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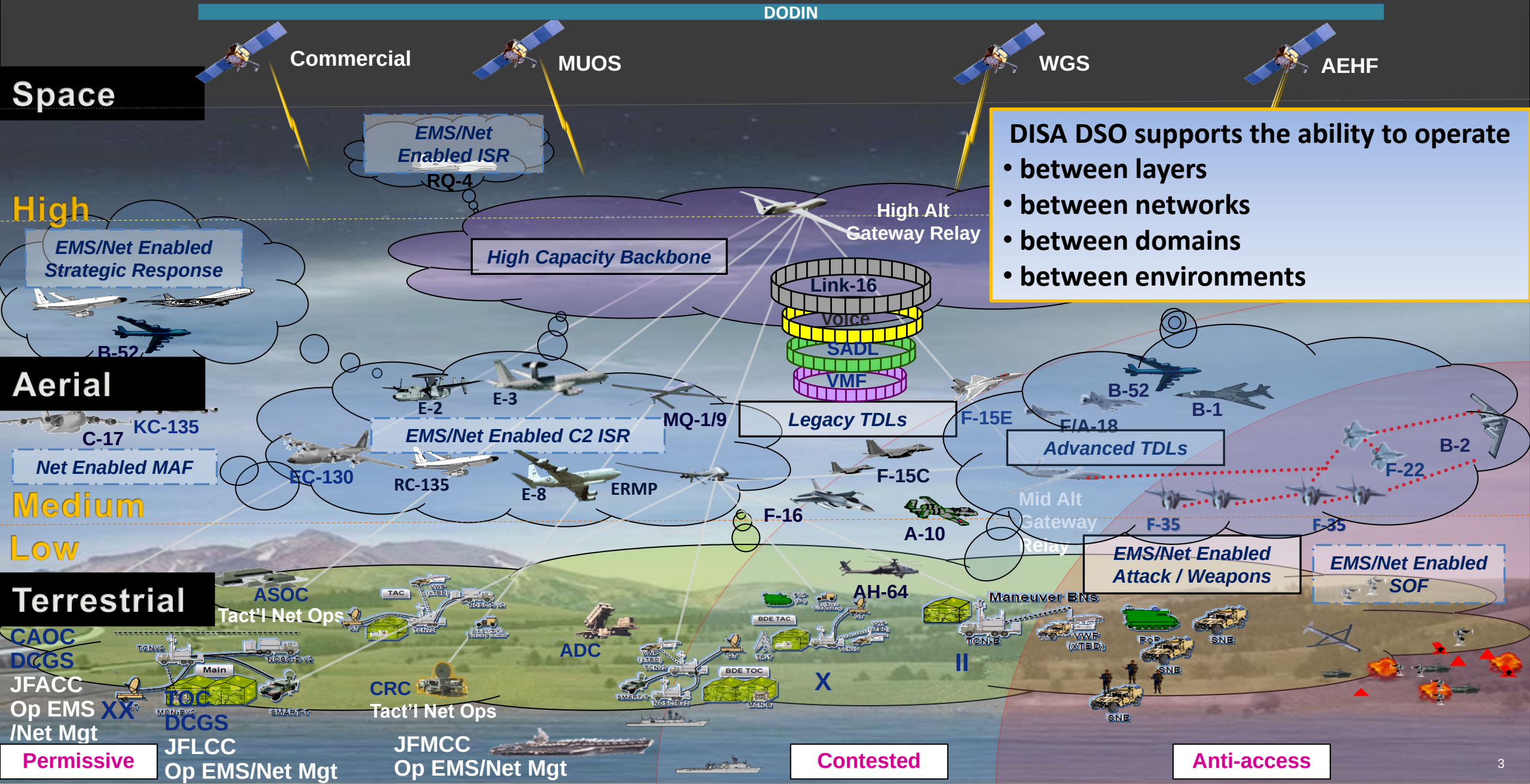
# Agile Electromagnetic Spectrum Operations

