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# Addressing Navy Information Technology Technical Authority through System of Systems Engineering & Integration

**26 September 2013**


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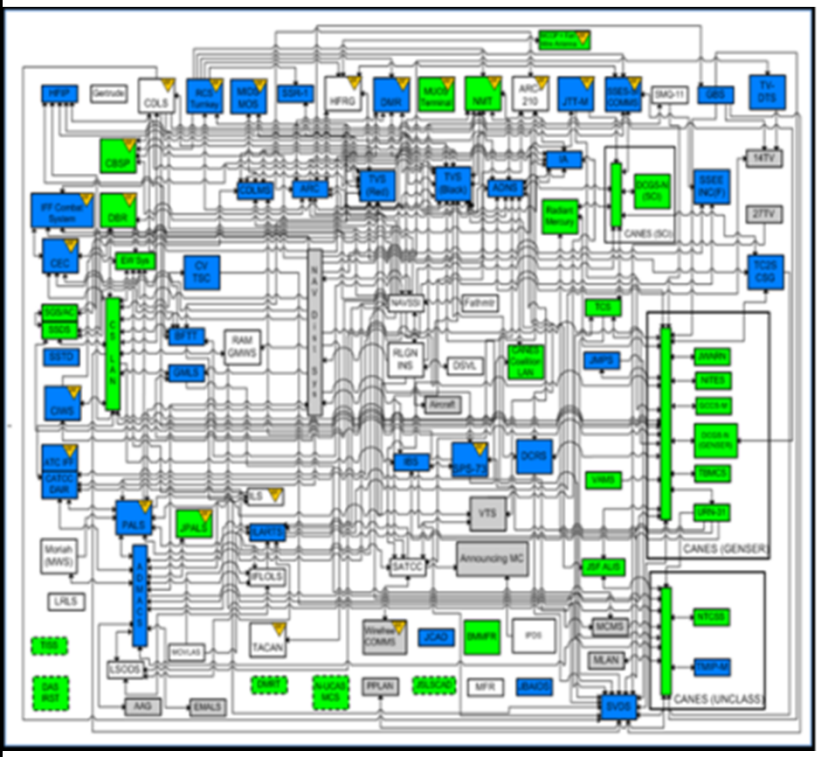
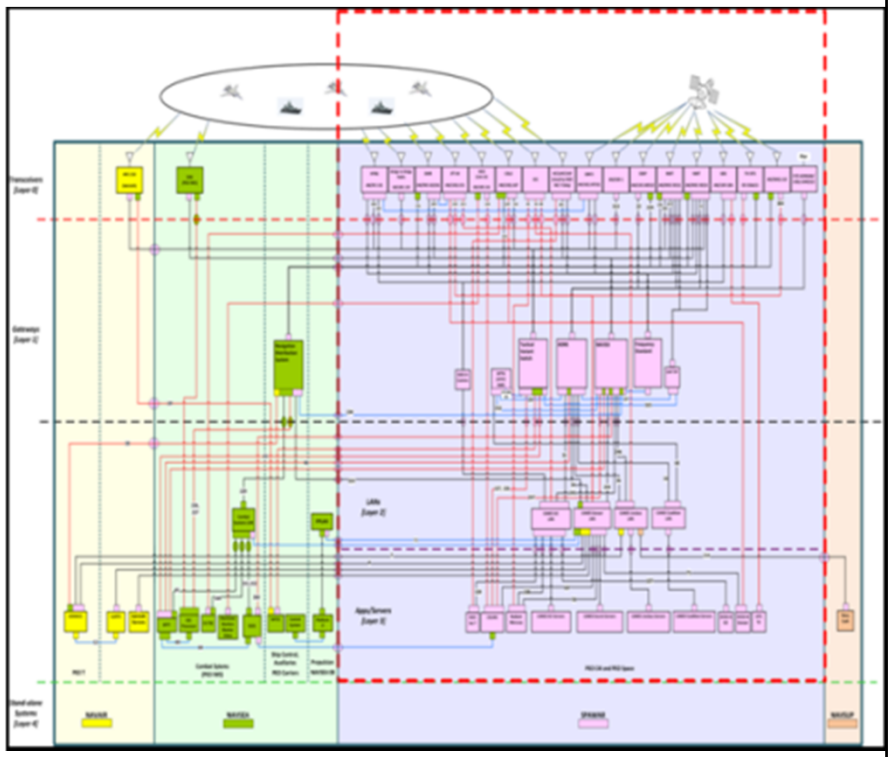
# Navy IT TA Drivers for Change

- Integration and Interoperability among interdependent platforms and supporting assets from independent acquisition activities
- Increasing reliance on information, network, and communication systems for enhanced coordination and execution.





# Navy IT TA Expectations

***IT Acquisition and Sustainment***

Improve development coordination by providing the context for how each system fits into the larger SoS.

***Fleet IT Users***

Deliver improved warfighting capability with IT Systems that integrate seamlessly into platforms and mission areas.

***IT Acquisition Decision Makers***

Enhance planning, management and budget process with comprehensive understanding of IT Portfolio and mission effects of investment plans.

