA	Tennessee Valley Authority	$10,687,857	48
USPS	Inspection Service	$1,761,760	12
TOTAL		**$1,008,552,502**	

[1/] Amount specified will be transferred to the agency following the notification period. If actual project costs differ from the transferred amount, such discrepancies will be disposed of in accordance with the CSEA. Due to rounding, amounts may differ from figures included in the President's Budget.

[2/] Timeline indicated represents the estimated time to completion of spectrum relocation activities, in months, beginning from the date of the transfer of funds to the agency.

SUMMARY OF RELOCATION PLANS

Twelve Federal agencies use spectrum in the 1710 MHz to 1755 MHz band and are participating in the spectrum relocation effort, which will clear this spectrum for commercial use. The scope of the effort is in part captured by the fact that there are 1,990 NTIA-issued Federal frequency assignments in this spectrum. Federal communications systems utilize these frequency assignments to transmit voice, data, and video information to facilitate agency operations. Agencies are eligible for reimbursement of costs associated with relocating these systems from the affected spectrum, as specified in Section 202 of the CSEA, to achieve "comparable capability of systems, regardless of whether that capability is achieved by relocating to a new frequency assignment or by utilizing an alternative technology."[2] In some instances, agencies received funds through other appropriations that are to be used to migrate communications systems from the 1710 MHz to 1755 MHz band. Of the 1,990 Federal frequency assignments in the band, 606 will be relocated via appropriations other than the SRF.

The majority of the affected systems are fixed microwave systems, which transmit voice and data signals from site to site to enable a variety of agency activities. Other systems are more specialized, such as law enforcement video and voice surveillance. In addition, several agencies utilize mobile aeronautical systems to facilitate national security and research activities.

The cost of relocating these systems is affected by many variables related to the systems themselves as well as relocation plans. Fixed microwave systems can generally utilize commercially-available technology, and may require a simple re-tuning to accommodate a change in frequency. Some new frequencies may require a more significant system modification if the characteristics of the spectrum are sufficiently different than the 1710 MHz to 1755 MHz band. Relocation activity is also affected in some instances by rugged terrain surrounding a site or communication tower, which may impede the accessibility of the site and necessitate additional technical requirements for operational continuity. Some agencies using analog systems will also transition to a digital format, in order to improve communications efficiency and capability.

More specialized systems such as those used for surveillance and law enforcement purposes may not be able to utilize commercial technology, and agencies will work with vendors to develop equipment that meets these operational needs and is informed by ongoing research on best practices and standards taking place in the private sector and the Federal government, such as the SAFECOM

[2] Section 202 of P.L. 108-494, the Commercial Spectrum Enhancement Act, which amended Section 113(g) of the National Telecommunications and Information Administration Organization Act. See 47 U.S.C. 923(g).

program, managed by the Department of Homeland Security. The development of replacement video systems, in particular, generally entails a more significant cost than voice or data systems.

The following pages detail the specific plans of each participating agency to relocate their communications systems from the 1710 MHz to 1755 MHz band of spectrum. The amounts associated with these plans represent the best estimates of each agency at the present time, which will be transferred to agency accounts in accordance with the CSEA. In the event that agencies request to receive additional transfers, such requests will be reviewed by OMB, and the Congress will be notified as appropriate and required by the CSEA. If transferred amounts exceed actual relocation costs, excess amounts will be returned to the SRF. Following the completion of Federal relocation activity, not later than December 2014, SRF balances will be deposited in the general fund of the Treasury.[3]

Congress will be provided with regular updates on the progress of spectrum relocation activities, which will be submitted by NTIA as required by Section 207 of the CSEA on an annual basis following the initial transfer of funds.

[3] Section 204 of P.L. 108-494, the Commercial Spectrum Enhancement Act, which created a new Section 118 of the National Telecommunications and Information Administration Organization Act, specifies in sub-section d(3) that Spectrum Relocation Fund balances shall revert to the general fund of the Treasury not later than eight years after the deposit of auction proceeds. Since the Fund received such proceeds in December 2006, balances will be deposited into the general fund not later than December 2014.

AGENCY PLANS

Table 2 below provides an overview of the agencies' frequency assignments and communications systems that are involved in spectrum relocation activities. The following pages provide more detailed information on each agency's plans for relocating their systems from the 1710 MHz to 1755 MHz band of spectrum.

