COMMERCE SPECTRUM MANAGEMENT ADVISORY COMMITTEE ("CSMAC")

TRANSITION REPORT

December 13, 2008

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COMMERCE SPECTRUM MANAGEMENT ADVISORY COMMITTEE
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I. INTRODUCTION

In May 2003, President George W. Bush established the "Spectrum Policy Initiative" ("SPI") which called for "a comprehensive review of spectrum management policies . . . with the objective of identifying recommendations for revising policies and procedures to *promote more efficient and beneficial use of spectrum without harmful interference to critical incumbent users.*"[1] The U.S. Department of Commerce was specifically directed to prepare legislative and other recommendations to:

- Facilitate a modernized and improved spectrum management system;
- Facilitate policy changes to create incentives for more efficient and beneficial use of spectrum and to provide a higher degree of predictability and certainty in the spectrum management process as it applies to incumbent users;
- Develop policy tools to streamline the deployment of new and expanded services and technologies, while preserving national security, homeland security, and public safety, and encouraging scientific research; and
- Develop means to address the critical spectrum needs of national security, homeland security, public safety, Federal transportation infrastructure, and science.[2]

This report summarizes the efforts of the Department of Commerce, through the National Telecommunications and Information Administration ("NTIA"), to implement these directives to date. This report also summarizes related Federal Communications Commission ("FCC" or "Commission") actions. NTIA is an operating unit of the Department of Commerce responsible for administering Federal Government use of the radio spectrum, whereas the Commission is an independent agency responsible for non-Federal use of the radio spectrum.[3]

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[1] *Presidential Memo on Spectrum Policy: Spectrum Policy for the 21st Century*, 39 Weekly Comp. Pres. Doc. 726, 727 (May 29, 2003) (emphasis added) ("SPI Memo"), *available at* http://www.whitehouse.gov/news/releases/2003/06/20030605-4.html.

[2] SPI Memo § 2.

[3] *See* 47 C.F.R. § 2.105(a). NTIA approves the spectrum use by Federal departments and agencies and maintains the Federal Government Table of Frequency Allocations.

II. NTIA IMPLEMENTATION

Over the five years since adoption of the SPI, NTIA has taken significant steps to implement the vision contained therein. It has "proposed an 'evolutionary' approach toward spectrum policy" with the ultimate goal being "efficient and effective use of the spectrum and, where appropriate, assured dynamic access to spectrum to be achieved in judicious and incremental steps."[4] NTIA's efforts to advance the SPI and promote more efficient and beneficial use of spectrum without harmful interference to critical incumbent users are chronicled below followed by a discussion of the role of the Commerce Spectrum Management Advisory Committee ("CSMAC" or "Committee") in achieving three specific recommendations that were made: (1) establishment of a Spectrum Management Advisory Committee; (2) creation of a Test-Bed for the purpose of evaluating technologies and methods for improving spectrum sharing between federal government and non-federal government users;[5] and (3) steps toward facilitating interoperability of first responder communications and other government communications.[6]

[4] U.S. DEP'T OF COMMERCE, SPECTRUM MANAGEMENT FOR THE 21ST CENTURY —THE PRESIDENT'S SPECTRUM POLICY INITIATIVE —SECOND ANNUAL PROGRESS REPORT 4-5 (Oct. 2007) *available at* http://www.ntia.doc.gov/reports/2007/spectrumpolicysecondreport2007.pdf ("Second Annual Progress Report").

[5] *Id.* at 12*;* U.S. DEP'T OF COMMERCE, SPECTRUM POLICY FOR THE 21ST CENTURY — THE PRESIDENT'S SPECTRUM POLICY INITIATIVE: REPORT 1 — RECOMMENDATIONS OF THE FEDERAL GOVERNMENT SPECTRUM TASK FORCE app. B at B-2 (June 2004), *available at* http://www.ntia.doc.gov/reports/specpolini/presspecpolini_report1_06242004.pdf ("Report 1").

[6] Report 1 app. B at B-2.

A. Reports and Analysis

In June 2004, the Department issued a two-part series of reports entitled "Spectrum Policy for the 21st Century — the President's Spectrum Policy Initiative."[7] Among other things, the Reports recommended:

- Establishing a Spectrum Management Advisory Committee "to advise the Assistant Secretary of Communications and Information, Department of Commerce on needed reforms to spectrum policies and management to enable the introduction of new spectrum dependant technologies and services including expediting America's access to broadband services";[8]
- Creating a Spectrum Sharing Innovation Test-Bed for the purpose of evaluating technologies and methods for improving spectrum sharing between federal government and non-federal government users;[9] and
- Facilitating interoperability of first responder communications and other government communications.[10]

In November 2004, President George W. Bush directed the heads of executive departments and agencies to submit a plan to implement the recommendations from the June reports. NTIA submitted such a plan in March 2006[11] which described seven projects encompassing the recommendations of the two earlier reports. Each project had a number of subtasks, as reflected below:

A. Improve stakeholder participation and maintain high qualifications of spectrum managers;

1. Establish a Commerce Spectrum Management Advisory Committee (CSMAC)

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[7] Report 1; U.S. DEP'T OF COMMERCE, SPECTRUM POLICY FOR THE 21ST CENTURY — THE PRESIDENT'S SPECTRUM POLICY INITIATIVE: REPORT 2 — RECOMMENDATIONS FROM STATE AND LOCAL GOVERNMENTS AND PRIVATE SECTOR RESPONDERS (June 2004), *available at* http://www.ntia.doc.gov/reports/specpolini/presspecpolini_report2_06242004.pdf ("Report 2").

[8] Report 2 app. B at B-2.

[9] Report 1 app. B at B-2.

[10] *Id.*

[11] U.S. DEP'T OF COMMERCE, SPECTRUM MANAGEMENT FOR THE 21ST CENTURY — PLAN TO IMPLEMENT RECOMMENDATIONS OF THE PRESIDENT'S SPECTRUM POLICY INITIATIVE (Mar. 2006), *available at* http://www.ntia.doc.gov/osmhome/reports/ImplementationPlan2006.pdf ("Implementation Plan").

2. Establish a high-level interagency advisory group – the Policy and Plans Steering Group (PPSG)

3. Resolve inter-governmental spectrum disputes through the existing White House Policy Coordinating Committee (PCC) process and revise the NTIA/FCC MOU to provide an additional minimum 15 business days to accommodate the PCC process

4. Expand the role of the FCC Defense commissioner

5. Promote a career development program and spectrum management training

B. Reduce international barriers to U.S. innovations in technologies and services;

1. Improve U.S. preparations for World Radiocommunication Conferences (WRCs)

2. Improve international spectrum management policies and regulatory environment

C. Modernize federal spectrum management processes with advanced information technology;

1. Implement advanced information management systems

D. Satisfy public safety communication needs and ensure interoperability;

1. Spectrum sharing between federal and non-federal public safety agencies

E. Enhance spectrum engineering and analytical tools;

1. Develop analytical approaches, software tools, and engineering techniques for evaluating and improving the efficiency and effectiveness of federal spectrum use

2. Develop and promote recognition in the spectrum management community for best practices in spectrum engineering

3. Conduct a pilot program to evaluate approaches and techniques to increase spectrum sharing between federal and non-federal spectrum users

4. Develop and promote the use of modern analytic tools for spectrum engineering

F. Promote efficient and effective use of spectrum; and

G. Improve planning and promote use of market-based economic mechanisms in spectrum management.

NTIA proposed organizing working groups for each of these projects. These working groups would incorporate federal agencies including the FCC. In November 2008, NTIA released an update on the status of each of the above tasks and subtasks.[12]

In a recent implementation effort, NTIA released a November 2008 report setting an agenda for improving spectrum use through economic incentives, both in the federal government and more broadly. The report set forth a series of tasks and subtasks. The potential approaches include spectrum user fees, sharing and trading of spectrum between federal and non-federal users, federal use of commercial services, modification of exclusive licensing rights, and improving secondary markets for spectrum. NTIA will also explore legislative and administrative changes necessary to adopt such incentives. Recommendations are slated for the fourth quarter of 2009.

Following these plans, NTIA has taken significant steps towards implementing the SPI, consistent with the recommendations contained in Reports 1 and 2. These efforts, some of which pre-date the June 2004 Reports and the Implementation Plan, are listed below:

DATE	ACTION
January 2003	NTIA works with the FCC, NASA, and the Department of Defense to open up spectrum in the 5 GHz band to unlicensed commercial applications.[13]
January 2004	NTIA seeks public participation in President's Spectrum Initiative and invites comments on spectrum policy reform from all interested parties.[14]

[12] U.S. DEP'T OF COMMERCE, IMPLEMENTATION PLAN FOR THE PRESIDENT'S INITIATIVE ON SPECTRUM MANAGEMENT: NOVEMBER 2008 UPDATE (Nov. 2008), unpublished.

