



2016 DOD T&E Spectrum Activity

Western Regional Partnership (WRP)

Test Resource Management Center (TRMC)

4800 Mark Center Drive

Alexandria, VA 22350

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Purpose



This briefing is provided to inform regional and local leaders of actions the DOD T&E community is taking relative to electromagnetic spectrum (EMS) management which may be helpful during consideration and development of regional plans which may rely on EMS resources to execute.



TRMC Missions

DoD (Charter) Directive 5105.71

MRTFB OVERSIGHT / T&E INFRASTRUCTURE

- *Plan for and assess the adequacy of the MRTFB to provide adequate testing in support of the development, acquisition, fielding, and sustainment of defense systems*
- Support the Department's objective of ensuring compliance with DoDD 7000.14-R
- Review proposed significant changes to T&E facilities and resources of the MRTFB before they are implemented by the DoD Components
- Issue guidance to the DoD Components, through the USD(AT&L), with respect to MRTFB planning
- Maintain an awareness of other T&E facilities and resources, within and outside the DoD, and their impacts on DoD requirements
- Serve as Executive Agent for Cyber Test Ranges

STRATEGIC PLAN

- *Complete a strategic plan for T&E not less often than once every 2 fiscal years*

BUDGET CERTIFICATION

- *Submit report to the SECDEF containing the comments of the Director concerning all such proposed budgets, together with the Director's certification as to whether such proposed budgets are adequate*

PROGRAMS

- *Administer the CTEIP (Central Test and Evaluation Investment Program) and T&E/S&T Program*

