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# Assured Dynamic Spectrum Access, Evolving Toward Revolutionary Change A DoD Perspective “Brief to DoD UAS Summit”



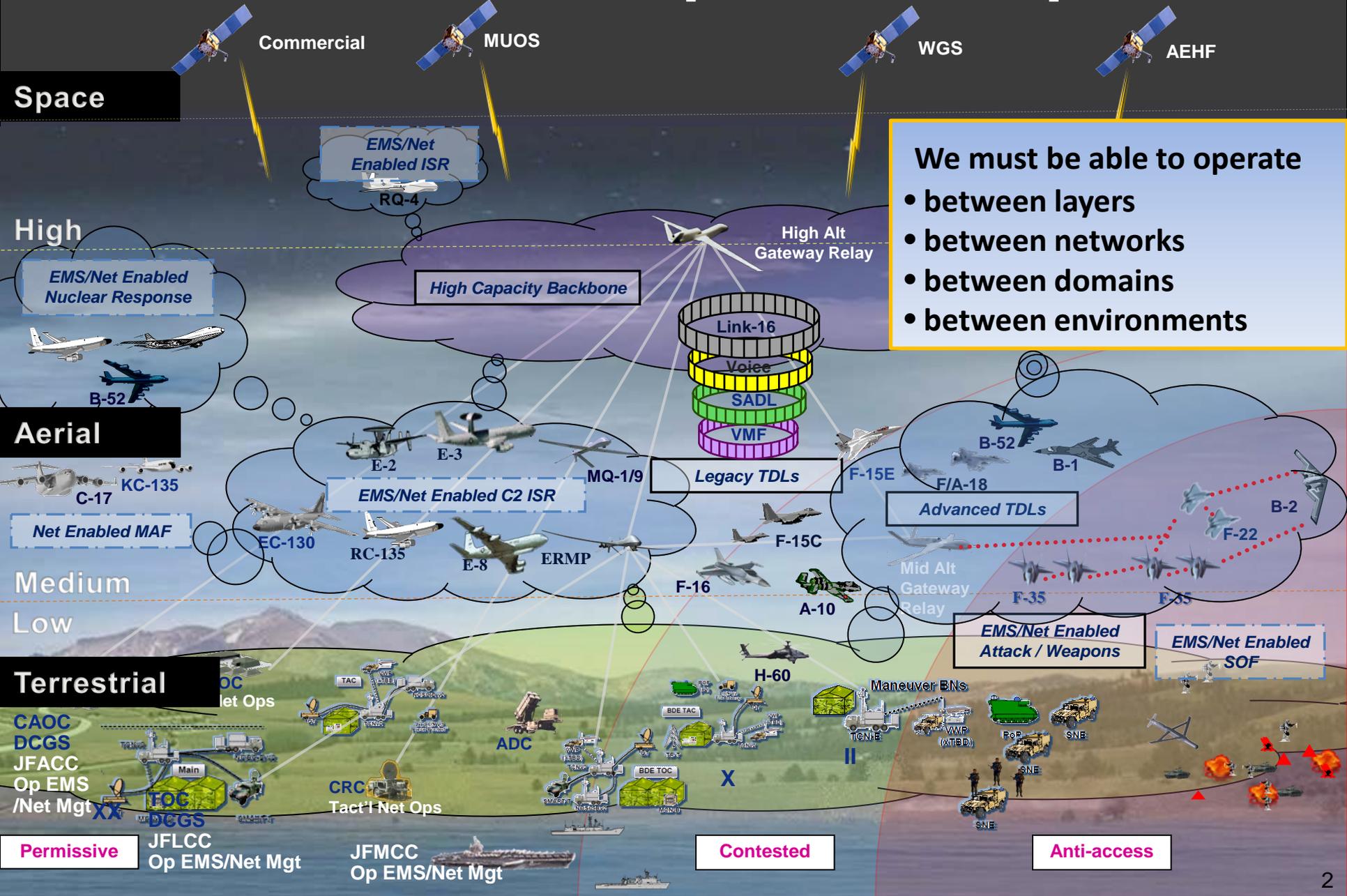
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18 March 2015