## Increasing the Agility of Spectrum Maneuver for DoD

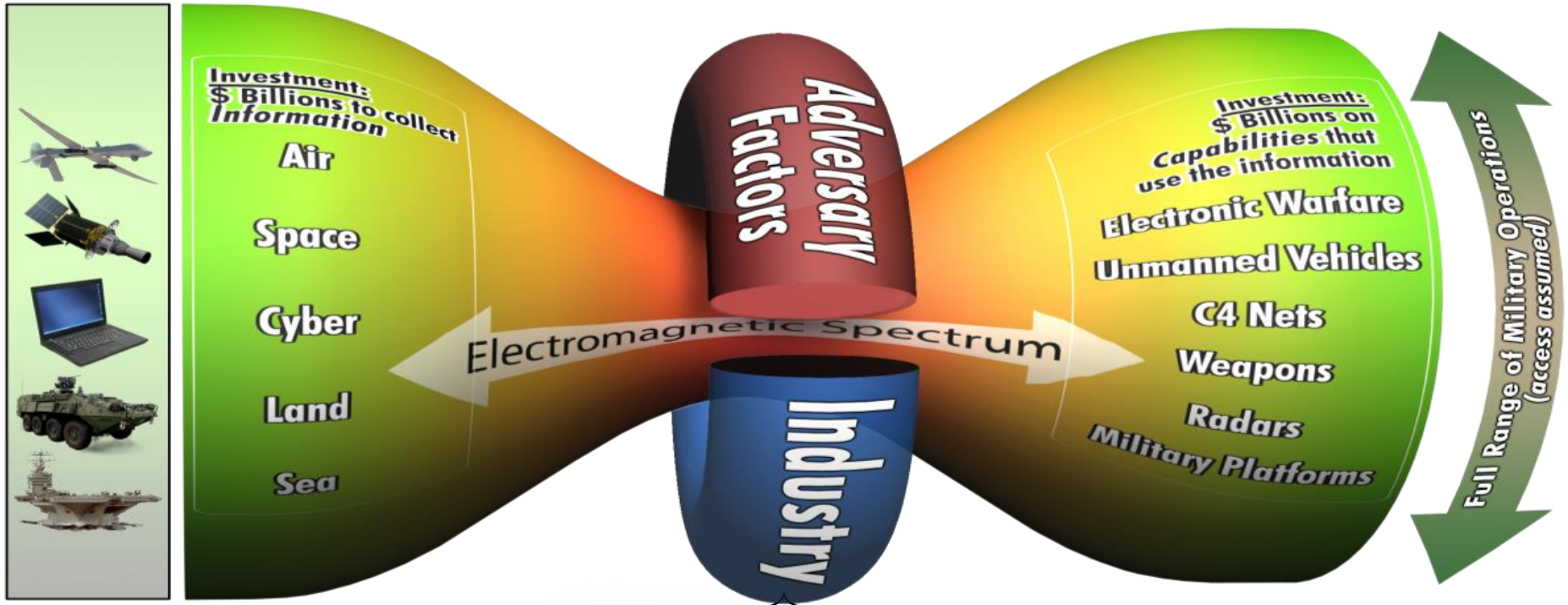
Alan Rosner, Ed Coyle, Kasey Pugh
Defense Spectrum Organization
1 December 2020

# Mission Success Depends on Spectrum



# Rapidly Changing Spectrum Operational Environment

- Directed Energy (EMP, HPM, laser)
- GPS jammers
- Digital RF Memory
- MMW
- Advanced C2 nets
- Weaponized COTS
- Proliferation




- Broadband technologies
- IEEE Standards
- Speed/Throughput/ Streaming Content
- Economic Growth
- Job Creation

**The foundation upon which DoD builds weapons systems is changing;**
**DoD efforts to recognize and to build to a new foundation is critical to national security.**

COTS: Commercial Off The Shelf
C2: Command and Control
C4: Command, Control, Communications and Computers
EMP: Electromagnetic Pulse
GPS: Global Positioning System
HPM: High Power Microwave
IEEE: Institute of Electrical and Electronics Engineers
MMW: Millimeter Wave
RF: Radio Frequency

# Implementing Electromagnetic Spectrum Operations

## Goal: Implement Agile Electromagnetic Spectrum Operations

**Complex EMS Environment**


**EMS MODERNIZATION LINES OF EFFORT**

- DATA COLLECTION AND AGGREGATION
- DATA ANALYTICS
- EMS UNDERSTANDING/ SITUATIONAL AWARENESS
- SPECTRUM ACCESS AND SHARING
- STANDARDIZED AUTOMATION INTERFACES

ENABLERS: CLOUD, ARTIFICIAL INTELLIGENCE

**MILITARY SUPERIORITY**

SPACE, AIR, MARITIME

DISTRIBUTABLE — AGILE EMSO

SECURE — EMS SUPERIORITY

TAILORABLE — JOINT ALL DOMAIN COMMAND AND CONTROL

**ENHANCED ALL DOMAIN OPERATIONS**

MISSION PARTNER ACCESS

KEY ATTRIBUTES

ENABLED US/ COALITION ACTIONS

Electromagnetic Battle Management (EMBM)
Operational Command and Control of the Electromagnetic Spectrum for Combatant Commands

Spectrum Management Coordination System (SMCS)
Sharing with Broadcast Electronic News Gathering in the US

Telecommunications Advanced Research & Dynamic Spectrum Sharing Systems (TARDyS3)
Sharing with Citizen's Broadband Radio Service in the US