[13] Press Release, U.S. Department of Commerce, Agreement Reached Regarding U.S. Position on 5 GHz Wireless Access Devices (Jan. 31, 2003), http://www.ntia.doc.gov/ntiahome/press/2003/5ghzagreement.htm; *see also Revision of Parts 2 and 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, ET Docket No. 03-122, Report and Order, 18 FCC Rcd 24484 (Nov. 18, 2003).

February 2004	NTIA conducts a two-day public safety spectrum management forum, February 10–11, 2004.[15] The forum was established to garner public comment on the objectives of the SPI as they relate to public safety.
April 2004	NTIA issues a report to Congress on "further actions needed in the allocation of spectrum to the civilian sector for the effective deployment of third generation (3G) wireless devices in the United States."[16] According to the Report, the major actions that must be completed to achieve this objective were: (1) enactment of the President's proposal to create a spectrum relocation fund; (2) completion of the FCC's rules to identify spectrum for some Federal operations that must relocate; and (3) an auction scheduled by the FCC.
August 2004	NTIA files comments with the FCC regarding the merits of an Interference Temperature Metric to quantify and manage interference and to expand available unlicensed operation in certain frequency bands.[17]
January 2005	NTIA convenes the Policy and Plans Steering Group (PPSG), a high-level interagency panel advising NTIA on complex and pressing issues that affect Federal spectrum. PPSG subsequently meets four additional times through 2008.
February 2005	NTIA files comments with the FCC regarding the development and deployment of cognitive radio (CR) technology.[18]
March 2005	NTIA releases Report TR-05-419. The report examines the interference potential of ultrawideband ("UWB") signals and procedures for characterizing ultrawideband emissions and measuring interference susceptibility of C-Band satellite digital television receivers.[19]

[14] *United States Spectrum Management Policy For the 21st Century*, Notice of Inquiry, 69 Fed. Reg. 4923 (Feb. 2, 2004).

[15] *See Public Safety Spectrum Management Forum*, Notice of Public Meeting, 69 Fed. Reg. 1973 (Jan. 13, 2004). *See also* "National Forum on Public Safety Spectrum Management," http://www.ntia.doc.gov/ntiahome/ntiageneral/specinit/forum2/index.html (last visited Nov. 16, 2008).

[16] Letter from Michael D. Gallagher, Acting Assistant Secretary for Communications and Information, National Telecommunications and Information Administration, to Richard B. Cheney, President of the Senate, *available at* http://www.ntia.doc.gov/congress/2004/3Gletter_04152004.pdf (posted online Apr. 15, 2004).

[17] Comments of the National Telecommunications and Information Administration, ET Docket No. 03-237 (Aug. 13, 2004).

[18] Comments of the National Telecommunications and Information Administration, ET Docket No. 03-108 (Feb. 15, 2005).

[19] U.S. DEP'T OF COMMERCE, INTERFERENCE POTENTIAL OF ULTRAWIDEBAND SIGNALS PART 1: PROCEDURES TO CHARACTERIZE ULTRAWIDEBAND EMISSIONS AND MEASURE INTERFERENCE
(continued on next page)

May 2005	NTIA charters the CSMAC.[20]
December 2005	NTIA releases cost and timeline information regarding the relocation of incumbent federal users from the 1710-1755 MHz band in order to open up spectrum for advanced wireless broadband services.[21]
March 2006	NTIA releases another UWB report that provides results from tests that measured digital television ("DTV") susceptibility to UWB interference.[22] The authors are with the Institute for Telecommunication Sciences, NTIA, U.S. Department of Commerce.
March 2006	NTIA releases a plan to implement the recommendations of the President's Spectrum Policy Initiative.[23]
March 2006	NTIA holds a workshop on "Improving Spectrum Management through Economic or Other Incentives."
June 2006	NTIA issues a Notice of Inquiry seeking public comment on the creation of a spectrum sharing innovation test-bed.[24]
August 2006	NTIA proposes FCC rulemaking to establish regulatory parity between U.S. government satellite earth stations and commercial satellite earth stations communicating with commercial satellite systems in various frequency bands.[25]
September 2006	NTIA transmits to Congress a report required by the Commercial Spectrum Enhancement Act ("CSEA"), "Spectrum Relocation Report: Compensation Options for Relocation Costs of Federal Entities," on the various policy options to compensate Federal entities for relocation costs incurred when the entities' spectrum is allocated by the Federal

SUSCEPTIBILITY OF C-BAND SATELLITE DIGITAL TELEVISION RECEIVERS, NTIA Report TR-05-419 (Feb. 2005), *available at* http://www.its.bldrdoc.gov/pub/ntia-rpt/05-419/index.php.

[20] Implementation Plan at 5.

[21] "1710 - 1755 MHz Introduction,"
http://www.ntia.doc.gov/osmhome/reports/specrelo/index.htm (last visited Nov. 16, 2008).

[22] U.S. DEP'T OF COMMERCE, INTERFERENCE POTENTIAL OF ULTRAWIDEBAND SIGNALS
PART 3: MEASUREMENT OF ULTRAWIDEBAND INTERFERENCE TO C-BAND SATELLITE DIGITAL TELEVISION RECEIVER, NTIA Report TR-06-437 (Feb. 2006), *available at* http://www.its.bldrdoc.gov/pub/ntia-rpt/06-437/06-437.pdf.

[23] *See* Implementation Plan.

[24] *The President's Spectrum Policy Initiative Spectrum Sharing Innovation Test-Bed*, Notice of Inquiry, 71 Fed. Reg. 33282 (June 8, 2006).

[25] *Amendment to the National Table of Frequency Allocations to Provide Allocation Status for Federal Earth Stations Communicating with Non-Federal Satellites*, Petition for Rulemaking of NTIA, RM-11341 (filed Aug. 4, 2006).

	Communications Commission for unlicensed, public safety, shared, or non-commercial use.[26]
February 2007	The Office of Management and Budget (OMB) issues a Report to Congress, prepared in consultation with NTIA, regarding the plans of Federal agencies for spectrum relocation funds.[27]
February 2007	The Departments of Commerce and Homeland Security enter into a memorandum of understanding regarding the methodology for awarding public safety interoperability communications grants.[28]
March 2007	NTIA re-charters CSMAC for an additional two years.
June 2007	NTIA holds a public meeting to discuss the public safety interoperability communications grant program.[29]
June 2007	NTIA issues a report analyzing the District of Columbia's pilot program, "Wireless Accelerated Responder Network," which exemplified the use of a public safety network on which federal, state, local and private users share the available bandwidth.[30] The report determines that public safety agencies should use commercial broadband services, where appropriate, if they can satisfy their broadband requirements.
October 2007	NTIA issues its Second Annual Report summarizing the accomplishments of the Federal agencies in carrying out the President's Spectrum Policy Initiative during the second year of its implementation.[31] During this time period, the 15 Federal agencies that are major spectrum users accelerated their efforts to improve spectrum management.

[26] U.S. DEP'T OF COMMERCE, SPECTRUM RELOCATION REPORT: COMPENSATION OPTIONS FOR RELOCATION COSTS OF FEDERAL ENTITIES (Sept. 2006), *available at* http://www.ntia.doc.gov/osmhome/reports/2006/SpecRelo_HR5419.pdf.

[27] OFFICE OF MGMT. AND BUDGET, COMMERCIAL SPECTRUM ENHANCEMENT ACT REPORT TO CONGRESS ON AGENCY PLANS FOR SPECTRUM RELOCATION FUNDS (Feb. 16, 2007) *available at* http://www.ntia.doc.gov/reports/2007/OMBSpectrumRelocationCongressionalNotification_final.pdf.

[28] *Memorandum of Understanding Between The National Telecommunications and Information Administration, U.S. Department of Commerce, and the Office of Grants and Training, U.S. Department of Homeland Security*, Agreement No. M72177 (Feb. 16, 2007), *available at* http://www.ntia.doc.gov/otiahome/psic/PSICMOU_Executed_2-16-2007.pdf.

[29] *See Public Safety Interoperable Communications Grant Program Public Meeting*, Notice of Public Meeting, 72 Fed. Reg. 28685 (May 22, 2007).

[30] U.S. DEP'T OF COMMERCE, SPECTRUM POLICY FOR THE 21ST CENTURY – THE PRESIDENT'S SPECTRUM POLICY INITIATIVE: A PUBLIC SAFETY SHARING DEMONSTRATION (May 2007), *available at* http://www.ntia.doc.gov/reports/NTIAWARNReport.pdf.

[31] Second Annual Progress Report.

