



# Lead Systems Integration: A Key Enabler for System of Systems Engineering and Integration

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# The Problem Plainly Stated



***“Our current system is like a machine to which we just keep adding important and wanted items but without a cohesive strategy for an elegant, interwoven system. Considered on their own, the addition and growth of individual elements may be useful. But when ownership organizations do not see how their contribution fits into the whole and think their element is an end-state in itself, effective communication and execution are inhibited.”***

- ADM William Gortney, ADM Harry Harris, USNI Proceedings, May 2014

# Research Issue

- The U.S. Navy has been exploring, and developing processes and strategies to address the engineering and acquisition challenges associated with System of Systems (SoS).
- Strategies:
  - Lead Systems Integration (LSI)
  - Navy Integration and Interoperability (I&I)
  - Information Technology Technical Authority (IT TA)
  - System of Systems Engineering and Integration “Vee”
- This research explored the strengths of each development and acquisition concepts and provide a framework that better defines LSI across the SoS and complex system lifecycle.

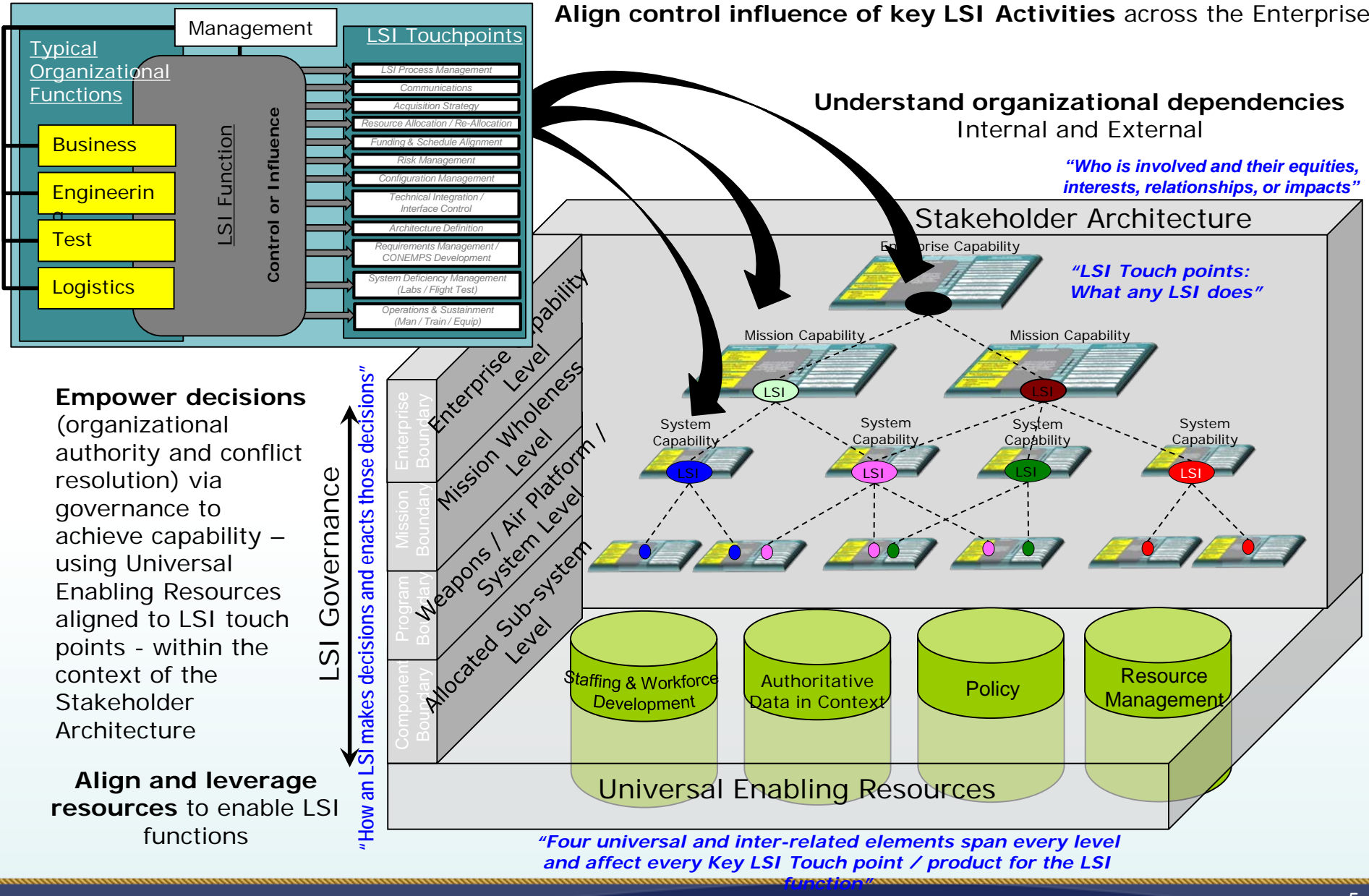
**While each strategy offers insights and partial solutions to the challenges posed by the SoS, and complex systems, development and acquisition environment, none address the complete problem.**