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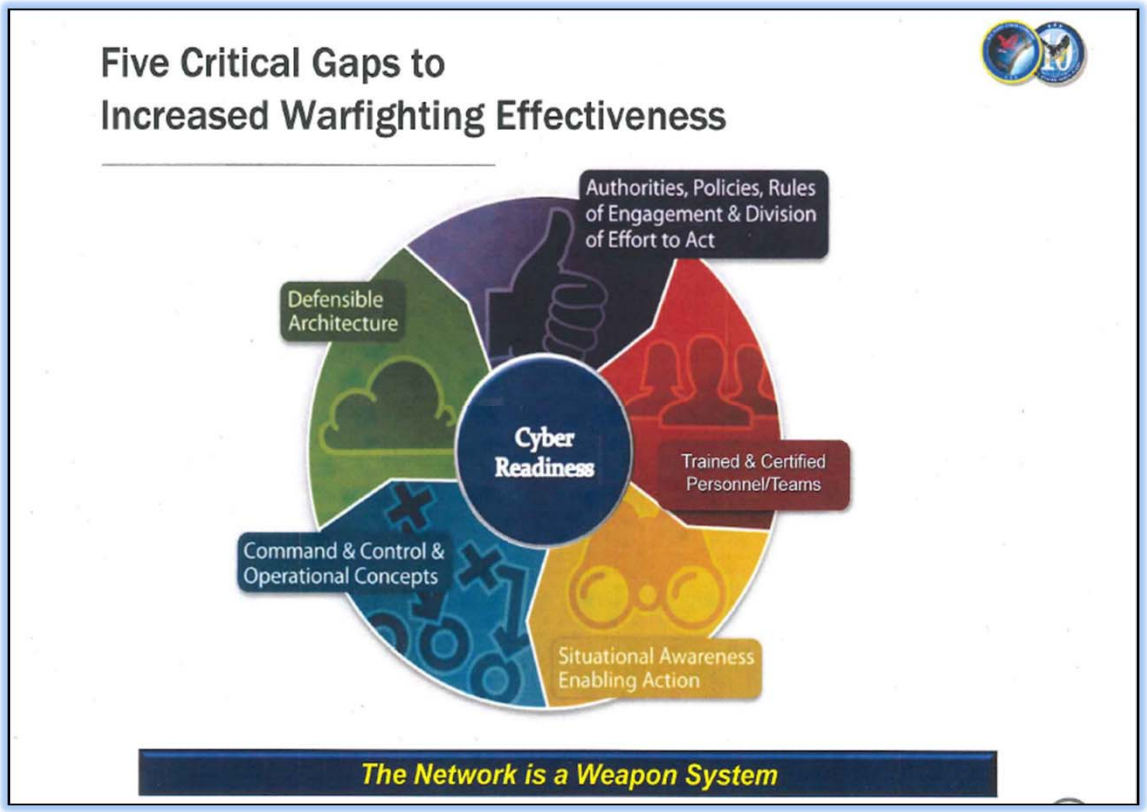
# How Does Navy IT TA Improve Warfighting Effectiveness?




*Slide from VADM Rogers C10F 04 APR 2013 NFOSES Brief*

- **Reference architectures enables development & fielding of stable Defense-in-Depth solutions**
- **Orchestrates IT capability transitions across the DOTMLPF**
- **Reduces training requirements by standardization & documenting interfaces**
- **Closes most I&I gaps enabling end-to-end operational SA & response**
- **Network architecture enables seamless access by users throughout the warfighter domain**

**SoSE&I Methodology provides Knowledge and Perspective to meet Navy IT TA Challenges**

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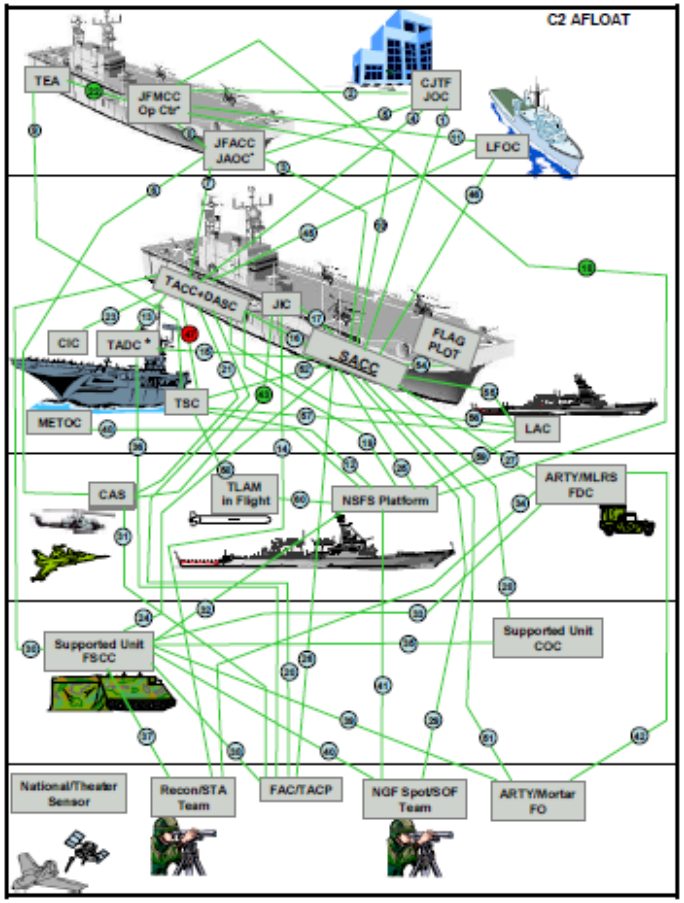
# Our SoSE&I Definition

- **System of Systems Engineering and Integration (SoSE&I)** is the planning, analyzing, organizing, and integrating the capabilities of a mix of existing and new constituent systems into an SoS capability greater than the sum of the capabilities of the constituent systems.

# Key Elements of SPAWAR SoSE&I

- Definition and control of a ***Managed SoS baseline*** that directly tracks to delivered capabilities
- Formal method of ***Governance*** and change control that puts discipline & rigor into investment decisions at the enterprise-level
- An established ***SoS Test, Evaluation and Certification methodology*** to evaluate delivered capabilities in context of mission performance




***SoSE&I approach puts systems engineering rigor & discipline into every Navy IT Acquisition & Sustainment decision***

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# Why a SoSE&I approach?

