Air Force Materiel Command

Capability-Driven System of System Engineering (SoSE) Process & MS&A Considerations & Recommendations NDIA SE Conference

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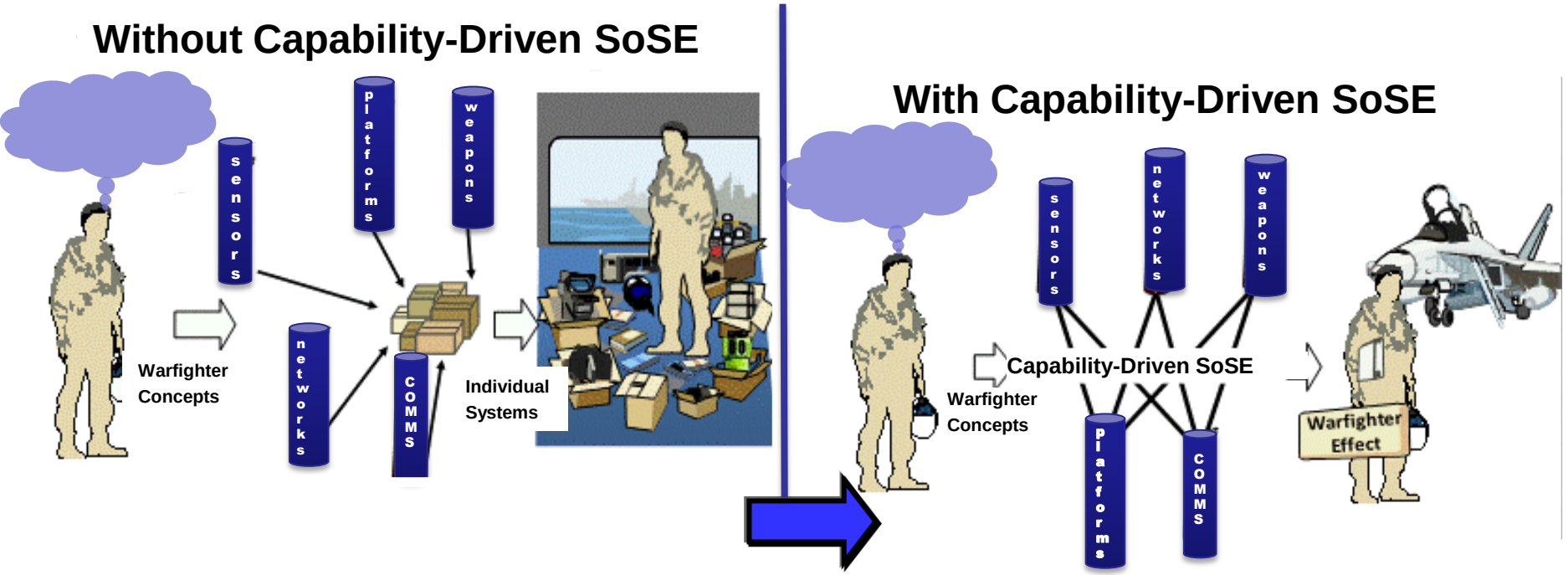
AF SoSE Team
Lead: Mitch Miller
Chief Architect
HQ AFMC/EN
937-257-5245