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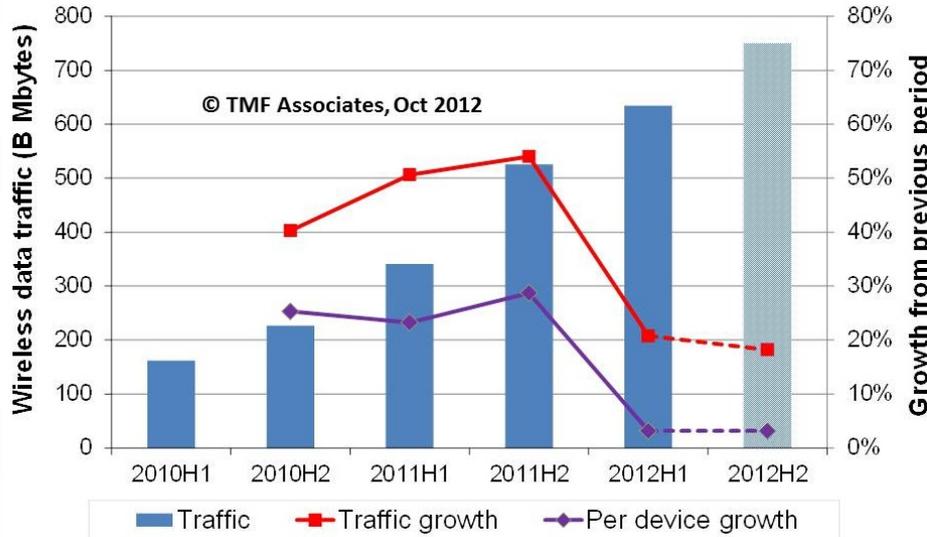
# Mission Success Depends on Spectrum



We must be able to operate

- between layers
- between networks
- between domains
- between environments

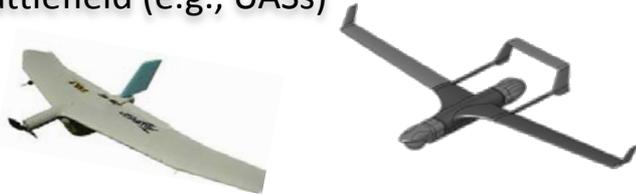
# This is a Race: Both on the Battlefield and in the Marketplace



# Warfighter Spectrum Demands

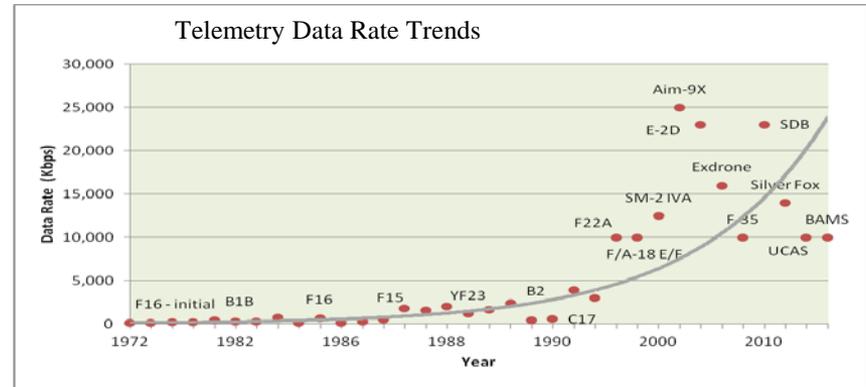


Increasing number of devices and communication links required for the battlefield (e.g., UASs)