- Provides a single framework for driving integration, interoperability & standards into and across the Navy IT enterprise
- Provides enterprise-level control of the Navy's IT Architecture & Requirements Baseline
- Risk & Opportunity management for technical, cost & schedule elements for every program in the Navy IT Portfolio

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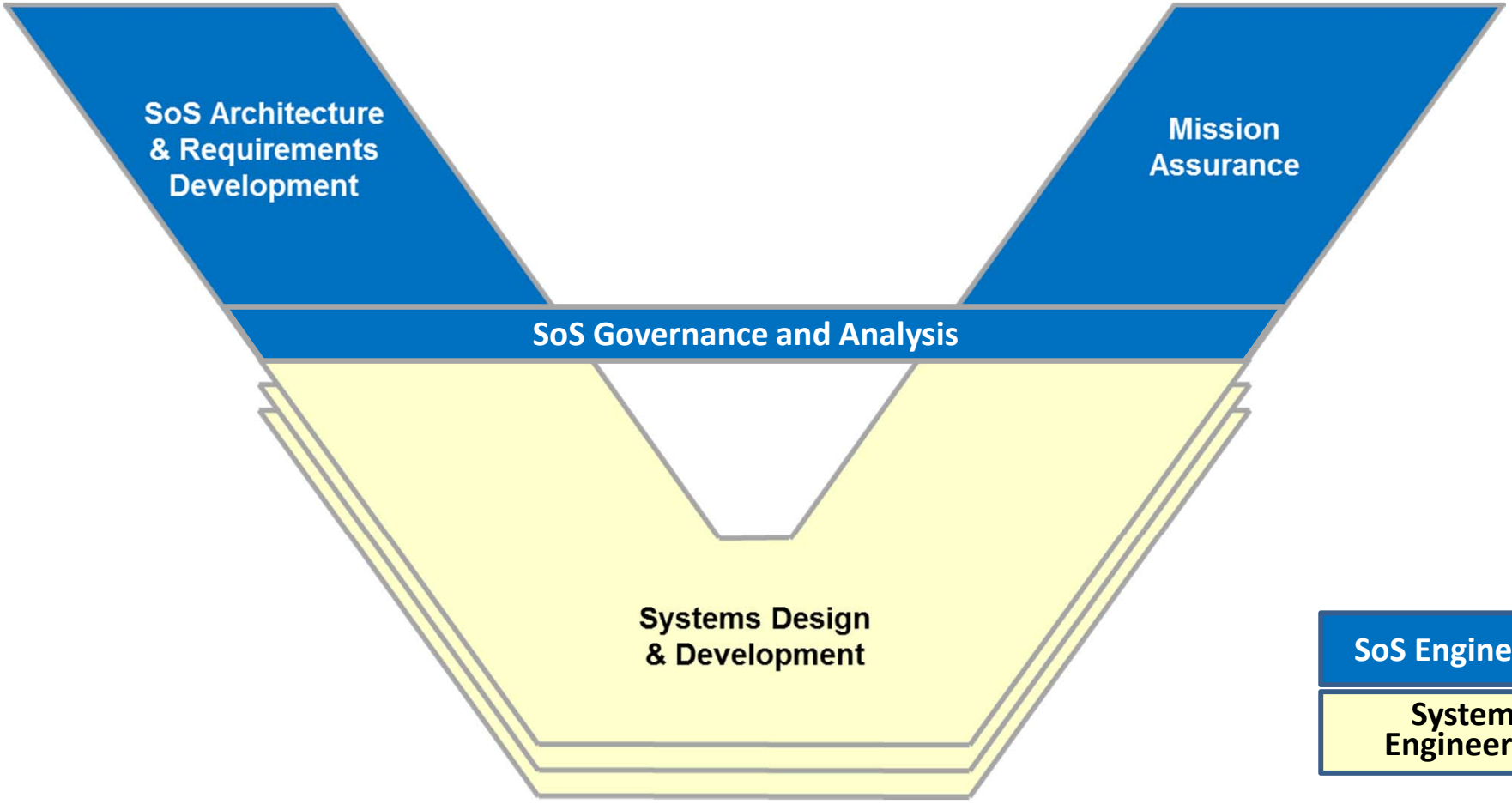
# SoSE&I "Vee"