BLUF

- "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



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

Ref: Navy HICAP Brief

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

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

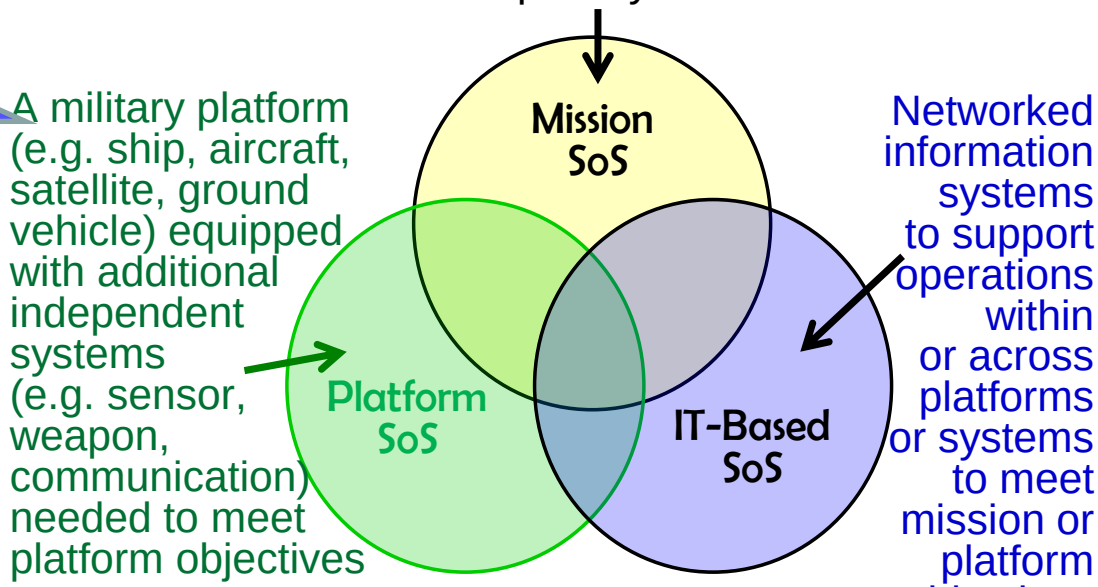
Virtual: Like collaborative, but systems don't know about each other

Capability Driven Approach

Today's Policy Driven approach

SoS Domains

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



DoD SoS Domains

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

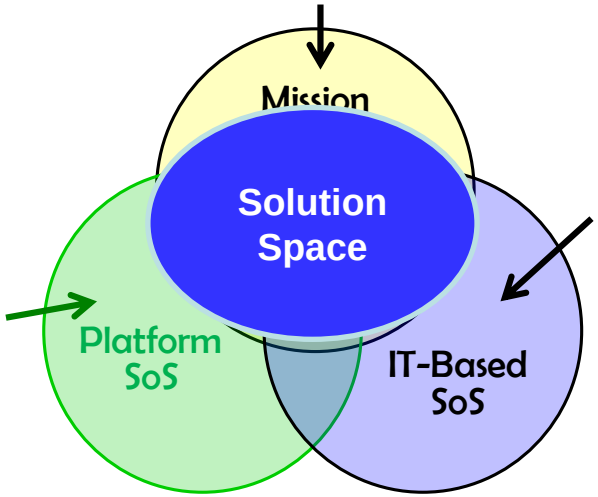
F-22 Raptor

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

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

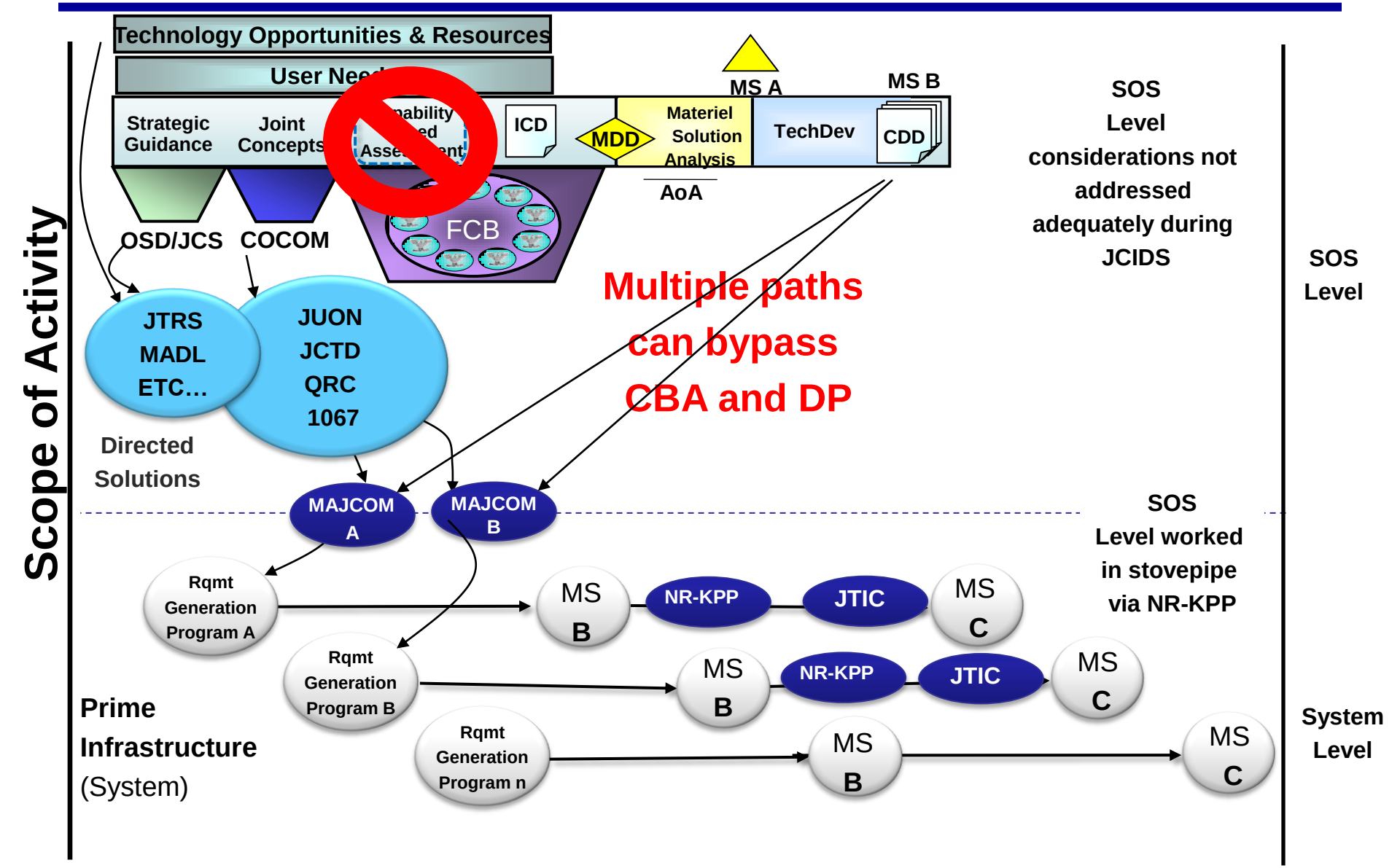
- ✓ Baseline current systems engineering processes in use, and current policy directives (As Is)
- ✓ Survey potential SoS engineering processes within AFMC, AFSPC, DoD, other Services, and industry that address mission effectiveness in a SoS environment
- • Develop SoSE strategy/process to assess operational 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 defendable 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

