



# Air Force Materiel Command

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**Capability-Driven System  
of System Engineering  
(SoSE) Process & MS&A  
Considerations &  
Recommendations  
NDIA SE Conference  
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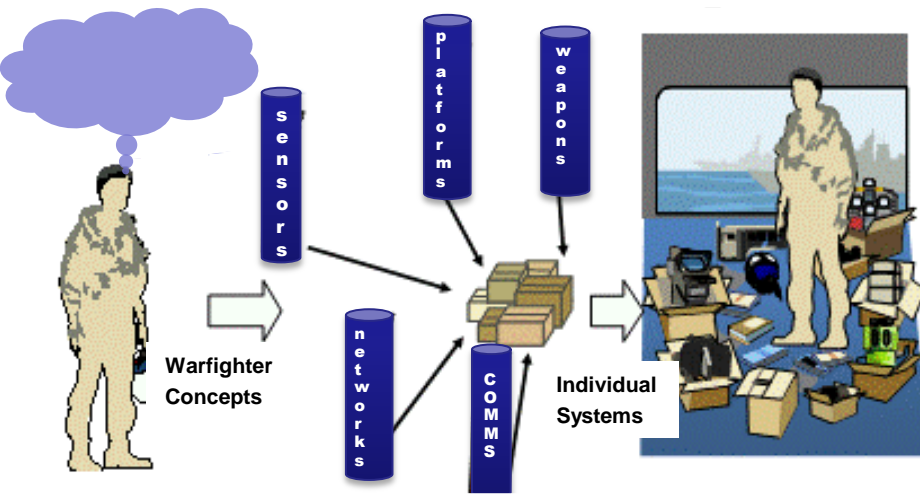
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***Integrity ★ Service ★ Excellence***

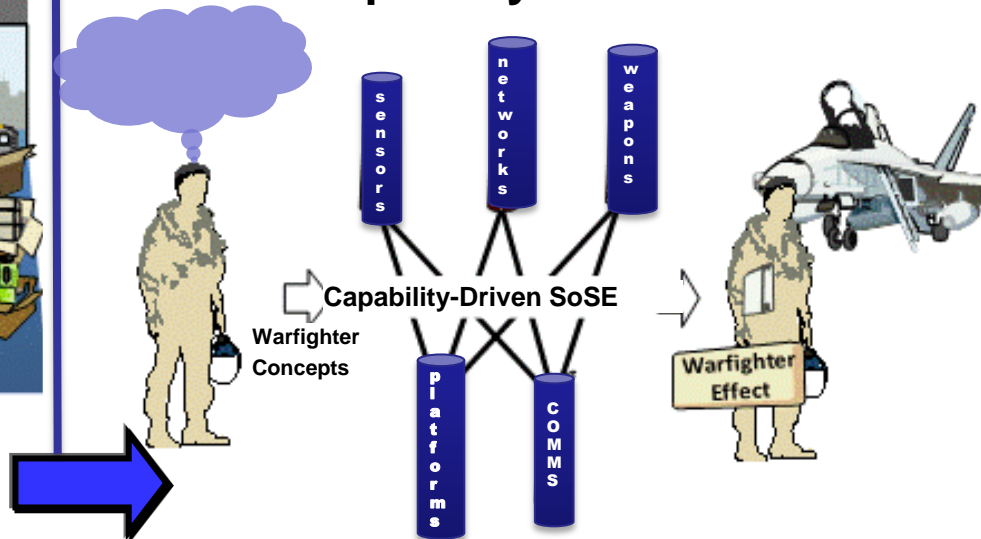


- “We fight like we train and we build like we’re organized”
- We are NOT organized to procure mission capabilities!
- By law we procure pieces and parts not necessarily warfighting capability

## Without Capability-Driven SoSE



## With Capability-Driven SoSE



**Develop Processes and Governance to Ensure Mission Effectiveness and Cost are Quantified Early in the Life Cycle**



# Systems of Systems

**SoS: A set or arrangement of systems that results when independent and useful systems are integrated into a larger system that delivers unique capabilities**

## Types of SoS

**Directed:** SoS objectives, management, funding and authority; systems are subordinated to SoS

**Acknowledged:** SoS objectives, management, funding and authority, however systems retain their own management, funding and authority in parallel with the SoS