SoS Engineering

Systems Engineering

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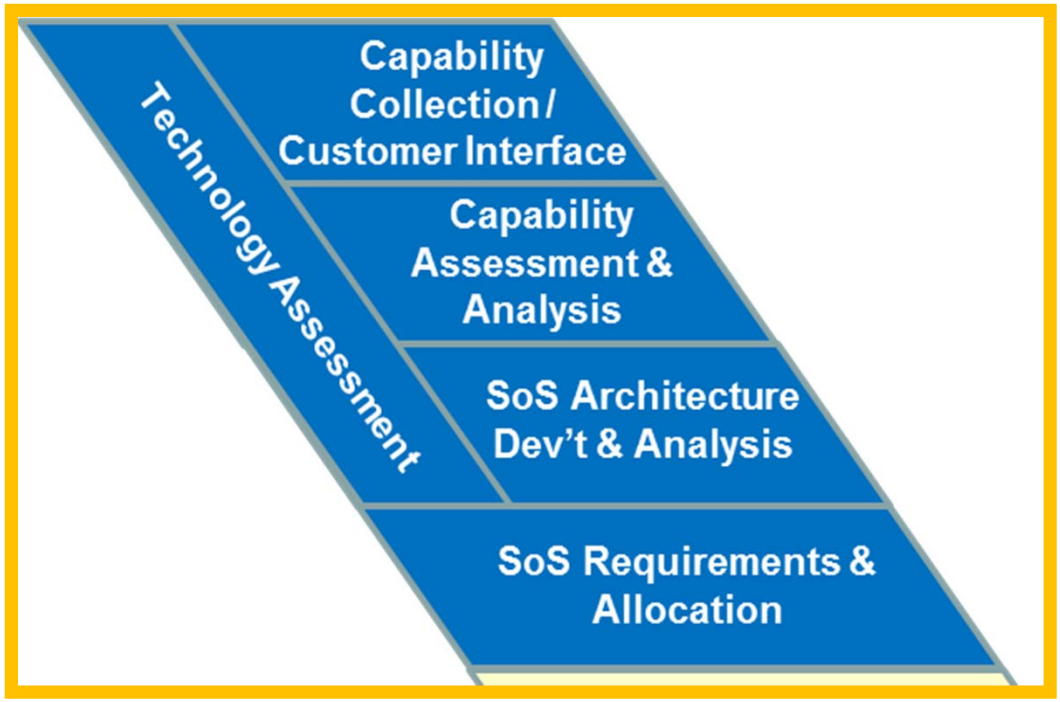
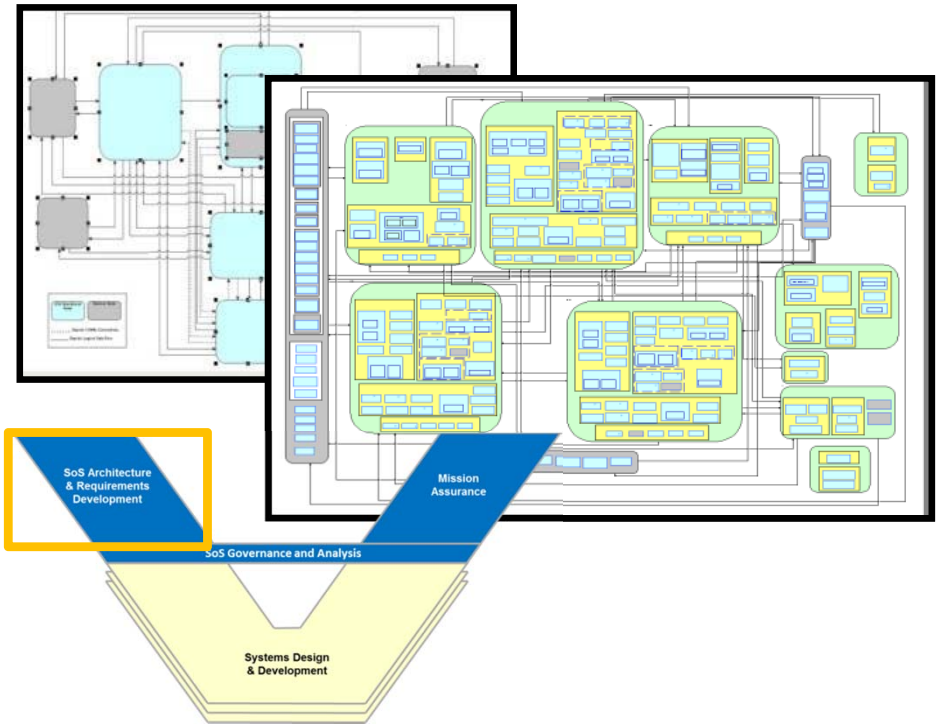
# SoS Architecture & Requirements Development




## Benefits

- Comprehensive plan to align systems that are meant to work together for mission success
- Provides a foundation from which Navy Resource Sponsors can prioritize user needs and budget issues
- Establishes Overarching Requirements Baseline to improve Integration & Interoperability across the IT Acquisition Portfolio

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# Architecture and Requirements Development: Key Lessons Learned

**It is really hard to change a tire while you are driving a car… but not impossible !**

- Developing and implementing refined Processes and Technology enhancements
- Balancing the development of the SoS perspective while continuing to deliver systems oriented analysis results
- Coordination across diverse stakeholders and charting a course

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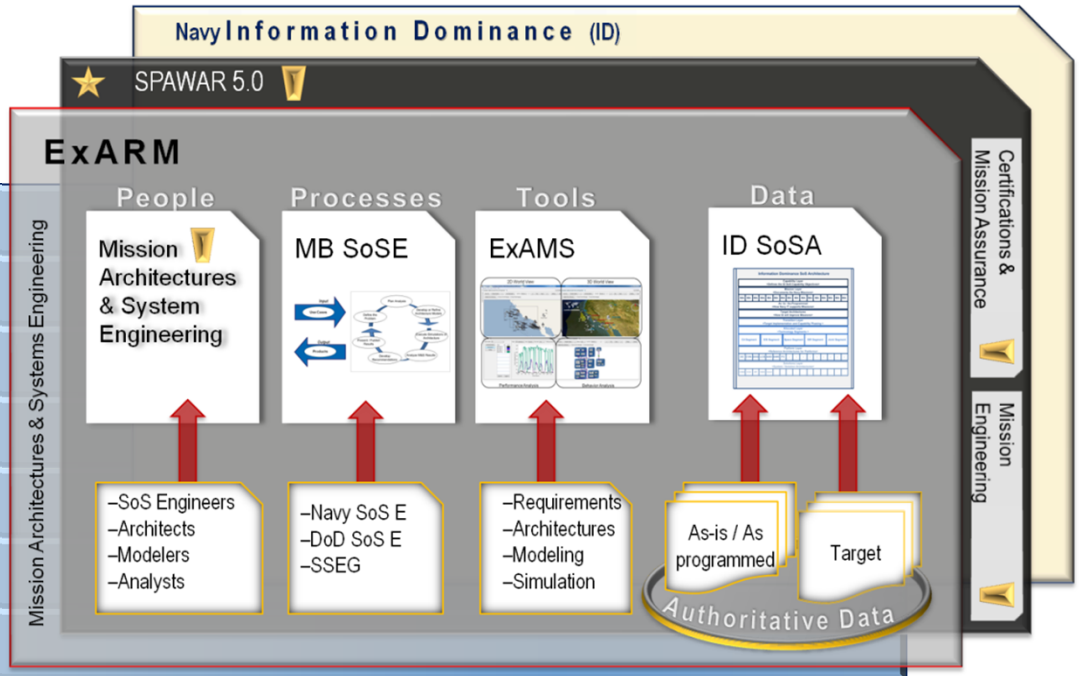
# Processes and Technology Enhancements