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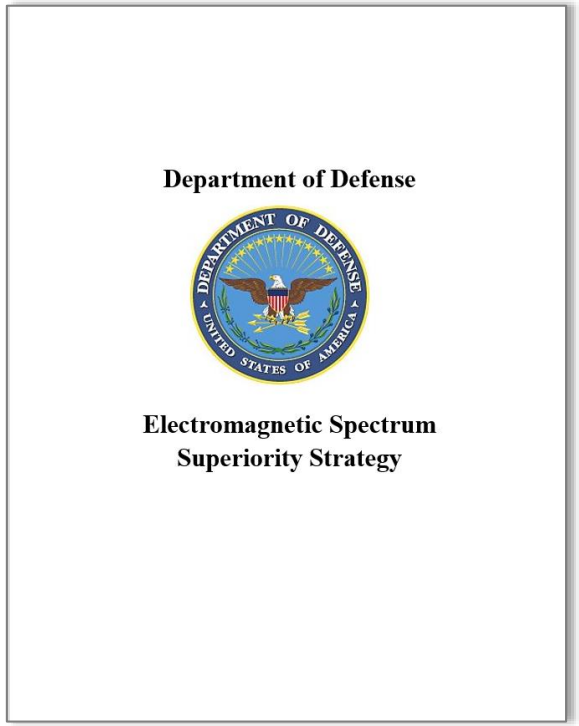
# Electromagnetic Battle Management (EMBM)

Alan Rosner
Program Manager
1 December 2020

# Electromagnetic Spectrum (EMS) Superiority Strategy

## EMS Strategy's Vision: "Freedom of Action in the Electromagnetic Spectrum"




- **5 Goals:**
  - **Develop Superior EMS Capabilities**
  - **Evolve to an Agile, Fully Integrated EMS Infrastructure**
  - **Pursue Total Force EMS Readiness**
  - **Secure Enduring Partnerships for EMS Advantage**
  - **Establish Effective EMS Governance**

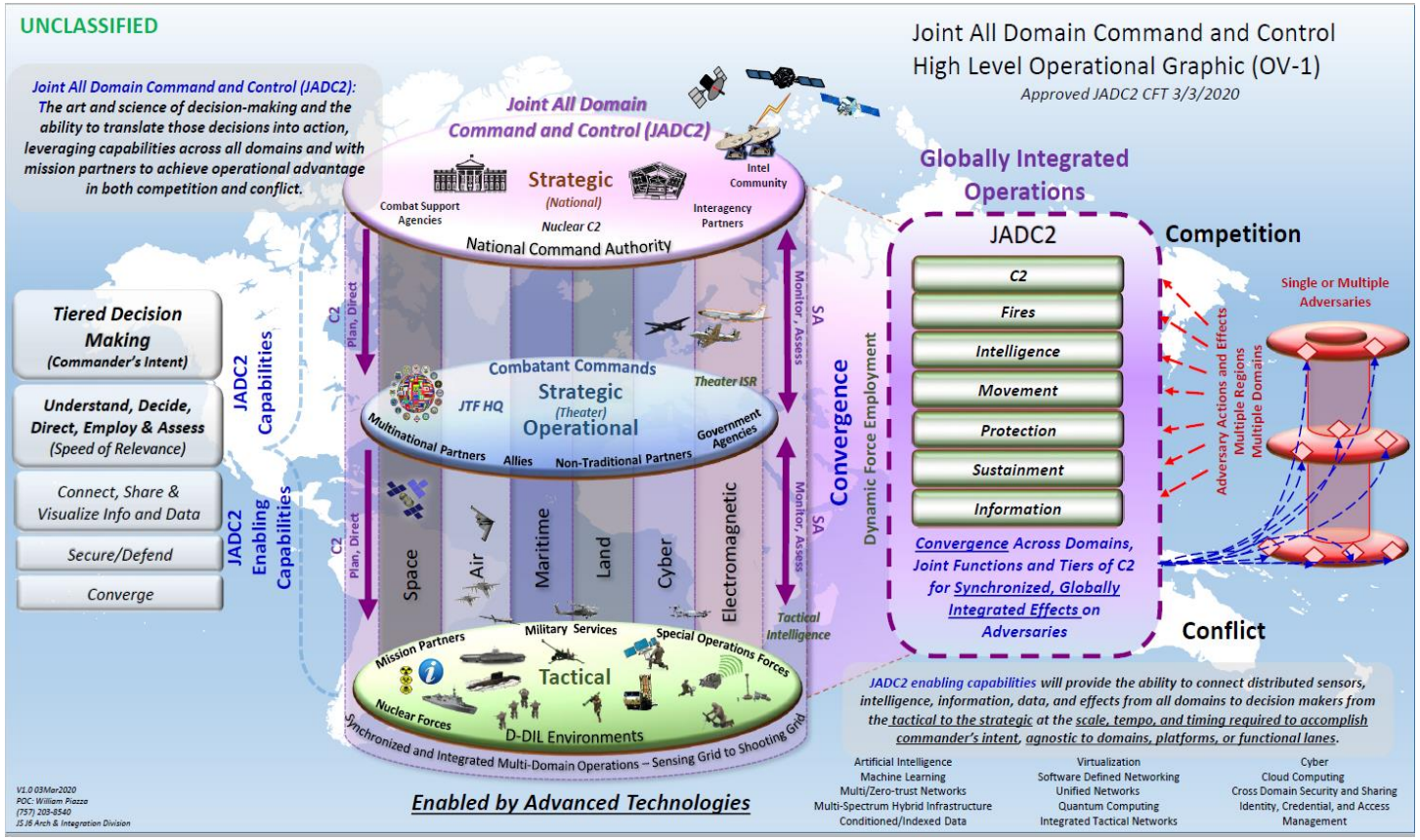
Focus on superiority in congested and contested electromagnetic operating environments (EMOE) of conflict, and the need to test, train, and operate in congested and constrained peacetime EMOEs