**Capability Driven Approach**

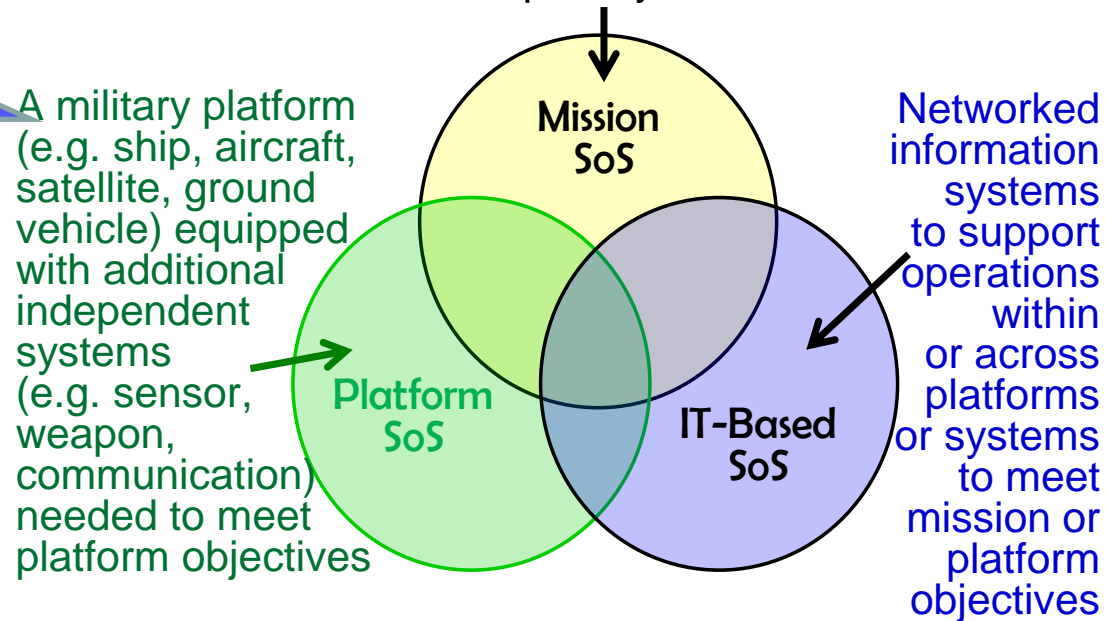
**Collaborative:** No top down objectives, management, authority, responsibility or funding at the SoS level; Systems voluntarily work together to address shared or common interest

**Today's Policy Driven approach**

**Virtual:** Like collaborative, but systems don't know about each other

## SoS Domains

Sets of systems working together to provide a broader capability or mission





# DoD SoS Domains

F-22 Raptor



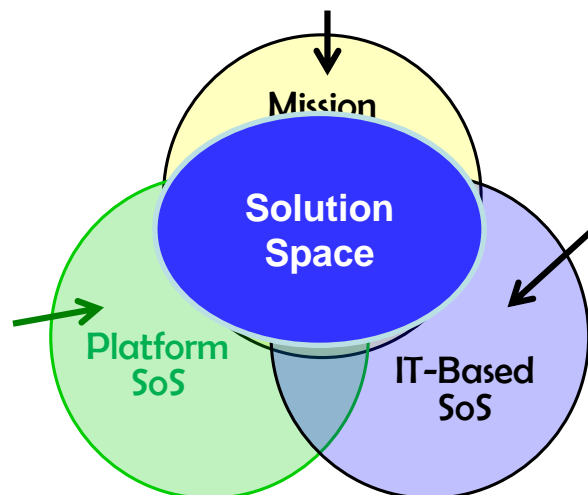
## Platforms

A military platform (e.g. ship, aircraft, satellite, ground vehicle) equipped with independent systems (e.g. sensor, weapons, communications) needed to meet platform objectives

OCA/DCA/SEAD/etc  
...In a realistic environment

## Missions

Sets of systems working together to provide a broader capability or mission



## Air Operations Center



## Information Technology

Networked information systems to support operations within or across platforms or systems to meet mission or capability objectives