Table 2 - Affected Agency Frequency Assignments and Communications Systems

AGENCY	BUREAU	NUMBER OF FREQUENCY ASSIGNMENTS RELOCATING	TYPES OF SYSTEMS				NUMBER OF FREQUENCY ASSIGNMENTS TO BE RELEASED BETWEEN 0 AND 12 MONTHS				NUMBER OF FREQUENCY ASSIGNMENTS TO BE RELEASED BETWEEN 13 AND 24 MONTHS				NUMBER OF FREQUENCY ASSIGNMENTS TO BE RELEASED BETWEEN 25 AND 36 MONTHS				NUMBER OF FREQUENCY ASSIGNMENTS TO BE RELEASED BETWEEN 37 AND 48 MONTHS				NUMBER OF FREQUENCY ASSIGNMENTS TO BE RELEASED BEYOND 48 MONTHS			
			FIXED (MICROWAVE)	FIXED (TRANSPORTABLE)	MOBILE (LAND)	MOBILE (AERO)	FIXED (MICROWAVE)	FIXED (TRANSPORTABLE)	MOBILE (LAND)	MOBILE (AERO)	FIXED (MICROWAVE)	FIXED (TRANSPORTABLE)	MOBILE (LAND)	MOBILE (AERO)	FIXED (MICROWAVE)	FIXED (TRANSPORTABLE)	MOBILE (LAND)	MOBILE (AERO)	FIXED (MICROWAVE)	FIXED (TRANSPORTABLE)	MOBILE (LAND)	MOBILE (AERO)	FIXED (MICROWAVE)	FIXED (TRANSPORTABLE)	MOBILE (LAND)	MOBILE (AERO)
Agriculture	Forest Service	(4) 406	(4) 406	(0) 0	(0) 0	(0) 0	(4) 27				245				134											
DOD	Air Force	(19) 46	(19) 29	(0) 3	(0) 2	(0) 12	(5) 5								(14) 24	3	2	5				7				
DOD	Army	(179) 210	(30) 40	(147) 155	(1) 10	(1) 5	(9) 10				(1) 8		9	(1) 4	(20) 22	(147) 155	(1) 1	1								
DOD	Navy	(62) 173	(8) 33	(46) 47	(1) 2	(7) 91	0	(28) 28		0					(8) 33	1	(1) 2	(7) 91						(18) *18		
DOE	Bonneville Power Administration	(7) 185	(7) 179	(0) 6	(0) 0	(0) 0	(7) 21	6			31				31				40				56			
DOE	South Western Power Administration	(17) 94	(17) 94	(0) 0	(0) 0	(0) 0					(17) 94															
DOE	Western Area Power Administration	(141) 291	(141) 291	(0) 0	(0) 0	(0) 0	(34) 34				(105) 107				148				(2) 2							
DOE	NNSA - Albuquerque Office	(0) 11	(0) 6	(0) 5	(0) 0	(0) 0					6	5														
DOE	NNSA - Nevada Office	(0) 11	(0) 8	(0) 0	(0) 1	(0) 2					8		1	2												
DOE	NNSA - Oakland Office	(0) 3	(0) 2	(0) 0	(0) 0	(0) 1					2			1												
DHS	Customs and Border Protection	(0) 118	(0) 118	(0) 0	(0) 0	(0) 0	118																			
DHS	Immigration and Customs Enforcement	(0) 4	(0) 0	(0) 4	(0) 0	(0) 0		4																		
DHS	Secret Service	(0) 1	(0) 0	(0) 1	(0) 0	(0) 0		1																		
HUD	Inspector General	(0) 1	(0) 0	(0) 1	(0) 0	(0) 0						1														
DOI	Bureau of Reclamation	(0) 34	(0) 34	(0) 0	(0) 0	(0) 0	0				24				10											
DOI	Geological Survey	(0) 16	(0) 16	(0) 0	(0) 0	(0) 0									16											
DOI	National Park Service	(0) 44	(0) 44	(0) 0	(0) 0	(0) 0									44											
DOJ	Alcohol, Tobacco, and Firearms	(0) 2	(0) 0	(0) 2	(0) 0	(0) 0										2										
DOJ	Drug Enforcement Agency	(0) 1	(0) 0	(0) 1	(0) 0	(0) 0										1										
DOJ	Federal Bureau of Investigation	(119) 120	(119) 119	(0) 1	(0) 0	(0) 0									(119) 119	1										
DOT	Federal Aviation Administration	(0) 120	(0) 120	(0) 0	(0) 0	(0) 0	1				20				53				46							
Treasury	Inspector General & IRS (shared)	(0) 1	(0) 0	(0) 1	(0) 0	(0) 0										1										
NASA	NASA	(0) 2	(0) 1	(0) 0	(0) 0	(0) 1	1							1												
TVA	Tennessee Valley Authority	(58) 94	(58) 94	(0) 0	(0) 0	(0) 0	(58) 58								12				24							
USPS	Inspection Service	(0) 2	(0) 0	(0) 2	(0) 0	(0) 0		2																		
TOTAL		(606) 1990	(403) 1634	(193) 229	(2) 15	(8) 112	(117) 275	(28) 41	(0) 0	(0) 0	(123) 545	(0) 6	(0) 10	(1) 8	(161) 646	(147) 164	(2) 5	(7) 97	(2) 112	(0) 0	(0) 0	(0) 7	(0) 56	(18) 18	(0) 0	(0) 0

( ) Numbers in parentheses are to be relocated through appropriations other than the SRF and do not add to totals.

* The 18 Navy assignments to be released beyond 48 months are in protected sites.

Department of Agriculture

Agency: **USDA**	Bureau: **Forest Service**
Account: Capital Improvement and Maintenance, Forest Service, USDA	Account Number: 12-1103
Amount: $21,578,486	Timeline: 36 Months
Number of Frequency Assignments: 406 (4 through other appropriation)	Number of Systems: 27

The USDA Forest Service is receiving reimbursement through the SRF for the displacement of communications infrastructure associated with 402 of its 406 total frequency assignments in the 1710 MHz to 1755 MHz band. The displaced infrastructure is made up of microwave systems primarily used to carry radio control signals. The USDA Forest Service plans to install alternative replacement systems that will continue to perform radio control functions. These replacement systems will primarily be based on next-generation data radio technologies using Radio over Internet Protocol (RoIP) that will allow USDA's replacement systems to eventually interface with the Forest Service's and USDA's corporate networks and a variety of software applications. They will be based on standard Internet interfaces allowing for seamless interoperability with other systems that are Internet capable. In addition to seamless interface and the ability to add additional systems easily, the new technology allows systems to provide faster and more efficient transmissions with data delivery guarantees, to maintain data records of transmissions, and results in a lower cost of ownership. A few links may be moved to another band, likely to be in the 7 gigahertz (GHz) range, using existing technology due to the remote locations of the systems. In those instances, the ability to install the landlines to support the newer systems would not be cost effective.

USDA has increased its estimates for cost and project timelines since its original estimate in December 2005. USDA has determined that an additional $5 million is required for additional project personnel and contractor support for coordination with new AWS licensees, as well as administrative support costs such as budget, human resources, procurement and line officer support, as well as the facility and supply costs associated with the people working directly on the relocation. Also, the Department estimates that an additional six months will be required to complete relocation to allow for adverse weather conditions that may delay the ability to reach numerous mountain top radio sites in remote locations.

Department of Defense

Agency: **DOD**	Bureau: **Air Force**
Accounts: 57X3010, Aircraft Procurement, AF. - $40,000,000 57X3020, Missile Procurement, AF. - $60,000,000 57X3080, Other Procurement, AF. - $6,596,381 57X3400, O&M, AF - $157,100 Total: $106,753,481	
Amount: $106,753,481	Timeline: 48 months
Number of Frequency Assignments: 46 (19 through other appropriations)	Number of Systems: 36

The consolidated Air Force (AF) cost to move or modify AF equipment/systems from the 1710 MHz to 1755 MHz band has been identified as $106.8 M. The major Air force systems that are affected by this relocation are tactical control links that support Precision Guided Munitions and fixed point-to-point microwave systems that support many of the AF range communication requirements. Relocation efforts will consist of analysis of system options, range infrastructure evaluations, procurement of replacement equipment, building up of necessary infrastructure to support the new system, range testing, and frequency authorization work for spectral usage.

The AGM-130/GBU-15 Weapon Data Link (WDL) system operates in the 1710 MHz to 1850 MHz spectrum bands and will be impacted by the loss of the 1710 MHz to 1755 MHz band in CONUS.

These weapons systems provide the only real-time interactive weapon flight and control from launch to target (i.e. "man-in-the-loop" vs. "lock-on & leave"). Based on extensive technical evaluations, the anticipated service life for the AGM-130 is at least 2020.

To reduce both implementation cost and the effect upon the warfighter, the present tactical frequencies will be maintained and two training frequency pairs (2 video and 2 command frequencies) will be added within the 1755 MHz to 1850 MHz band. The following equipment will be affected: 73 ea AXQ-14 Pod, 21 ea ZSW-1 Pod, 340 ea WDL/SDL, and 73 units of associated test equipment.

These frequencies will be used for training, operations, and launches in the continental U.S., specifically during the Air Force's Annual Weapon System Evaluation Program (WSEP), and for testing any new requirements for the AGM-130 and GBU-15 weapon systems.

Other relocation activities involve fixed point-to-point microwave systems. Relocation efforts will consist of procurement of replacement equipment, building up of necessary infrastructure to support the new system, testing, and frequency authorization work for spectral usage.