March 2008	NTIA releases the "Federal Strategic Spectrum Plan" – a comprehensive report on the use of the nation's airwaves by the U.S. federal government, based on submissions of spectrum plans from 15 Federal agencies.[32]
April 2008	NTIA releases the First Annual Progress Report on the Relocation of Federal users from the 1710-1755 MHZ Spectrum Band, which details progress from the commencement of relocation activity in March 2007 through December 2007.[33] This is the first federal spectrum band selected for relocation pursuant to the Commercial Spectrum Enhancement Act.
November 2008	NTIA releases a report setting forth its plan to further President Bush's Spectrum Policy Initiative by (1) identifying and implementing economic incentives for efficient spectrum use by federal government agencies; and (2) addressing economic incentives for efficient spectrum use more broadly, including by developing legislative recommendations to increase the FCC's incentive authority.[34]
November 2008	NTIA issues the Spectrum Policy Initiative Progress Report for Fiscal Year 2007.[35] This report summarizes federal agency actions in support of the Initiative through November 2007, and summarizes NTIA-led activities through September 2008.

[32] U.S. DEP'T OF COMMERCE, SPECTRUM POLICY FOR THE 21ST CENTURY – FEDERAL STRATEGIC SPECTRUM PLAN (Mar. 2008), *available at* http://www.ntia.doc.gov/reports/2008/FederalStrategicSpectrumPlan2008.pdf.

[33] U.S. DEP'T OF COMMERCE, 1710-1755MHZ SPECTRUM BAND RELOCATION – FIRST ANNUAL PROGRESS REPORT (April 2008), *available at* http://www.ntia.doc.gov/reports/2008/SpectrumRelocation2008.pdf.

[34] U.S. DEP'T OF COMMERCE, SPECTRUM MANAGEMENT FOR THE 21ST CENTURY – PLAN TO IDENTIFY AND IMPLEMENT INCENTIVES THAT PROMOTE MORE EFFICIENT AND EFFECTIVE USE OF SPECTRUM (Nov. 2008), *available at* http://www.ntia.doc.gov/osmhome/reports/Incentives_Plan.pdf.

[35] U.S. DEP'T OF COMMERCE, SPECTRUM MANAGEMENT FOR THE 21ST CENTURY – THE PRESIDENT'S SPECTRUM POLICY INITIATIVE: PROGRESS REPORT FOR FISCAL YEAR 2007 (Nov. 2008), *available at* http://www.ntia.doc.gov/osmhome/spectrumreform/FY2007%20Progress%20Report_for_Fiscal_Year_2007_Final_25Nov08_rev_1Dec08.pdf.

B. CSMAC Efforts

As discussed above, the Secretary of the U.S. Department of Commerce established the CSMAC on May 19, 2005[36] "to advise the Assistant Secretary of Communications and Information, Department of Commerce on needed reforms to spectrum policies and management in order to enable the introduction of new spectrum dependant technologies and services, including expediting America's access to broadband services."[37] The CSMAC is comprised of spectrum policy experts, appointed as "Special Government Employees," who were selected based on their diverse backgrounds, experiences and points of view.

In the three years since its creation, the CSMAC has held six public meetings and has worked extensively to advance the goals of the SPI consistent with its Charter. At the recommendation of NTIA's then-Assistant Secretary for Communications and Information, John M.R. Kneuer, the CSMAC established two subcommittees, one to address technical sharing efficiencies and one to address operational sharing efficiencies, with a particular focus on "how to incentivize the Federal Government to realize the efficiencies."[38] Various CSMAC working groups have been established to analyze specific issues and provide recommendations for possible adoption by the CSMAC. To date, the following reports have been issued by the CSMAC:

- Opportunities Relating to the Spectrum Sharing Test Bed

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[36] *See* U.S. DEPARTMENT OF COMMERCE, CHARTER OF THE SPECTRUM MANAGEMENT ADVISORY COMMITTEE (May 19, 2005), *available at* http://www.fido.gov/facadatabase/docs_charters/25109_Charter_(2005-05-20-10-28-52).htm. The Charter was renewed in 2007. *See* U.S. DEP'T OF COMMERCE, CHARTER OF THE SPECTRUM MANAGEMENT ADVISORY COMMITTEE (Mar. 28 2007), *available at* http://www.fido.gov/facadatabase/docs_charters/25109_Spectrum%20Charter%203-28-07_(2007-03-30-10-34-21).pdf

[37] *See* Report 2 app. B at B-2.

[38] Minutes of the U.S. Department of Commerce, Commerce Spectrum Management Advisory Committee, December 13, 2006 Meeting at 2, *available at* http://www.ntia.doc.gov/advisory/spectrum/meeting_files/December_2006_Minutes.pdf.

- Opportunities for Government Adoption of Commercial Technologies
- Recommendations for Improving the Process for Identifying Spectrum for Future Reallocation or Sharing
- Report on Spectrum Efficiency
- Report on Operational Efficiency
- Streamlining Federal/Non-Federal Sharing of Radio Systems
- Transitioning Federal Land Mobile Radio Systems to More Spectrally Efficient Technologies

In addition, considerable work has been done regarding recommendations for implementation of OMB Circular A-11. The CSMAC Subcommittee on Circular A-11 Implementation recently drafted a memorandum which summarized the efforts so far, described the remaining areas of genuine disagreement, and offered a series of recommendations for the next iteration of the Committee.[39] The next CSMAC should move forward with this item consistent with the recommendations in the memorandum, and work to issue OMB Circular A-11 implementation recommendations as early as practicable next year.

On August 1, 2008, NTIA issued a public notice seeking nominations for new CSMAC members.[40] The deadline for submitting nominations was September 26, 2008.[41] It is anticipated that additional members will be added to the Committee by the end of the year.

C. Test-Bed Implementation

The Test-Bed program was proposed as a vehicle for achieving the objectives embodied in the SPI, including the more efficient use of spectrum, the rapid deployment of new and innovative technologies, and addressing the spectrum needs associated with critical government

[39] Draft Memorandum from CSMAC Subcommittee on Circular A-11 Implementation, to CSMAC (Nov. 26, 2008) (on file with CSMAC).

[40] *Notice: Call for Applications, Commerce Spectrum Management Advisory Committee,* Notice and Request for Applications to Serve on Advisory Committee, 73 Fed. Reg. 44972 (Aug. 1, 2008).

[41] *Notice: Request for Applications, Commerce Spectrum Management Advisory Committee*, Reopening of Application Period, 73 Fed. Reg. 52646 (Sept. 10, 2008) (The due date in the Notice was incorrect, according to NTIA's webpage. *See* http://www.ntia.doc.gov/reports.html).

functions, such as national security, homeland security, and public safety. The goal of the Test-Bed program was clearly spelled out by the Department of Commerce — to study the feasibility of federal and non-federal users sharing the same spectrum.

On June 7, 2006, NTIA solicited public comment on "the establishment of a spectrum sharing Test-Bed to explore innovative ways to make more intensive use of the nation's airwaves and promote continued economic growth and national security."[42] NTIA proposed detailed criteria that should be used to determine whether a particular technology or application were suitable for the Test-Bed program. Fourteen parties filed comments, which were reviewed by the CSMAC to form recommendations to be provided to NTIA.

On December 6, 2007, the CSMAC issued recommendations to NTIA regarding implementation of the test-bed program based on the public comments, information provided to the Committee, and publicly available information. The CSMAC concluded that, given the fundamental importance of broadband to our national economic development and homeland security, broadband should be a component of any technology chosen for deployment in the Test-Bed program, to the extent feasible. Nonetheless the CSMAC recognized numerous government operations, including telemetry and radars, that may be able to more efficiently use the spectrum resource without a broadband solution. Therefore, although the use of broadband technologies was generally preferred, the CSMAC concluded that the federal government may also benefit from test bed applications that improve the efficiency of narrowband technologies.

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[42] Press Release, U.S. Dep't of Commerce, NTIA Seeks Public Comment on Creation of Spectrum Sharing Innovation Test Bed (June 7, 2006), *available at* http://www.ntia.doc.gov/ntiahome/press/2006/specshare_060706.pdf; *The President's Spectrum Policy Initiative Spectrum Sharing Innovation Test Bed*, Notice of Inquiry, 71 Fed. Reg. 33282 (June 8, 2006). On June 8, 2006, the FCC initiated a companion proceeding. *See Federal Communications Commission Seeks Public Comment on Creation of a Spectrum Sharing Innovation Test-Bed,* ET Docket No. 06-89, Public Notice, 21 FCC Rcd 6693 (rel. June 8, 2006) ("*FCC Notice*").

Based on its review of the record and additional materials provided to the Committee, four specific technologies and services were recommended for the Test-Bed: dynamic spectrum access; multi-antenna signal processing ("MAS"); airborne video; and mobile satellite service with an ancillary terrestrial component ("MSS/ATC"). Each of these technologies/services was evaluated and only two — dynamic spectrum access and multi-antenna signal processing — were deemed to satisfy each of the criteria established by NTIA for the test bed.