# Approach

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- ✓ **Baseline current systems engineering processes in use, and current policy directives (As Is)**
- ✓ **Survey potential SoS engineering processes within AFMC, AFSPC, DoD, other Services, and industry that address mission effectiveness in a SoS environment**
- **Develop SoSE strategy/process to assess operational effectiveness and LCC (< 5000.02 starts)**
- **Pilot process with selected capability gaps and multiple use case scenarios**
- **Identify DOTmLPF changes from AS IS needed to implement the new process**



# SoSE Team Findings (AS-IS)

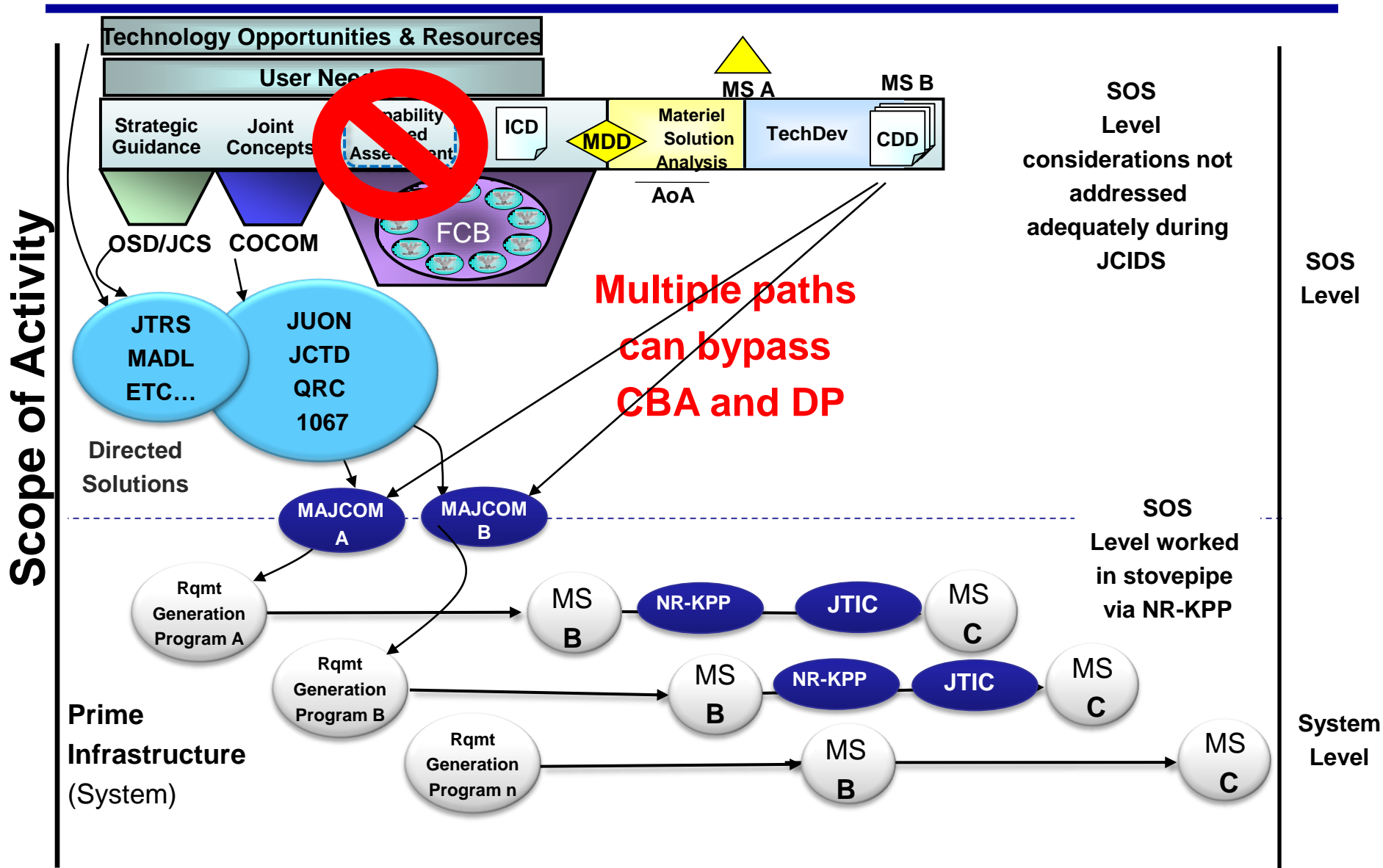
- No systematic Capability-driven process exists to transform Mission-specific capability gaps and Concepts of Employment into SoS capability requirements that can be allocated down to system level platforms, sensors, weapons, networks, etc...
- There is resistance to invest MS&A tools to:
  - Inform both requirements & acquisition decision makers on warfighting capability gaps with credible performance data
    - Quantify mission effectiveness improvements providing defensible POM positions (Provides Cost Benefit)
    - Perform interoperability assessments prior to MS-C production decisions (true interoperability)