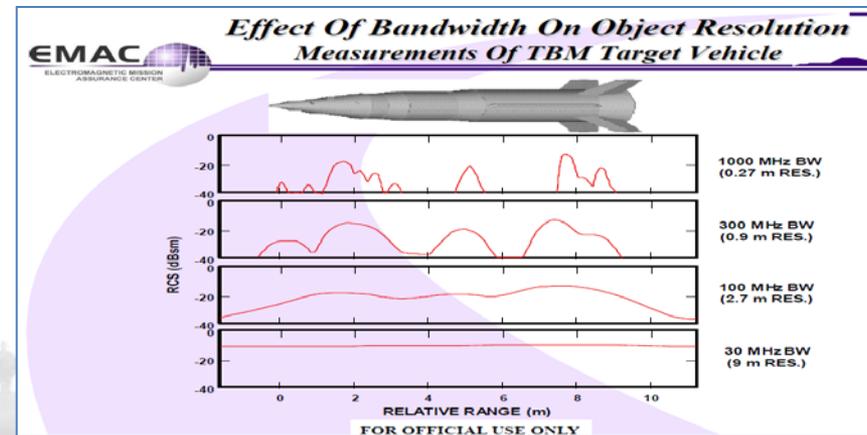


DoD's inventory of UASs stood at 167 in 2002  
.....today it numbers over 10,000 and climbing

Increasing data rates for testing (e.g., telemetry)



Changing threat – radars need more spectrum to detect smaller/stealthier targets at longer ranges



DoD Spectrum Needs are Also Growing Exponentially!

# Perpetual Relocation Not Sustainable

- **Comparable Spectrum: Limited places to relocate DoD without loss of capability (PL 106-65)**
  - Favorable, technically viable spectrum bands are already congested
  - The function/capability requirements drive the spectrum band options
- **Cost: Potentially high cost**
- **Timelines: Realities of DoD/Federal relocations don't match commercial schedules**
  - Systems reengineering, acquisition, and procurement drive DoD timelines
  - Funding to modify systems not provided until after auction
  - Protection zones are needed until transitions are complete (exacerbates the problem)

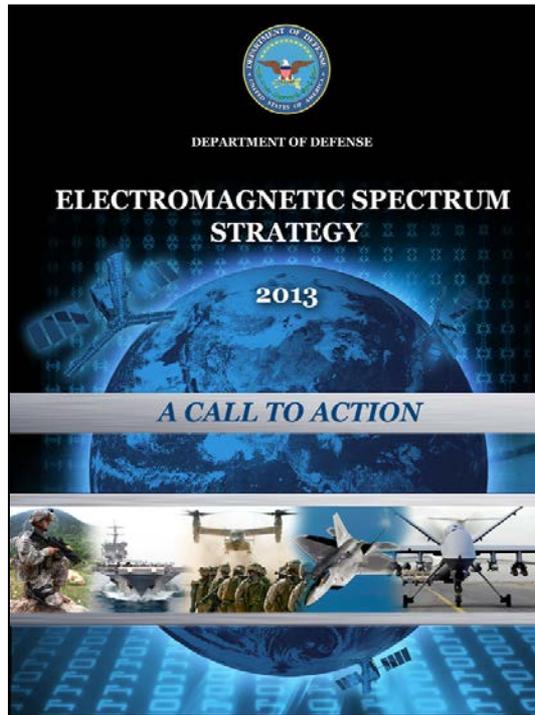
**National Spectrum Policy Makers United on This Reality**

# Spectrum Sharing Key to Global Operational Flexibility and Effectiveness

- **National efforts to improve spectrum access must converge toward an end goal of global operational effectiveness**
- **Spectrum Sharing is key to assured spectrum access: both efficient and effective use once access is gained**
- **Spectrum policy and regulatory frameworks must evolve to balance and enable rapidly developing technology advances around spectrum sharing to benefit both federal and non-federal requirements**
- **The framework must support new agile systems that will be built for a more contested and congested operational environments**