- The **Executable Architecture Requirements Model (ExARM) is the SPAWAR 5.0** SoS analytic framework that includes the People, Processes, Tools and Data used to develop fact based decisions throughout the SoS engineering lifecycle:

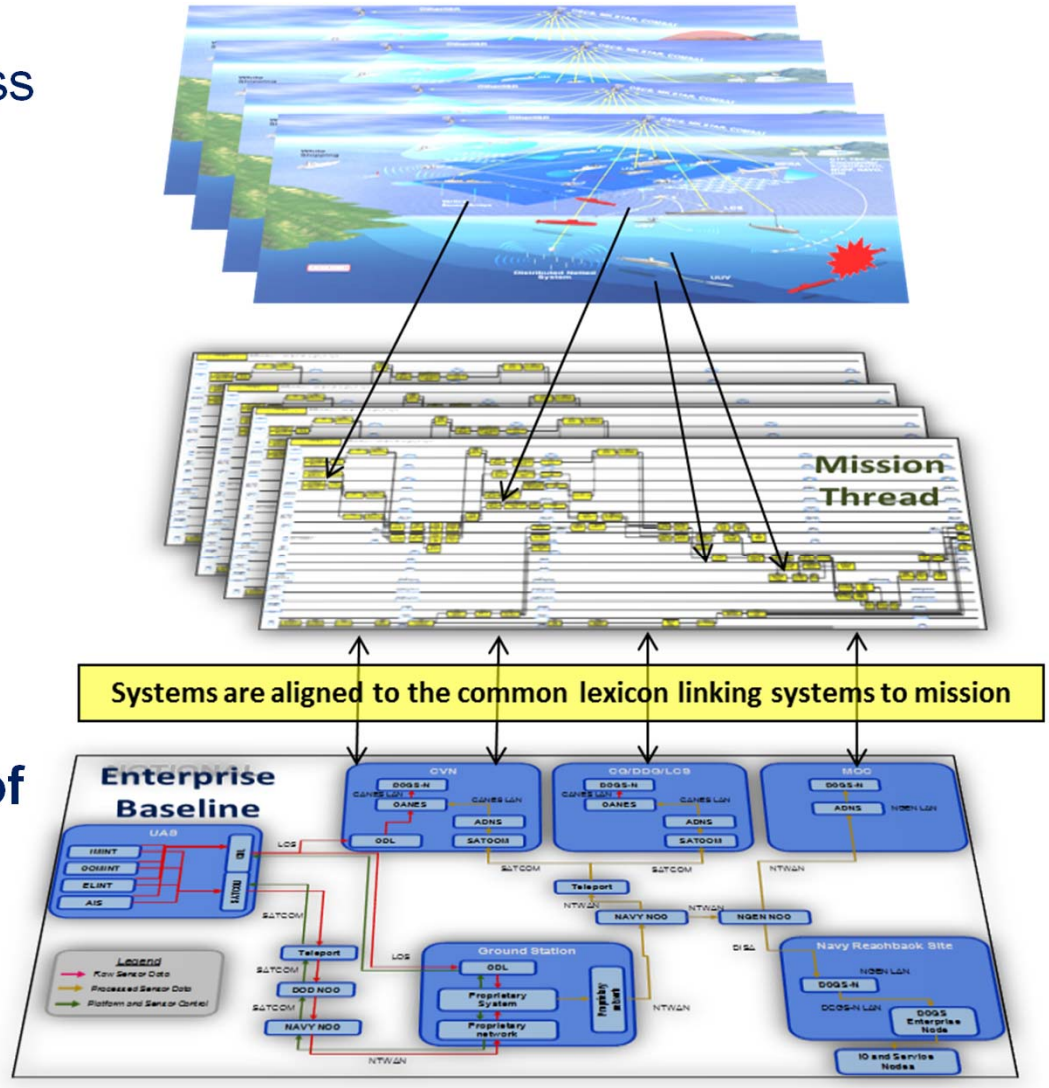



- **Simulation and analysis of architecture data**
- **Technical direction and engineering decisions**
- **Cross mission and cross platform relationships**
- **Used by SPAWAR engineers and analysts**
- **Investment decisions and priorities**
- **Relevance to operational needs**
- **Increased level of visibility into Navy projects**
- **Repeatable analysis of the architecture and engineering data**
- **Consistent guidance and results based on consistent SoS data**

# Balancing Strategic and Tactical Needs

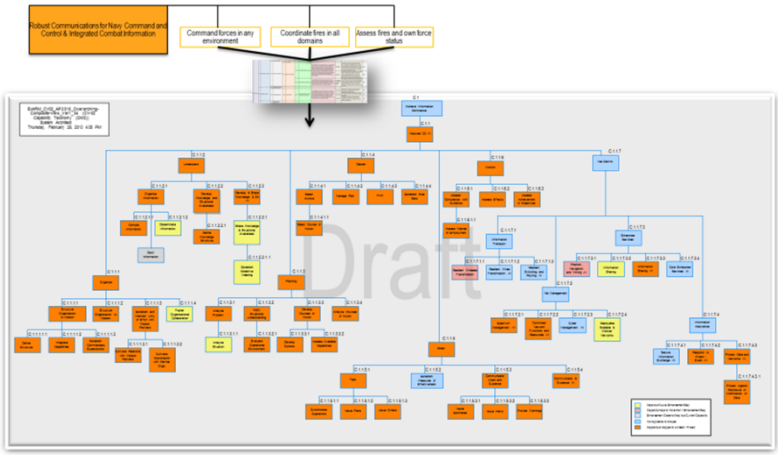
- Establishes library of mission / business areas within the enterprise
- Establishes common data set of all activities / processes
- Establishes common lexicon for how systems support the activities across the enterprise
- Establishes relationship between Mission Operations and Systems