*Need a means to ensure systems are integrated to deliver the required capability and LCC is known*





# As-Is Requirements Development Environment Limited or No "SoS Mission Based Assessments"

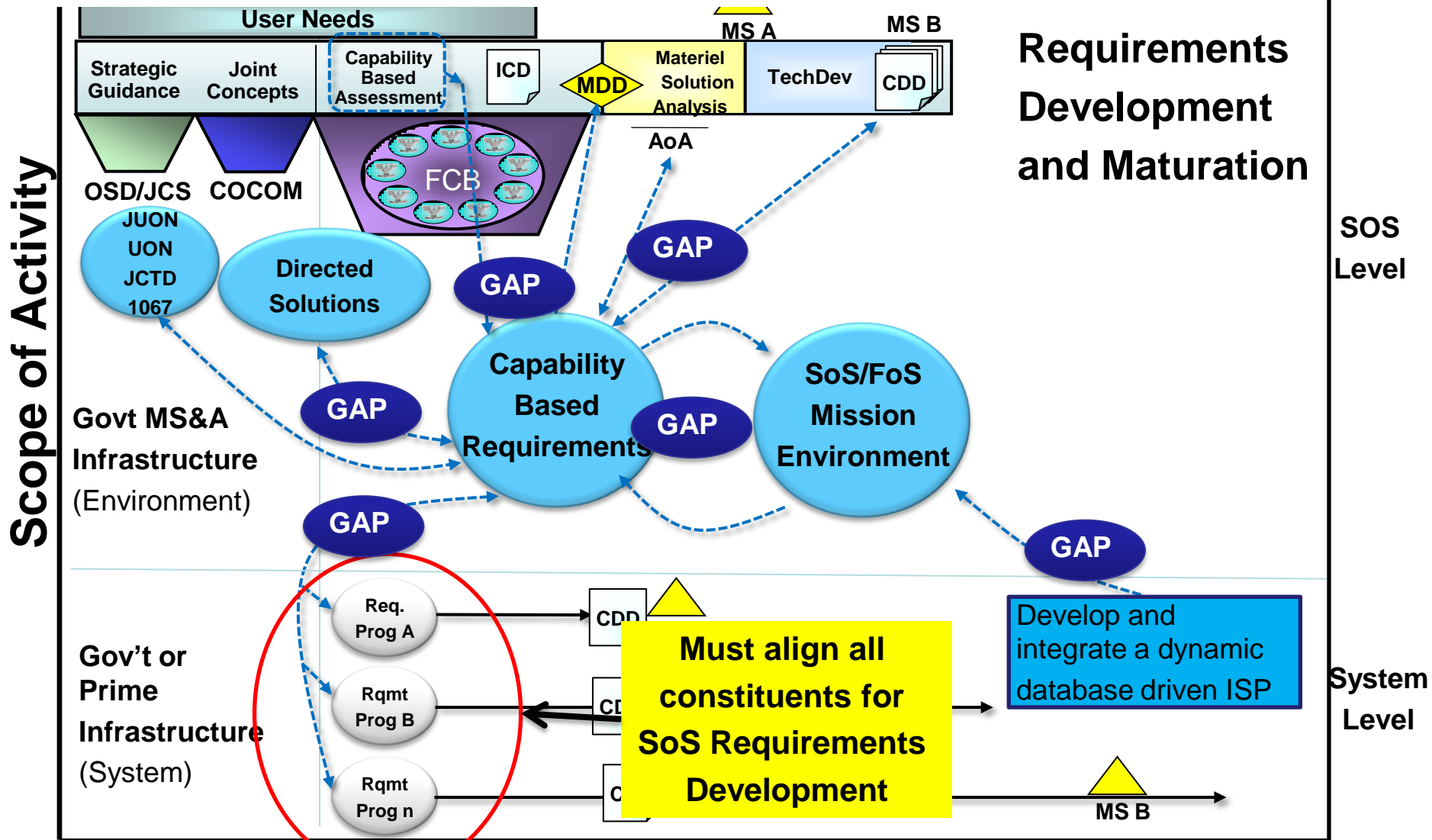




# Notional Requirements Way Forward

## Develop More