The following Air Force sites will be involved in spectrum relocation activities:

Site	System
AFMC (Hill AFB, UT)	PGMs
AETC (Luke AFB, AZ)	Microwave
AFMC (Hill, AFB, UT)	Microwave
Nellis AFB, NV	Microwave
Eastern Range (Cape Canaveral, FL)	Microwave
AFFTC (Edwards AFB, CA)	Microwave
AFMC (Eglin AFB, FL)	Microwave

Agency: **DOD**	Bureau: **Army**
Accounts: 21X2035, Other Procurement, Army. - $15,303,043 21X2020, O&M, Army - $630,000 Total: $15,933,043	
Amount: $15,933,043	Timeline: 36 months
Number of Frequency Assignments: 210 (179 through other appropriations)	Number of Systems: 31

The consolidated Army cost to move or modify Army equipment/systems from the 1710 MHz to 1755 MHz band has been identified as $15.933 million, which will provide for the migration of fixed point-to-point microwave systems to new frequencies primarily in support of the United States Army Corps of Engineers (USACE).

The systems used by USACE are fixed point-to-point microwave links utilized for a variety of information transfer applications needed to support the USACE mission. Most systems multiplex information into separate voice and data channels. Voice traffic is in support of various navigation, coastal, flood control, and other specialized operations needed to support the mission on a daily basis. Data traffic can range from sending continuous streams of hydrological data, supervisory control and data acquisition (SCADA) connections, and radio remote audio/control applications. Reliance on these systems is critical to the overall efficiency and effectiveness of daily operations. In many instances, the safety of USACE employees, other Federal, state, and local agencies' employees, our industry partners, and the public can depend on it. In addition, many districts and divisions heavily rely upon these systems in support of the disaster recovery and continuation of operations plans (COOP). USACE must assure the ability to transfer information during times of loss of electrical power, telephone and data land line services, etc. Many of these systems are designed to operate during extended periods of public utility outages.

USACE frequency managers report that a total of 105 systems were/are affected by the need to relocate 1710 MHz to 1755 MHz equipment to another band or transmission medium. Many of these systems have already been relocated to another information transfer medium or have been replaced with non-licensed wireless (spread spectrum type) equipment. USACE operations did have many more systems in the affected band that have already been shutdown for other reasons and are not applicable to the 1710 MHz to 1755 MHz Relocation.

There are 13 USACE systems located throughout the U.S. utilizing frequencies within the 1710 MHz to 1755 MHz range.

The following districts have systems still in use:

District/Element	Number of Links	Equipment
NAE - New England District	1	Farinon SS-2000
SAM - Mobile District	1	Motorola Starpoint
NWP - Portland District	3	Granger 6015
NWK - Kansas City District	3	Motorola Starpoint
SPK - Sacramento District	4	Motorola Starpoint
SWT - Tulsa District	1	Motorola Starpoint

To ensure that the transition is accomplished in a timely and cost efficient manner, a portion of the initial funding will be used to refine existing analysis and to develop a more detailed, accurate, and comprehensive transition plan. Our intention is to work with the Army Product Manager Defense Wide Transmission Systems (PM DWTS) Team to develop a standardized transition plan. The Army PM DWTS Team will work with Army Information Systems Engineering Command, USACE Engineers Spectrum Center and local USACE frequency/technical personnel to develop the detailed transition plan and associated costs. This will allow for a centralized management and implementation approach.

PM DWTS will define the requirements and perform preliminary site surveys to firm up requirements, ensure the accuracy of cost estimates, determine the most cost-feasible solution to implement the approved plan.

Agency: **DOD**	Bureau: **Navy**
Accounts: 17X1319, RDT&E, Navy. - $72,873,000 17X1810, Other Procurement, Navy - $900,000 17X1507, Weapons Procurement, Navy - $60,692,000	
Amount: $134,465,000	Timeline: 36 months
Number of Frequency Assignments: 173 (62 through other appropriations)	Number of Systems: 29

The total identified costs for replacing or modifying Navy systems affected by the reallocation of the 1710 MHz to 1755 MHz band is currently $134.465 million.

The major Navy systems that are affected by this relocation are fixed point-to-point microwave systems, airborne/land based Video/Telemetry systems, security video microwave systems, and data links between the Standoff Land Attack Missile – Expanded Response (SLAM-ER) and pod. Relocation efforts will consist of analysis of system options, range infrastructure evaluations, procurement of replacement equipment, building up of necessary infrastructure to support the new system, range testing, Electromagnetic Interference (EMI) Control, Radiation Hazard Surveys and frequency authorization work for spectral usage.

Description of Affected Systems

Fixed Point to Point Systems

The Navy employs long-range point-to-point microwave systems in the 1710 MHz to 1755 MHz band. These systems primarily operate at fixed locations and employ directional antennas. The Navy microwave operations in this band provide communications link connectivity between geographically separated sites and at test ranges or training areas. Navy relocation solutions for fixed point-to-point systems vary from basic RF replacements using alternate frequency bands such as the 7/8 GHz bands.

Airborne/Land Video / Telemetry Systems

The Navy employs airborne-video/telemetry systems in the 1710 MHz to 1755 MHz band. Airborne Radio Telemetry Systems are used for Test Ranges. During remote operations, Airborne Radio Telemetry systems display and record precise measurements of vehicle, engine, position and other sensor data. These measurements are used for real-time monitoring, observation and analysis of data points and for instant status updates during test flights. These Airborne systems are planned for replacement by similar systems and operate at 1755-1850 MHz. Fixed land based systems are planned for replacement by equivalent systems and will operate at 7/8 GHz bands.

Precision Guided Munitions (PGM)

Precision-guided munitions (smart munitions or smart bombs) are self-guiding weapons intended to maximize damage to the target while minimizing "collateral damage." Because the damage effects of an explosive are a function of distance, quite modest improvements in accuracy enables a target to be effectively attacked with much smaller bombs. These weapons make use of computerized guidance systems. The SLAM-ER Program office is investigating alternative frequencies for use by the two data links.

Weapon Susceptibility Analysis

The Hazards of Electromagnetic Radiation to Ordnance (HERO) test program evaluates ordnance across the entire electromagnetic environment (EME). Moving transmitters or emitters to another frequency band will not substantially impact the levels currently stated in MIL-STD-464; however, if the transmitter or emitters are sufficiently powerful, then environments in MIL-STD-464 will have to be re-evaluated which could be time consuming and costly.

HERO Surveys and Emission Control Bills could be impacted, particularly, if the transmitters or emitters are placed in a band that is not currently in use onboard the Fleet Asset. The HERO program will review the entire survey database and perform analysis to determine any necessary changes.

The ashore Hazards of Electromagnetic Radiation to Personnel (HERP) and to Fuel (HERF) could be impacted if equipment and shore stations are upgraded to different frequency bands. HERP/HERF considerations will be more fully analyzed following equipment replacements, purchases, and installations related to spectrum relocation activities.