# Vision for Change: Spectrum Strategy

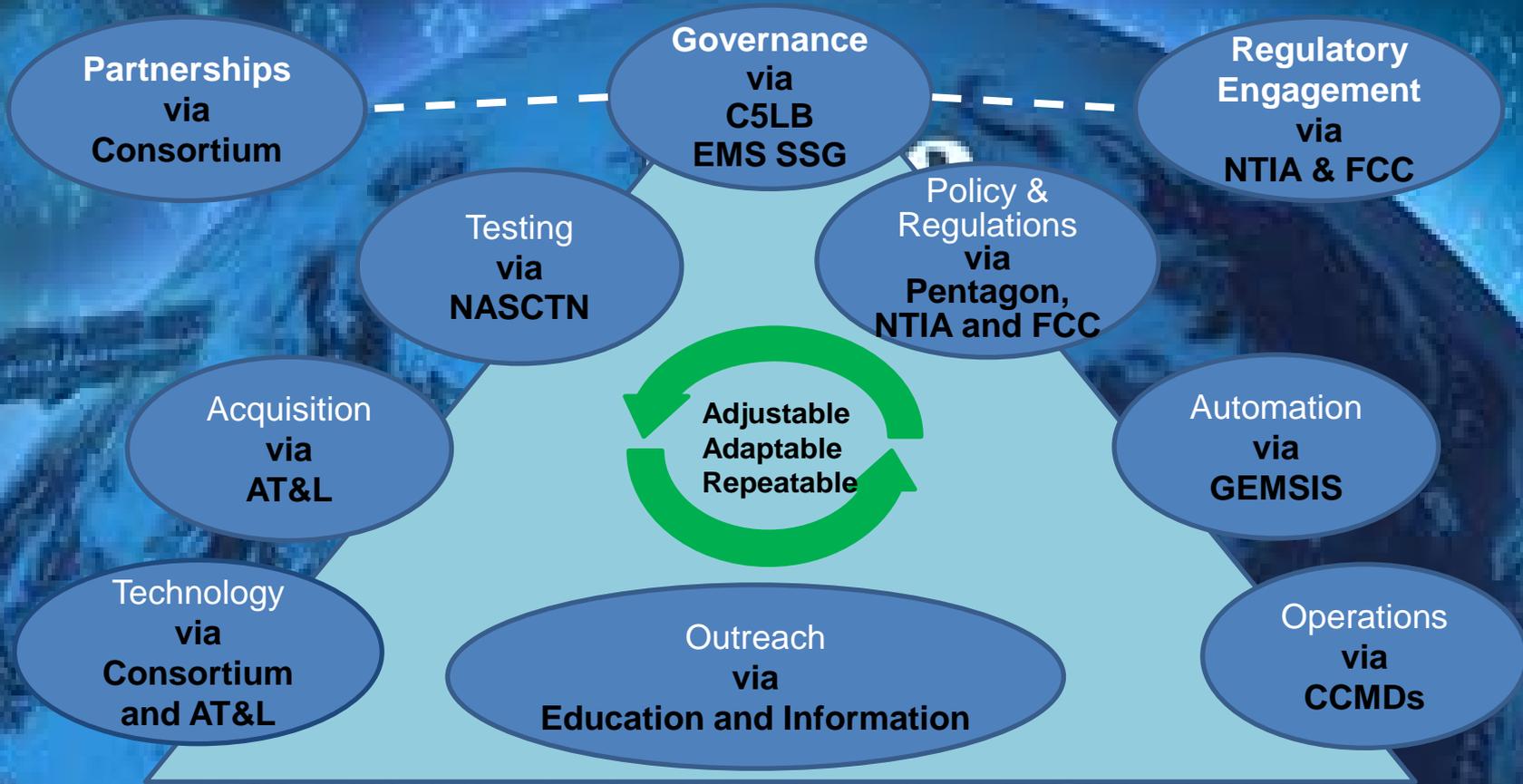
**EMS Strategy's Vision:** "Spectrum Access When and Where Needed to Achieve Mission Success"



- **“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

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

# End-to-End Integrated Spectrum Strategy Execution

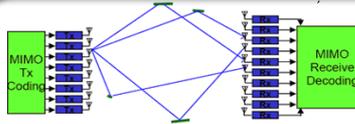


NASCTN: National Advanced Spectrum and Communications Test Network  
 GEMISIS: Global Electromagnetic Spectrum Information System  
 EMS SSG: Electromagnetic Spectrum Strategy Senior Steering group  
 NTIA: National Telecommunications and Information Administration

FCC: Federal Communications Commission  
 C5LB: Command, Control, Communications, Computer, and Cyber (C5) Leadership Board  
 AT&L: Acquisition, Technology, and Logistics  
 CCMD: Combatant Command