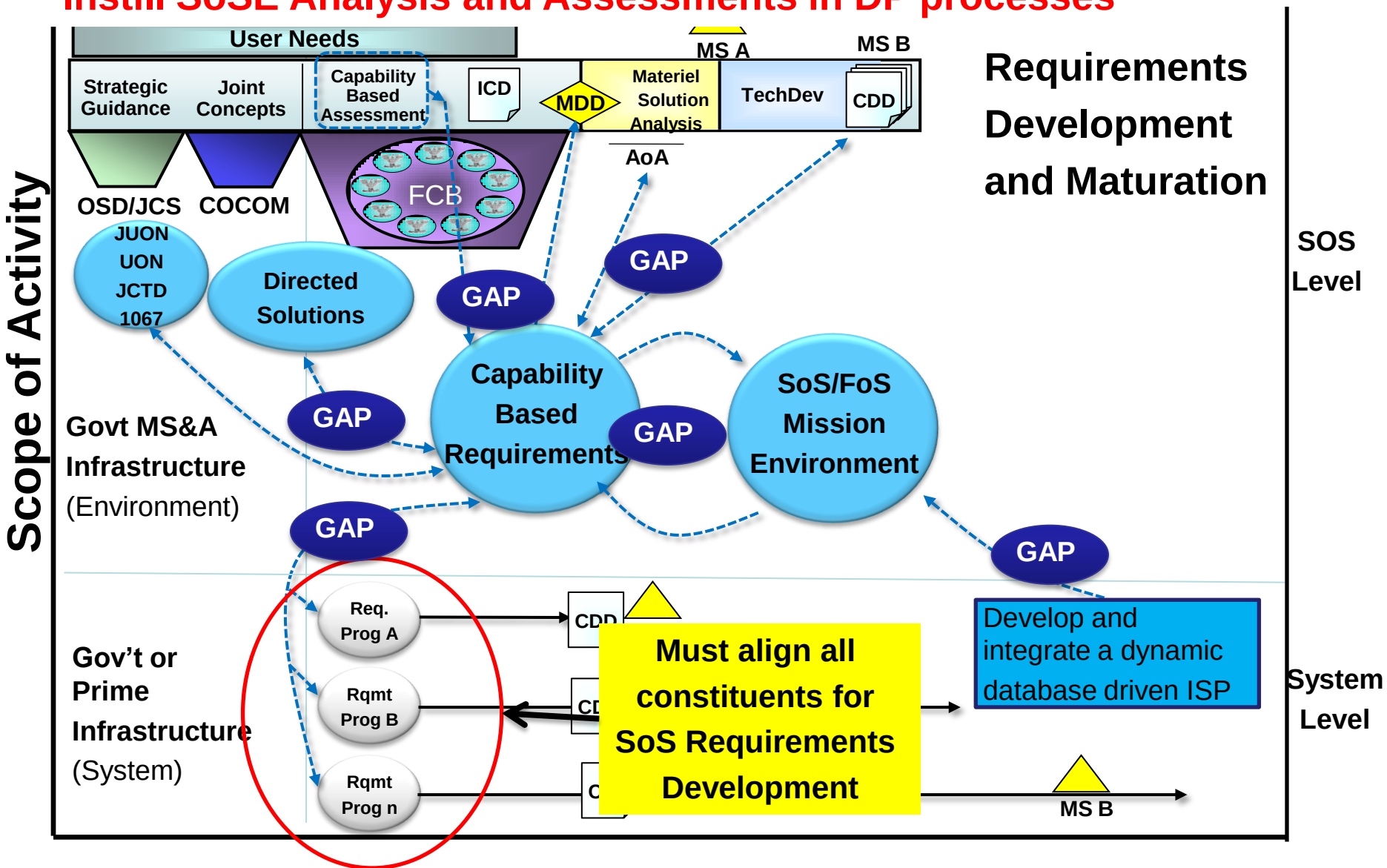
As-Is Requirements Development Environment
Limited or No "SoS Mission Based Assessments"