# EMBM Background

- **EMBM capability is the JEMSO material solution for JEMSOCs providing user-defined operational pictures, relevant data, and supporting C2 capabilities**
  - **EMBM tools specifically for CCMD and JTF JEMSOCs:**
  - **Initially: USCENTCOM, USEUCOM, USAFRICOM and USINDOPACOM implementing JEMSOCs in FY20-21**
- **EMBM is envisioned as the solution set for the EMS Domain in JADC2**

CCMD: Combatant command
EMBM: Electromagnetic Battle Management
JADC2: Joint All Domain Command and Control
JEMSO: Joint Electromagnetic Spectrum Operations
JEMSOC: Joint Electromagnetic Spectrum Operations Cells
Joint Task Force: JTF

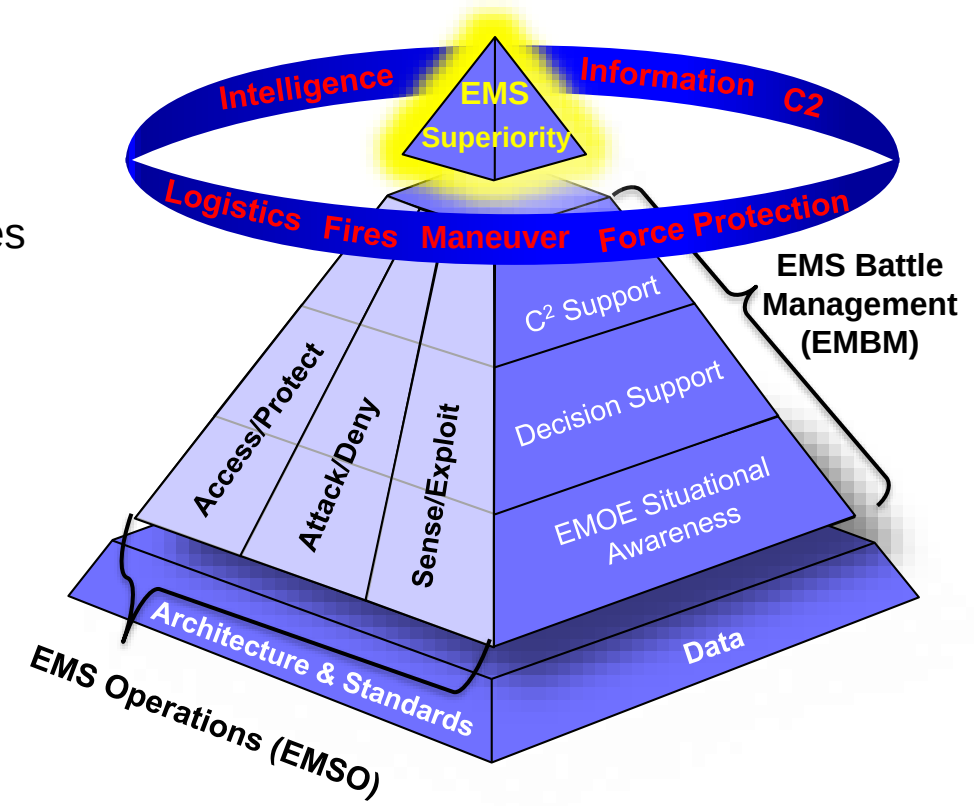
Joint All Domain Command and Control
High Level Operational Graphic (OV-1)