The following sites will be involved in relocation activities:

Facility/Function	System
Beaufort/Parris Island, SC	Fixed Point to Point
Keyport, WA (Maynard Peak/Gold Mountain/ Bangor, WA, Bruce Peak/ Cottle Hill, Canada)	Fixed Point to Point
Patuxent River, MD	Airborne Video/Telemetry
Point Mugu/China Lake, CA	Airborne Video/Telemetry
Cherry Point, NC	Fixed Point to Point
DoD Test Ranges	Precision Guided Munitions
Panama City	Land Based Video/Telemetry
HERO & RADHAZ Surveys	ALL
Kittery, ME	Microwave

Agency: **DOD**	Bureau: **DOD-wide support activity**
Accounts: 97X0400, RDT&E Defense Wide, $76,500,000 97X0100, O&M Defense Wide, $21,700,000	
Total Amount: $98,200,000	Timeline: 72 Months
Number of Frequency Assignments: N/A	Number of Systems: N/A

The migration of DOD systems out of the 1710 MHz to 1755 MHz band will present new technical challenges as DOD continues to increase its utilization of wireless networks and systems. These challenges will require DOD to accomplish accelerated program changes for numerous systems, while avoiding impacts to existing critical operations. To support the rapid changes required to make the 1710 MHz to 1755 MHz band available to the commercial wireless industry in the shortest possible timeframe, there will be a need to fund activities common to all systems necessary to plan for and facilitate the relocation of DOD systems.

These common activities are the Spectrum Management Transition Initiative (SMTI), the Spectrum Technology Test-bed Initiative (STTI), and the DOD Spectrum Relocation Management Office (DSRMO). These initiatives will support a systematic approach to re-accommodation of the affected spectrum dependent systems as well as spectrum re-engineering for existing systems currently operating in the alternate frequency bands. These initiatives will also assist the DOD in relocating to alternate spectrum and in the identification of "comparable spectrum" as required by 47 U.S.C. 921.

The SMTI will provide enhancements and upgrades to automated spectrum management assessment and analysis capabilities. The effort will focus on reducing the DOD operational presence in the 1710 MHz to 1755 MHz band as soon as possible, and will support Army, Navy, and Air Force systems in their concurrent transitions to other bands, with minimal impact to incumbent systems in those bands, ensuring the viability of the transitioned systems for the long-term. The other bands that will be required to accommodate the relocated systems already support many existing systems, and accommodating the relocation of systems from the 1710 MHz to 1755 MHz band into these bands will be technically and operationally challenging. The DOD requirements to share and exchange information among warfighting elements continues to grow, forces are required to accomplish expanded functions, and the need to support improved automated spectrum management capabilities is urgent. The SMTI will provide the ability to maximize spectrum efficiency and effectiveness through improved dynamic spectrum management and supporting "spectrum situational awareness"

across all Services and systems. The total cost for the SMTI effort is estimated at $48.5M, and the project is anticipated at six years in duration.

The STTI will provide a simulation-based analysis capability that permits evaluation of the operational implications of transitioning relocated systems from the 1710 MHz to 1755 MHz band to other spectrum bands and supports the modeling of new spectrum management concepts, techniques and technologies. This simulation-based capability will be used to assist programs that are relocating systems from the 1710 MHz to 1755 MHz band with regard to alternative technical designs, relocation and band sharing strategies, and quantifying more refined costs and risks to support relocation-associated acquisition decisions. The results of these analyses will facilitate the development of new spectrum-efficient policies for managing spectrum. For example, it is required to plan for an increased number of systems in an existing band by demonstrating the potential of using improved antenna designs, signal coding schemes and adaptive technologies. The test-bed will also support the ability to emulate the electromagnetic environment of the battlefield and the ramifications of the transition of the relocated systems into alternate bands. The test-bed will allow the merits of these potential improvements to be quantified so that when combined with other factors, such as cost, policy-level decisions can be made pertaining to their use. The simulation test-bed capability will provide a “proving ground” for progressive spectrum management concepts, as well as the ability to model performance where measurement results are not available by extending and scaling results. The test-bed capability is a required capability to support the accelerated transition of DOD systems out of the 1710 MHz to 1755 MHz band. The total cost for the Spectrum Technology Test-Bed Initiative (STTI) is estimated at $28M, which will be utilized over a period of six years.

The DSRMO will be chartered to oversee the 1710 MHz to 1755 MHz cost reimbursement and spectrum relocation process to its full completion for all affected DOD systems. The DSRMO will provide integrated oversight of DOD’s relocation efforts, including tracking and monitoring the progress of DOD’s relocation to support NTIA's annual report to Congress, and managing the geographically-based interaction with the wireless industry to enable a rapid national build-out of Advanced Wireless Services. The DOD Spectrum Relocation Management Office will also interface with NTIA and OMB, responding to queries, and ensuring all DOD systems are relocated successfully and in a timely manner. Funding to support the DOD Spectrum Relocation Management Office to relocate all affected DOD systems from the 1710 MHz to 1755 MHz band is estimated at $21.7M, spread over six years. While the estimated time to relocate all DOD systems from the 1710 MHz to 1755 MHz band is 48 months, the DSRMO may continue beyond that date to ensure operational continuity following the transition.

Department of Energy

The Department of Energy (DOE) will be relocating 595 frequency assignments in support of the 1710 MHz to 1755 MHz relocation, of which 165 are relocated via appropriations other than the SRF. DOE's estimated costs to relocate systems through the SRF from the 1710 MHz to 1755 MHz band are $176,820,959.

The Department of Energy frequency assignments in the 1710 MHz to 1755 MHz band are used by the Bonneville Power Administration (BPA), the Southwestern Power Administration (SWPA), the Western Area Power Administration (WAPA), and the National Nuclear Security Administration (NNSA). The following pages detail the relocation plans for each of these DOE entities, including the DOE Headquarters element that will perform an integrated oversight function for DOE's relocation from the 1710 MHz to 1755 MHz band.

DOE will begin the relocation process as soon as funds from the Spectrum Relocation Fund are received. DOE will be able to relocate some systems in as little as 12 months. The largest portion of DOE's assignments will be relocated within 36 months after receipt of funds. A small number of DOE assignments are projected to require as long as 72 months to relocate due to the remoteness of the associated site locations and the need to install new repeater sites through land acquisitions or leases. These few assignments are anticipated to have no impact on use of the band by new Advanced Wireless licensees due to their existing operation in very remote locations. DOE intends to relocate all assignments as expeditiously as possible.

Agency: **Department of Energy**	Bureau: **Bonneville Power Administration (BPA)**
Account: Bonneville Power Administration Fund, DOE	Account Number: 89-4045
Amount: $48,627,399	Timeline: 72 months
Number of Frequency Assignments: 185 (7 through other appropriations)	Number of Systems: 14

The Bonneville Power Administration (BPA) will be relocating 14 multi-link fixed microwave systems that are comprised of point-to-point microwave links from the 1710 MHz to 1755 MHz band to other Federal Government frequency bands. BPA's multi-link microwave systems are primarily located in remote areas of the United States characterized by very rugged terrain.