Notional Requirements Way Forward

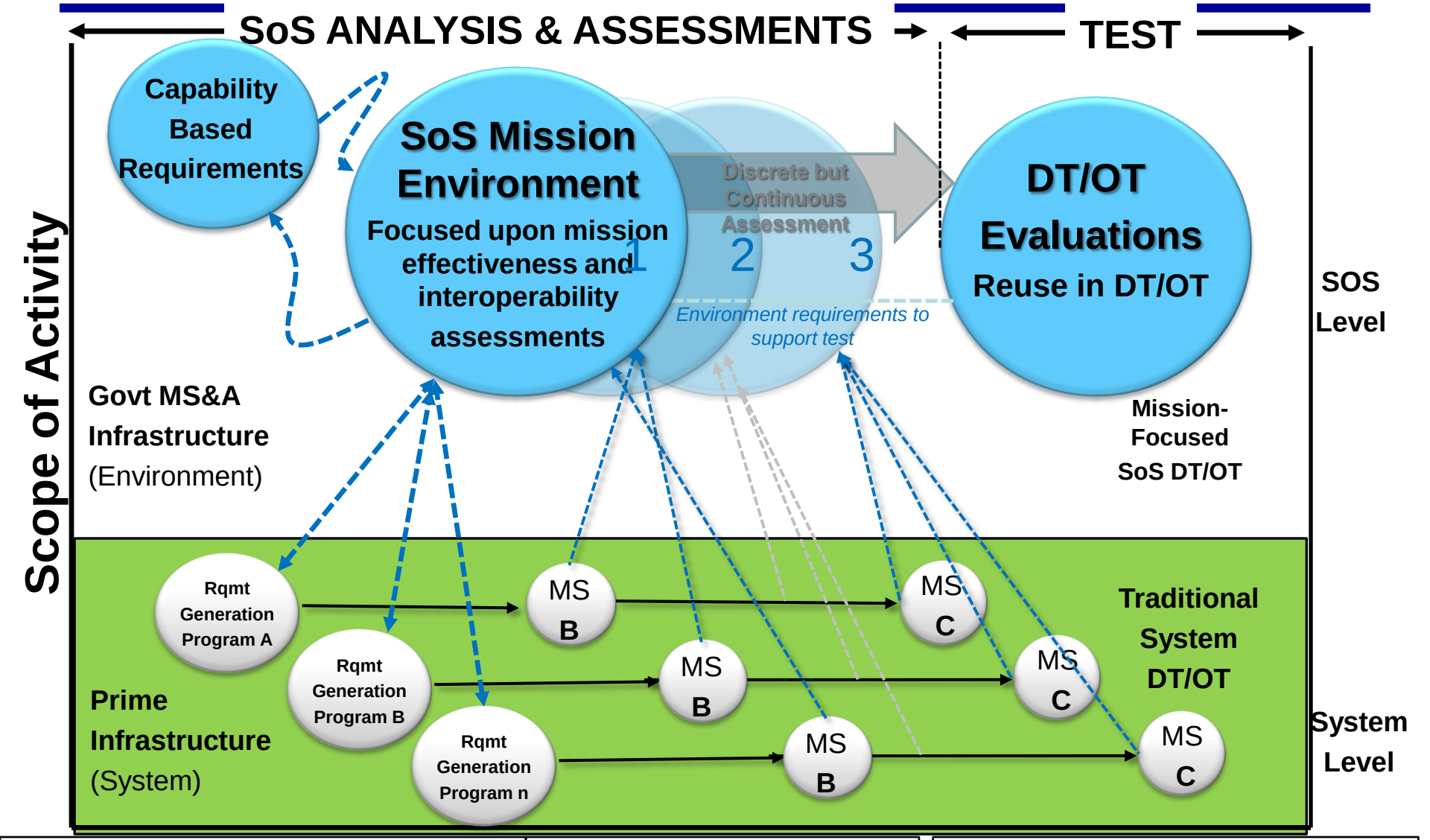
Develop More Critical SL Reviews with Defined Criteria in JCIDS