# EMS S&T and R&D Focus: Initial Sharing Technologies

**Multiple Input, Multiple Output (MIMO)**



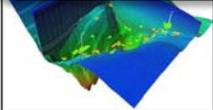
**Spectrum Access Architecture**



**Dynamic Spectrum Access (DSA) & Frequency Reuse (FR) Technologies**



**Modeling & Simulation of the Electromagnetic Environment (EME)**



**Air/Maritime Training Instrumentation (AMTI) Waveform**



**Interference Tolerance & Hardening Technologies**



**Millimeterwave & Free Space Optical technologies**



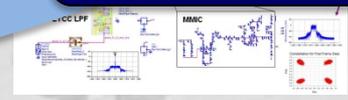
**Spectrum Situational Awareness (SA), Spectrum Command & Control (C2) & Mgt. of the Electromagnetic Environment (EM)**



**Radar & commercial-communications sharing technology**



**Adaptive RF Technologies**



# UAS Spectrum Challenges

- **DoD UAS Inventory increases driving the need for greater spectrum access**
- **BLOS Challenges**
  - Access to MILSATCOM is limited
  - Predominant access through COMSAT but not assured needed bandwidth
  - Bandwidth driver is mission data (e.g., full motion video, SIGINT, and Radar)
- **LOS Challenges**
  - Legacy UAS (e.g., Predator/Reaper) data links operate in bands not allocated for such use
  - Transitioning to Common Data Link (CDL) poses programmatic challenges
  - Increased competition from commercial systems affecting DoD spectrum access
- **SUAS Challenges**
  - Limited spectrum available <4GHz
  - Initial analog SUAS data link needed changes to accommodate new cell phone system in-theater – resulted in Digital Data Link (DDL) development with modules covering different frequency bands
  - DDL is just one of many systems operating in 1755-1780 MHz band and needing to relocate due to broad band industry pressure for greater access.
  - Additional module needed for utilization of pending access to 2025-2110 MHz

# UAS BLOS Activities

- **Gained WRC-15 Globally Harmonized BLOS Allocation**
- **Supported U.S. and Russian deliberations regarding orbital and frequency disputes**
- **Conducted regulatory assessment of DoD SATCOM procurement options (SATCOM Strategy)**
- **Evaluated emerging SATCOM concept proposals for regulatory compliance and interference risk mitigation (Pathfinder)**
- **Continuing to study UAS global spectrum access and bandwidth utilization**

# UAS LOS Activities

- **F&B IPT assessed projected UAS sensor bandwidth requirements in 5030-5091 MHz band**
- **Refined UAS LOS spectrum sharing techniques and developed policy and users guide**
- **Studying approaches for addressing 5 GHz legacy spectrum access challenges**
- **Continuing to encourage development of spectral efficient and flexible alternatives**

# SUAS LOS Activities

- **F&B IPT assessed SUAS DDL relocation options given industry push for, leading to auction of, 1755-1780 MHz band**
  - Retained access of 1780-1850 MHz band
- **Studied spectrum sharing feasibility with commercial users of 2025-2110 MHz band – concluded sharing would not impact operations**
- **Encouraging SUAS developers to explore even greater spectral efficient and flexible alternatives**

# WRC-15



- **November 2-27, 2015 / Geneva, Switzerland**
- **Key Issues/Agenda Items**
  - **AI 1.1** Additional spectrum for mobile broadband (< 6 GHz)
  - **AI 1.5** Commercial fixed satellite service networks to satisfy global unmanned aircraft systems (UAS) beyond line of sight (BLOS) aviation command and control (C&C) requirements for traveling in civilian airspace
  - **AI 1.6** Feasibility of commercial satellite systems operating in a NATO harmonized frequency band at 14 GHz
- **Active engagement and advocacy are key**
  - WRC Outreach--Engage allied/coalition mission partners

