Defense Information Systems Agency
Department of Defense

Spectrum Transformation - The Transition to the Global Electromagnetic Spectrum Information System (GEMSIS)

Alan Rosner, GEMSIS PMO
Dan O'Neill, DSO
7 May 08

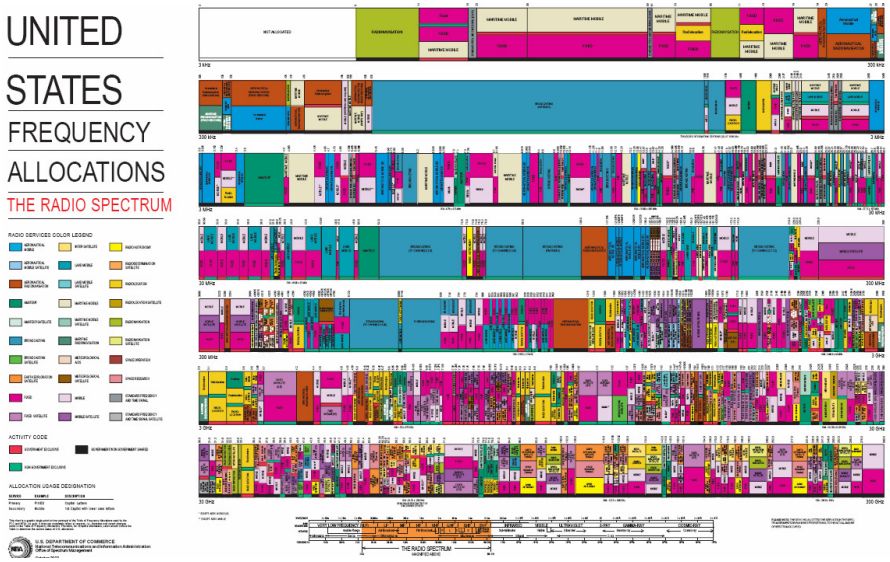
Overview

- GEMSIS Background
- Defense Spectrum Management Architecture (DSMA)
- Supporting Defense Spectrum Organization (DSO) Activities
  - Data Standardization
  - Spectrum Management Transition Initiative (SMTI)
  - Spectrum Technology Testbed Initiative (STTI)
  - Near-Term Improvements
- GEMSIS Program
  - Increment 1 - Sustain Coalition Joint Spectrum Management Planning Tool (CJSMPT) & Host Nation Spectrum Worldwide Database – Online (HNSWDO)
  - Increment 2 - Conduct an Analysis of Alternatives (AoA)

What is GEMSIS?

GEMSIS Overview

- Provides commanders with increased common picture of spectrum situational awareness of friendly and hostile forces.
- Integrated Spectrum Operations across the entire Department of Defense
- Interoperability with Federal, State and Local Government spectrum agencies and coalition forces.



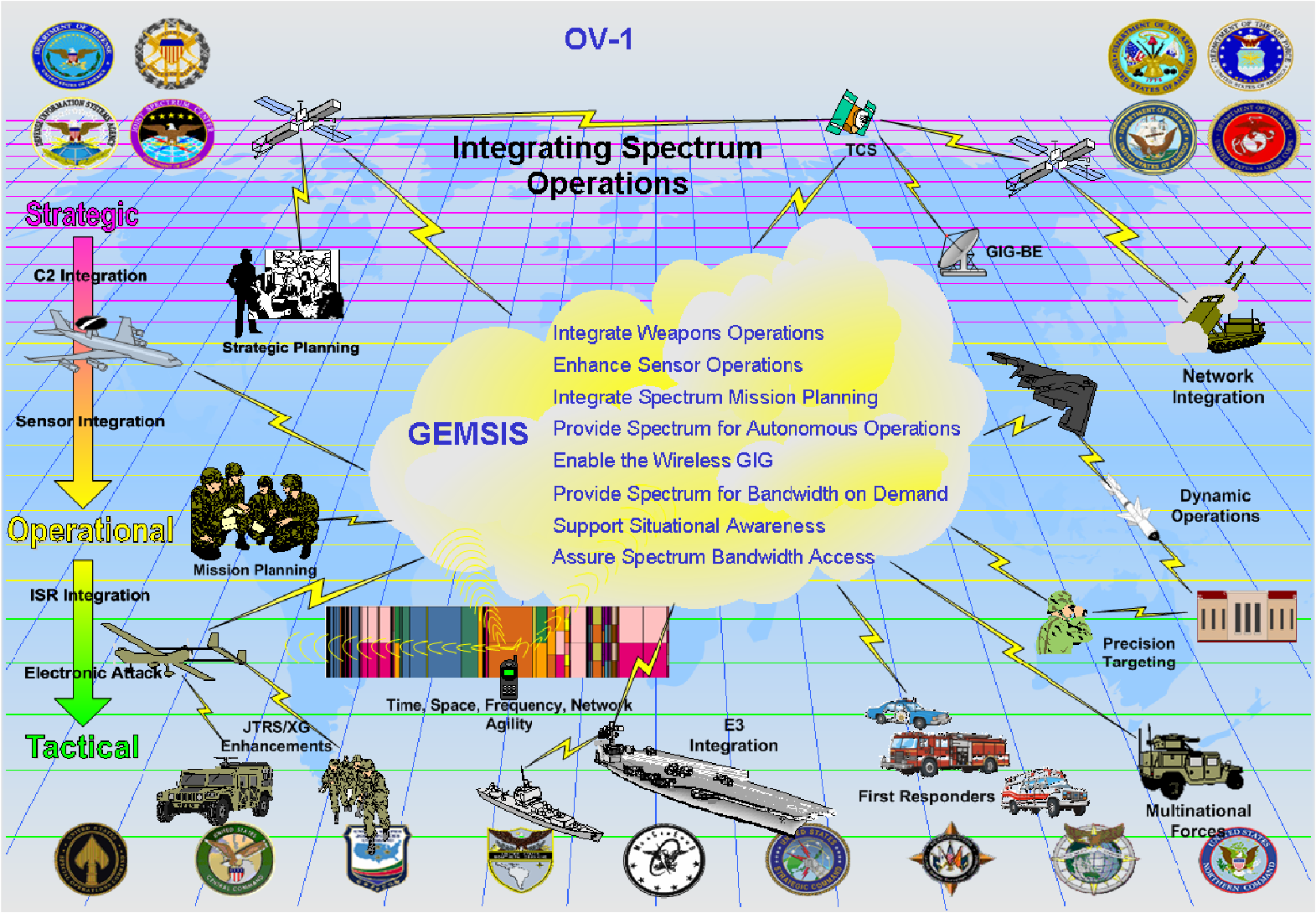
Full Spectrum Dominance

- Fully Integrated
- Expeditionary
- Networked
- Decentralized
- Adaptable
- Decision Superiority
- Lethality

Concept of Operations

- GEMSIS transforms spectrum operations from a preplanned and static frequency assignment system into a responsive and agile capability to request, assign, allocate, and deconflict portions of the electromagnetic spectrum.