Instill SoSE Analysis and Assessments in DP processes



Notional To-Be Analysis/Test Concept

Moving towards a "SoS Mission Based" Philosophy

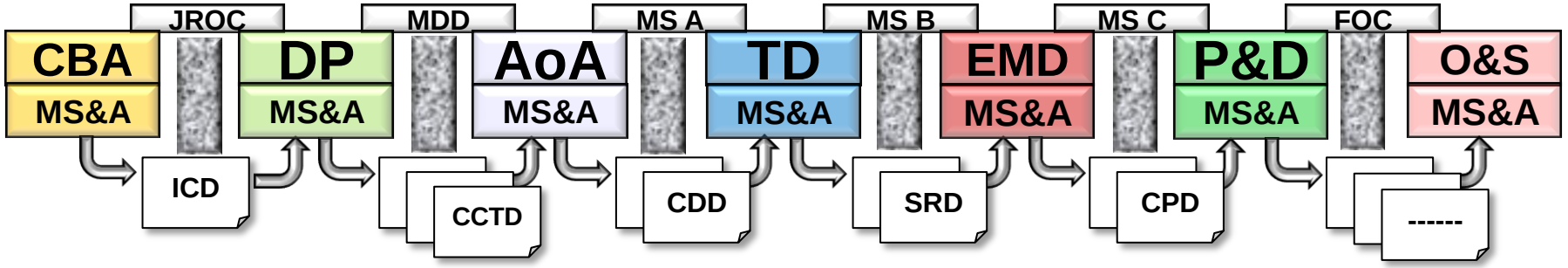


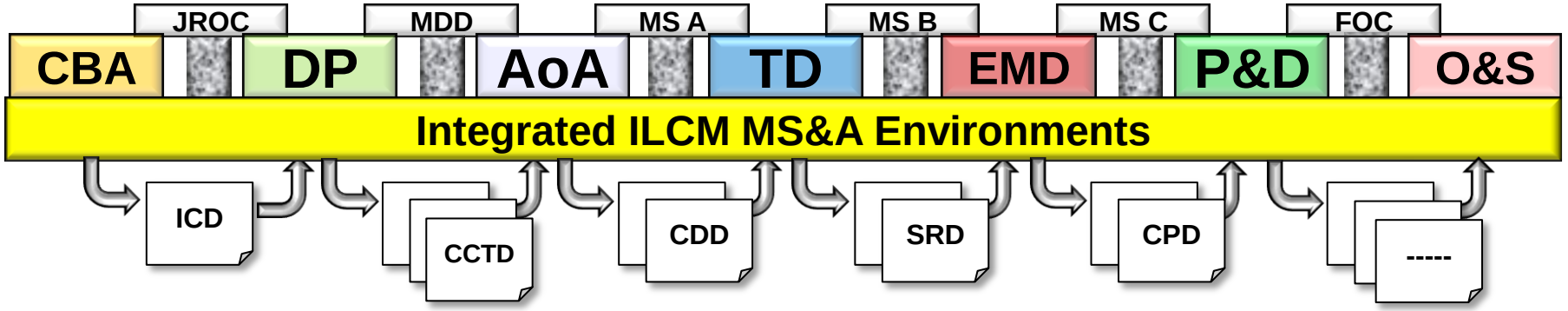
Today's Process & Infrastructure
Tomorrow's needed Process & Infrastructure