## DISA is Providing Key Enabling Support to JEMSO & JADC2

# DISA/DSO Supporting Activities for JEMSO and EMS C2

- **Defense Spectrum Organization (DSO) Working to Align & Integrate Data Delivery for EMSO capabilities**
  - Conducted an EoA for EMBM
  - Preparing for the acquisition of EMBM System
  - Developed overarching architecture alignment among EMS activities with key DoD architectures
  - Providing EMS Data from GEMSIS JSDR to Army EWPMT, a key component of EMBM
  - DSO participation in EMS VIEW JCTD, which includes Army EWPMT & USMC SSF interfaces
  - Working to expand GEMSIS JSDR capabilities to close situational awareness gap and improve understanding of the EMOE
  - Support to JEMSIAF in increasing production rate, quantity and quality of Blue Force platform/system/equipment data

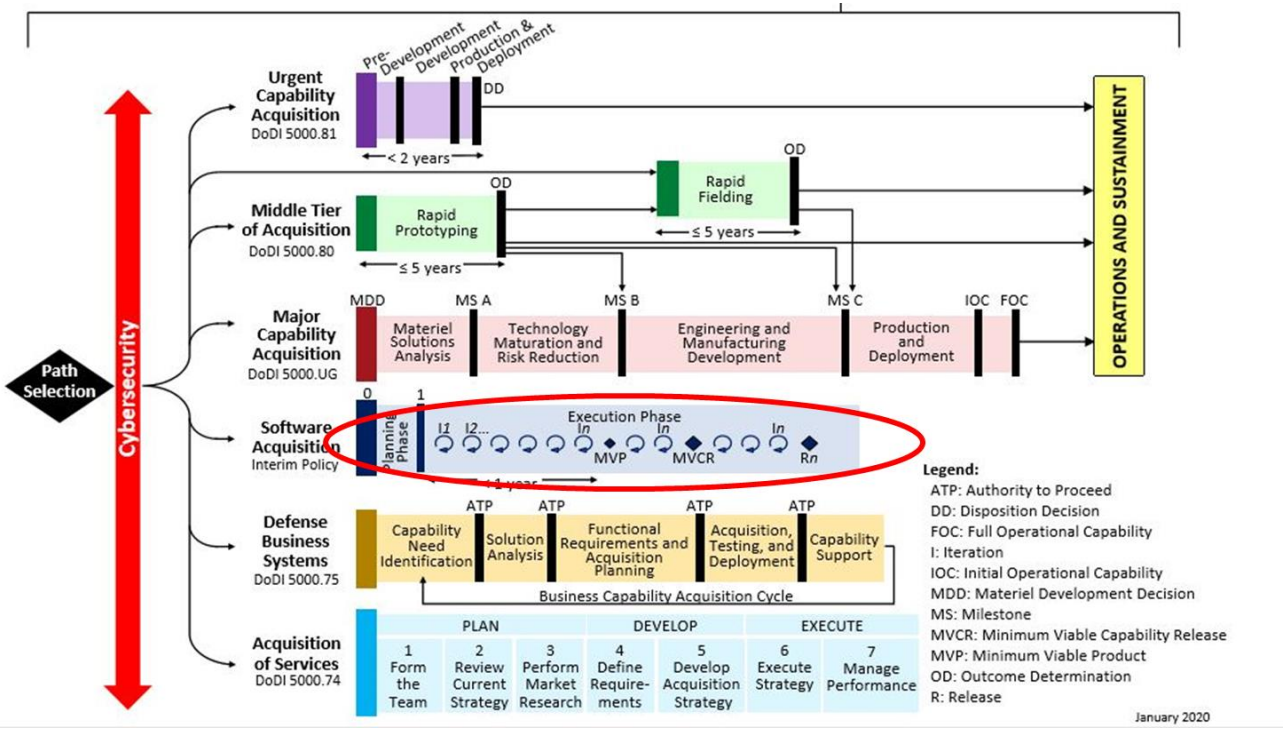


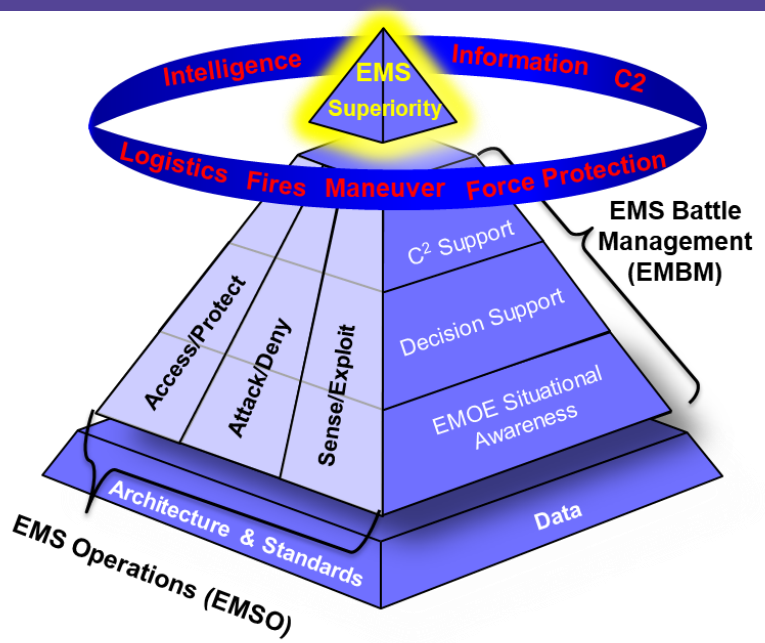

EoA: Evaluation of Alternatives
EMBM: Electromagnetic Battle Management
EMOE: Electromagnetic Operational Environment
GEMSIS: Global Electromagnetic Spectrum Information System
JSDR: Joint Spectrum Data Repository

EWPMT: Army Electronic Warfare Planning and Management Tool
JEMSIAF: Joint Electromagnetic Spectrum Information Analysis and Fusion
JCTD: Joint Capability Technology Demonstration
SSF: Spectrum Services Framework

# EMBM Acquisition

**EMBM is a new start in FY21 under the Adaptive Acquisition Framework (AAF), Software Pathway that will leverage capabilities from GEMSIS, Army EWPMT, FADE/MIST and other capabilities to provide EMS operational capabilities in support of JTFs for JEMSOCs**




- **EMBM enables commander control and synchronization of the EMOE**