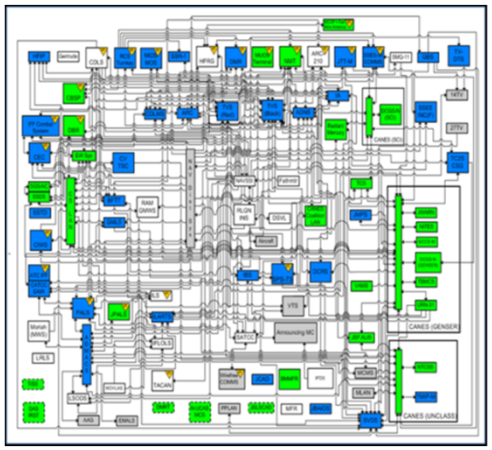
- **Result: A common understanding of how the "As-is" and "As programmed" Portfolio of systems support the missions of the enterprise.**

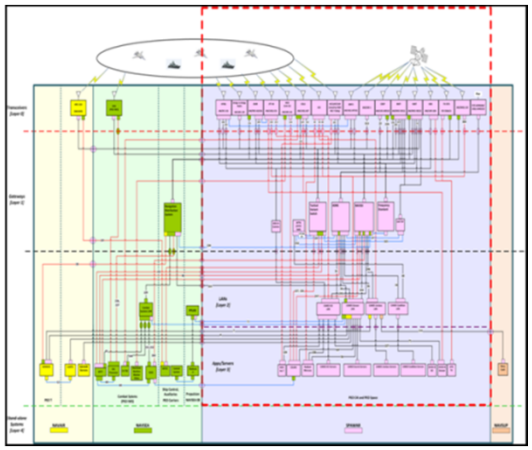


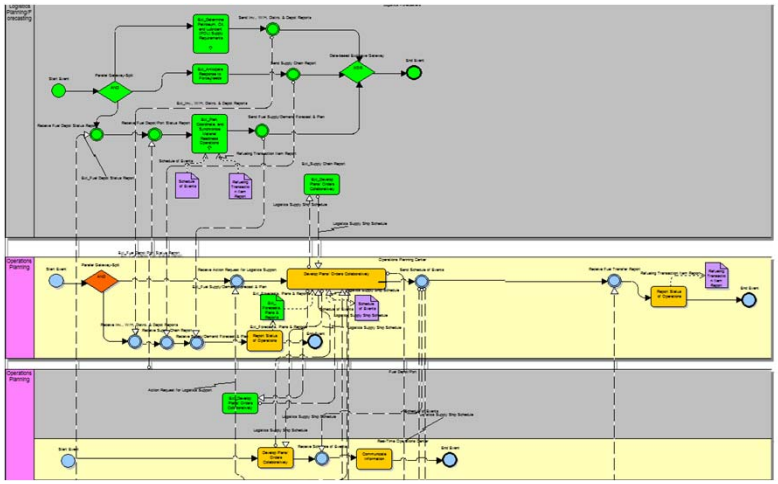
# Stakeholder Diversity

- Strategic analysis and portfolio management for POM
- Operational analysis to understand mission impact of alternative solutions
- Platform architectures to represent current system installs and manage deployment



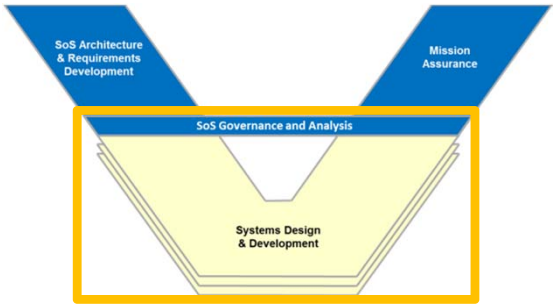


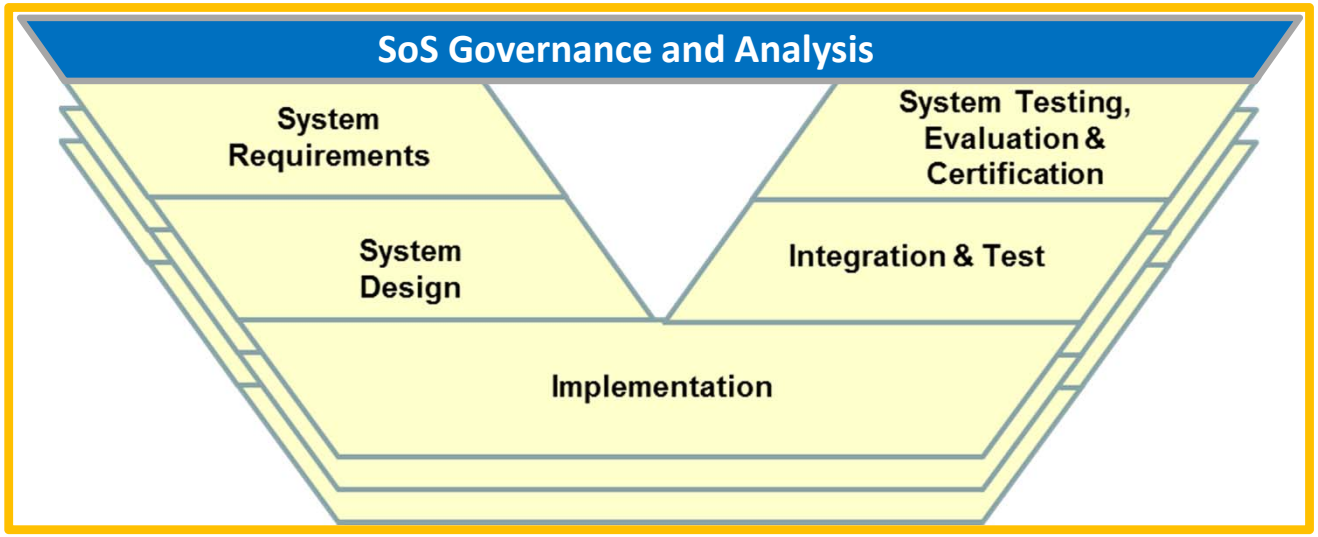


# SoSE&I Role in Systems Design & Development

## Benefits

- Provides a focus SoS mission success vice system optimization
- Establishes a framework for better coordination among individuals systems and programs