Execution Time →

Programs are largely in independent development paths using "isolated" IER/NR-KPP solutions

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





Way Forward

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


LEADING EDGE TECHNOLOGY
WORLD CLASS SUSTAINMENT
WAR-WINNING SYSTEMS

Current Team

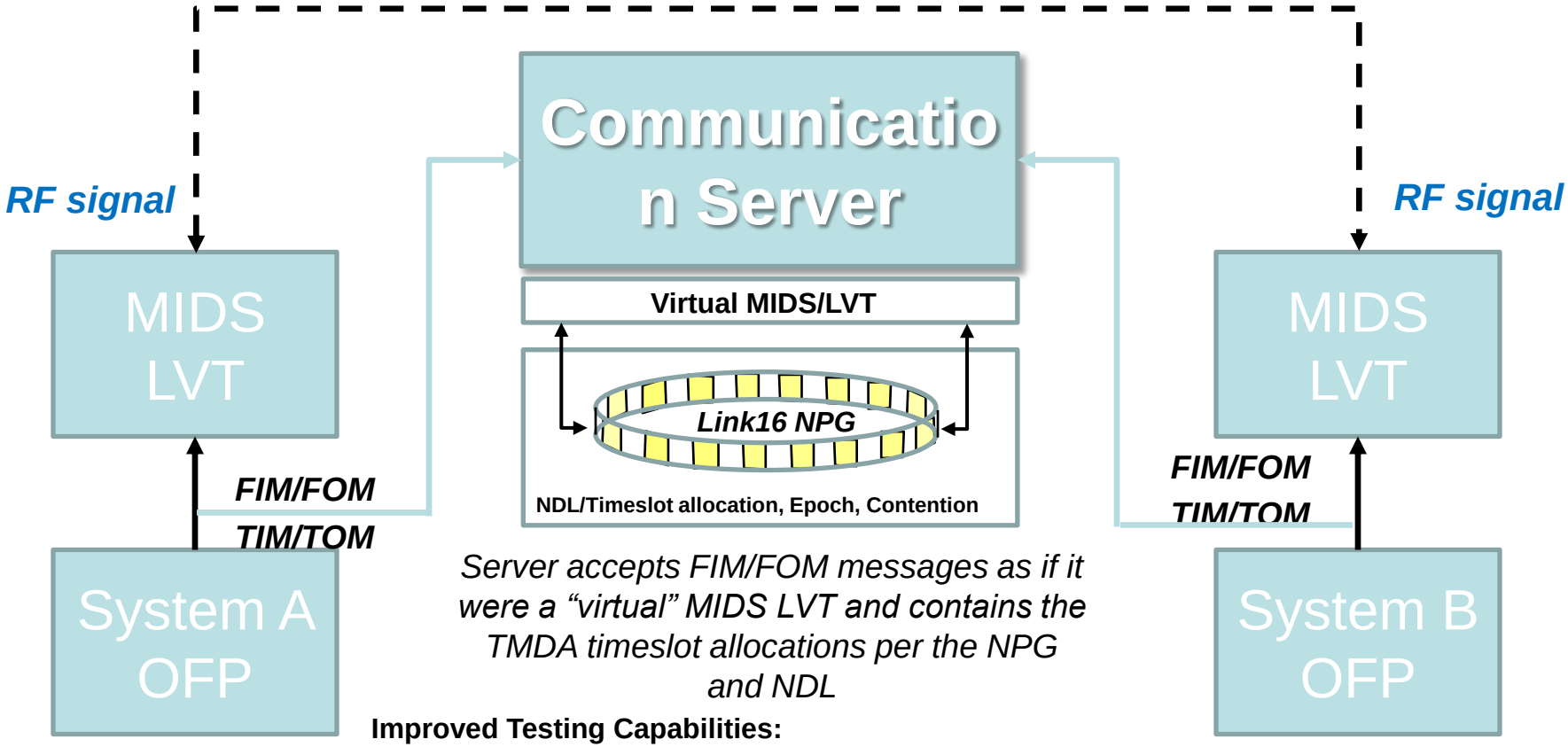
Advisory

- 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



Server accepts FIM/FOM messages as if it were a "virtual" MIDS LVT and contains the TMDA timeslot allocations per the NPG and NDL