- **EMBM Key Gaps**
  - SA
  - Command & Control
  - Decision Support

EWPMT: Electronic Warfare Planning and Management Tool
FADE: Fusion Analysis Development Effort
MIST: Multi-INT Spatial Temporal

EMOE: Electromagnetic Operational Environment
EWPMT: Electronic Warfare Planning and Management Tool
FADE: Fusion Analysis Development Effort

MIST: Multi-INT Spatial Temporal
SA: Situational Awareness

# EMBM Status

- **EMBM is a New Start in FY21**
  - **All activities are acquisition planning pending approval of FY21 budget**
  - **Requirements have been documented and approved by the JROC**
    - **Captured in CNS and corresponding IT Box CDD**
  - **User Agreement**
    - Key document under AAF
      - **An agreement between the operational and acquisition communities to gain commitment to continuous user involvement and assign decision-making authority in the development and delivery of software capability releases**
    - USSTRATCOM-Operational Sponsor
    - JEWC-User Representative
    - DISA DSO-Program Manager
  - **EMBM RFI was out in November**
    - Analyzing data in preparation of future RFP

AAF: Adaptive Acquisition Framework
CDD: Capability Development Document
CNS: Capability Needs Statement

DISA: Defense Information Systems Agency
DSO: Defense Spectrum Organization
JEWC: Joint Electronic Warfare Center

JROC: Joint Requirements Oversight Council
RFI: Request for Information
RFP: Request for Proposal