GEMSIS Overview



Provide Capabilities to Spectrum Access When and Where Needed

Unclassified

GEMSIS Capabilities

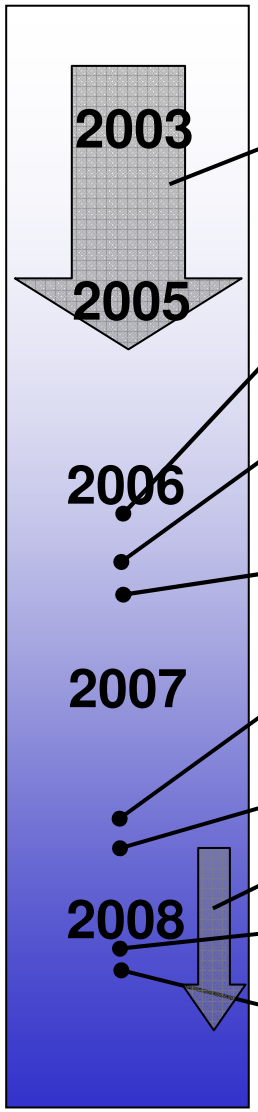
Near-Term Capabilities

1. End-to-End Spectrum Supportability
   - Web Enabled/ Total Process Visibility
   - Equipment Certification Status/ Host Nation Comments
2. Software Definable Radio Waveform Spectrum Management Support
3. End-to-End Frequency Assignment
   - Interoperability with National Telecommunications & Information Administration/North Atlantic Treaty Organization (NTIA/NATO)
   - Interoperability with Software Defined Radio (SDR) waveforms
4. Strategic Spectrum Management Planning
5. Modeling and Simulation for Mission Planning and Rehearsal – Provide realistic determination of spectrum availability and supportability prior to mission.
6. Modeling and Simulation for Acquisition – Spectrum guidance to developers prior to acquisition.
7. Spectrum Transformation to Global Information Grid (GIG)/Net-centric Environment.

Far-Term Capabilities

1. GEMSIS enabled standards, protocols, and utilities in all future Radio Frequency spectrum dependent equipment.
2. Autonomous spectrum operations and deconfliction.
3. Integration of spectrum considerations, bandwidth requirements, and information priority within mobile ad-hoc networks.
4. Adaptive array antenna capabilities with SDR to increase frequency reuse.

GEMSIS History



- 2003: GEMSIS supporting documentation developed: Initial Capabilities Document (ICD), Concept of Operations, Analysis, Architecture
- 2005: GEMSIS ICD approved by Joint Requirements Oversight Committee on 23 Jan 06
- 2006: GEMSIS Program Management Office (PMO) Initiated Under DISA Program Executive Office – Information Assurance/Network Operations (PEO-IAN), 3 People
- 2006: Program Objective Memorandum 08 Issue Paper developed and approved
- 2007: GEMSIS PMO Transferred to DISA Program Executive Office for Satellite Communications, Teleport, and Services (PEO-STS)
- 2007: GEMSIS Program initiated as a New Start (FY08)
- 2007: Additional GEMSIS PMO Government Staff hired (Ongoing)
- 2008: GEMSIS Removed from OSD Oversight List and designated as DISA Special Interest. (ACAT III)
- 2008: GEMSIS PMO located at the DSO/Joint Spectrum Center (JSC), Annapolis, MD (Feb 08) (Reports to PEO-STS)

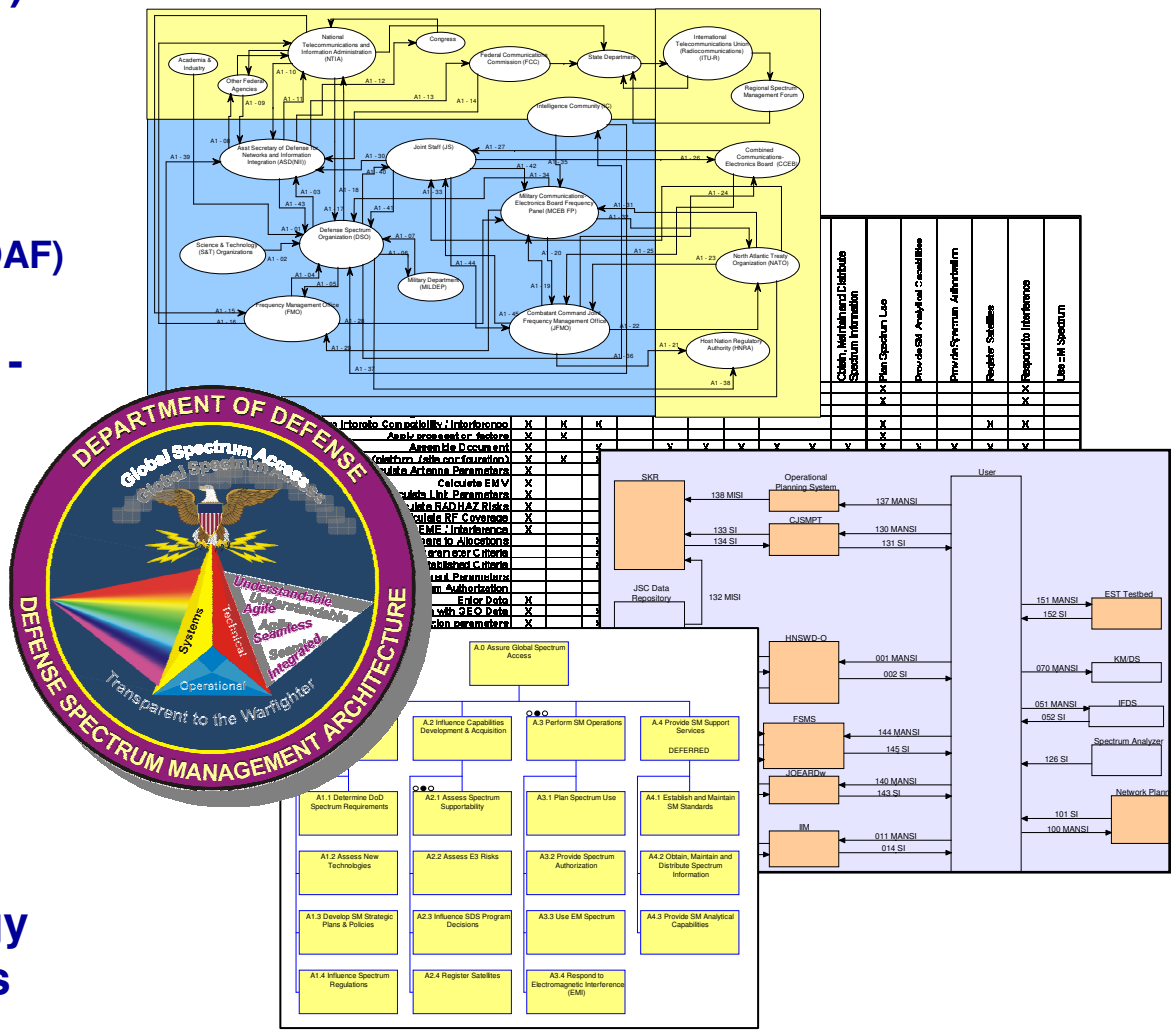
DSO Activities

Meanwhile !