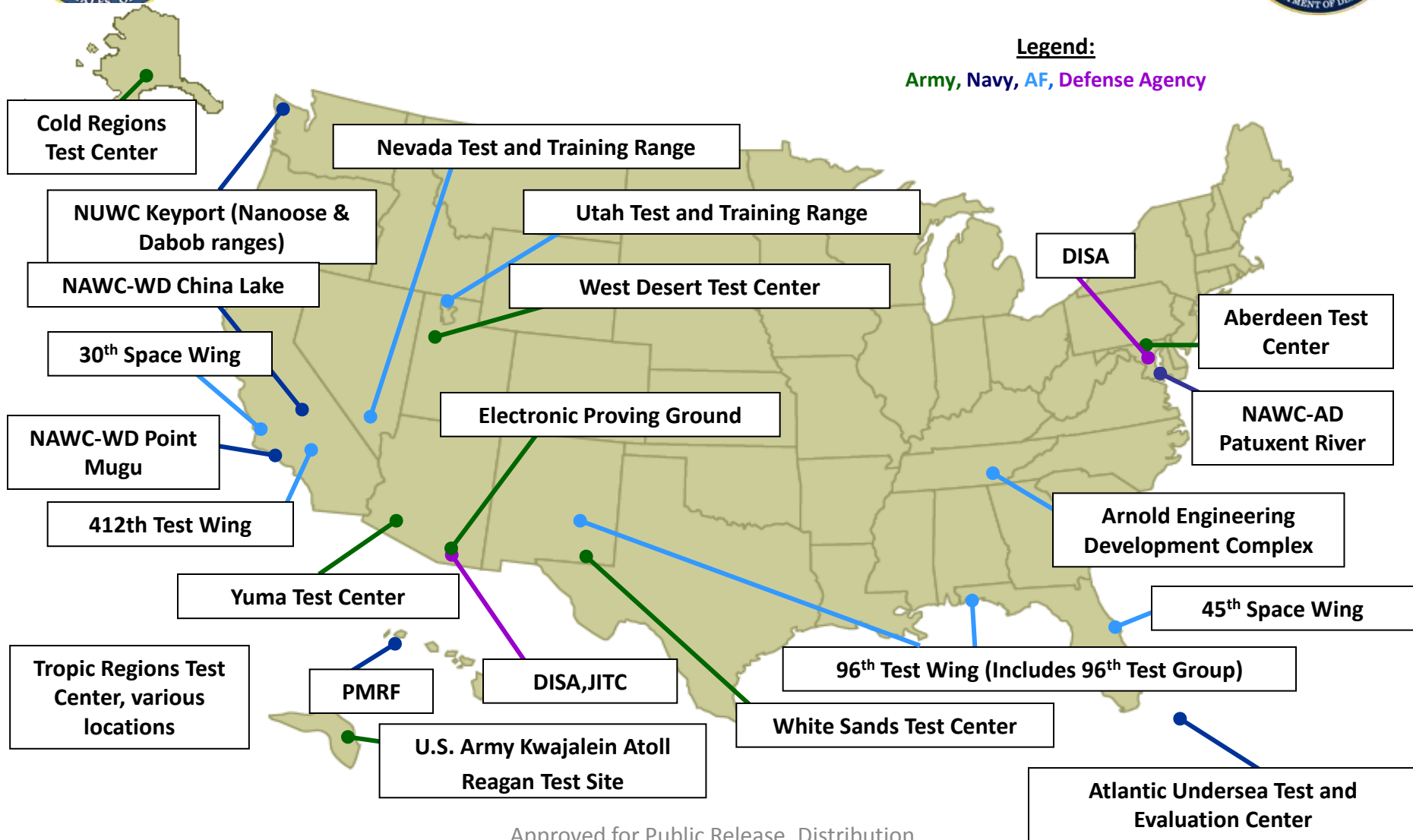
CAPABILITIES

- Administer the JMETC (Joint Mission Environment Test Capability)
- Manage the NCR (National Cyber Range)



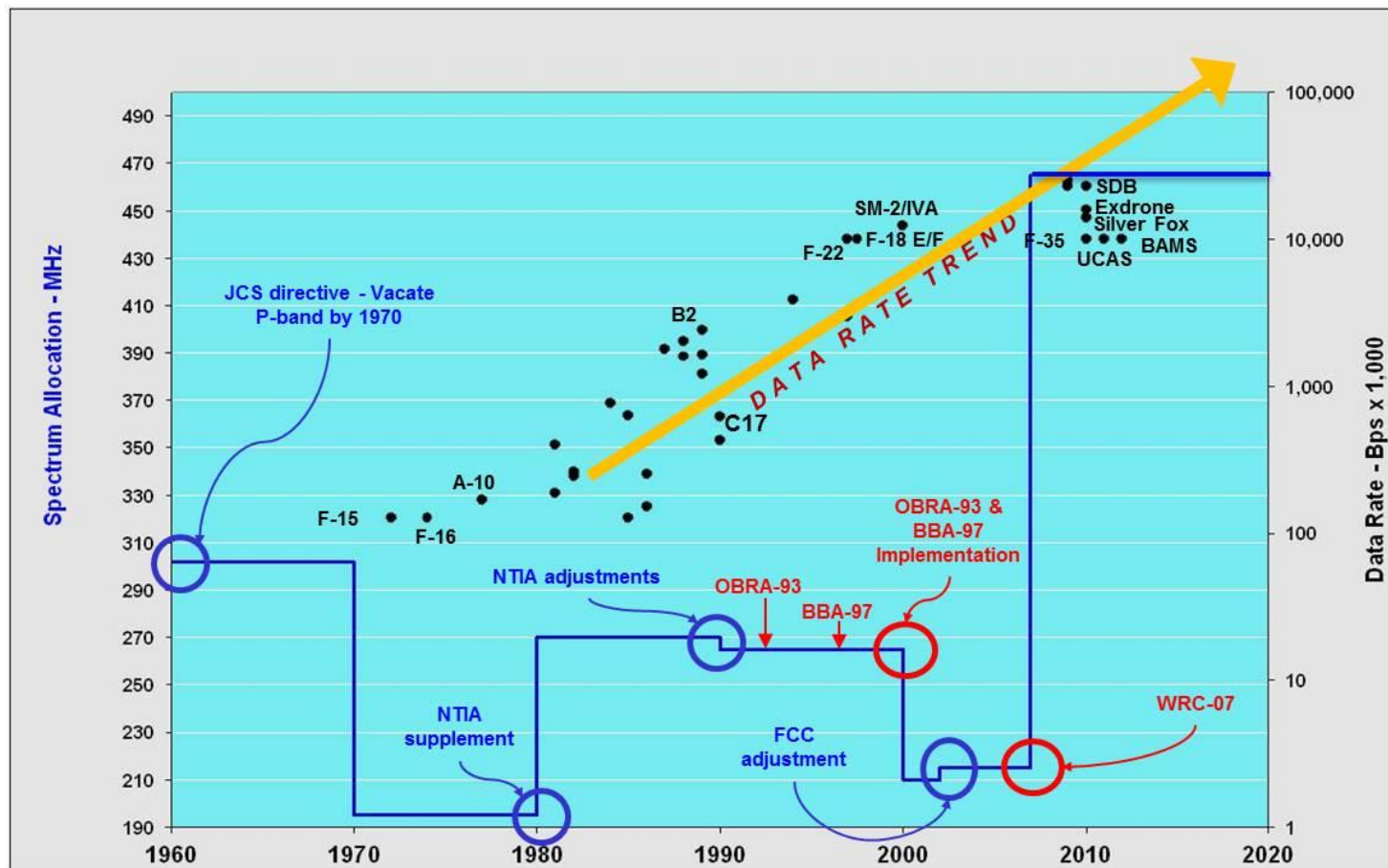
The Steward of the DoD Test Infrastructure