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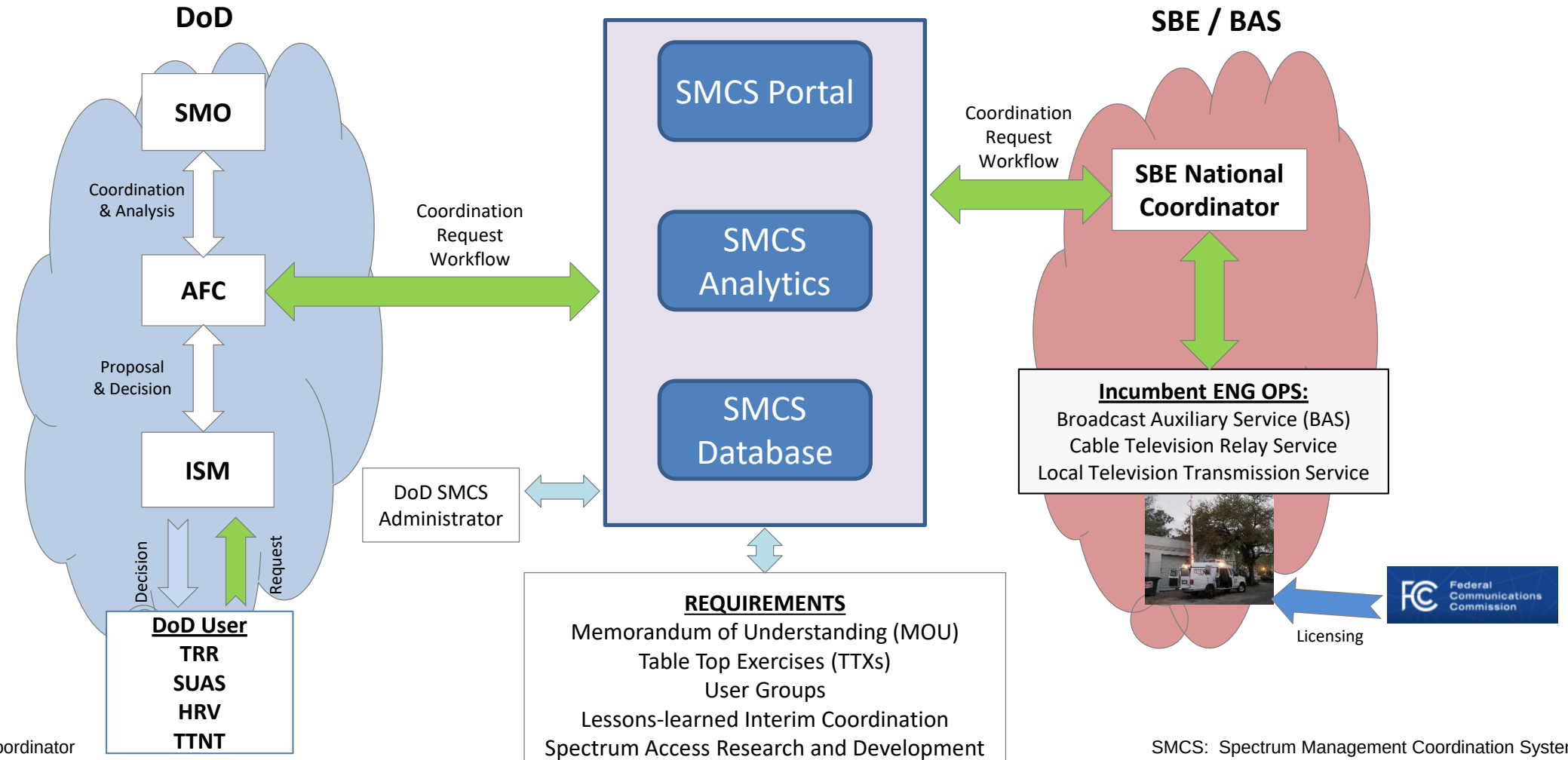
# 2025-2110 MHz Spectrum Management Coordination System (SMCS)

Ed Coyle
Defense Spectrum Organization
SMCS Lead Engineer
1 December 2020

# SMCS OV-1 Operational Concept Graphic




AFC: Area Frequency Coordinator
ENG: Electronic News Gathering
HRV: High Resolution Video
ISM: Installation Spectrum Manager
SBE/BAS: Society of Broadcast Engineers or SBE-ENG/BAS

SMCS: Spectrum Management Coordination System
SMO: Spectrum Management Office
SUAS: Small Unmanned Aerial System
TTNT: Tactical Targeting Network Technology
TRR: Tactical Radio Relay

# 2025-2110 MHz Coordination Process Evolution

| Manual Sharing (Person-in-the-Loop) *Today* | SMCS Threshold (Person-on-the-Loop) *Base Year* | SMCS Objective (Completely Automated) *Year 5* |
|---|---|---|
| Email | Coordination Portal | Machine-to-Machine |
| Good Engineering Judgement | Analytical Tools | Analytical Tools |
| SBE National Coordinator (performs local SBE coordination) | Database<br>Equipment<br>Operations<br>Coordination History | Database<br>Equipment<br>Operations<br>Coordination History |

**Challenges**

- Capturing Local Coordination and ENG use
- Resolving gaps between TTXs and MOU

**Challenges**

- Culture Change(s)
- Possible dependencies on advanced / emerging Spectrum Management architectures

**Enabling Spectrum Sharing Between DoD and Commercial Users**

# DoD and Broadcast Auxiliary Service Systems (BAS)

| DoD System Type | Characteristics |
|---|---|
| Tactical Radio Relay (TRR) | • Ground based (15m)<br>• Directional antennas<br>• Low power<br>• Narrowband (BW<< BAS channel) |
| Small Unmanned Aircraft Systems (SUAS) | • Low Altitude (<2,000ft)<br>• Omni-directional antenna<br>• Low power<br>• BW < single BAS channel |
| Tactical Targeting Network Technology (TTNT) | • High altitude<br>• Omni-directional antenna<br>• High Power<br>• BW > single BAS channel |
| **BAS/ENG Asset Type** | **Characteristics** |
| Fixed Links | • Studio Transmitter Links (STL)<br>• Intercity Relay (ICR)<br>• Community Antenna Relay Service (CARS)<br>• Local Television Transmission Service (LTTS) |
| Mobile/Portable Links | • Mobile Vans for on-scene reporting<br>• Helicopters and Blimps for traffic reports, sporting events, etc.<br>• Radius of operation 100 km avg. around TV studios |

| | 2025 | DRL 1 | 2025.5 | Channel 1 | 2037.5 | Channel 2 | 2049.5 | Channel 3 | 2061.5 | Channel 4 | 2073.5 | Channel 5 | 2085.5 | Channel 6 | 2097.5 | Channel 7 | 2109.5 | DRL 2 | 2110 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Width, MHz | | 0.5 | | 12 | | 12 | | 12 | | 12 | | 12 | | 12 | | 12 | | 0.5 | |
| Center, MHz | | 2025.25 | | 2031.5 | | 2043.5 | | 2055.5 | | 2067.5 | | 2079.5 | | 2091.5 | | 2103.5 | | 2109.75 | |