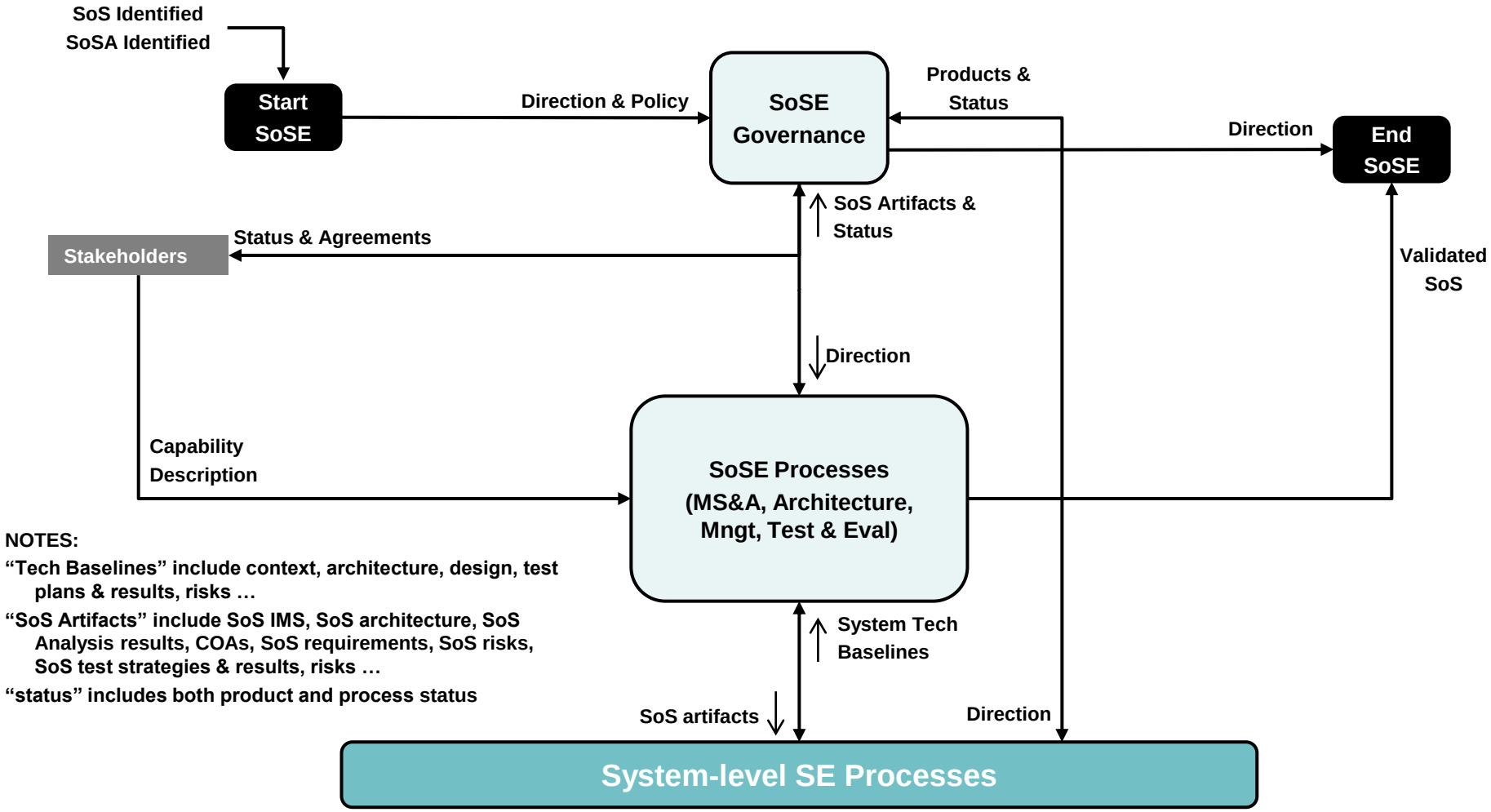
Improved Testing Capabilities:

- **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



NOTES:

"Tech Baselines" include context, architecture, design, test plans & results, risks …

"SoS Artifacts" include SoS IMS, SoS architecture, SoS Analysis results, COAs, SoS requirements, SoS risks, SoS test strategies & results, risks …

"status" includes both product and process status