- **While GEMSIS was being initiated, the DISA DSO has been working on several important transformational activities.**
  - **Defense Spectrum Management Architecture (DSMA)**
  - **Standardizing Spectrum Data Exchange Format**
  - **Transforming existing data sources to the new standard and creating services to expose data.**
  - **Developing near-term spectrum supportability improvements.**
    - **Host Nation Spectrum Worldwide Database Online (HNSWDO),**
    - **Defense Knowledge Online, single sign-on**
    - **Equipment Location – Certification Information Database (EL-CID)**
  - **Developing of capabilities in support of the relocations of systems from the 1710-1755 MHz band to permit advanced wireless services.**

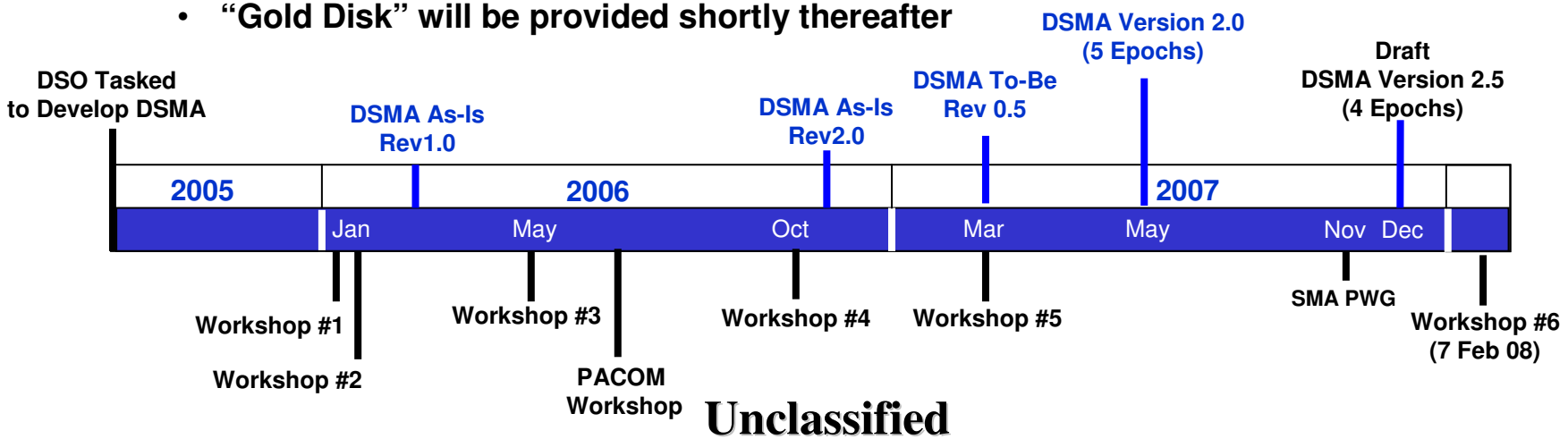
DSMA Overview

- **Enterprise Architecture (EA) for DoD Spectrum Management (SM)**
  - SM component of the GIG
  - Department of Defense Architectural Framework (DoDAF) v1.5
- **Full sets of "As-Is" products - Base-line is 2006 (v1.0)**
- **Representative products for four "To-Be" epochs and associated Transition Architectures (TAs)**
  - TA1: 2007-2012
  - TA2: 2012-2016
  - TA3: 2016-2020
  - TARGET: 2020+
- **Includes a Transition Strategy & Roadmap, which describes the architectures in text as snapshots in time**