# Lead Systems Integration (LSI)

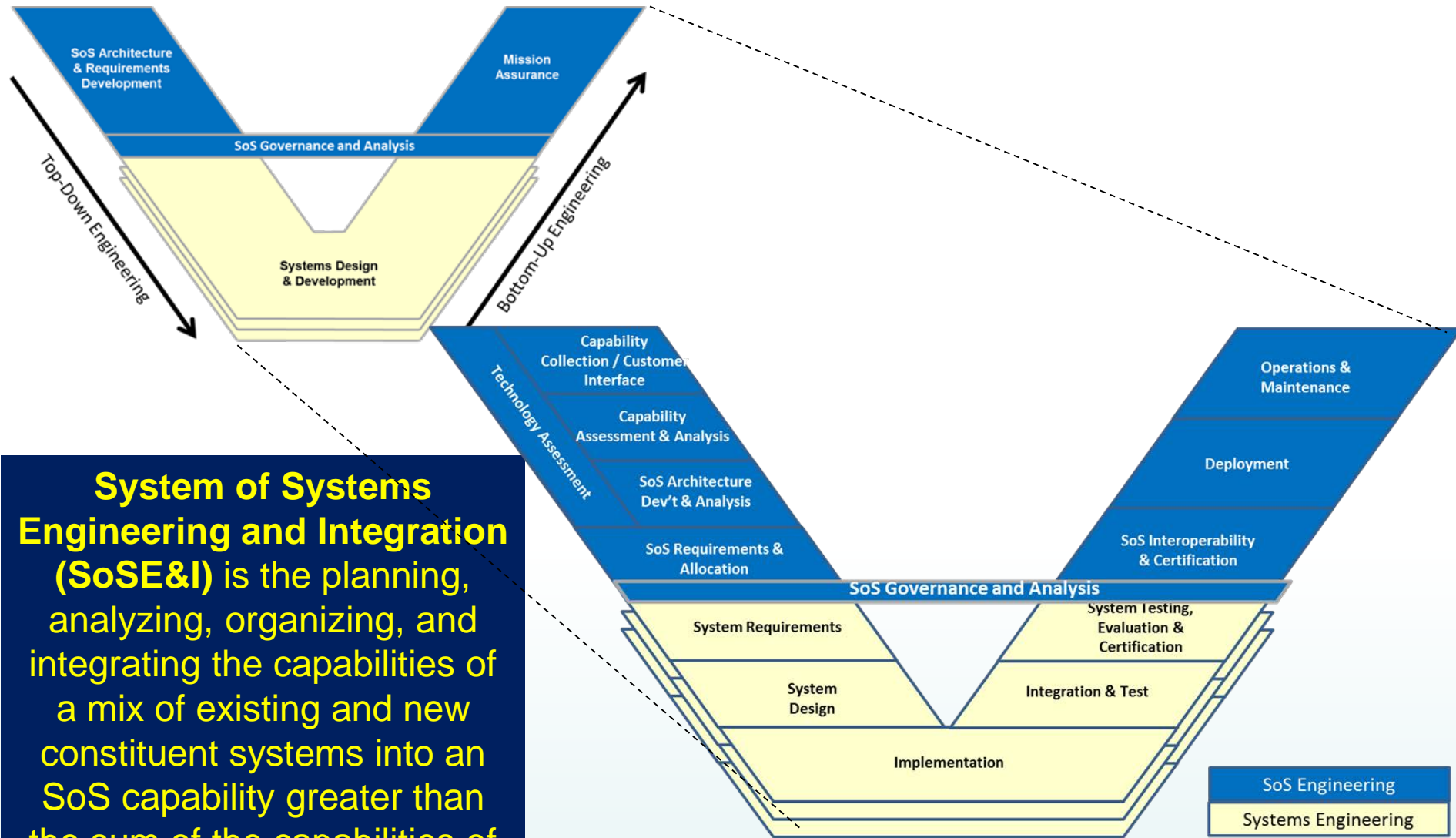
- **Lead Systems Integration** – An acquisition strategy that employs a series of methods, practices, and principles to increase the span of both management and engineering acquisition authority and control to acquire SoS or highly complex systems.
- In 2008 Public Law 110-181, Congress directed Secretary of Defense to:
  - Size and Train the workforce to perform Inherently governmental functions
  - Minimize and eventually eliminate contractors as LSI