Of BPA's 185 frequency assignments, 88 are required for various microwave repeater sites due to the transition of systems to bands that are significantly higher in frequency. These higher frequency bands will not support the path distances currently supported by the 1710 MHz to 1755 MHz band and therefore the repeater sites are required. There are 28 of the new BPA repeater site assignments that will take as long as 72 months from receipt of relocation funds to complete the installation of the new equipment. The extensive time required is a result of DOE needing, in most cases, to execute land acquisitions or leases and pursue environmental approvals that will both contribute significantly to the amount of schedule that is required. In addition, many of these sites are in very remote areas with rugged terrain where site access is only possible during the summer months. DOE does not believe that the extensive time required to integrate these 28 new assignments will have any impact on AWS licensees, given their remote location in southern Idaho where population density is low.

Bonneville Power Administration's existing fixed operational 1710 MHz to 1755 MHz analog microwave paths are dispersed non-uniformly across BPA's transmission service area. The new BPA systems will be installed in the States of Idaho, Oregon, Washington, and Montana. Most of the new microwave links will be supported by new digital radio systems operating in either the 4 GHz or 7/8 GHz bands. Some existing analog radio systems operating in the 1710 MHz to 1755 MHz band will be permanently retired as a result of integrating affected communications baseband traffic into operational or new SONET digital radio/fiber optic systems. Engineering planning for the new services to replace the 1710 MHz to 1755 MHz paths incorporate mission-critical requirements for maintaining existing high system reliability.

Agency: **Department of Energy**	Bureau: **Southwestern Power Administration (SWPA)**
Account: Operation and Maintenance (O&M), Southwestern Power Administration, DOE	Account Number: 89-0303
Amount: $8,091,360	Timeline: 24 months
Number of Frequency Assignments: 94 (17 through other appropriations)	Number of Systems: 1

The estimated cost for Southwestern Power Administration (Southwestern) to vacate the 1710 MHz to 1755 MHz band represents the funding required to relocate a single significant fixed microwave system that is supported by 94 frequency assignments.

Over the last several years, Southwestern has been constructing a digital backbone communication network consisting of fiber optics and digital microwave systems. The digital backbone is nearing completion. The communications traffic from the legacy analog microwave system will be moved over to this new digital backbone. There are some analog microwave radio paths that will be replaced by digital microwave operating in the 4 GHz or 7 GHz band, and there are also analog microwave links that connect to mobile repeater sites that will be replaced using 900 MHz radios. The cost for the installation of these replacement radios and associated equipment is included in the estimate.

SWPA cost estimates have increased by $1,791,360 since the initial analysis. This increase is primarily due to a rise in steel prices and increases in overall construction and design costs.

Agency: **Department of Energy**	Bureau: **Western Area Power Administration (WAPA)**
Account: Construction, Rehabilitation, Operations, and Maintenance, WAPA, DOE	Account Number: 89-5068
Amount: $108,202,200	Timeline: 36 months
Number of Frequency Assignments: 291 (141 through other appropriations)	Number of Systems: 6

WAPA plans to relocate systems from the 1710 MHz to1755 MHz band with a combination of microwave radio and fiber optics. The timeline for relocation will be driven by both the replacement technology and the geographic location of the system. Weather and terrain impact the length of the feasible construction season as well as constructions methods. The relocation times from the date of the agency's receipt of relocation funds and technologies for each system are noted below.

System	Technology	Relocation Time (months)
Sierra-Nevada Region	Radio & Fiber	30
Rocky Mountain Region	Fiber	28
Desert Southwest Region	Radio	30
Upper Great Plains - Montana	Radio & Fiber	36
Upper Great Plains - North Dakota	Radio & Fiber	36
Upper Great Plains - South Dakota	Radio & Fiber	36

For the Sierra-Nevada Region system, 159 miles of radio will be replaced with fiber optics; the balance will be microwave radio. Regarding the Rocky Mountain Region system, all 26 miles of radio will be replaced with fiber optics. The Desert Southwest Region system will be replaced entirely with microwave radio. The Upper Great Plains systems are all interconnected and replacement of the three separate systems will be coordinated. The three systems have a total of 582 miles of radio being replaced with fiber optics, while the balance will be microwave radio.

The selection of fiber optics for certain portions of the replacement system was done for technological and economic reasons. The very long microwave radio paths would not be able to operate at higher frequencies without the development of new repeater sites, which would be more expensive than fiber optics. Also, areas that are highly congested with current spectrum use were also chosen for fiber optics to eliminate interference problems. Additionally, where the number of sites could be reduced by consolidating systems, fiber optics also proved to be the more economical solution. This was accomplished by increasing capacity to provide for the additional circuits as well as taking advantage of existing fiber optic networks.

Agency: **Department of Energy**	Bureau: **National Nuclear Security Administration (NNSA)**
Account: Office of the Administrator, NNSA, DOE	Account Number: 89-0313
Amount: $10,900,000	Timeline: 24 months
Number of Frequency Assignments: 25	Number of Systems: 15

The National Nuclear Security Administration (NNSA) will be relocating fixed microwave point-to-point systems and mobile tele-command and video systems from the 1710 MHz to 1755 MHz band to other Federal frequency bands. The various systems are located in the states of New Mexico, Nevada, Texas, Arkansas, and California.

Agency: **Department of Energy**	Bureau: **Departmental Administration**
Account: Departmental Administration	Account Number: 89-0228
Amount: $1,000,000	Timeline: 72 months
Number of Frequency Assignments: N/A	Number of Systems: N/A

The Department of Energy Headquarters will oversee and monitor the timely relocation of all DOE assignments from the 1710 MHz to 1755 MHz band. DOE will be relocating 595 of the 1990 Federal assignments (nearly 30 percent) that need to be relocated in support of this multi-year relocation effort. DOE headquarters will monitor and help facilitate and expedite the progress of the relocation by all DOE elements, the coordination with new commercial wireless licensees, and the deactivation of associated DOE 1710 MHz to1755 MHz frequency assignments, develop annual progress reports, and provide an integration and oversight function for the DOE relocation. DOE intends to relocate systems as expeditiously as possible.

Department of Homeland Security

Agency: **DHS**	Bureau: **Customs and Border Protection**
Account: Salaries & Expenses	Account Number: 70-0530
Amount: $74,349,990	Timeline: 12 Months
Number of Frequency Assignments: 118	Number of Systems: 60

Customs and Border Protection (CBP) is examining the microwave 1710 MHz to 1755 MHz transition nationwide, and has identified costs of $74.35 million to relocate 118 frequency assignments. Beginning with a detailed requirements analysis, CBP has identified key operating areas that are ready to begin upgrading their microwave infrastructure for voice, data, and video transmission. Specifically, a proof of concept is currently underway at the Mount Lemmon repeater site along the southwest border.

Efforts are underway there to begin to upgrade and transition to a new microwave backhaul, involving a requirements analysis, system design, equipment procurement, and spectrum planning. This effort is being coordinated with the SBInet Program Management Office (PMO) as well as all relevant CBP users. Ongoing efforts also include the identification of spectrum for transition being done in coordination with the DHS Wireless Management Office (WMO).