In addition to public comment and the CSMAC recommendations, NTIA also sought input from the federal agencies on the Interdepartment Radio Advisory Committee ("IRAC"). The public comments as well as the recommendations and comments provided by the CSMAC and the IRAC were used to develop the federal portion of the Test-Bed Pilot Program. Based on this input, NTIA concluded that the Test-Bed would examine Dynamic Spectrum Access ("DSA") technologies employing spectrum sensing and/or geo-location techniques in the 410-420 MHz frequency range. To address potential interference to incumbent spectrum users, the Test-Bed will be performed in three phases that include both laboratory and field measurements:

- **Phase 1 – Equipment Characterization**. Equipment employing DSA techniques will be sent to the NTIA Institute for Telecommunication Sciences in Boulder, Colorado and characterization measurements of the DSA capabilities in response to simulated environmental signals will be performed.

- **Phase 2 – Evaluation of Capabilities**. After successful completion of Phase 1, the DSA capabilities of the equipment in the geographic area of the Test-Bed will be evaluated.

- **Phase 3 – Field Operation Evaluation.** After successful completion of Phase 2, the DSA equipment will be permitted to transmit in an actual radio frequency signal environment. An automatic signal logging capability will be used during the operation of the Test-Bed to help resolve interference events if they occur. A point-of-contact will also be established to stop Test-Bed operations if interference is reported.

On February 5, 2008, NTIA issued a public notice soliciting participation in the Test-Bed, which would be jointly administered by NTIA and the FCC.[43] The deadline for applications to participate was February 29, 2008 and the following parties were selected to participate: Adapt4 LLC; Adaptrum Inc.; BAE Systems; Motorola Inc.; Shared Spectrum Company; Virginia Polytechnic Institute and State University.

D. Steps Toward Improving Interoperability

NTIA's efforts toward improving interoperability were described by John M. R. Kneuer, former Assistant Secretary for Communications and Information for NTIA as follows:

> NTIA's Institute for Telecommunication Sciences has been actively involved in the standards-setting process for public safety communications. We have partnered with agencies and programs such as the National Institute of Standards and Technology's Office of Law Enforcement Standards, DHS's Office for Interoperability and Compatibility (OIC) and the SAFECOM Program, the Department of Justice's Office of Community Oriented Policing Services, the Federal Partnership for Interoperable Communications, and DHS Chief Information Officer's Wireless Management Office. NTIA is working daily with prominent members of the public safety community, including representatives of the International Association of Chiefs of Police, International Association of Fire Chiefs, the Association of Public Safety Communication Officials International, the National Association of State Emergency Medical Services Directors, the National Public Safety Telecommunications Council, the National Governors Association, and the National League of Cities. Our work is centered on developing a long-term standardized approach for nationwide communications interoperability and information sharing among local, State, and Federal public safety agencies, and short-term interim solutions to facilitate communications while the long-term approach is being completed.
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> NTIA's long-term approach is based on an accelerated, yet structured, process that includes the public safety community to produce a comprehensive qualitative and quantitative statement of requirements for public safety communications (OIC's Public

[43] *Spectrum Sharing Innovation Test-Bed*, Notice of Solicitation of Participation, 73 Fed. Reg. 6710 (Feb. 5, 2008).

> Safety Statement of Requirements), an architecture framework that describes the current and required future states of interoperability (OIC's Public Safety Architecture Framework), and interface standards that define the elements and performance of the interoperability architecture (Project 25 (P25) standards). Short-term, interim solution work is focused on testing and evaluating products and services offered currently to the community to determine if they can enable higher degrees of immediate interoperability effectively and economically. All segments of the NTIA program begin and end with practitioner input and acceptance. NTIA and its federal partners continue to work alongside practitioners to complete the remaining interface standards for P25, the digital narrowband solution that federal departments, such as Homeland Security, Justice and Defense, and many State and local entities have adopted.[44]

On February 10–11, 2004, NTIA conducted a public safety spectrum management forum to garner public comment on the objectives of the SPI as they relate to public safety.[45] Two years later, Congress passed the Digital Television Transition and Public Safety Act of 2005 which authorized NTIA, in consultation with DHS to award grants not to exceed $1 billion in the aggregate through fiscal year 2010 to further public safety interoperable communications. The grant program will assist public safety agencies in the acquisition of, deployment of, or training for the use of interoperable communications systems that can utilize reallocated public safety spectrum in the 700 MHz band for radio communication.

In February 2007, the Departments of Commerce and Homeland Security entered into a memorandum of understanding regarding the methodology for awarding the public safety

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[44] Testimony of John M. R. Kneuer, Acting Assistant Secretary for Communications and Information, National Telecommunications and Information Administration, U.S Department of Commerce before the Committee on Homeland Security, U.S. House of Representatives (Mar. 14, 2007) *available at* http://www.ntia.doc.gov/congress/2006/Kneuer_interoperable_042506.htm.

[45] *See Public Safety Spectrum Management Forum,* Notice of Public Meeting, 69 Fed. Reg. 1973 (Jan. 13, 2004). *See also* "National Forum on Public Safety Spectrum Management," http://www.ntia.doc.gov/ntiahome/ntiageneral/specinit/forum2/index.html (last visited Nov. 16, 2008).

interoperability communications grants.[46] NTIA also determined that public-safety answering point (PSAPs) would be eligible for a portion of $1 billion in interoperability grant funds.

That same month, NTIA issued a report analyzing the District of Columbia's pilot program, "Wireless Accelerated Responder Network," which exemplified interoperability because that public safety network allowed federal, state, local and private users to share the available bandwidth.[47] The report determined that public safety agencies should use commercial broadband services, where appropriate, if they can satisfy their broadband requirements.

On July 18, 2007, U.S. Commerce Secretary Carlos M. Gutierrez and U.S. Homeland Security (DHS) Secretary Michael Chertoff announced that $968 million in Public Safety Interoperable Communications ("PISC") Grants to help state and local first responders improve public safety communications during a natural or man-made disaster for all 50 States, the District of Columbia and the U.S. Territories.[48] NTIA held four one-day PISC workshops that addressed the mechanics of the grant program, including the technology objectives, investment justifications, financial management/audits, and allowable costs.[49] On September 30, 2007, the PSIC Grant Program awarded $968,385,000 to fund interoperable communications projects from the 56 States and Territories.

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[46] *Memorandum of Understanding Between The National Telecommunications and Information Administration, U.S. Department of Commerce, and the Office of Grants and Training, U.S. Department of Homeland Security*, Agreement No. M72177 (Feb. 16, 2007), *available at* http://www.ntia.doc.gov/otiahome/psic/PSICMOU_Executed_2-16-2007.pdf.

[47] U.S. DEP'T OF COMMERCE, SPECTRUM POLICY FOR THE 21ST CENTURY – THE PRESIDENT'S SPECTRUM POLICY INITIATIVE: A PUBLIC SAFETY SHARING DEMONSTRATION (May 2007), *available at* http://www.ntia.doc.gov/reports/NTIAWARNReport.pdf.

[48] Press Release, U.S. Dep't of Commerce, "Secretaries Gutierrez and Chertoff to Announce Nearly $1 Billion in Grants for First Responder Communications," (July 17, 2007), *available at* http://www.ntia.doc.gov/ntiahome/press/2007/PSIC_071707.pdf.

[49] *See* "PSIC Grant Program Technical Assistance," http://www.ntia.doc.gov/psic/techassistance.html (last visited Nov. 17, 2008).

III. FCC IMPLEMENTATION EFFORTS

The Federal Communications Commission has also made significant strides in spectrum management to improve the efficient use and maximize the value of the spectrum. Many such actions are consistent with the President's Spectrum Policy Initiative and coordinated with NTIA. Examples of such efforts follow.

A. 700 MHz/DTV Transition

The legislatively-mandated DTV transition opens the 698-806 MHz Band (commonly called the "700 MHz Band") for wireless services, including public safety and commercial services. The FCC established a new band plan and rules for this reclaimed spectrum, dividing the band into five blocks and 1091 licenses. One spectrum block is a single 10 MHz nationwide license intended to facilitate a public/private partnership. The private licensee would construct a nationwide interoperable network that could be utilized by public safety in exchange for access to public safety spectrum on a preemptible basis.

As required by statute, the FCC auctioned these licenses. The auction began January 24, 2008 and ended March 18, 2008, with total provisionally winning bids exceeding $19 billion. All available licenses had provisional winning bids except for the Public Safety/Private Partnership D-Block license, which did not receive a bid meeting the reserve price. The FCC has since initiated a further rulemaking proceeding to consider rule modifications for the proposed partnership. The FCC is dedicated to successfully providing a nationwide interoperable public safety network using the 700MHz D block.