Major Range and Test Facility Base (MRTFB): The "Critical Core"





DOD T&E Data Rate Trends vs. Spectrum Availability



Increased Weapon System Complexity and Reductions in Available RF Spectrum Limit the Amount & Types of T&E Missions a Range Can Support



President's 500 MHz Goal Status of Spectrum Bands In Progress Review



Frequency Band	Spectrum Made Available (megahertz)	Spectrum Identified and In Process (megahertz)	Spectrum Identified for Study (megahertz)	Spectrum for Potential Future Study (megahertz)
Wireless Communications Service (WCS): 2305-2320 and 2345-2360 MHz	30			
H Block: 1915-1920 and 1995-2000 MHz	10			
Advanced Wireless Services AWS-4: 2000-2020 and 2180-2200 MHz	40			
AWS-3: 1695-1710, 1755-1780, and 2155-2180 MHz	65			
3.5 GHz Citizens Broadband Radio Service (CBRS): 3550-3650 MHz	100			
UHF TV Incentive Auction: 512-698 MHz		42-126		
1675-1680 MHz			5	
2020-2025 MHz			5	
5 GHz Unlicensed National Information Infrastructure (U-NII) U-NII-2B: 5350-5470 MHz			120	
5 GHz U-NII-4: 5850-5925 MHz			75	
1300-1350 MHz				50
1350-1390 MHz			40	40
1680-1695 MHz				15
2700-2900 MHz				200
2900-3100 MHz				200
3100-3550 MHz				450
Totals (megahertz):	245	42-126	205	955

Next Auction: 3/29/16
Non-Fed Broadcaster spectrum



Next DoD/Federal band
To be studied for auction
consideration post 2018



576

- **576 megahertz of spectrum has been identified toward achieving the 500 megahertz goal**
 - **Includes spectrum already made available (245), spectrum currently being auctioned/reallocated (42-126), and spectrum under analysis for reallocation to establish potential sharing mechanisms**

U.S. Department of Commerce · National Telecommunications and Information Administration