Agency: **DHS**	Bureau: **Immigration and Customs Enforcement**
Account: Salaries & Expenses	Account Number: 70-0540
Amount: $3,559,281	Timeline: 12 Months
Number of Frequency Assignments: 4	Number of Systems: 4

The Immigration and Customs Enforcement (ICE) Technical Operation Support (TOS) program maintains agency-wide electronic surveillance operations on 4 frequency assignments, for which relocation costs have been estimated at $3.56 million. Surveillance operations are centered on collection of evidence in the investigation of import/export and immigration violations. The nature of ICE investigations requires two types of equipment and associated infrastructure.

The first is the covert collection of evidence during meetings with suspected criminals. This type of operation requires surveillance equipment to be highly concealable and secure from both physical and electronic detection to ensure officer/agent safety. In addition, the evidence collected during these operations must be protected from interception or corruption of data. The operations are typically short in duration, i.e. 1 to 2 hours, and occur at various locations. The nature of these operations requires the equipment to be highly concealable, for on-the-body or common room decorations concealment, to avoid physical or electronic detection, and the equipment must be highly mobile and rugged for quick turn deployments.

The second activity is the long-term covert observation and collection of evidence at known locations of suspected criminal activity. These operations require that surveillance equipment blend into the surroundings and be capable of operating for long periods while transmitting information to remote collection locations. The equipment is similar to that used for short term activities. However, the long term exposure to the elements adds complexity to the design of the systems, and as with the short duration systems, evidence collected during these missions must be protected from interception or corruption.

The ICE TOS program maintains video surveillance equipment to address these two major investigative activities. For the short-term surveillance, small body-worn and "brick" transmitters, receivers and associated components are inventoried for the collection of evidence. For the long-term surveillance, larger complex video systems including high power transmitters and "pole-cams" are inventoried and deployed.

ICE also maintains a fixed microwave site in support of video surveillance activities.

Agency: **DHS**	Bureau: **Secret Service**
Account: Salaries & Expenses	Account Number: 70-0400
Amount: $105,800	Timeline: 12 Months
Number of Frequency Assignments: 1	Number of Systems: 1

The USSS Technical Operations Support program supports agency wide electronic surveillance operations throughout the United States and Protectorates with surveillance operations centered on collection of evidence on Presidential protection threats as well as financial counterfeiting violations. The nature of the missions is, as with ICE, along two primary paths.

Path 1 is the covert collection of evidence requiring surveillance equipment that is highly concealable and secure from both physical and electronic detection to ensure officer/agent safety. The missions are typically short duration, i.e. 1 to 2 hours, and occur at various

locations. The equipment is highly concealable, either for on-the-body use or as common room item concealments. Path 2 is long-term covert observation at known locations requiring equipment blended into the surroundings and capable of operating for long periods of time, i.e. months, while transmitting information to remote collection locations.

Agency: **DHS**	Bureau: **DHS Chief Information Officer**
Account: Office of the CIO	Account Number: 70-0102
Amount: $11,979,761	Timeline: 12 months
Number of Frequency Assignments: N/A	Number of Systems: N/A

DHS Office of the Chief Information Officer (OCIO) will provide coordinated management of spectrum relocation activities across DHS components, including administration, procurement, and coordination with commercial AWS licensees. In addition, the OCIO will perform further analysis of DHS capital investments related to spectrum relocation in order to ensure cost-effectiveness, risk mitigation, timely completion, and operational success. The OCIO has indicated that this analysis may lead to revised cost estimates, particularly in ICE and USSS, as relocation activities commence and more detailed analysis is performed in light of desired operational capabilities. In the event of a request for reimbursement above the approved amount for any DHS component, as with all agencies, the request will be reviewed by OMB, and Congress will be notified as appropriate, consistent with the provisions of the Commercial Spectrum Enhancement Act.

Department of Housing and Urban Development

Agency: **HUD**	Bureau: **Office of Inspector General**
Account: HUD-OIG Salaries and Expenses	Account Number: 86-0189
Amount: $21,115.00	Timeline: 24 Months
Number of Frequency Assignments: 1	Number of Systems: 5

The Office of Inspector General (OIG) of the Department of Housing and Urban Development (HUD) will relocate five surveillance systems that share a frequency assignment in the 1710 MHz to 1755 MHz band. Affected systems use video capability, in some cases accompanied by audio capability, in support of OIG investigations. Relocation plans entail minor modifications to support wireless communications in the 1755 MHz to 1850 MHz band.

The following HUD OIG systems will be included in relocation efforts:

1. *Location:* Region 7/8 HUD-OIG (Kansas City, KS, St. Louis, MO, Denver, CO, Billings, MT, Salt Lake City, UT).

   Equipment: One GMS Video Transmitter and one GMS Video Receiver – L Band, equipment utilized in video surveillance activity, in support of HUD-OIG investigations.

   Modification: Existing system will be replaced with equipment operating in the 1755 MHz to 1850 MHz frequency band.

2. *Location:* Region 9 HUD-OIG (Los Angeles, CA, Las Vegas, NV, Phoenix, AZ, Sacramento, CA, San Francisco, CA, Seattle, WA).

   Equipment: Three (3) L-3 Communications Audio/Video Microwave Transmitters, operating on the 1710 MHz to 1800 MHz frequency band, equipment utilized in conducting video surveillance, in support of HUD-OIG investigations.

   Modification: Existing systems will be replaced with equipment operating in the 1755 MHz to 1850 MHz frequency band.

Department of the Interior

Agency: **Department of the Interior**	Bureau: **Bureau of Reclamation**
Account: Water and Related Resources	Account Number: 14-0680
Amount: $4,550,000	Timeline: 36 Months
Number of Frequency Assignments: 34	Number of Systems: 2

The Bureau of Reclamation has 34 sites in total, located in Wyoming and Colorado, that will be involved in spectrum relocation activities. The North Platte River Project has 22 sites and the Fryingpan Arkansas Project has 12 sites. The current systems are Analog Microwave and will be replaced with Digital Microwave on alternative frequencies. The replacement systems will provide Reclamation with enhanced capabilities including increased bandwidth. Detailed capabilities and capacities include; a) integration of data networking capabilities such as remote monitoring, b) convergence with multiple voice gateways, i.e., telephone and cellular, c) ability to transfer data at a much higher rate and reliability than analog packet radio, and d) high level of encryption ensuring communications are secure between law enforcement officers.

System	Cost	Months to Relocate
North Platte River Project	$ 2,805,000	24 months
Fryingpan Arkansas Project	$ 1,745,000	36 months
Total, All Systems	$ 4,550,000	

Agency: **Department of the Interior**	Bureau: **U.S. Geological Survey (USGS)**
Account: Surveys, Investigations, and Research	Account Number: 14-0804
Amount: $6,158,949	Timeline: 36 Months
Number of Frequency Assignments: 16	Number of Systems: 1

USGS currently operates seven microwave sites in the affected spectrum, in support of earthquake data collection and hazards reduction. Funds will be used for replacement radios, installation, test equipment, operation of 4 new repeater sites and training.