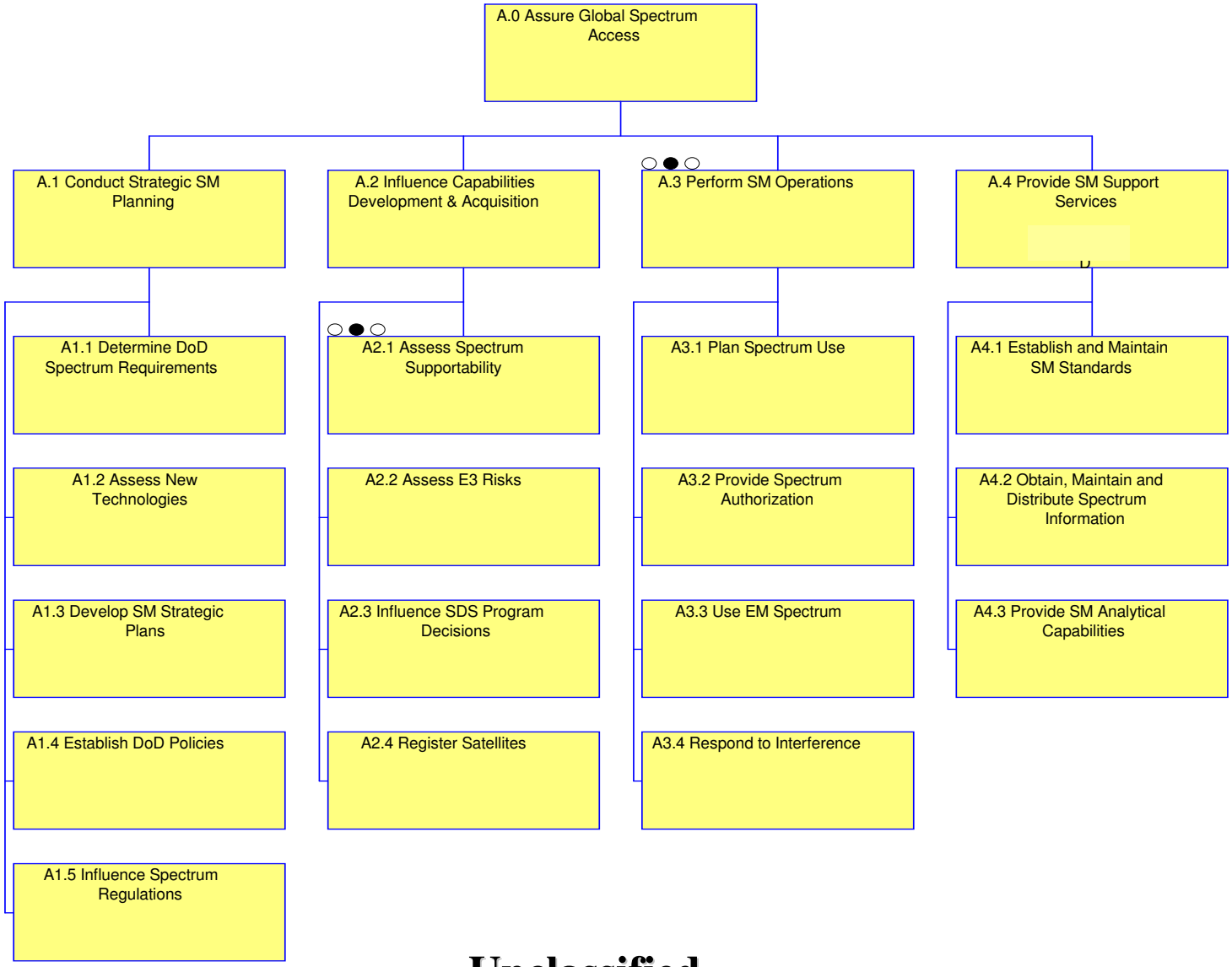


DSMA Efforts To-Date

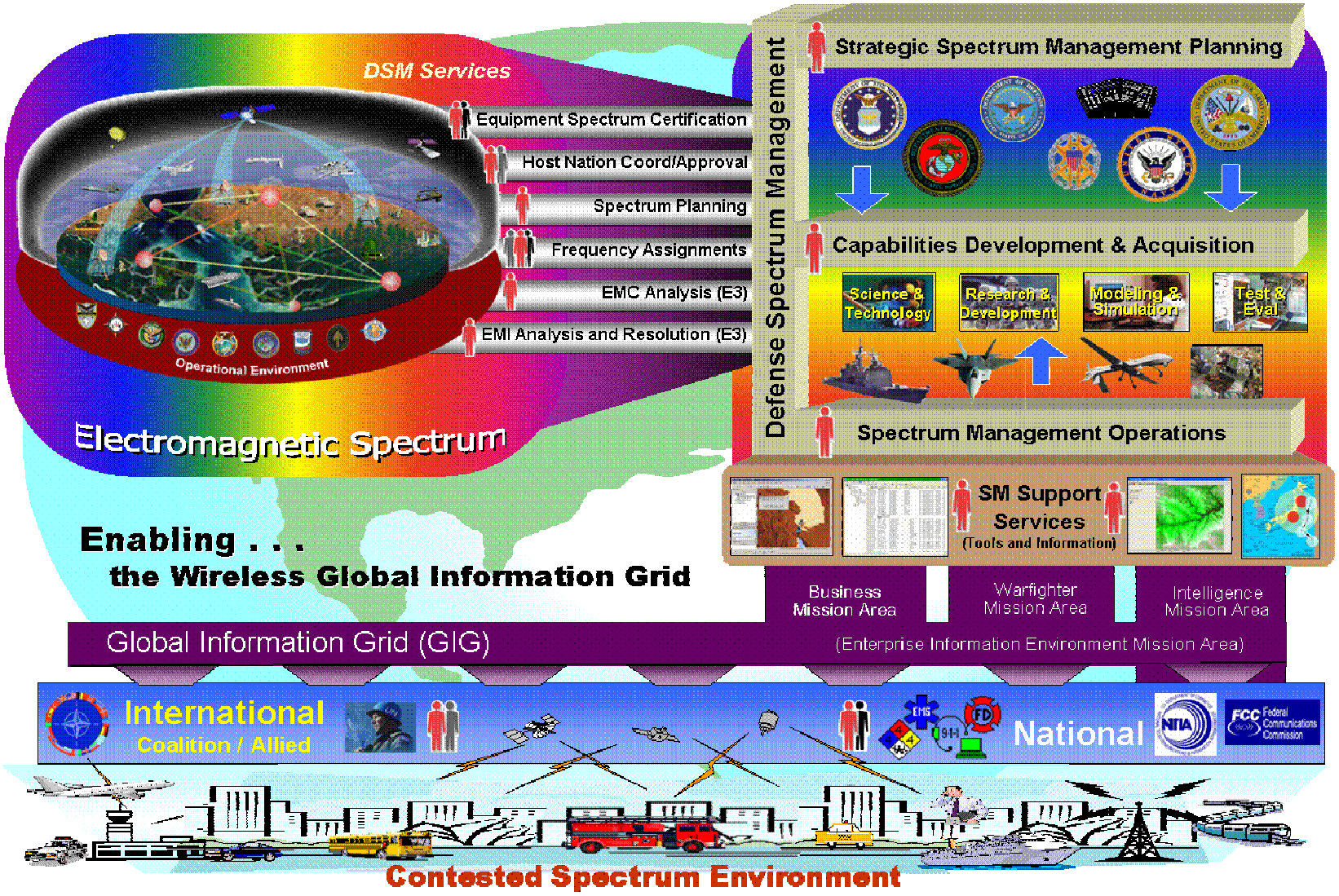
- Development began with monthly working meetings within the Spectrum Management Architecture Permanent Working Group (SMA PWG)
  - 8 Meetings in 1st 6 months
  - Provided domain expert guidance
- DSMA "As-Is (2006)" published in Nov 2006
- DSMA V2.0 published in May 07 – First Set of "To-Be" Views
- DSMA V3.0 "To-Be" architectures and Transition Strategy & Roadmap
  - Presented latest update at workshop in Feb 08
  - Inputs received from participants
  - Will be baselined in June 08
    - Includes full set of products with TS&R and reference documents
    - "Gold Disk" will be provided shortly thereafter



Defense Spectrum Management Operational Activities



Conceptual Graphic for "As-Is" Architecture 2006



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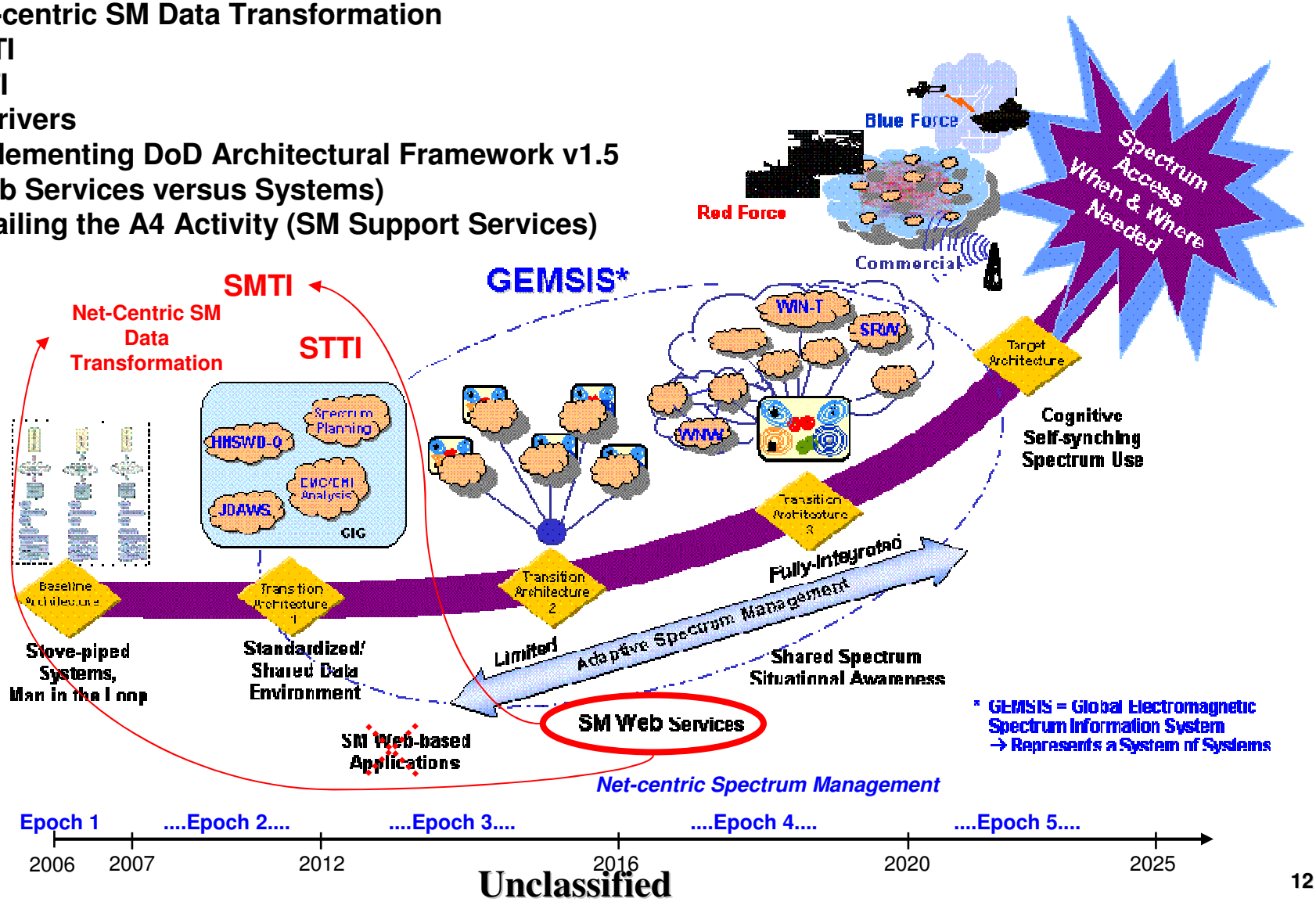
Key Changes to SM Transformation Plan