DATE	ACTION
February 2006	The President signs the DTV Act, which sets a firm deadline for the transition (Feb. 19, 2009) and sets deadlines for completion of the auction of 700 MHz licenses (must start before January 28,

	2008, and auction proceeds must be deposited the appropriate fund by June 30, 2008).[50]
July 2007	The FCC adopts a Second Report and Order revising the 700 MHz band plan and service rules to promote the creation of a nationwide interoperable broadband network for public safety and to facilitate the availability of new and innovative wireless broadband services for consumers.[51] This Order establishes a Public/Private partnership for the 700MHz D Block.
August 2007	The FCC adopts final service rules for the 700 MHz band.[52]
January 24, 2008	The 700 MHz auction begins (Auction 73).[53]
March 18, 2008	The Auction 73 ends, with total provisionally winning bids exceeding $19 billion dollars.[54] However, there is only one bid on the D block, and it does not meet the reserve price.
March 20, 2008	The FCC "decouples" the D Block from Auction 73 so as to gather new comments on how to proceed.[55]
May 2008	The FCC releases a Second Further Notice of Proposed Rule Making revisiting the decisions concerning the 700 MHz Public/Private Partnership, and considering revisions to this partnership as well as alternative rules in the event the D Block licensee is no longer required to enter into a mandatory public/private partnership.[56]

[50] *See* Deficit Reduction Act of 2005, Pub. L. No. 109-171, 120 Stat. 4 (2006) ("DRA"). Title III of the DRA is the DTV Act.

[51] *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, et al.*, WT Docket No. 06-150 *et al.*, Second Report and Order, 22 FCC Rcd 15289 (2007).

[52] *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands et al.*, WT Docket No. 06-150 *et al., Second Report and Order*, 22 FCC Rcd 15289 (2007).

[53] *Auction of 700 MHz Band Licenses Scheduled for January 16, 2008*, AU Docket No. 07-157, Public Notice, DA 07-3415 (August 17, 2007).

[54] *Auction of 700 MHz Band Licenses Closes*, Public Notice, DA 08-595 (Mar. 20, 2008).

[55] *Auction of the D Block License in the 758-763 and 788-793 MHz Bands*, AU Docket No. 07-157, Order, 23 FCC Rcd 5421 (Mar. 20, 2008).

[56] *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band*, WT Docket No. 06-150, PS Docket No. 06-229, Second Further Notice of Proposed Rulemaking, 23 FCC Rcd 8047 (rel. May 14, 2008).

September 2008	The FCC releases a Third Further Notice of Proposed Rule Making regarding the 700 MHz D Block.[57] This FNPRM maintains the public/private partnership, but proposes auctioning the 700 MHz D Block spectrum on both a nationwide and regional basis. There would be a WiMAX and a LTE license for auction in each of the 58 regional markets. The public comment cycle closed November 12, 2008.

B. 1710-1755 MHz Band

This spectrum was transferred from federal to non-federal use pursuant to the Omnibus Budget Reconciliation Act of 1993 (OBRA-93). The FCC allocated the 1.7 GHz spectrum along with spectrum in the 2110-2155 MHz band for advanced wireless services (AWS) on a licensed basis. The licenses were awarded pursuant to competitive bidding, and in a fall 2006 auction, the FCC received net winning bids totaling $13.7 billion. A subsequent 2008 auction for licenses not awarded in 2006 generated $13.4 million in net winning bids.

DATE	ACTION
February 1995	NTIA identifies the 1710-1755 MHz band for transfer from exclusive use by the Federal Government to the FCC, effective in 2004, pursuant to OBRA-93.[58]
January 2001	FCC releases notice of proposed rulemaking seeking comment on allocating the 1710-1755 MHz band for AWS.[59]
July 2002	NTIA offers a plan that could largely clear 1710-1755 and 2110-2170 MHz bands of Federal Government users by no later than

[57] *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band*, WT Docket No. 06-150, PS Docket No. 06-229, Third Further Notice of Proposed Rulemaking, 23 FCC Rcd 14301 (rel. Sept. 25, 2008).

[58] Spectrum Reallocation Final Report, Response to Title VI – Omnibus Budget Reconciliation Act of 1993, NTIA Special Publication 95-32 (Feb. 1995).

[59] Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems, ET Docket No. 00-258, *Notice of Proposed Rulemaking and Order*, 16 FCC Rcd 596 (2001)

	December 31, 2008.[60]
November 2002	FCC releases order allocating spectrum in the 1710-1755 and 2110-2155 MHz bands for AWS.[61]
November 2002	FCC releases notice of proposed rulemaking seeking comment on service rules for AWS-1 bands.[62]
November 2003	FCC releases order adopting service rules for the AWS-1 bands, with licenses to be awarded via competitive bidding. [63]
August 2005	FCC releases order on reconsideration addressing petitions seeking reconsideration of the AWS-1 order.[64]
August 2006	AWS-1 auction commences.
September 2006	FCC completes auction of 1,087 AWS-1 licenses and announces net winning bids totaling $13.7 billion.[65]
August 2008	FCC completes a second auction of 35 AWS-1 licenses that raised net winning bids totaling $13.4 million.[66]

[60] *U.S. Department of Commerce, National Telecommunications and Information Administration, "An Assessment of the Viability of Accommodating Advanced Mobile Wireless (3G) Systems in the 1710-1770 MHz and 2110-2170 MHz Bands," Report,* at 2-4, rel. July 22, 2002.

[61] Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems, ET Docket No. 00-258, *Second Report and Order,* 17 FCC Rcd 23193 (2002).

[62] Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, WT Docket No. 02-353, *Notice of Proposed Rulemaking,* 17 FCC Rcd 24135 (2002)

[63] Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, WT Docket No. 02-353, *Report and Order*, 18 FCC Rcd 25162 (2003).

[64] Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, WT Docket No. 02-353, *Order on Reconsideration*, 20 FCC Rcd 14058 (2005).

[65] FCC Public Notice, *Auction of Advanced Wireless Services Licenses Closes*, 21 FCC Rcd 10521 (WTB rel. Sept. 20, 2006).

[66] FCC Public Notice, *Auction of AWS-1 and Broadband PCS Licenses Closes*, 23 FCC Rcd 12749 (WTB rel. Aug. 25, 2008).

C. Spectrum Sharing Innovation Test Bed

As mentioned previously, the FCC is working with NTIA to fulfill the Department of Commerce's recommendation to establish a Spectrum Sharing Test Bed.[67] In June 2006, the FCC issued a public notice discussing the goals, implementation and evaluation of a Test-Bed program, and seeking public comment.[68] After receiving positive feedback and coordinating with NTIA, in February 2008, the FCC designated 10 MHz of spectrum in the 470-512 MHz band as a Spectrum Sharing Innovation Test-Bed (Test-Bed) and identified procedures for interested parties to conduct technology tests in that band.[69] The Test-Bed is intended to provide a venue for demonstrating techniques to provide for better sharing between federal government and non-federal radio users. See *supra* Section I (C) for more details.

D. Public Safety / 800 MHz Rebanding

The FCC in July 2004 adopted a comprehensive plan to reconfigure the 800 MHz band to address a growing problem of harmful interference to public safety communication systems caused by high-density commercial wireless systems operating within interleaved portions of the band. The plan called for the separation and relocation of public safety and enhanced specialized mobile radio operators from interleaved spectrum assignments into an upper and lower band segments. In exchange for getting access to 10 MHz of spectrum in the 1910-1920 MHz band, the FCC required Sprint Nextel to relinquish certain spectrum holdings in the 800 MHz band and to cover incumbent relocation costs associated with moving public safety and industrial/business licensees to their new spectrum assignments.

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[67] *supra* at 10-12.

[68] *Federal Communications Commission Seeks Public Comment On Creation of a Spectrum Sharing Innovation Test-Bed*, ET Docket No. 06-89, Public Notice, FCC 06-77 (rel. Jun 8, 2006).

DATE	ACTION
March 2002	FCC releases notice of proposed rulemaking seeking comment on proposals to remedy interference to public safety systems in the 800 MHz band.[70]
July 2004	FCC releases order to reconfigure 800 MHz band plan to mitigate interference by separating commercial and public safety operations into separate contiguous blocks.[71] The FCC requires that the band reconfiguration be completed through a phased transition process within thirty-six months of a publicly announced start date, *i.e.*, by June 26, 2008. The FCC also adopts 18-month and 30-month interim benchmarks that must be satisfied.
December 2004	FCC releases supplemental order clarifying and modifying transition provisions in the July 2004 order.[72]
June 2005	The 36-month transition period begins June 27, 2005.[73]
October 2005	FCC order addressing petitions for reconsideration of the July and December 2004 orders is released.[74]
September 2007	FCC establishes new benchmarks and procedures to expedite the 800 MHz rebanding process.[75]
June 2008	The FCC grants multiple requests by public safety licensees for

[69] Federal Communications Commission Designates Spectrum and Provides Guidance for Participation in a Spectrum Sharing Innovation Test-Bed, ET Docket No. 06-89, Public Notice, DA 08-295 (rel. Feb. 5, 2008).

[70] Improving Public Safety Communications in the 800 MHz Band; Consolidating the 900 MHz Industrial/Land Transportation and Business Pool Channels, WT Docket No. 02-55, *Notice of Proposed Rulemaking*, 17 FCC Rcd 4873 (2002),

[71] Improving Public Safety Communications in the 800 MHz Band; Consolidating the 800 and 900 MHz Industrial/Land Transportation and Business Pool Channels, WT Docket 02-55, *Report and Order*, 19 FCC Rcd 14969 (2004).