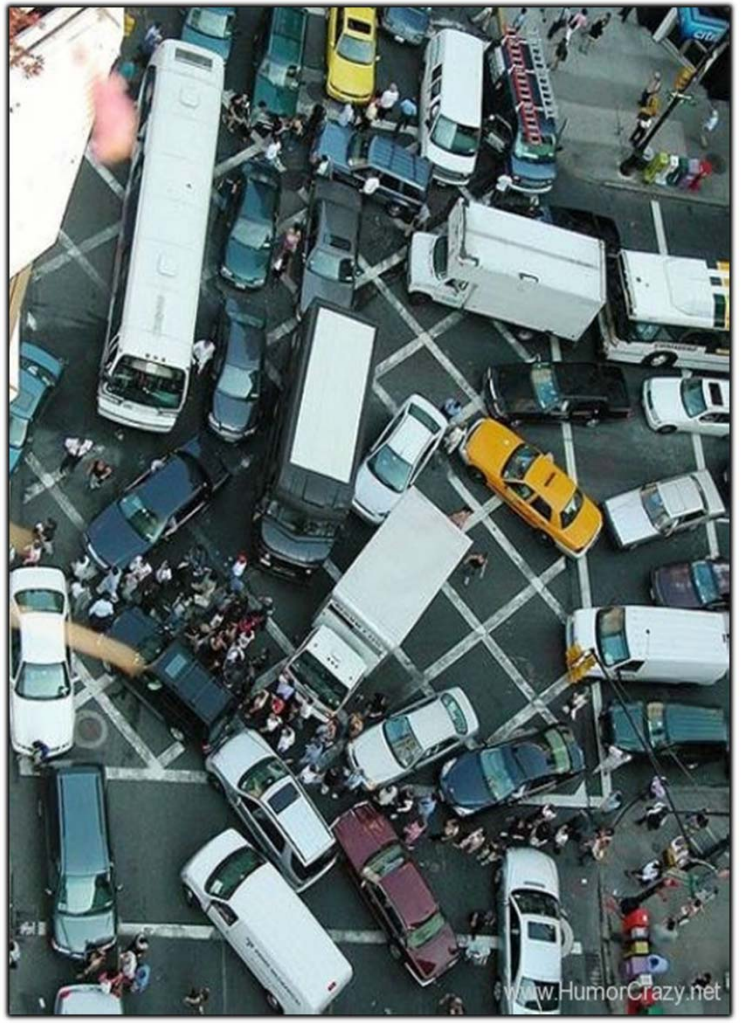


# SoS Governance

**Governance –** the set of rules, policies, and decision-making criteria that will guide the SoS to achieving its goals and objectives.

- A cornerstone of effective System of Systems (SoS) is a sound governance structure.
- Governance is well represented in the IT world, but a discussion of how to apply it to an SoS is absent.
- **IT TA will implement governance with the IT Technical Advisory Board (TAB)**



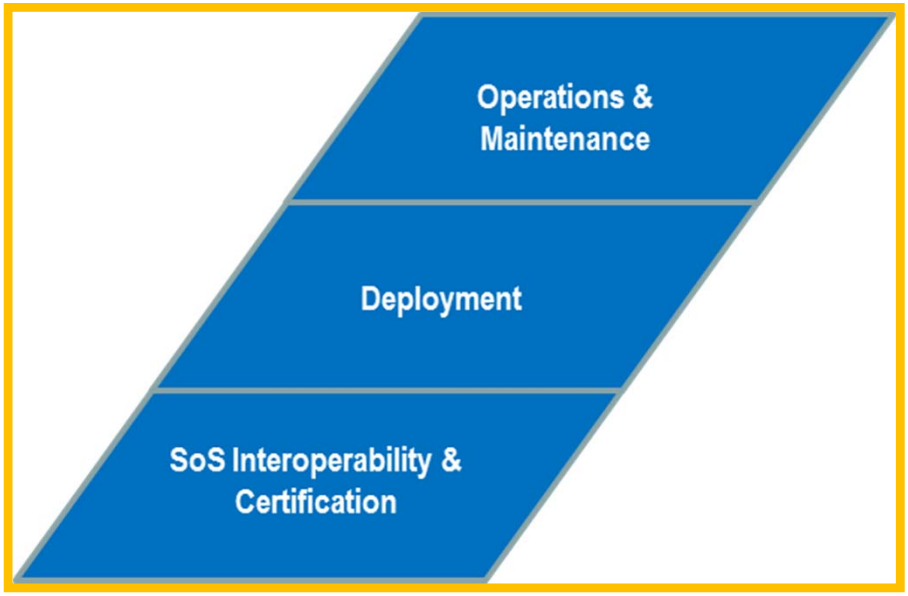
# Criteria-Based Governance Framework

- **Criteria 1: Organizational Structure, Standards and Policies**
  - The organizational structure, standards, policies, and the management environment must be understood to develop effective governance.
  - To be successful, the governance must be consistent with the organization.
    - Virtual SoS (such as the Internet) organizational structures are loosely defined, therefore the governance is limited to standards bodies.
    - Directed SoS (such as a Space SoS) organizational structures are very well defined, therefore governance tightly couples the constituent systems.
- **Criteria 2: Governance Composition and Principles**
  - Determines the degree of participation, responsiveness, consensus, inclusiveness, and accountability needed in the governance strategy.
    - Virtual SoS, participation is limited to standards committees. Typical SoS participants not included in the decisions of suggested changes.
    - Directed SoS, a high degree of participation, inclusiveness, responsiveness, and consensus.