- Several new initiatives bring capabilities earlier
  - Net-centric SM Data Transformation
  - SMTI
  - STTI
- Other Drivers
  - Implementing DoD Architectural Framework v1.5 (Web Services versus Systems)
  - Detailing the A4 Activity (SM Support Services)



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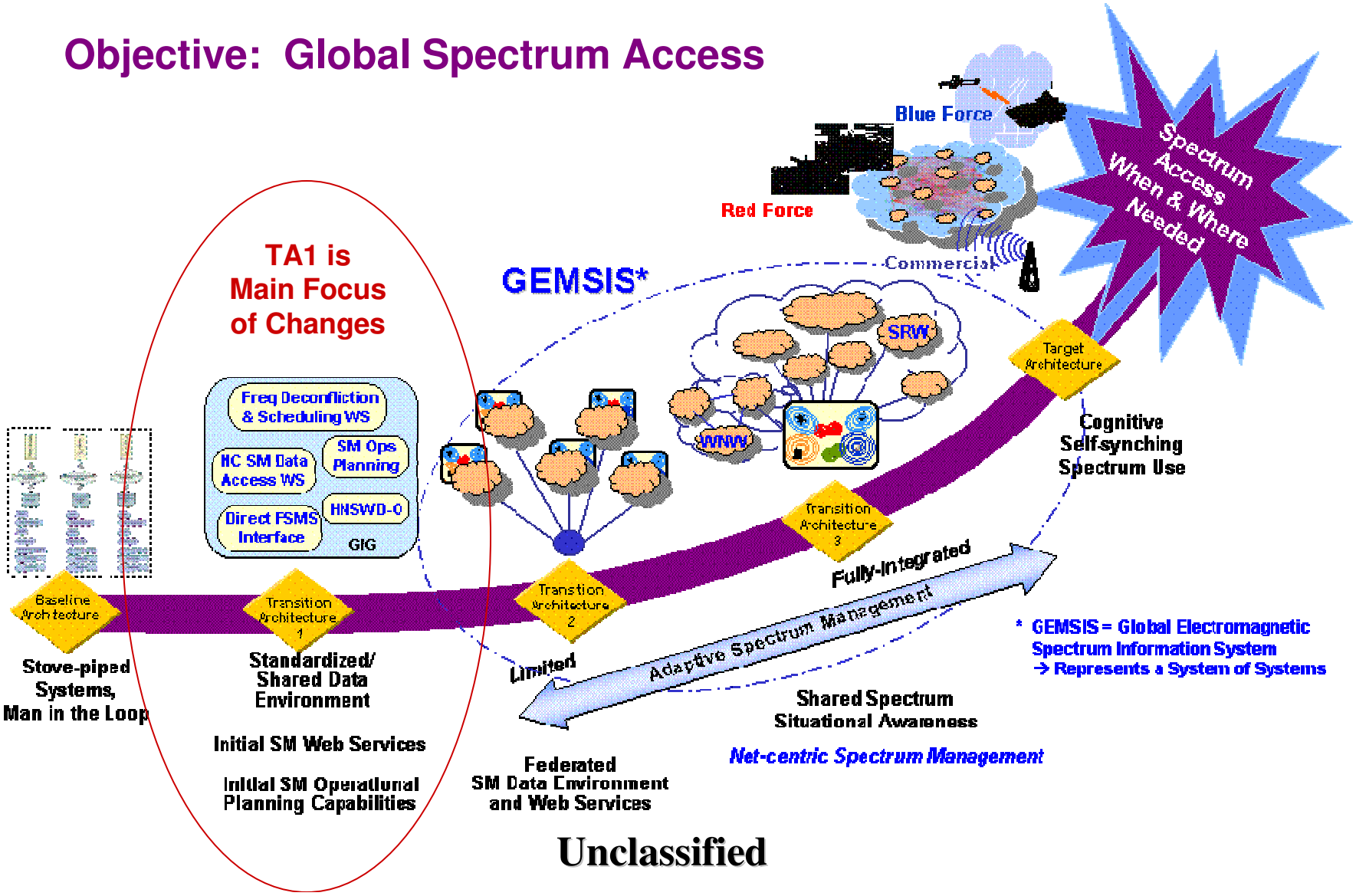
DSMA Draft v3.0 Evolution

Objective: Global Spectrum Access



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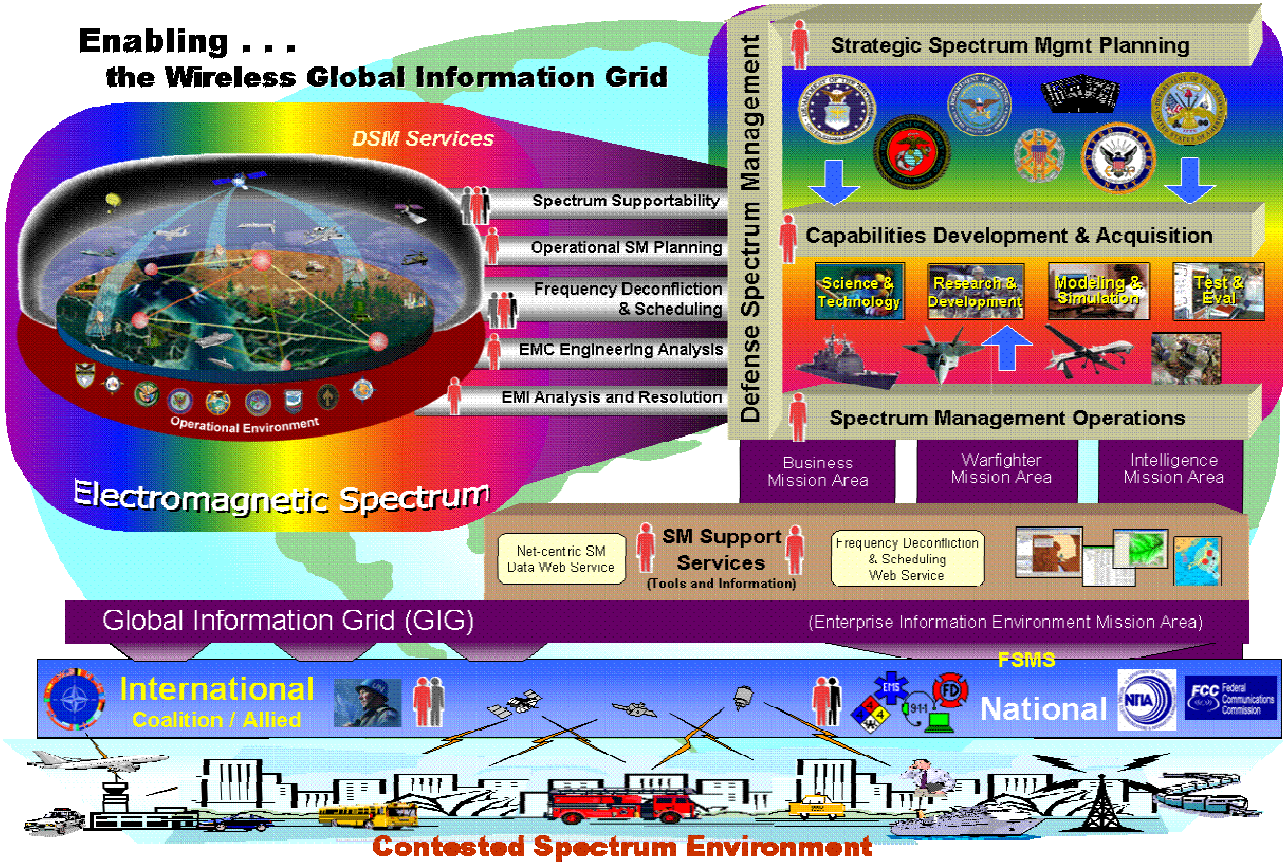
Conceptual Graphic for Transition Architecture 1: 2007-2012