Agency: **Department of the Interior**	Bureau: **National Park Service (NPS)**
Account: Construction and Major Maintenance	Account Number: 14-1039
Amount: $14,703,000	Timeline: 36 Months
Number of Frequency Assignments: 44	Number of Systems: 2

NPS operates two systems in the 1710 MHz to 1755 MHz band, and will utilize digital microwave technology to replace the existing analog microwave systems at Natchez Trace Parkway and Blue Ridge Parkway. The new digital technology will provide these parks with more reliable, efficient and versatile systems that have expansion capability in the future.

Relocation Cost Estimates by System:

System	Cost	Months to Relocate
Natchez Trace Parkway	$10,571,000	36
Blue Ridge Parkway	$4,132,000	36
Total All Systems	$14,703,000	

Department of Justice

Agency: **Department of Justice (DOJ)**	Bureau: **Alcohol, Tobacco, Firearms, and Explosives (ATF)**
Account: Spectrum Relocation Fund (S&E Account)	Account Number: 15-X-0700
Amount: $48,024,000	Timeline: 36 months
Number of Frequency Assignments: 2	Number of Systems: 1641

The Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) currently utilizes frequencies 1710 MHz and 1719 MHz for the transmission of covert surveillance video. The video transmission systems utilized by ATF are small portable transmitters, receivers, and repeaters installed in various concealments and are frequently worn on the body. All ATF video transmission systems are used throughout the United States and Territories (US&T). This surveillance is a critical part of ATF efforts to enforce alcohol, tobacco, firearms, arson, and explosives laws. Video transmitters are worn by undercover agents, which play a crucial role in providing and maintaining agent safety.

ATF expects to perform further capital-investment analysis related to spectrum relocation to ensure cost-effectiveness, risk mitigation, timely completion, and operational success. ATF has indicated that this analysis may lead to revised cost estimates as relocation activities commence and more detailed analysis is performed in light of desired operational capabilities. In the event of a request for reimbursement above the approved amount, as with all agencies, the request will be reviewed by OMB and Congress will be notified as appropriate, consistent with the provisions of the Commercial Spectrum Enhancement Act.

Agency: **Department of Justice (DOJ)**	Bureau: **Drug Enforcement Administration (DEA)**
Account: Salaries and Expenses (S&E)	Account Number: 15-1100
Amount: $74,772,000	Timeline: 36 months
Number of Frequency Assignments: 1	Number of Systems: 1

The Drug Enforcement Administration (DEA) has identified relocation costs of $74.77 million related to a system operating at 1744 MHz. This frequency is currently used by DEA for video and audio surveillance in the United States and Puerto Rico.

DEA uses microwave systems in the 1744 MHz frequency band for Agent/Officer Safety, as well as to collect evidence and intelligence in support of DEA's Mission. The systems used by this frequency are mostly portable in nature and are moved from one location to another, often at a moment's notice, to monitor time sensitive events. The systems are deployed in a surreptitious manner to limit the exposure of the equipment to targets of investigation and the general public.

DEA expects to perform further capital-investment analysis related to spectrum relocation to ensure cost-effectiveness, risk mitigation, timely completion, and operational success. DEA has indicated that this analysis may lead to revised cost estimates as relocation activities commence and more detailed analysis is performed in light of desired operational capabilities. In the event of a request for reimbursement above the approved amount, as with all agencies, the request will be reviewed by OMB and Congress will be notified as appropriate, consistent with the provisions of the Commercial Spectrum Enhancement Act.

Agency: **Department of Justice**	Bureau: **Federal Bureau of Investigation**
Account: Salaries and Expenses	Account Number: 15-0200
Amount: $139,225,000	Timeline: 36 months
Number of Frequency Assignments: 120 (119 through other appropriations)	Number of Systems: 119 + One, Video Surveillance

The FBI has a total of 120 frequency assignments associated with the relocation effort, 119 assignments allocated to Fixed Microwave Operations that are to be relocated with other appropriations, and one to Video Surveillance system to be relocated through the SRF.

The FBI has been utilizing spectrum in the L Band (1700 MHz to 1850 MHz) for Video Surveillance purposes since the mid 1980s. The demand for video surveillance technology began to grow tremendously in the early 1990s. The FBI expanded its video surveillance operation to the S Band (2200 MHz to 2300 MHz) in 1994, and to the C Band (4400 MHz to 5000 MHz) and X band (8100 MHz to 8500 MHz) in 1996.

In order for the FBI to relocate out of the 1710 MHz to 1755 MHz spectrum, several things must be considered. Due to the relatively close spectrum, the L Band and S Band channels are designed to be collocated within most of the FBI's microwave systems. In addition, the FBI also has many systems such as Microwave Repeaters and Microwave Information Gathering Systems where the equipment operates across bands. These systems can receive in the L or S Band and transmit in the C or X Band.

The current microwave transmission systems are analog-modulated, and require 17 MHz of spectrum per channel. One solution to maintaining the required operating channels in less spectrum would be to replace the FBI's analog systems with the recently developed digital transmission systems, which require 8 to 12Mhz per channel. The FBI is examining a transition from analog to digital technology for this reason.

The FBI expects to perform further capital-investment analysis related to spectrum relocation to ensure cost-effectiveness, risk mitigation, timely completion, and operational success. FBI has indicated that this analysis may lead to revised cost estimates as relocation activities commence and more detailed analysis is performed in light of desired operational capabilities. In the event of a request for reimbursement above the approved amount, as with all agencies, the request will be reviewed by OMB and Congress will be notified as appropriate, consistent with the provisions of the Commercial Spectrum Enhancement Act.

Agency: **Department of Justice (DOJ)**	Bureau: **General Administration (Office of the Chief Information Officer)**
Account: Law Enforcement Wireless Communications	Account Number: 15-0132
Amount: $800,000	Timeline: 36 months
Number of Frequency Assignments: N/A	Number of Systems: N/A.

The DOJ Office of the Chief Information Officer (OCIO) will provide oversight of spectrum relocation activities across all affected DOJ components. Support will be provided to the Department's capital investment review process to ensure that spectrum relocation activities will be cost-effective, that risks will be mitigated, and that relocation is completed in a timely fashion.

Department of Transportation

Agency: **Department of Transportation (DOT)**	Bureau: **Federal Aviation Administration**
Account: Facilities and Equipment, FAA	Account Number: 69-8107
Amount: $58,062,020	Timeline: 48 months
Number of Frequency Assignments: 120	Number of Systems: 21

The FAA intends to use an approach similar to the one used successfully in the 1996 to 1998 timeframe when 48 frequency assignments in 2 GHz spectrum were relocated. FAA estimates that present relocation efforts can be completed in 48 months at a cost of $58.1 million.

To minimize risk to operational capabilities, improved technologies and communications alternatives have been identified for satisfying displaced service requirements, as they relate to planning, engineering, and implementation. Geography plays a key role in this relocation effort since many of the displaced systems are located in either oceanic environments or mountainous terrain. These circumstances introduce unique challenges related to site accessibility under adverse atmospheric conditions during certain calendar seasons, in addition to problems resulting from long open-water microwave radio hops.