**Need Your Help to Influence Change!**

# The End State of Successful Strategy Implementation

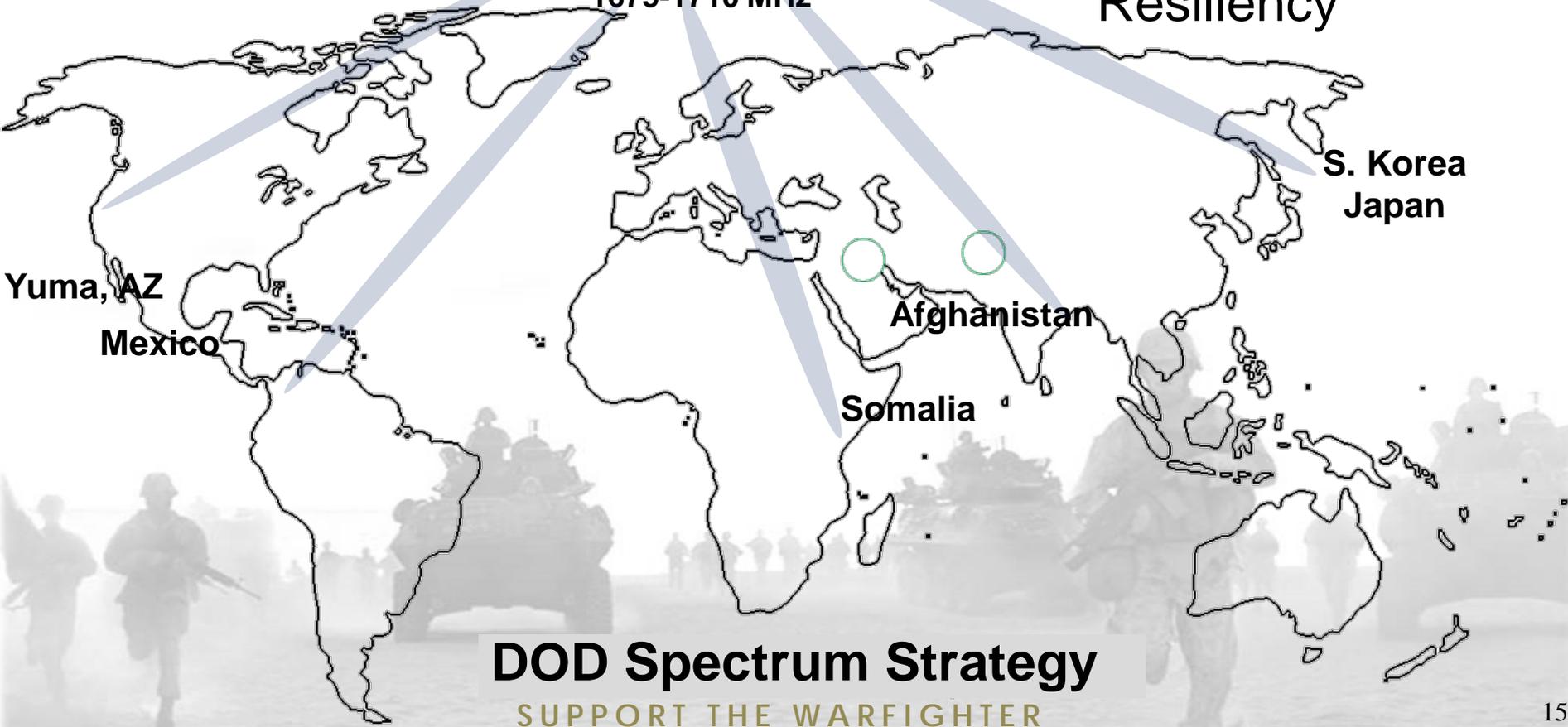
## Small Unmanned Aerial Vehicles

Multi-Band,  
Flexible,  
Adaptable

Capability  
Enabling  
Global  
Resiliency



1780-1850 MHz  
2025-2110 MHz  
2200-2290 MHz  
1675-1710 MHz



**DOD Spectrum Strategy**

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# Conclusion

## “Things are a Changing”

- **DoD UAS spectrum access is being challenged by emerging commercial market needs**
- **DoD is taking deliberate actions**
- **Implementing and executing a proactive vs reactive strategy**
- **Advocating spectrum sharing techniques, technologies and processes**
- **Building partnerships with all stakeholders**
- **Promoting Innovation**
- **Encouraging S&T/R&D EMS Technology Investment**
- **Institutionalizing EMS Operations**
- **Advancing accountable and responsive governance**
- **Advancing revolutionary changes through evolutionary approaches**
- **Integrated methodologies are key to success**

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