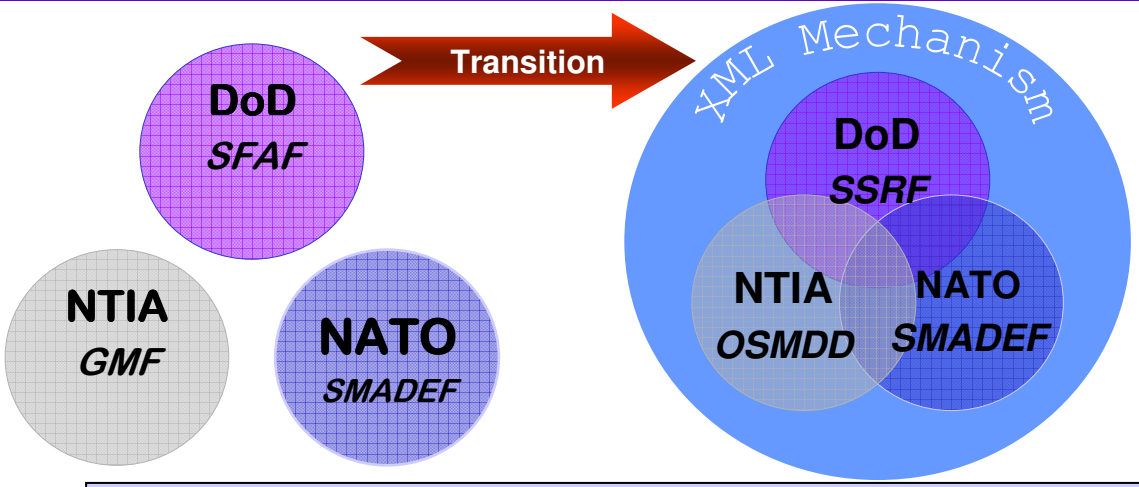


- Standardized Net-centric SM Data Web Service
- Initial integration with NTIA's Federal SM System (FSMS)
- SMTI/STTI Capabilities
- Initial Frequency Deconfliction and Scheduling Web Service
- Initial Operational SM Planning Capability
- Department of Navy SM System

Putting DSMA in Action

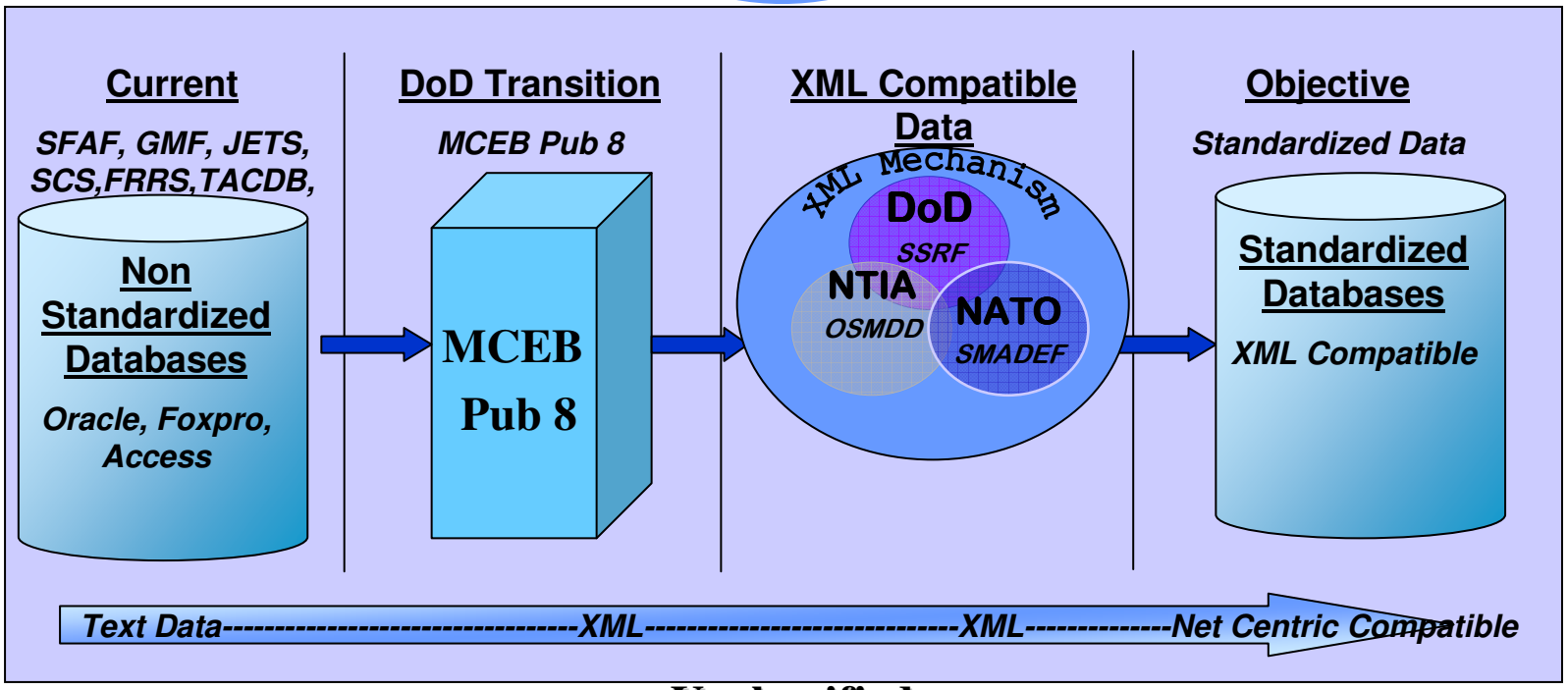
- Community Use
  - Support GEMSIS Activities
  - Support Spectrum Capabilities Advisory Committee
- Registering in the DoD Architecture Registry System
  - Allows for discovery by other architecture projects
- Federating DSMA with other DoD Architectures
  - Documents linkage to other mission areas and functional domains

Data Standardization Overview



Key Forums

- DoD Data Std Work Group
- SMADEF Drafting Group (SDG)
- Data Std Study Group (DSSG)
- Spectrum Operations Permanent Working Group (SOPWG)



Some Abbreviations & Acronyms

- **FRRS** – Frequency Resource Record System
- **GMF** – Government Master File
- **JETS** – JSC Equipment, Tactical, & Space Database
- **MCEB Pub 8** – Military Communications-Electronics Board Publication 8
- **OSMDD** – Office of Spectrum Management Data Dictionary
- **SCS** – Spectrum Certification System
- **SFAF** – Standard Frequency Action Format
- **SMADEF** – Spectrum Management Allied Data Exchange Format
- **SSRF** – Standard Spectrum Resource Format
- **TACDB** – Tactical Database