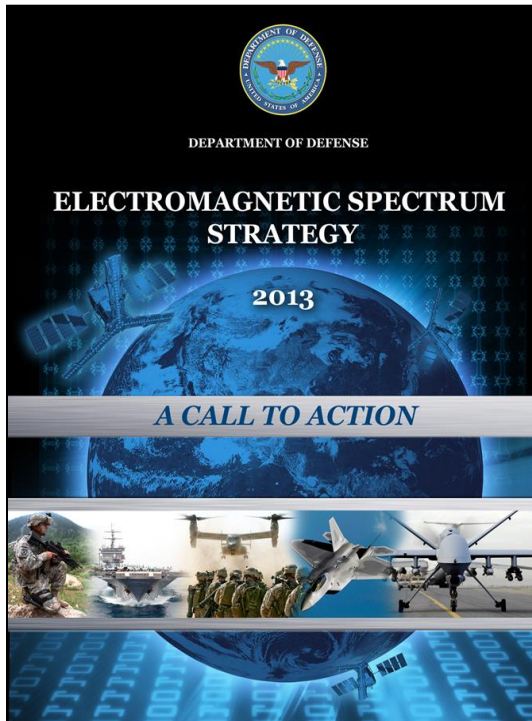




Vision for Change: DOD Spectrum Strategy



EMS Strategy's Vision: "Spectrum Access When and Where Needed to Achieve Mission Success"



- “Call to action,” 3 Goals:
 - Expedite development of spectrum dependent systems with increased efficiency, flexibility and adaptability
 - Increase agility of DoD operations
 - Sharpen responsiveness to ongoing spectrum regulatory and policy changes
- Complemented with Roadmap and Action Plan to guide implementation
 - Finalized and already generating immediate and progressive effects

Focus on Cultural and Technology Transformation: from reactive to proactive; evolve governance, accountability and oversight; collaboration and partnerships; embrace and exploit technology innovation



DoD Case for Change



- Electronic Warfare threats have become agile, cheap, more complex, commercial, flexible and operate across wide bands of spectrum including in non-Federal bands
 - Adversaries not honoring International Telecommunication Union (ITU) or any national spectrum allocation tables
- Sharing with non-traditional partners
 - Example: Radar sharing with commercial broadband
- Ever increasing and complex sharing environment
- Industry/Commercial existing use and future growth
- Military/Federal existing use and future growth
- Technology advancing the realm of the possible for improved military access/sharing with commercial
- Global operations



Advanced Wireless Services – 3 (AWS-3) Auction Transition Status



- In support of the President’s Broadband Initiative, the 1695-1710 MHz and 1755-1780 MHz bands have been auctioned for commercial mobile broadband usage (~ \$41B revenue for US Treasury)
 - In the 1695-1710 MHz band, DoD MetSat operations will share without system or ops modifications
 - In the 1755-1780 MHz band, DoD is utilizing a combination of sharing, compression and relocation to other bands (including the 2025-2110 MHz band)
- DoD is receiving \$3.1B to implement its approved Transition Plans
 - FY16 Spectrum Relocation Funds (SRF) were received in February 2016 and have been distributed
 - FY17 SRF will be requested in June/July 2016 to expedite the transfers
- 2 portals are established to coordinate early entry requests from the carriers
 - Early entry coordination requests for 1755-1780 MHz band should be directed to the DoD 1755-1780 MHz portal managed by Defense Spectrum Office
 - Requests for the 1695-1710 MHz band should be directed to the ITS portal
 - Over 180 requests have been processed since the 1755-1780 MHz portal opened in November 2015



DoD AWS-3 Transition Related Activities



Coordination Activities

AWS-3 Licensee Coordination Portal

Purpose: Facilitate coordination to allow early entry of commercial licensees in the 1755-1780 MHz band

Lead: DSO

Key Stakeholders:

- MILDEPS
- NTIA

2025-2110 MHz Coordination

Purpose: Negotiate MOU and develop coordination tool to share the 2025-2110 MHz band with the Broadcasters

Lead: DoD CIO (MOU) / DSO (Tool)

Key Stakeholders:

- MILDEPS
- Nat. Assn. of Broadcasters (NAB)
- Society of Broadcast Engineers (SBE)

System Transitions

Purpose: Modify existing systems in the 1695-1710 and 1755-1780 MHz bands to relocate to new bands or share the existing band in accordance with the approved MILDEP transition plans

Lead: MILDEPS

Technology Activities

Spectrum Sharing Test and Demonstration

Purposes:

- (1) Facilitate expanded and expedited access to the 1755-1780 MHz band by commercial licensees
- (2) Identify, demonstrate, and operationalize techniques that support increased sharing between LTE and incumbent DoD systems