Critical SL Reviews with Defined Criteria in JCIDS

### Instill SoSE Analysis and Assessments in DP processes

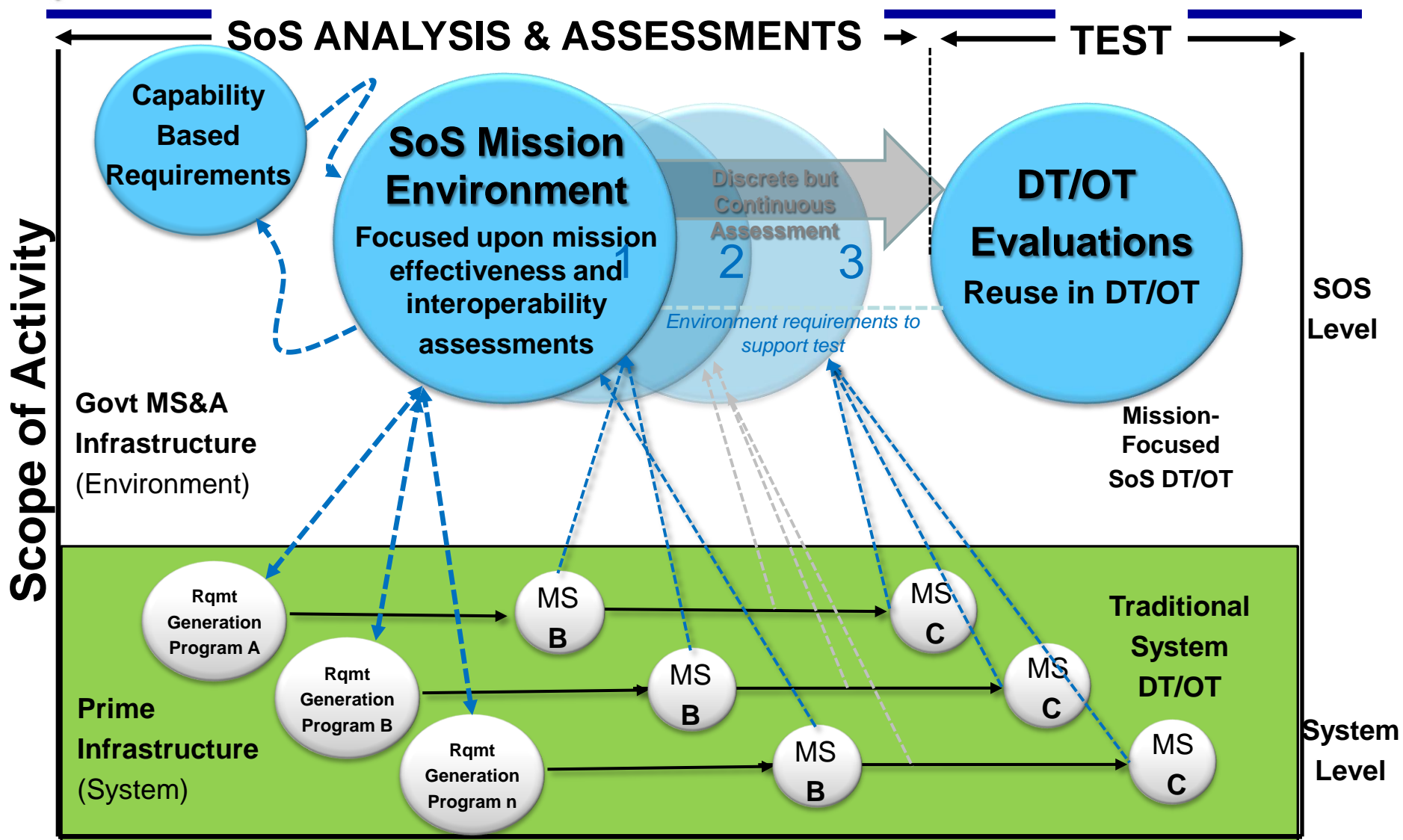






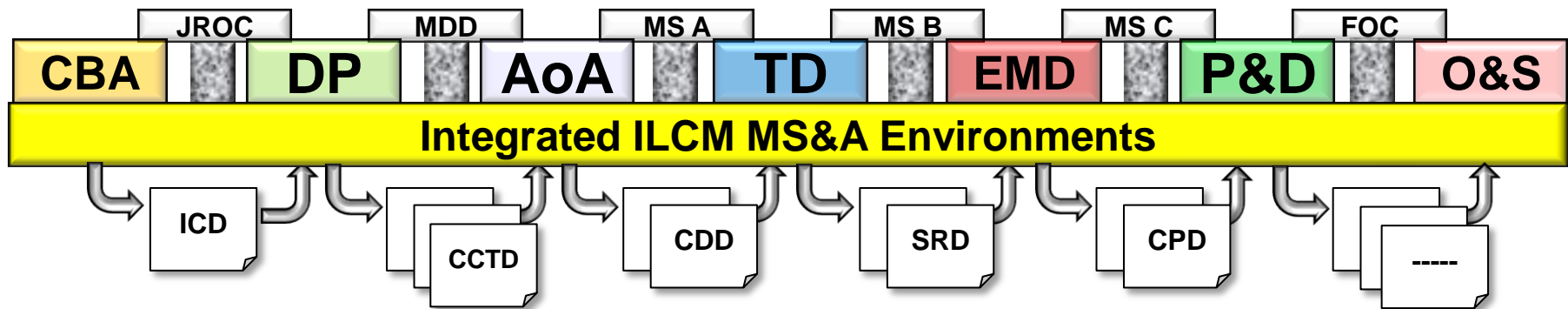
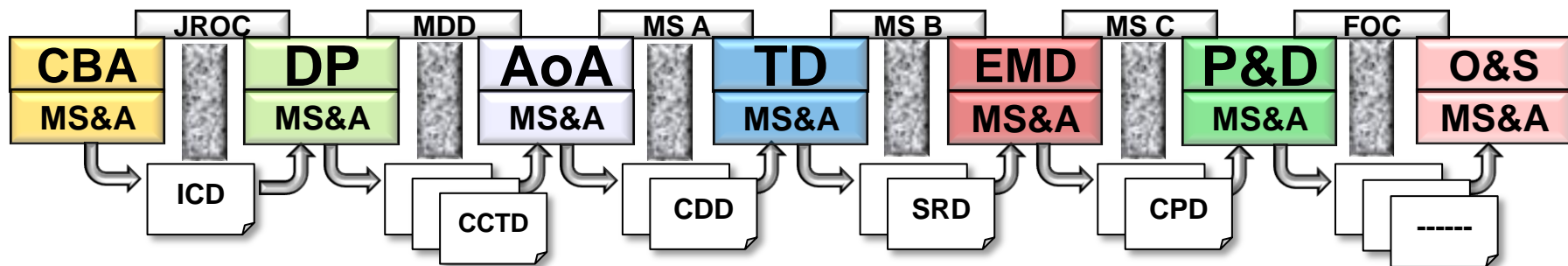
# Notional To-Be Analysis/Test Concept

Moving towards a “SoS Mission Based” Philosophy





# Strategically Move to an Integrated Weapon System Life Cycle MS&A Process





# Way Forward

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- Develop and Execute Pilot
- Brief appropriate results to NDIA when complete
- Engage Industry Stakeholders