Net-Centric Data Transformation (NCDT)

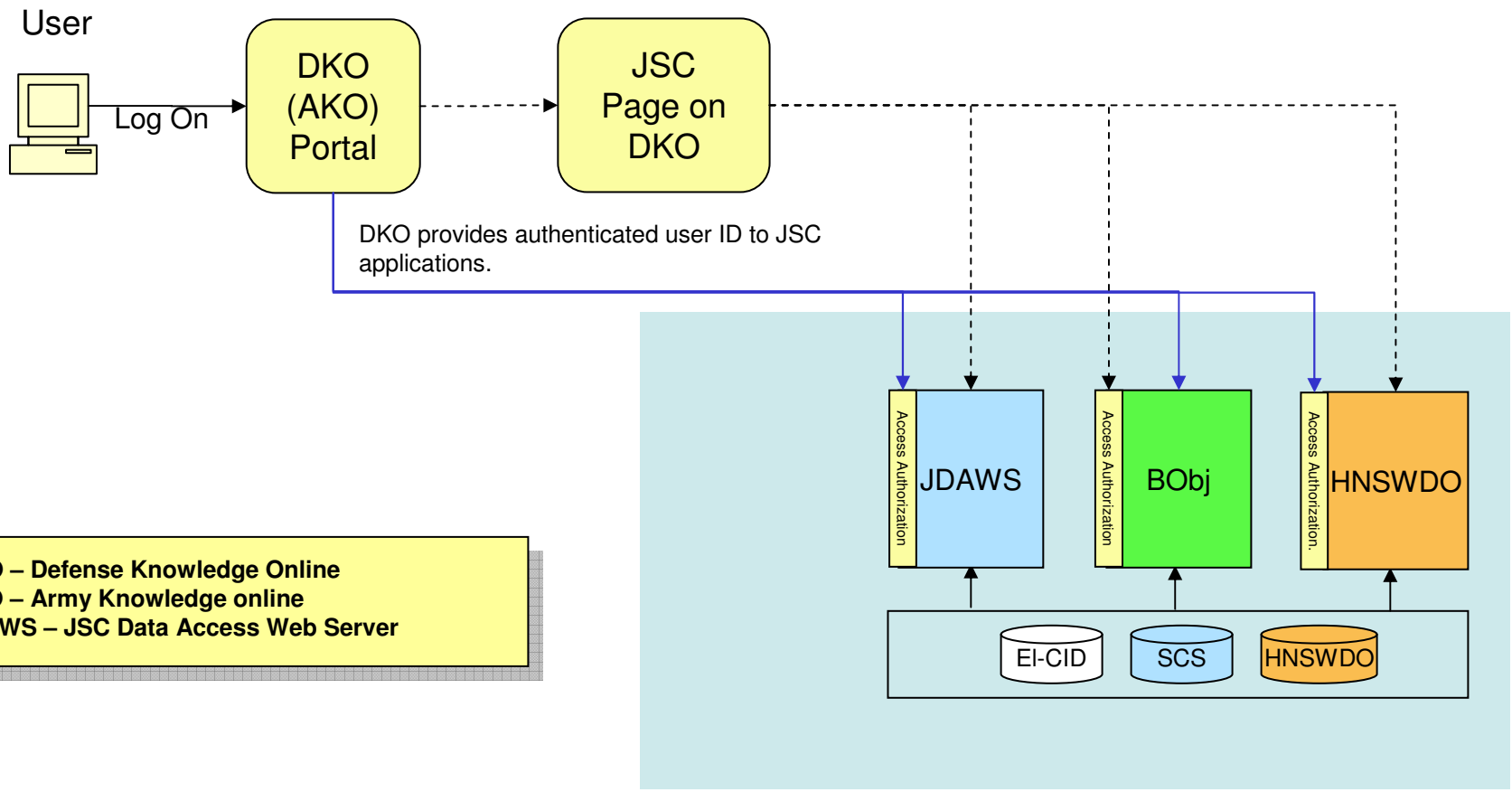
The next foundational step beyond the MCEB Pub 8 data standard is to establish a data repository and begin transforming data and tools.

Under This Effort We Will:

- **Develop a Comprehensive Net-Centric Data Implementation Plan**
- **Establish the initial MCEB Pub 8 compliant data repository**
  - Develop a robust net-centric compatible interface to the repository
    - Register the Pub 8 metadata in the DoD Metadata Registry
    - Map existing databases into the new data repository
    - Develop and register initial services for exposing data
    - Develop initial web interfaces to exploit new services
    - Establish a robust multi-layered security environment
    - Obtain DoD Information Assurance Certification and Accreditation Process (DIACAP) accreditation for repository and services
  - Support the SCS to EL-CID Data Conversion
  - Provide a capability to capture measured data (spectrum analyzer) into repository – CENTCOM Requirement
  - Establish a Net-Centric Data Transformation Development/Testing Environment (required to isolate production and development environments)

This effort will have a significant impact! Legacy tools that use these databases need to transform to use the new Pub 8 data repository!

Near-Term Improvements



DKO – Defense Knowledge Online
AKO – Army Knowledge online
JDAWS – JSC Data Access Web Server

Access Enhancements | HNSWDO | JDAWS | Single Sign-on | Link | XML-Based Protocol