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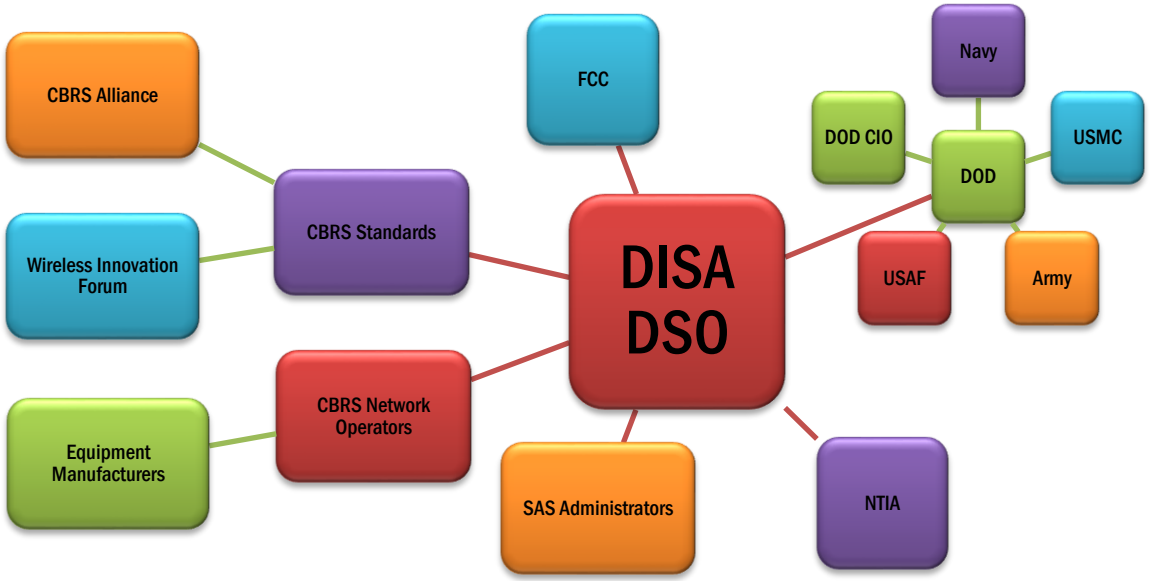
# Telecommunications Advanced Research & Dynamic Spectrum Sharing Systems (TARDyS3) Program

Kasey Pugh
TARDyS3 Lead Engineer
1 December 2020

# Telecommunications Advanced Research & Dynamic Spectrum Sharing Systems (TARDyS3)

- **DOD Spectrum Sharing Team**
  - DSO government team that will lead the DOD activities in the 3550-3650 MHz band
  - Support the CBRS commercial standards development process
- **CBRS Sharing Ecosystem Assessment**
  - Comprehensive assessment program to prove the viability of permanent sharing between DOD and CBRS
- **TARDyS3 Tool Suite**
  - Interference prevention, detection, resolution (IPDR) capability
  - Spectrum scheduling system (S3) capability enabling sharing between DOD ranges and CBRS in the 3550-3650 MHz band
  - Built on the Platform One Party Bus




**NTIA**: National Telecommunications & Information Administration
**FCC**: Federal Communications Commission
**CBRS**: Citizens' Broadband Radio Service
**SAS**: Spectrum Access System

# TARDyS3 Potential Future Needs

- **Cloud-Native Bi-Directional Cross-Domain Solutions (IL-2/5/6)**
- **Spectrum Scheduling Business Process Automation**
- **Electromagnetic Interference Prediction Functionality**
- **Asynchronous Operations (e.g. supporting end users with degraded, intermittent, limited network connectivity)**


Dynamic spectrum sharing advances U.S. leadership in 5G and enables America's national and economic security

# For More Information

- **DSO Strategic Planning Division: DSN 312-375-3799 CML 301-225-3799**
- **Business Management Division:  DSN 313-919-2683 CML 410-919-2683**
- **Joint Spectrum Center (Spectrum Operations Support Center (SOSC)): DSN 313-919-2836 CML 410-919-2836**
  - **SOSC E-mails:**
    **NIPRNet: disa.sosc@mail.mil;**
    **SIPRNet: disa.sosc@mail.smil.mil**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