Lead: DSO

Key Stakeholders:

- DoD CIO
- ASD (R&E)
- Service Labs
- CAC/NASCTN

Spectrum Access R&D Program

Purpose: Foster the development of innovative technology to reduce DoD's risks associated with the AWS-3 transition

Lead: DoD CIO

Key Stakeholders:

- ASD (R&E)
- Joint Staff
- National Spectrum Consortium
- MILDEPS
- Service Labs



DoD Spectrum Access Research and Development Program



- DoD enterprise spearheaded by the DoD CIO, Assistant Secretary of Defense, Research and Engineering (ASD (R&E)), and Joint Staff, to develop and field innovative spectrum technologies
- Leverages DoD's Science & Technology/Research & Development (S&T/R&D) resources while drawing upon the expertise of academia/industry via the National Spectrum Consortium (NSC)
- Leverages the ongoing DoD EMS Strategy activities focusing on:
 - EMS efficiency, flexibility and adaptability to improve spectrum access
 - EMS agility to dynamically sense and move to unused spectrum bands
 - EMS resilience to operate in both congested and contested spectrum environments
- Initial funding is reserved by OMB from the SRF for DoD R&D to mitigate transition and operational risks associated with the AWS-3 transition



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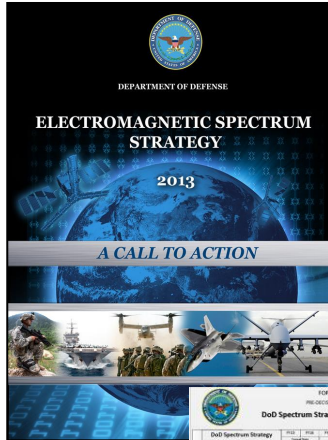




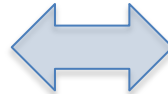
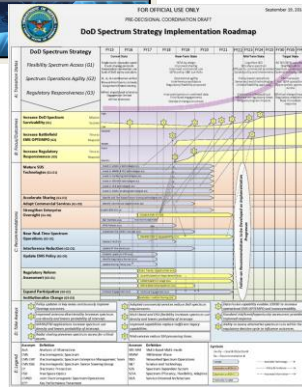
Communications Plan



DOD CIO Strategy



DOD CIO Roadmap and Action Plan



- DEFEND the T&E mission
 - Build advocacy
 - Strong, early requests
 - Prepare for WRC's
 - Continuous vigilance
- DEVELOP spectrum efficient technologies
 - Modulation
 - Protocols & Services
 - Frequency reuse
 - Spectrum sharing
- DEVISE new approaches
 - Satellite
 - Extremely high frequencies
 - Free space optics
 - Networking

T&E Annual Report

T&E Common Operating Picture (COP)

Test and Evaluation
Executive Agent
Board of Directors
Reference Panel
Cover Statement
Supporting PT14-24 Investments
May 2012