ATC Spectrum Engineering Services, as the FAA representative to NTIA, as well as The Harris Corporation under the FAA Telecommunications Infrastructure (FTI) Contract, are advising the FAA program office in this extensive effort to ensure that sound technical and economic decisions are made when replacing the impacted 2 GHz systems with solutions which are consistent with that major contract's long-term communications goals and objectives.

The technology being replaced is digital and analog microwave radio, operating in the 1710 MHz to 1755 MHZ frequency band. The 21 systems being replaced utilize 120 frequency assignments and consist of 82 radio sites located in the CONUS, Alaska, and on Pacific and Caribbean islands. Pursuant to the FTI contract, each new system will be addressed to select the technology needed to provide the standard of telecommunications required by the FAA. The new systems utilize a cost-effective mix of technologies, of which 7125 MHz to 8500 MHz digital microwave radios under current frequency planning assignments through NTIA may be the most dominant.

Department of the Treasury

Agency: **US Department of the Treasury**	Bureau: **Treasury Inspector General for Tax Administration (TIGTA)**
Account: Treasury Inspector General for Tax Administration	Account Number: 20-0119
Amount: $892,000	Timeline: 28 months
Number of Frequency Assignments: 1	Number of Systems: 10

The TIGTA shares a common frequency assignment with the Internal Revenue Service. The relocation of current 1710 MHz to 1755 MHz tactical microwave systems within TIGTA will entail the research, development, and deployment of both a wired and wireless Internet Protocol (IP) based solution while maintaining Radio Frequency (RF) fallback for situations and scenarios where IP based transmission is not technically feasible.

Previous tactical microwave systems employed simple "signal scrambling" technology which is very easily compromised in the contemporary security environment. After extensive research in preparation for this transition, TIGTA also anticipates that due to the high-level sensitivity of taxpayer investigations under Title 26, Internal Revenue Code, and agent/employee safety, the current level of operational security needed to maintain an acceptable level of risk will greatly increase. The use of digital RF and IP based tactical microwave transmission systems will require a new generation of security features to mitigate threats through the use of appliance based firewall security, IP video channel tunneling, complex digital encryption, and also incorporate a Message-Digest algorithm 5 (MD5) or Secure Hash Algorithm (SHA) cryptographic hash function commonly used to check and verify the integrity of digital evidence throughout its usable life.

Because the technology of the 1710 MHz to 1755 MHz replacement, surveillance systems are moving from analog to digital and employing network based IP technology where a new skill set will be needed to configure, maintain, and successfully operate these systems. Additional training at both the advanced and user levels will be necessary to insure a successful transition.

Agency: **US Department of the Treasury**	Bureau: **Internal Revenue Service (Criminal Investigation)**
Account: Enforcement	Account Number: 20-0913
Amount: $4,409,000	Timeline: 28 months
Number of Frequency Assignments: 1	Number of Systems: 100

The Internal Revenue Service, Criminal Investigation Division (CI) shares a common frequency assignment with TIGTA and will implement similar relocation plans. The above funding will be used to replace existing tactical microwave systems currently operating in the 1710 MHz to 1755 MHz band. The replacement systems will include tactical microwave and Internet protocol primarily used to support technical investigative activities such as covert video and audio surveillance, undercover video and audio communications and surveillance tracking. Although the replacement bands have not been identified, the relatively wide bandwidth needed for video surveillance activities may require these sensitive operations to move to higher bands, primarily the 4400 MHz to 4940 MHz and the 7 GHz and 8 GHz bands.

The anticipated transition from analog to digital replacement systems will require both advanced and basic training for users. A portion of CI's funding will be used for this purpose.

National Aeronautics and Space Administration

Agency: **National Aeronautics and Space Administration**	Bureau: **NASA**
Account: Exploration Capabilities, NASA	Account Number: 80-0115
Amount: $740,000	Timeline: 24 Months
Number of Frequency Assignments: 2	Number of Systems: 2

The following systems will be involved in spectrum relocation efforts, which are anticipated to last 24 months to completion and cost $740,000.

Johnson Space Center will replace a transportable Security Office Covert Video Surveillance System. Relocation plans, including engineering studies, are complete. The video surveillance system will be relocated using commercial off-the-shelf equipment, which will undergo thorough review, verification, and calibration, prior to finalization of the project.

Dryden Flight Research Center will replace an Air to Ground Video Telemetry System. Relocation plans, including engineering studies, are complete. The video telemetry system will be relocated using commercial off-the-shelf equipment, which will undergo thorough review, verification, and calibration, prior to finalization of the project.

Tennessee Valley Authority

Agency: **Tennessee Valley Authority**	Bureau:
Account: TVA fund	Account Number: 64-4110
Amount: $10,687,857	Timeline: 48 months
Number of Frequency Assignments: 94 (58 through other appropriations)	Number of Systems: 6

The total estimated relocation or modification cost for the Tennessee Valley Authority's radio communications systems in the 1710 MHz to 1755 MHz band is $10,687,857. This total represents estimated costs to relocate six fixed microwave systems supported with 36 frequency assignments, including four new assignments for additional repeater stations required due to operating in a higher frequency band.

The estimated costs and timelines for each system are as follows:

Site	Cost	Timeline
Nashville/Paradise Fossil Plant	$4,396,600	48 months
Shawnee Fossil Plant/DOE USEC	$1,993,900	36 months
Weakly/Hickman	$1,109,300	48 months
Power System Control Center/Bellefonte Nuclear Plant	$1,875,400	48 months
Oak Ridge/Bull Run Fossil Plant	$656,330	36 months
Franklin/Sewanee	$656,327	36 months

United States Postal Service

Agency: **USPS**	Bureau: **Inspection Service**
Account: Payment to the Postal Service Fund	Account Number: 18-1001
Amount: $1,761,760	Timeline: 12 Months
Number of Frequency Assignments: 2	Number of Systems: 508

The U.S. Postal Inspection Service (USPIS) is the Federal Law Enforcement arm of the USPS. Relocation activities affect 508 pieces of equipment (systems and individual units) currently maintained in inventory. The Technical Services Division (TSD) of the USPIS is responsible for identifying and purchasing suitable replacement equipment to successfully accomplish the agency's mission.

TSD has developed the following relocation plan:

- Secure a minimum of two (2) replacement frequencies;
- Research current microwave technologies for replacement equipment;
- Purchase microwave systems which include cameras with pan-tilt-zoom functionality, a microwave receiver with a recording device, including appropriate transmitters, which can be concealed in covert enclosures;
- Purchase the following as individual units: microwave transmitters, receiver kits with a recording device, antennas, and microwave amplifiers;
- Research and purchases to be completed within 12 months following the release of funds from the Spectrum Relocation Fund; and
- TSD will maintain a small inventory of replacement equipment, with the majority being deployed to the eighteen (18) field divisions.