[72] Improving Public Safety Communications in the 800 MHz Band, WT Docket No. 02-55, *Supplemental Order and Order on Reconsideration*, 19 FCC Rcd 25120 (2004).

[73] FCC Public Notice, *WTB Announces that 800 MHz Band Reconfiguration will Commence June 27, 2005, in the NPSPAC Regions Assigned to Wave 1 and Specifies 800 MHz Reconfiguration Benchmark Compliance Dates*, 20 FCC Rcd 9961 (WTB/PS&CI Div. 2005).

[74] Improving Public Safety Communications in the 800 MHz Band, WT Docket No. 02-55, *Memorandum Opinion and Order*, 20 FCC Rcd 16015 (2005).

[75] Improving Public Safety Communications in the 800 MHz Band, WT Docket No. 02-55, *Third Memorandum Opinion and Order*, 22 FCC Rcd 17209 (2007).

	limited waivers of the June 26, 2008 deadline to allow additional time for planning, negotiations and modified rebanding schedules. The FCC also grants Sprint Nextel's requests for waiver of the 36-month deadline.[76]
October 2008	FCC modifies Sprint Nextel deadline to vacate the 800 MHz Interleaved Band (809-815/854-860 MHz), Expansion Band (815-816/860-861 MHz) and Guard Band (816-817/861-862 MHz) and ties obligations to progress towards completion of rebanding achieved by 800 MHz NPSPAC licensees in each NPSPAC Public Safety Region. Regardless of the pace of progress, the FCC requires Sprint Nextel to relinquish its entire non-border spectrum in the Interleaved Band, *i.e.*, all channels below 815/860 MHz, by March 31, 2010.[77]

E. 1390-1395 and 1432-1435 MHz Band

This spectrum was transferred from federal to non-federal use pursuant to the Omnibus Budget Reconciliation Act of 1993 (OBRA-93) and the Balanced Budget Act of 1997 (BBA-97). The FCC subsequently allocated the spectrum for licensed use subject to competitive bidding. The FCC auctioned the spectrum in the spring of 2007 and received net winning bids totaling $123.6 million.

DATE	ACTION
February 1995	NTIA identifies the 1390-1395 MHz band for transfer to non-government use pursuant to OBRA-93.[78]
February 1998	NTIA identifies the 1432-1435 MHz band for transfer to non-government use pursuant to BBA-97.[79]

[76] Improving Public Safety Communications in the 800 MHz Band, WT Docket No. 02-55, *Order*, 23 FCC Rcd 9558 (PSHSB 2008); Improving Public Safety Communications in the 800 MHz Band, WT Docket No. 02-55, *Order*, 23 FCC Rcd 9581 (PSHSB 2008).

[77] Improving Public Safety Communications in the 800 MHz Band, WT Docket No. 02-55, *Order*, FCC 08-253 (PSHSB rel. Oct. 29, 2008).

[78] National Telecommunications and Information Administration, U.S. Department of Commerce, Special Publication 95-32, *Spectrum Reallocation Final Report* (Feb. 1995).

[79] National Telecommunications and Information Administration, U.S. Department of Commerce, Special Publication 98-36, *Spectrum Allocation Report* (Feb. 1998).

November 2000	FCC seeks comment on reallocating spectrum to non-government use.[80]
January 2002	FCC releases order allocating 27 megahertz of spectrum from the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz bands for non-Government use.[81]
February 2002	FCC releases notice of proposed rulemaking seeking comment on service rules for the 1390-1395 and 1432-1435 MHz band (the 1.4 GHz band).[82]
May 2002	FCC adopts service rules for licensing the 1.4 GHz band pursuant to competitive bidding.[83]
February 2007	Auction of 1.4 GHz band licenses commences.
March 2007	Auction closes and winning bidders announced. Auction raises net winning bids totaling $123,599,000.[84]

F. 3650-3700 MHz Band

On March 10, 2005, the FCC adopted rules to allow the 3650-3700 MHz band (previously shared by government and commercial satellite services) to be used for terrestrial wireless broadband operations. The FCC implemented a non-exclusive licensing scheme for the

[80] Reallocation of the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands, *Notice of Proposed Rulemaking*, ET Docket 00-221, 15 FCC Rcd 22657 (2000)

[81] Reallocation of the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands, ET Docket No. 00-221, *Report and Order and Memorandum Opinion and Order*, 17 FCC Rcd 368 (2202).

[82] Reallocation of the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands, WT Docket No. 02-8, *Notice of Proposed Rulemaking*, 17 FCC Rcd 2500 (2002).

[83] Amendments to Parts 1, 2, 27 and 90 of the Commission's Rules to License Services in the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands, WT Docket No. 02-8, *Report and Order*, 17 FCC Rcd 9980 (2002).

[84] FCC Public Notice, *Auction of 1.4 GHz Band Licenses Closes, Winning Bidders Announced for Auction No. 69*, 22 FCC Rcd 4714 (WTB 2007).

band and designed the rules to provide flexibility for a variety of new terrestrial uses in order to encourage multiple entrants, including a requirement that equipment operating in the band incorporate a contention-based protocol to minimize interference. The FCC prohibited operations within 150 kms of approximately 100 grandfathered FSS Earth stations, and only allowed operation within 80 kms of three U.S. government radiolocation stations if coordinated with the FCC and NTIA. To provide further protection to the grandfathered earth stations, the FCC set maximum permissible power levels for both mobile and fixed or base stations operating in the band and required that mobile units be configured to transmit only when they could receive an enabling signal from a licensed base station.

DATE	ACTION
February 1995	NTIA identifies spectrum for transfer to non-government use pursuant to OBRA-93.[85]
December 1998	FCC releases notice of proposed rulemaking proposing to allocate the 3650 MHz band to the non-government fixed service on a primary basis and tentatively concluding not to allocate the band to land mobile service.[86]
November 1998	President exercises option under the BBA-97 and identifies the 3650 MHz band (in addition to other bands) as an alternative band for 15 MHz of spectrum in the 1990-2110 MHz band to satisfy the statutory mandate for NTIA to transfer 55 MHz of spectrum below 2 GHz for competitive bidding.[87]
October 2000	The FCC releases an order allocating the 3650 MHz band to fixed and mobile terrestrial services on a co-primary basis, but limited the mobile allocation to base station use only to protect

[85] Spectrum Reallocation Final Report, Response to Title VI -- Omnibus Budget Reconciliation Act of 1993, U.S. Department of Commerce, NTIA Special Publication 95-32 (Feb. 1995).

[86] Amendment of the Commission's Rules with Regard to the 3650-3700 MHz Government Transfer Band, ET Docket No. 98-237, *Notice of Proposed Rule Making and Order,* 14 FCC Rcd 1295 (1998).

[87] *Identification of Alternate Bands in Response to the Balanced Budget Act of 1997,* NTIA 98-39 (Nov. 1998).

	grandfathered fixed satellite service earth stations and Federal Government radiolocation operations.[88] The FCC found that the 3650 MHz band was an equivalent and viable substitute for the 15 megahertz of spectrum at 1990-2110 MHz and concluded that initial fixed and mobile service licenses in the 3650 MHz band would be assigned by competitive bidding and concurrently sought comments on the proposal.
December 2002	FCC releases notice of inquiry seeking comment on the possibility of lifting the current prohibition on unlicensed operations in the 3650 MHz band.[89]
April 2004	FCC releases notice of proposed rulemaking proposing to designate the 3650-3700 MHz band for unlicensed use.[90]
March 2005	FCC releases order adopting rules for non-exclusive licensing scheme for the 3650-3700 MHz band.[91]
May 2007	FCC addresses petitions for reconsideration of the 2005 order and affirmed its rules and policies for the 3650 MHz band.[92]
November 2007	FCC announces a November 15, 2007 start date for licensing and registration process for the 3650-3700 MHz band.[93]

IV. RECOMMENDATIONS

Considerable achievements have been made by NTIA and the FCC toward realizing the vision set forth in the SPI. The experience gathered over the past five years has been different

[88] Amendment of the Commission's Rules With Regard to the 3650-3700 MHz Government Transfer Band, ET Docket No. 98-237, *First Report and Order and Second Notice of Proposed Rule Making,* 15 FCC Rcd 20488 (2000).

[89] Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, ET Docket No. 02-380, *Notice of Inquiry*, 17 FCC Rcd 25632 (2002)

[90] Unlicensed Operation in the Band 3650-3700 MHz, ET Docket No. 04-151, *Notice of Proposed Rulemaking*, 19 FCC Rcd 7545 (2004).

[91] Wireless Operations in the 3650-3700 MHz Band, ET Docket No. 04-151, *Report and Order and Memorandum Opinion and Order*, 20 FCC Rcd 6502 (2005).

[92] Wireless Operations in the 3650-3700 MHz Band, ET Docket No. 04-151, *Memorandum Opinion and Order*, 20 FCC Rcd 6502 (2007).