Acknowledgement and support of T&E tools and forums

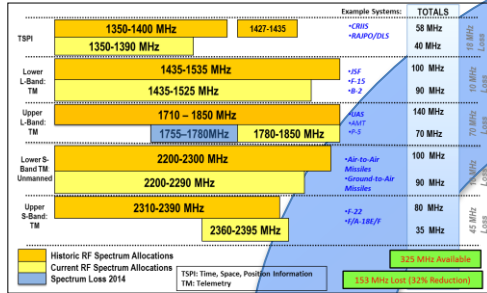


Common Operating Picture Content

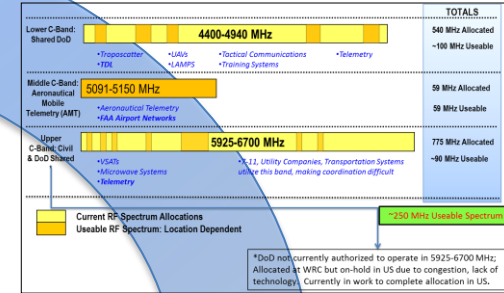
Spectrum Stewardship



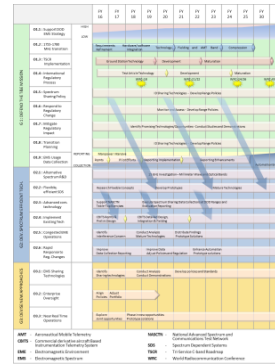
Spectrum Loss



Spectrum Transition



Spectrum Regulation



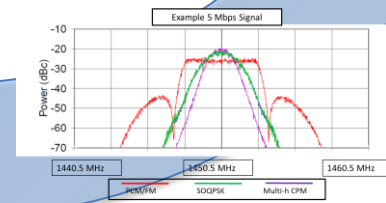
National Advanced Spectrum and Communications Test Network (NASCTN)



Policy and Standards



Technology Development



Increased Visibility and Raised Awareness of Test Community Efforts



Spectrum Encroachment



- Vandenberg AFB, CA (30th SW) and Patrick AFB, FL (45th SW): Both ranges have experienced problems with Unlicensed National Information Infrastructure (U-NII) devices (which includes unlicensed Wi-Fi) in 5 GHz C-Band frequencies impacting tracking radars authorized to support space launch activities. Ranges have spent significant resources to resolve impacts from unlicensed users whose operations exceeded interference thresholds during pre-launch activities to avoid mission degradation or launch delays.
- Increased noise by licensed 2 GHz cellular operators can mask receiver functions and impact pre-test and actual test mission data which raises additional mission safety and post mission data processing concerns. For example, cell phone tower signals near Patrick AFB, FL and Jonathan Dickinson Missile Tracking Annex, FL telemetry antennas can prevent telemetry data reception of launch activities at Cape Canaveral.



Adjacent Band Issues



- Aerospace & Flight Test Radio Coordinating Council (AFTRCC) has analyzed initial AT&T deployment proposals for operations in 2345-2360 MHz.
 - Coordination already completed for several thousand AT&T sites in numerous markets.
- Government Area Frequency Coordinators (AFCs) review and respond to AT&T coordination requests after analysis and recommendation from AFTRCC.



Adjacent Band Issues (cont.)



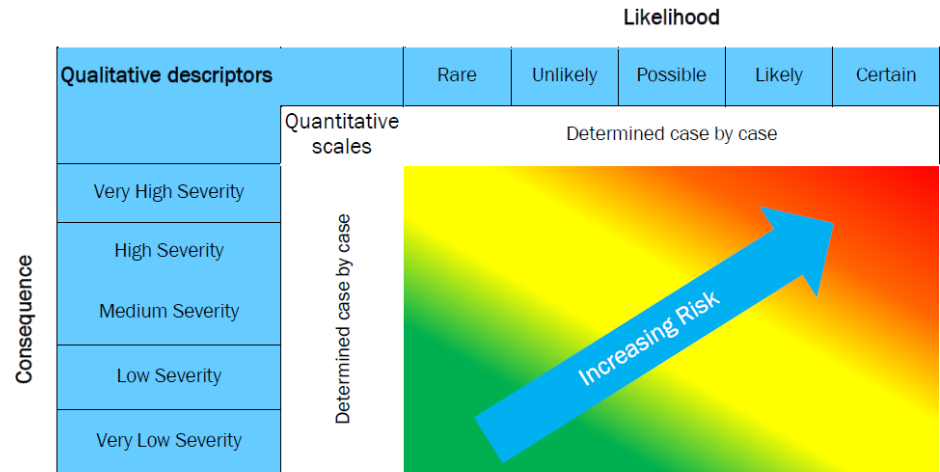
- With respect to Ligado Networks (aka “LightSquared”), AFTRCC has focused on revised, post-bankruptcy plan using the band 1526-1536 MHz, one megahertz removed from AMT.
- AFTRCC has negotiated an Non Disclosure Agreement (NDA) with Ligado, and exchanged AMT site data pursuant to that NDA.
- AFTRCC and Ligado have completed a Coordination Agreement. The Agreement provides for protection of Government and Non-Government flight test sites.