# Current Team

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## Advisory

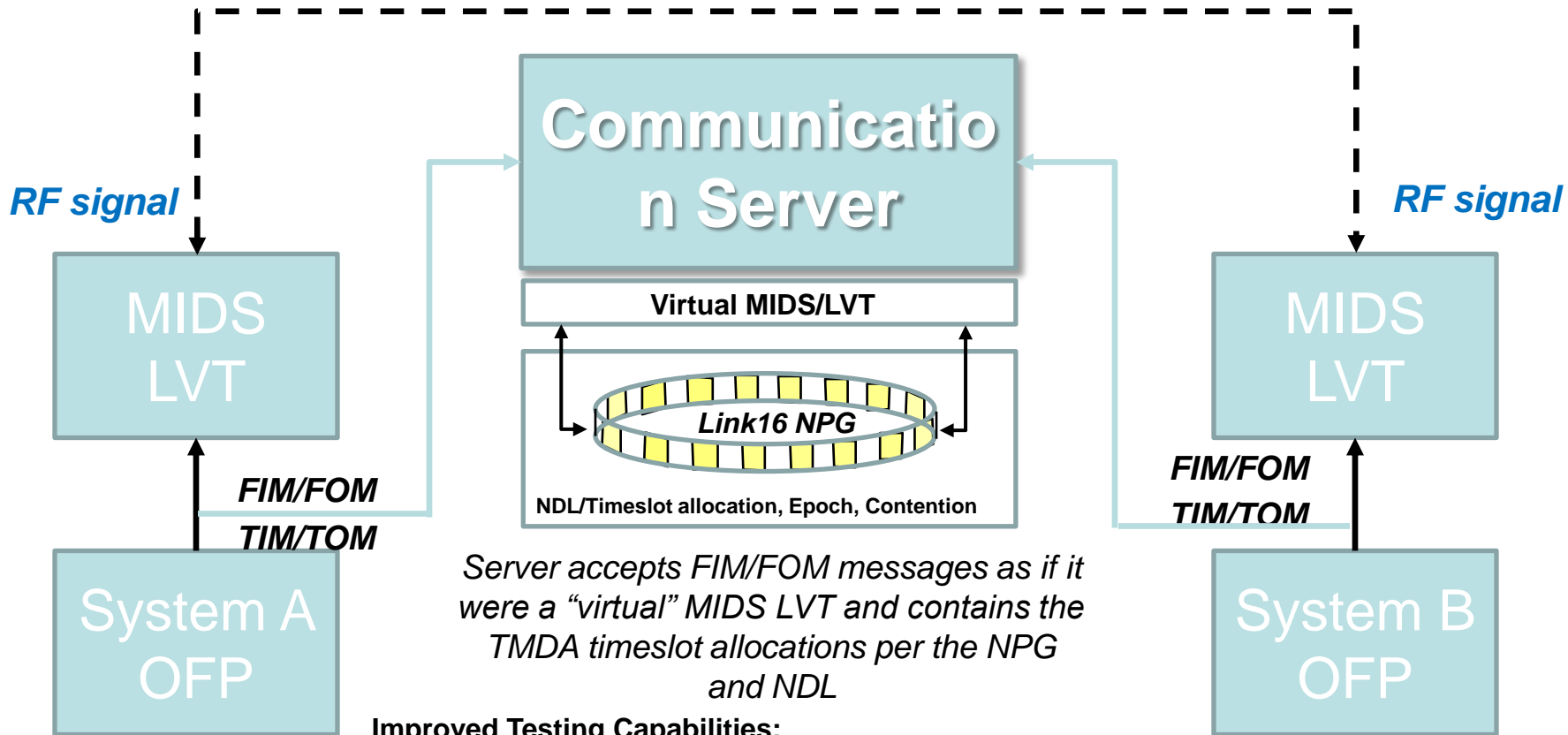
- AFMC/EN
- AFLCMC/EN: (Avionics/SL)
- OSD-ATL
- AFLCMC/EN (Eglin OL)
- AFLCMC/EN (Hanscom OL)
- WFI Council of Colonels (CoC)

## Working level

- AFMC/EN (Lead)
- AFLCMC/EBMS (Eglin OL)
- AFLCMC/EZA (W-P OL)
- AFLCMC/XZS (W-P OL)
- MITRE (Hanscom OL)
- SMC/EN
- ACC/AFC2IC/C2N
- ACC/A8W
- MIT LL
- HAF/A5RI
- AFLCMC/WI
- AFMC/A2



# NRKPP Distributed Communication Server Desired End State



## Improved Testing Capabilities:

- Supports Message Compatibility (tested today)
- Models Network Performance to support mission thread
- Ability of OFP to process, display, respond appropriately
- Network Timing to assess IERS in a mission thread under a network load
- QoS, NPG, NDL, Crypto Nets, Time Slot Blocks, Time Slot #s,...

Augment existing NRKPP! Assess critical message exchanges within the mission thread!





# Potential Approach for SoSE Governance

Build upon existing SE foundation (System-level SE Processes), augmented with minimal set of “new” SoSE-specific processes