# Criteria-Based Governance Framework

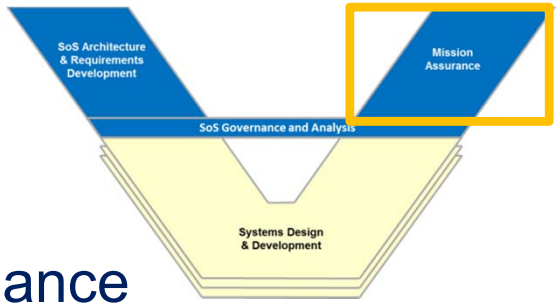
- **Criteria 3: Encapsulation**
  - Refers to how transparent the governance decisions are, and how enforcement is managed within the SoS.
    - Virtual SoS, the governance and decisions are made by a small number of stakeholders. Most stakeholders don't care how decisions are made or how the rules are enforced as long as they can achieve their missions and goals.
    - Directed SoS, stakeholders are closer to the decision-making process. Therefore, the governance strategy is required to be more inclusive and transparent.
- **Criteria 4: Governance Effectiveness and Interoperability**
  - Determines the effectiveness and interoperability attributes of the SoS
    - Virtual SoS, participation use the SoS for their own purposes, therefore governance effectiveness and interoperability should favor independence, decentralization, and heterogeneity.
    - Directed SoS, are designed to work together to achieve a common objective, therefore governance effectiveness and interoperability should focus on engineered effectiveness standards and tightly controlled interface standards.

# Mission Assurance




## Benefits

- Understanding of SoS performance in context of mission success to shape acquisition planning
- Develops a comprehensive operations and maintenance to better align IT baselines in the Fleet

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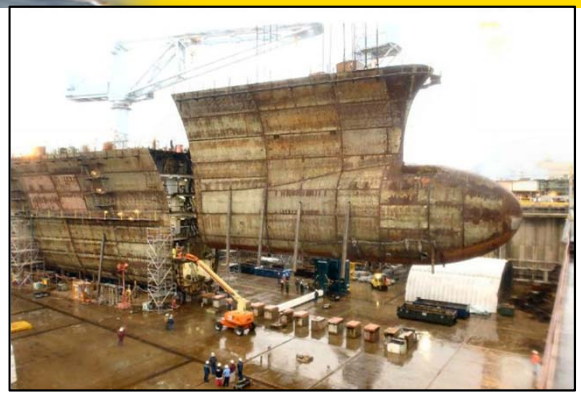
# Changes Due to Implementing IT TA Across Navy IT

| ACTIVITIES | BEFORE IT TA | AFTER IT TA |
|---|---|---|
| IT Specifications, Standards and Profiles | • Left to each program to adopt independently<br>• No enterprise wide understanding or accountability | • Provided to programs at various stages of development<br>• IT registration permits enterprise view of standards compliance |
| IT Interface Control Agreement | • Ad-hoc agreements between program offices<br>• No SoS Architecture considerations | • Analogous to WSID (Warfare System Interface Diagram) defining physical and logical parameters<br>• Placed under CM by SPAWAR<br>• Facilitate management of interface changes |
| Gate Reviews | • Not currently addressed | • Ensure enterprise meets stakeholder requirements |
| Certification Process | • Naval Warfare System Certification Policy (NWSCP) & C5IMP minimally address IA | • Bolster NWSCP and C5IMP to assess IT maturity<br>• Add framework to address operational and warfare risk |
| Waiver and Deviation Processes Coordination | • Each program handles independently<br>• Inter SYSCOM effect difficult to assess | • IT Technical Advisory Board (TAB)<br>• Joint SYSCOM board to adjudicate deviations<br>• Risk assessments based on SoS considerations |
| Information Assurance (IA) | • Addresses on system-by-system basis<br>• Each program addresses cyber risk independently | • Promotes holistic approach for Cybersecurity<br>• Permits inheritance of IA Controls and reduces redundant systems<br>• Provides clear IA requirements to Programs |

# How Does IT TA Apply & Benefit Platforms & Systems?



## SCN/ACN/New Starts

- Ensure I&I is built into new programs during R3Bs & early Gate reviews through authoritative enterprise IT models
- Inject design specs & standards upfront into AoAs & contract RFPs through reference architecture
- Support evolution to a standard but tailorable network configuration across all platforms

## In-development

- Influence design trades & risk reduction through standards & architecture
- Support I&I by providing authoritative platform IT data required for N2/N6 & N9I Integrated Capability Package evaluations
- Provide centralized coordination for IT waivers & certification

## Legacy/Sustainment

- Provide the Fleet, including Shore Commands, with a single TA POC responsible for technical IT issues
- Enable rapid technical evaluation of IT CASREP scope, impacts, & potential solutions for all affected systems
- Evaluate I&I impacts of IT upgrades & introduction of new platforms & systems

**IT TA Influences Every Phase of the Program Lifecycle**

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# What Happens After IOC?

- Develop IT & IA product sets prioritizing for high interest platforms
  - Develop additional artifacts focused on other afloat, shore & airborne platforms
  - Link up with SCN/ACN schedule (VA SSNs, LPDs, UAVs)
  - Implement as platforms go through major overhauls
  - Low impact or soon to be retired platforms will not be addressed
- Produce IT TA products & processes to support C4I capability builds
  - C4I capability builds support standard C4I configurations
- Continue development of Defense-in-Depth IA architecture & IA Risk Management Framework (RMF) to deal with emergent IA threats
- Inject TAB-approved architectures, requirements & design guidance, to include required interface agreements into acquisition & modernization cycle
  - R3Bs, SETRs, Gate Reviews, ATO, ITPR, NWSCP/other platform certification processes

**Multi-Year Effort Required for Initial Stand-up and Execution**

# Questions