Sharing Spectrum In Policy



- **Regulators are:**
 - Performing Risk Informed Interference Assessment (RIIA) for interfering events
 - Valuing scientific rigor in sharing proposals
 - Appreciating the complexity of future sharing



Assessing likelihood versus consequence of an interfering event¹

- **National Advanced Spectrum and Communications Test Network (NASCTN)**
 - Mission is aligned with these regulatory positions
 - Test results can help make these assessments

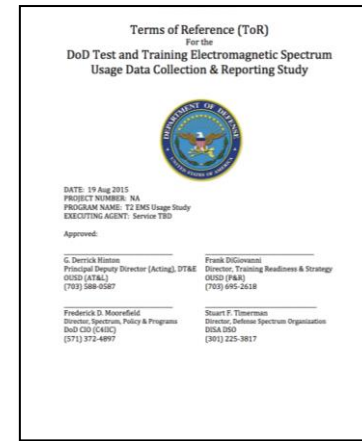
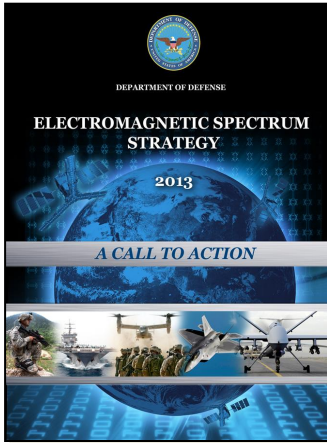
Regulators require trusted information as a basis for change

¹ A Quick Introduction to Risk-Informed Interference Assessment , April 2015. The Spectrum and Receiver Performance Working Group of the FCC TAC

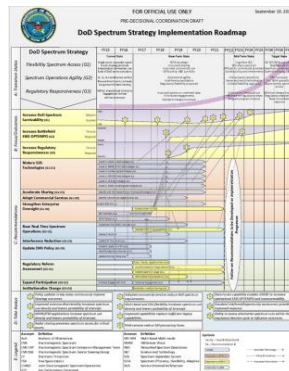


T2 EMS Usage Study

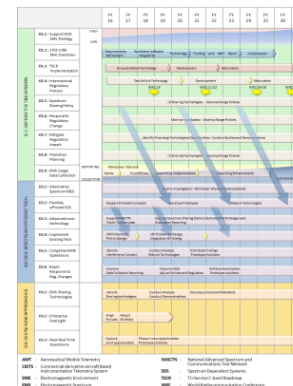
DOD CIO Strategy



T2 EMS Usage Study
Terms of Reference



DOD CIO Roadmap and Action Plan



T&E Spectrum Common Operating Picture



Recommendation 21
"Characterize (DoD) Spectrum Usage Data"



Questions



Pending Legislation Mobile Now Act



- Mandates only minimal editorial changes to the recently enacted Spectrum Pipeline Act, resolving the Administration's and agencies' objection to altering the Act.
- Creates a mandate by statute (vice an Administration goal) to meet the remaining 255 MHz of the President's 500 MHz broadband goal by 2020, changes were incorporated to expand the pool of spectrum to consider from below 3 GHz to below 6 GHz.
- Mandates appropriate feasibility assessment before decisions to reallocate federal bands, including critical radar spectrum identified in the draft (3100-3550 MHz).
- Mandated feasibility assessment with positive outcomes prior to FCC rulemaking relative to mandates for bands above 24 GHz with federal allocation, including ensuring provisions do not preclude current and future federal use of bands.
- Includes a version of Senator Schatz's unlicensed legislation, focused on development of a national plan for making additional unlicensed spectrum available. (Noting this version is less explicit than his previous bill about targeting Federal spectrum and more measured about conflating regulatory status/rights of unlicensed use relative to licensed use of spectrum.)
- New proposal from Senators Gardner (R-Colo) and Booker (D-NJ) that would require 100 MHz of the 255 MHz balance of the Administration's 500 MHz broadband goal to be met with unlicensed use and 100 MHz via licensed, exclusive use spectrum, while maintaining flexibility to consider both shared and clearing options.