Some More Abbreviations & Acronyms

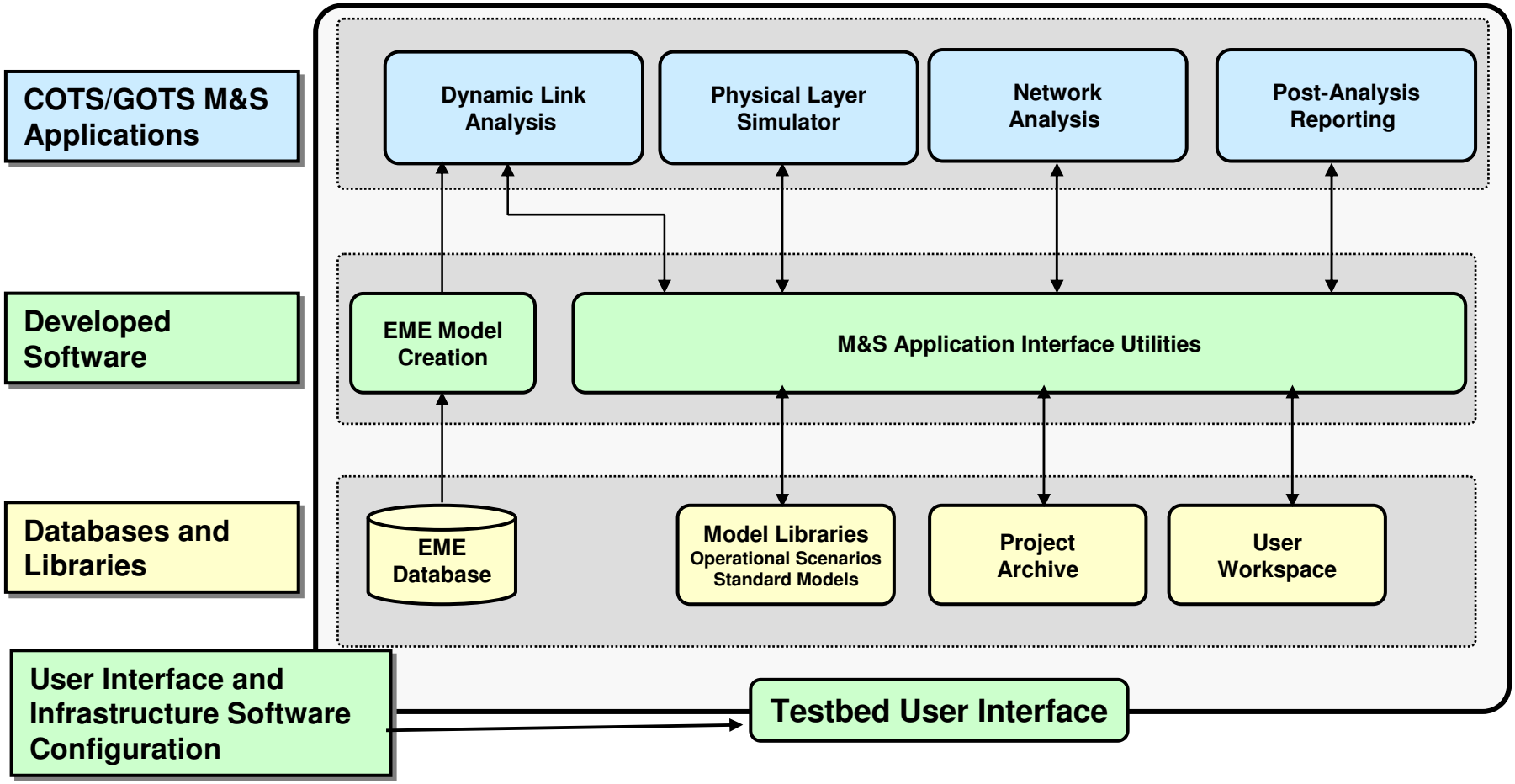
- CEOI – Communications – Electronics Operating Instructions
- COTS – Commercial Off-the-Shelf
- EME – Electromagnetic Environment
- EW – Electronic Warfare
- FSMdb – Federal Spectrum Management Database
- HF – High Frequency
- IFDS – Integrated Frequency Deconfliction System
- GOTS – Government Off-the-Shelf
- JDR – JSC Data Repository
- JRFL – Joint Restricted Frequency List
- JSIR – Joint Spectrum Interference Resolution
- M&S – Modeling & Simulation
- SOA – Service Oriented Architecture
- TRMS – Test Resource Management System
- UDDI – Universal Description Discovery and Integration
- US& P – United States and Possessions

Spectrum Management Transition Initiative

- **Objective:** Provide enhancements and upgrades to automated spectrum management assessment and analysis capabilities to: (1) relocate DoD out of the 1710-1755 MHz to other bands and (2) maximize spectrum efficiency and effectiveness
- SMTI will provide:
  - Improved frequency assignment algorithms
  - Improved user interface
  - Web access
  - Capability to support DoD acquisition of systems in new bands
- Supports DoD transition to the new spectrum data exchange standard

Spectrum Technology Testbed Initiative

- **Objective:** Provide a simulation-based analysis capability that enables evaluation of the operational implications of relocating systems from the 1710 - 1755 MHz band to other bands.



GEMSIS Execution Plan

JCTD

In Progress (CJSMPT)

Spectrum Planning Capability

- Automated capability to analyze CREW and blue force systems
- Capability to rapidly model spectrum use for operational planning
- Revalidating Phase II requirements & timeline
  - Originally scheduled for FY08 completion
  - Impacts JMUA/OT planning and timeline
  - Update to Oversight Group 7 April

POR

(GEMSIS Increment 1)

GEMSIS Increment 1

- Conduct OT&E on JCTD capability
- Develop CPD and SEP
- Sustain capability

(GEMSIS Increment 2)

GEMSIS Increment 2

- Develop Analysis of Alternatives (starting)

- CPD – Capability Production Document
- CREW - Counter Radio Controlled Improvised Explosive Device Electronic Warfare)
- JMUA – Joint Military Utility Assessment
- OT – Operational Test
- SEP – System Engineering Plan

GEMSIS Increment 1

- **HNSWDO**
  - **Presently operational (Version 2.1). Version 3 due July 08.**
  - **Evaluating documentation and testing requirements to support Milestone C**
- **CJSMPT**
  - **CJSMPT revised schedule plans for Joint Military Utility Assessment (JMUA) in Jan 09**
  - **GEMSIS will leverage JMUA to support Milestone C and follow on OT&E.**

ASD(PA&E)* AoA Guidance

- Signed AoA guidance for GEMSIS Increment 2
  - ✓ Examine the cost benefits of reasonable alternatives that satisfies required capabilities
  - ✓ Provide an analytical basis for aiding decision making among the alternatives
  - ✓ Aid decision-makers in judging whether any of the proposed alternative offers sufficient military and/or economic benefit to justify initiating a new program
  - ✓ Satisfy the Clinger-Cohen Act of 1996 requirement that investment in an Information Technology solution provides measurable improvements to DoD performance and to satisfy the requirement of selection 8088(c) of the DoD Appropriations Act, 2003 that an AoA be conducted

* Assistant Secretary of Defense for Program Analysis & Evaluation

dr1

Proposed AoA Way Ahead

- **Maintain momentum forward for enterprise, net-centric solutions effective for warfighter**

- **CJSMPT JCTD limited field assessment identified critical impact of data deficiencies that need to be addressed now**

- **Conduct a phased approach AoA**
  - **Initial Phase (~120 days): Define Data Status Quo and identify possible net-centric data repository strategies and prioritize high value foundational improvements to existing databases**
  - **Final (12-14 months): completed AoA tasking as defined by PA&E guidance signed 21 May 2007**

Initial Phase: Target POM 10

Final AoA Report: Target APOM 11/QDR

Slide 26

dr1 I asked her about the terminology regarding "Phase I/Phase II" or "Phase A/Phase B" with regard to the acquisition terminology. Said she understood completely and they have no preference for what we use in our Study Plan

Debra.Rippey, 2/26/2008

GEMSIS Capabilities

Capabilities	GEMSIS Increment 1	GEMSIS Increment 2 and Beyond (Notional)
End-to-End Spectrum Supportability	✓ HNSWDO	✓ Near-Term Improvements
Software Definable Radio Waveform Spectrum Management Support		
End-to-End Frequency Assignment		✓ SMTI Capabilities ?
Strategic Spectrum Management Planning		
Modeling and Simulation for Mission Planning and Rehearsal	✓ CJSMPT	
Modeling and Simulation for Acquisition		✓ STTI Capabilities ?
Spectrum Transformation to GIG/Net-centric Environment		✓ Pub 8, NCDT

- All capabilities are in the JROC approved GEMSIS ICD.
- SMTI and STTI capabilities support the relocation of DoD systems from 1710 -1755 MHz. These capabilities could be reused in GEMSIS

Summary

- **DISA is taking cooperative steps now to improve spectrum operations with an eye to integrating those capabilities in GEMSIS.**
  - **DSO activities**
    - **Developing an architecture for DoD spectrum management**
    - **Supporting development of a common XML data standard for spectrum information**
    - **Transforming and deploying web services for spectrum data**
    - **Building components to support the relocation of spectrum use that will be reusable for next generation frequency assignment and M&S capabilities.**
  - **GEMSIS (PEO-STS)**
    - **Increment 1 - Sustaining CJSMPT and HNSWDO**
    - **Increment 2 - Initiating an AoA (DISA Strategic Plans & Information)**


SPECTRUM
The Transformation has Begun …

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