[93] FCC Public Notice, *WTB Announces Start Date for Licensing and Registration Process for the 3650-3700 MHz Band*, 22 FCC Rcd 19802 (WTB 2007).

for each entity, and can be utilized to improve implementation of the SPI by both entities in the coming years. Moreover, the CSMAC has made numerous recommendations to NTIA that were designed to facilitate SPI implementation. Those recommendations are summarized below:

A. Opportunities Relating to the Spectrum Sharing Test Bed

- **Goal of Test Bed Program:** The goal of the Test-Bed program should be to study the feasibility of federal and non-federal users sharing the same spectrum.

- **Multiple Test-Beds:** If funding is available, the Test-Bed program should ultimately address multi-antenna signal processing and mobile satellite service with an ancillary terrestrial component. NTIA should not limit itself to any one family of technologies or any particular company's form of technology.

- **Funding for Multiple Test Beds:** NTIA should evaluate whether staffing and resource issues could be resolved by allowing private sector participants to bear the costs associated with the Test-Bed, allowing testing to occur without federal government staffing, or by seeking additional appropriations or reallocating funding to support multiple test beds.

- **Maximization of Participants:** NTIA should permit the maximum number of participants possible for monitoring and evaluation given the available resources. NTIA should not limit itself to any one family of technologies or any particular company's form of technology.

- **Protection of Incumbents:** Test-Beds should be implemented in a manner that protects incumbent licensees, such as by initially to deploy Test-Beds in areas where there are few incumbents and limited complexity; the first phase could be completed in a private laboratory.

- **Test Bed Location**: The optimal location for Test-Beds is within spectrum below 1 GHz or above 4.9 GHz. A variety of test bed environments should be utilized to ensure the production of meaningful data.

- **Peer Review of Public Reports:** Public reports subject to a peer review process should be made a condition of participation in the Test-Bed program, and could be incorporated into the Department of Commerce report summarizing the Test-Bed results.

B. Opportunities for Government Adoption of Commercial Technologies

- CSMAC identified two avenues for government adoption of commercial technologies. In some cases, it may be appropriate for government traffic to be carried by suitable commercial service networks. More commonly, it may be appropriate to incorporate commercial technologies and standards in some government-operated systems.
- Government radio systems will benefit from improved capacity and performance, new capabilities and greater economies-of-scale by incorporating widely-used commercial mobile communication technologies.
- Leveraging technologies based on open standards will lead to communication systems with flexible services and improved spectral efficiency.
- Government radio systems would benefit, to the extent that they have not done so already, from adopting common standards for radio systems across compatible applications and the sharing of networks and radio resources across compatible services/users/groups.
- The adoption of a common radio access system would facilitate common digital platforms with such features as co-channel frequency reuse, common coding of services, common authentication (authorization/accounting/billing, *etc*.), shared use of channels where applicable, compliance/interoperability testing, and adaptation to multiple radio waveform.
- Inter-working among the radio access networks using a common protocol will also provide benefits in both intercommunication among user groups and sharing of (terrestrial) network resources. The objective in introducing these techniques would be to move towards a commercially derived common system design to accommodate as many users and applications as possible to gain economies of scale in equipment availability and development.
- Considerable savings can be achieved through the adoption of a commercial standard as the basis for new government system's operations. The equipment for these systems may thus be based on commercial platforms, for both network and user terminal equipment, and hence benefit from the mass manufacture and global development of such equipment.
- The adopted system design and associated devices must be capable of meeting the rigorous operational requirements of governmental users, regardless of the underlying technology. Furthermore, any adoption of changes in technology or practices must take into account the need for ongoing continuity of the provision of the vital services provided by the government radio systems.
- To facilitate the adoption of system designs for government services it may be helpful for a government/industry committee to be formed to assist the development of appropriate requirements and standards.
- The introduction of new commercially derived networks and technologies for government radio communications must be considered in the context of continued assurance of service using the many existing systems.

- Synergy on the network side may be achieved through the development of inter-working protocols among the existing networks to facilitate improved coupling among systems and services. This inter-working should include a suitable common protocol that supports multiple services including real-time voice, multimedia and data transmissions.
- Synergy on the radio access side would be fostered through the evolution to a common, multi-capability radio standard. Such a standard would include multiple services (real-time voice, video, packet data, broadband and streaming data) in a common format to better enable common network and terminal platforms. If such a standard was derived from a common commercial standard, there would be benefits from the economies of scale from the procurement of devices for the large composite market.
- The evolution to the new common radio access system could be facilitated through the use of adaptive radios in the access network that can operate in multiple bands and provide services in a number of possible radio system configurations (including both the legacy and the new waveforms). Such flexible platforms on the access side would permit the continued use of the user's legacy radios while at the same time enabling the operation of new radios and devices as they become available.
- As the new common system is introduced and proven, the use of dual mode terminals and network stations would permit the gradual migration of traffic to the new system. This would enable conversion to happen as part of the equipment life-cycle and hence not require wholesale replacement of all equipment at once.
- The efficient use of spectrum allocated to government usage requires ongoing monitoring and proactive management. Such management involves monitoring allocations and usage, considering future needs and new technologies, and planning and adapting equipment and services to best suit the changing situations. The following describes these management points in some detail:

1. Monitor Allocations and Usage

i. maintain up-to-date "inventory" of radios systems in use, including where, why and technical details

ii. measure traffic usage of each application/service

iii. look for growth/shrinkage in uses. Note that some assignments will remain relatively constant.

2. Consider Future Needs and New Technologies

Operations should be evaluated in the following manner:

i. can it be combined with another (government) service?

ii. could it be accommodated on a commercial service?

iii. what are the future needs for growth/decline?

iv. is there new technology in this application?

v. can the service or system make use of a suitable standard?

vi. plan for future changes evolution

3. Plan and Adapt Equipment and Services

i. budget for ongoing evolution change

ii. shift to commercial services (or vice versa) where appropriate

iii. make proactive adjustments in system operations and services when practical

iv. develop continuous renewal & ongoing updates for those systems that have changing requirements or traffic growth

C. Recommendations for Improving the Process for Identifying Spectrum for Future Reallocation or Sharing

- **Future reallocations:** Future spectrum reallocations or sharing should be mandated only in response to particular needs/demand, such as creating a formal mechanism that commercial entities could use to trigger a reallocation under the Commercial Spectrum Enhancement Act.

- **Timeline:** Relocation process timeline should be clearly defined and consistently applied.

- **Information:** Improve information dissemination so that potential applicants for reallocated spectrum will have a clear understanding of the technical requirements of incumbents and their relocation needs. For example, commercial entities must have sufficient information to fully understand whether commercial deployments will be possible before the Federal operations are fully relocated

- **DoD Portal:** Portal established by the Department of Defense should be used as the baseline model for exchanging information between Federal Government and commercial entities regarding relocation issues.

- **On-line Capabilities:** Development of secure on-line capabilities that will allow, where feasible, for virtually instantaneous coordination between Federal and non-Federal systems operating on frequencies identified for relocation or sharing. This on-line database should build on the substantial success of NTIA's and the FCC's efforts in the 70-80-90 GHz bands.[94]

- **Oversight:** Centralized oversight responsibility for the relocation of Federal Government systems.

[94] *See Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands*, WT Docket No. 02-146, *Report and Order*, 18 FCC Rcd 23318 (2003); NTIA News Release, "NTIA and FCC Launch On-Line Registration for High-Speed Wireless Links Sharing Spectrum in the 70-80-90 GHz Bands" (Feb. 8, 2005).

- **Personnel funding:** Allocate of funds for agencies to hire personnel solely to address a relocation process.

- **Benchmarks:** Interim spectrum clearing benchmarks (measured by spectrum, geography, or a similar metric) to facilitate the deployment of commercial systems during the relocation process.

- **Incentives:** Incentives to spur agencies to identify spectrum for reallocation and to clear bands that have already been flagged for transition to other uses Future spectrum reallocations or sharing should be mandated in response to particular needs/demands;

D. Report on Spectrum Efficiency

- Users should be required to compare existing and proposed systems to other alternative ones within the same section of the taxonomy to justify the effectiveness of the specific system in meeting the mission goals while occupying a minimal resource footprint. It is important to realize in doing this that a narrow interpretation of efficiency may not capture larger efficiency gains available through the macro level sharing of systems among multiple Federal and non-Federal users.

- For at least the classes of personal communications systems, broadcast systems, and point to point systems, objective metrics of spectral efficiency do exist and should be used in the context of other mission requirements to assess proposed systems.

- Further research should be supported to define and improve efficiency metrics for other classes of systems. This should include definitions of types of efficiency relevant to the various categories of use as well as into the metrics for each type.

- It would be useful to catalog Federal uses of spectrum against the taxonomy provided in this report above to either validate the utility of this taxonomy or to improve it as necessary. It would also be useful to conduct an approximate evaluation of comparative spectrum efficiency of existing systems (*e.g.*, are federal systems generally less efficient than non-federal systems?).

- Continued research into cognitive systems should be undertaken to look for opportunities to harvest more spectrum uses opportunistically, particularly for uses where the primary mission requirements generate very intermittent use of the assigned bands.

- Given the general improvements in spectral efficiencies that are accruing from modern equipment, the single greatest improvement in efficiency may often come from sharing of systems and the spectrum they occupy between multiple Federal and/or non-Federal users.

E. Report on Operational Efficiency

NTIA should develop a new management structure for federal spectrum that emphasizes spectrum sharing and examines economic incentives (including user fees) for efficient spectrum use. Some recommended ways NTIA might achieve this goal include:

- Provide greater transparency in Federal agencies spectrum allocations. One recent successful example is the automated, web-based mechanism for coordinating Federal and non-Federal spectrum use in the 70 to 90 GHz range.

- Explore market or other mechanisms that empower spectrum incumbents with a greater degree of control over changes to their spectrum assignments and give them some benefit (such as financial arrangements) from spectrum sharing.

- Streamline spectrum sharing negotiation process by developing best practices, standard arrangements, and model agreements for sharing.

- Put policies and procedures in place to reduce the risk to incumbents that can arise from spectrum sharing.

- Consider whether a spectrum management policy emphasizing sharing should include an expanded use of real-time auctions that could take advantage of opportunistic spectrum-using technologies like Software Defined Radio and Cognitive Radio.

- Examine economic incentives, such as user fees paired with compensatory mechanisms to encourage efficient use and to allow the public sector incumbent to benefit from sharing.

F. Streamlining Federal/Non-Federal Sharing of Radio Systems

- NTIA should establish a clear process for non-federal entities to determine if federal spectrum resources might be available in a given region or for shared purposes with federal agencies.

- Both NTIA and FCC should develop informational pages on their respective websites that set forth collectively all of their respective rules and procedures for applying to use spectrum that is jointly allocated for use by federal and non-federal entities.

- NTIA should establish a focal point, perhaps the Chair of the IRAC System Planning Subcommittee, for state and local authorized entities to facilitate discussions between and among federal/state/local communities of interest.

- The FCC should establish a public tracking capability for applications seeking access to federal spectrum that allows the FCC applicant to readily identify when the FCC sent the application to the NTIA, when the NTIA responded, and whether it had specific questions regarding the merits or technical components of the application.

- The FCC and NTIA should attempt to align their application processes to expedite licensing of Federal users in non-federal spectrum and non-federal users in federal spectrum.

- The FCC and NTIA should document and report on their efforts to facilitate spectrum sharing among federal and non-federal users.

- The FCC and NTIA need to establish post-sharing enforcement policies and procedures.

- NTIA should establish a template for a spectrum-sharing Memorandum of Understanding that provides a realistic set of rights and obligations.

G. Transitioning Federal Land Mobile Radio Systems to More Spectrally Efficient Technologies

- Agencies should aggregate their spectrum and system resources into shared LMR networks that maximize the use of trunking.

- NTIA should work with all of the stakeholders, including federal agencies, to seek out opportunities to emulate this successful spectrum usage model with state and local entities in additional areas.

- Actionable best practices to ensure that LMR networks are shared:
    - Comprehensively develop political and stakeholder support
    - Centralize coordination among multiple agencies through a formal committee
    - Formalize coordination committees through executive orders, charters or memorandums of understanding
    - Emphasize coordination, partnership, and asset sharing
    - Conduct detailed analysis of current needs and capabilities while planning future developments
    - Prepare and provide a wide range of educational materials to stakeholders and decision-makers
    - Sponsor communications and interoperability forums where officials can learn about current challenges and plans, provided input into the process, or learn how to get involved
    - Solicit input from all interested parties or entities throughout the coordination, planning, and project processes Examine the successful strategies of similar states or regions

- There is value in emulating the successful ALMR spectrum use model where possible and encourage the NTIA and FCC to take steps that could shorten the time for approvals.

- Smart Antenna / Spatial-Division Medium Access, cognitive radio and software defined radio solutions should be evaluated as the government evolves to broadband wireless systems.

- NTIA spectrum sharing test bed should be used to test and mature cognitive radio technologies such as geo-location and spectrum sensing to protect incumbent primary users of the spectrum. As well, NTIA should consider releasing all unclassified information within GMF database to accelerate the use of cognitive radio techniques.

- The government deploys an interagency shared, national wireless broadband network. A single 3G technology for initial broadband wireless should be deployed. The two commercial 3G technologies that can provide wireless broadband are EV-DO Rev A / eHRPD (3GPP2 standards) and HSPA (3GPP standards). These technologies should be evaluated and one should be selected for this nationwide network.

- For 4G wireless broadband government service, this report recommends the use of either LTE or Mobile WiMAX (802.16e). It is recommended that the government selects its 4G technology based upon the determination of which has the greatest commercial support over the next 10 or more years.

- This report recommends that the government plays an active role evaluating and contributing to both the LTE and WiMAX 802.16e standard.

- Increase government's use of commercial wireless networks for government agency needs, including PPDR activities if commercial networks are able to satisfy PPDR requirements for coverage, reliability, access, and security. Possible approaches that need to be examined are the increase use of wireless priority service (WPS) and implementation of an "affiliate" network model, in areas of low population density.

- This report concurs with the recommendation from the September 19, 2008 CSMAC meeting that CSMAC, as part of its next charter, examine economic incentives, including fees, as a way to improve efficiency and that NTIA develop a new management structure that includes improved sharing and use of market incentives.

H. Recommendations for Further CSMAC Action

The current CSMAC also recommends that the next CSMAC take steps to finalize the report regarding implementation of OMB Circular A-11. In addition, the next CSMAC should move forward to determine the next steps necessary to implement the aforementioned recommendations. In particular, the next CSMAC should assist in expediting the creation of an inventory of federal spectrum use and to develop scorecards and other incentives for transitioning land mobile radio systems to more spectrally efficient technologies. Such incentives may include the creation of additional rights – such as spectrum leasing – for Federal users. The next CSMAC also should continue to evaluate the feasibility of further automating

the interference coordination process based on the millimeter-wave model for spectrum sharing between Federal and non-federal users. Any such process, however, must ensure the security of existing federal databases.

Finally, the experience gathered by the CSMAC members over the last few years has produced a number of procedural recommendations which, if implemented, could improve the ability of the CSMAC to work expeditiously and provide timely, valuable recommendations to NTIA regarding SPI implementation. These recommendations are set forth below.

- Enhance Diversity among Committee Members

  Committee membership should include individuals with wide-ranging expertise and who support a wide variety of technologies. Experts in government and nongovernment systems, lawyers, engineers, and economists should be represented. Technologies represented should include radars, CMRS, point-to-point microwave, and others. Balanced membership will facilitate the adoption of technologically neutral CSMAC recommendations and enhance the inputs into the various working groups.

- Improve Working Group Process

  In order to develop a wide-variety of recommendations for NTIA in a timely manner, the CSMAC has used working groups to focus on particular issues and prepare reports and recommendations for consideration by the full CSMAC. To ensure full participation by members and prompt preparation of reports and recommendations, these working groups should meet, either in person or via conference call, approximately once per month.

- Regularize Scheduling

  The CSMAC initially took a more flexible approach to scheduling its meetings. Over time, it has become clearer that a more regular schedule of meetings will enhance productivity. Moreover, although field visits have proven very useful, the Committee must be sensitive to the financial demands these meetings may place on members.

- Seek Additional Public Participation

  In order to ensure public participation and diverse viewpoints, NTIA should, after each CSMAC meeting, issue a Public Notice

and Solicitation of Comments requesting input (by a set deadline) on issues being considered before the next session.

- Improve Meeting Management

  To increase effectiveness of meetings, there should be timely distribution (within a week after a CSMAC meeting; more rapidly for working groups) of action items, and to whom the item is assigned. There should also be more timely distribution of meeting minutes while the meeting is still fresh in the minds of the participants. This will help ensure the accuracy of the minutes.

- Extend a Formal Invitation to the FCC and other Affected Federal Agencies

  CSMAC should formally invite the FCC and other affected Federal agencies to attend CSMAC meetings in the role of expert observers.

V. CONCLUSION

As demonstrated above, NTIA, the FCC, and major Federal agencies have taken significant steps toward achieving the goals of the President's Spectrum Policy Initiative, but challenges remain. Adopting the recommendations provided above is a first step toward overcoming those challenges and achieving the President's goal of more efficient and beneficial use of spectrum.

APPENDIX A - CSMAC Meetings

December 4, 2008 – Washington, DC

September 19, 2008 – Washington, DC

July 14, 2008 – San Jose, CA

April 30, 2008 – Washington, DC

February 8, 2008 – Boulder, CO

December 6, 2007 – Washington, DC

May 30, 2007 – Washington, DC

December 13, 2006 – Washington, DC