# LSI Framework

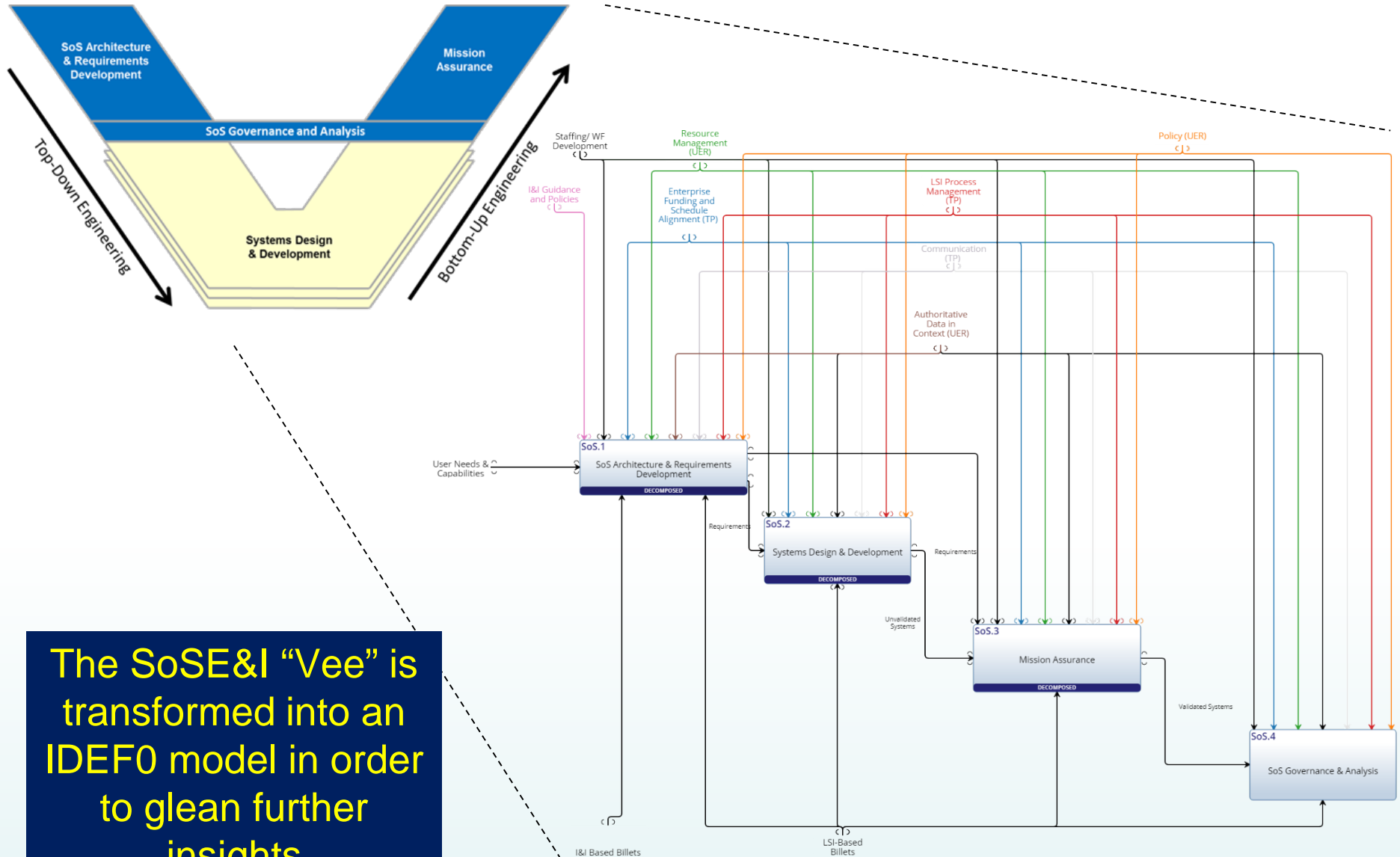


# The SoSE&I “Vee”: A Common Foundation



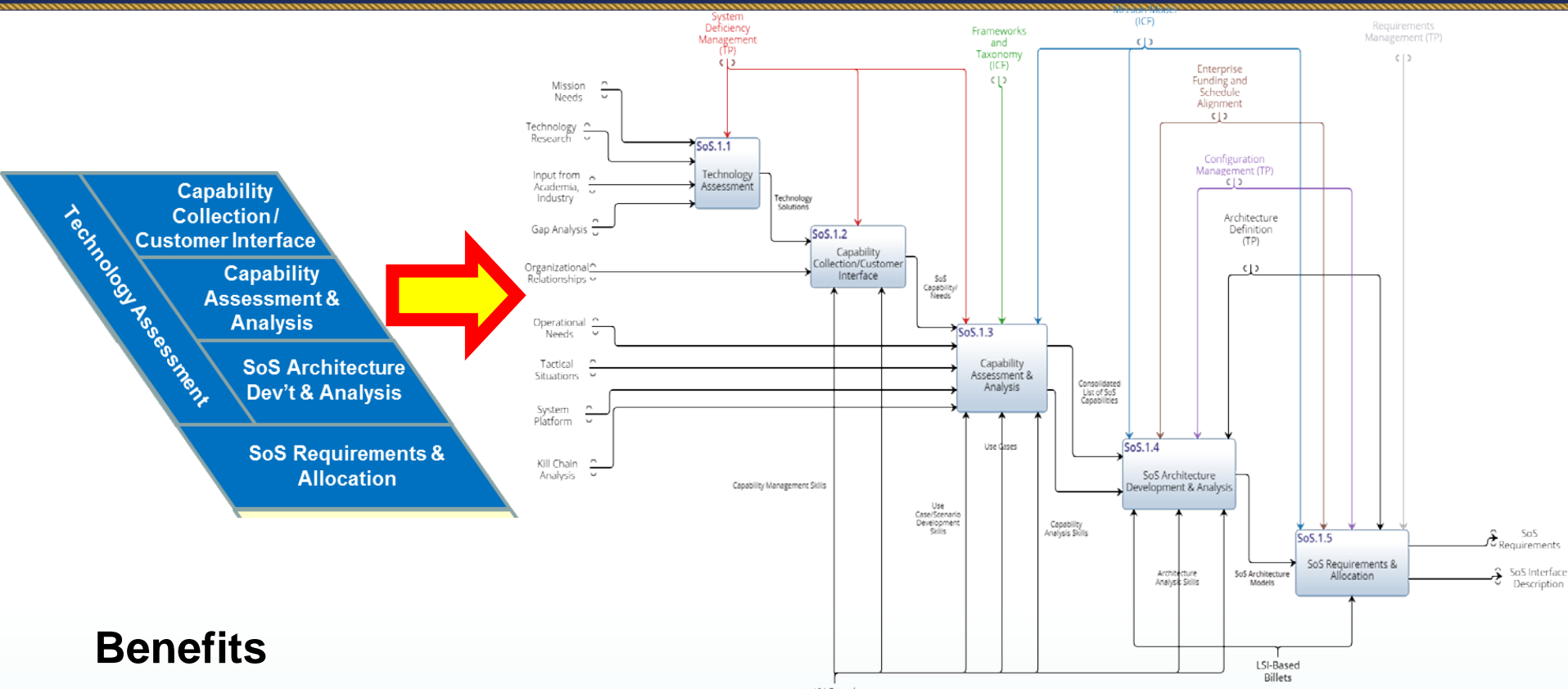
**System of Systems Engineering and Integration (SoSE&I)** is the planning, analyzing, organizing, and integrating the capabilities of a mix of existing and new constituent systems into an SoS capability greater than the sum of the capabilities of the constituent systems.

# The SoSE&I “Vee” Viewed as an IDEF0 Model



The SoSE&I “Vee” is transformed into an IDEF0 model in order to glean further insights

# SoS Architecture & Requirements Development

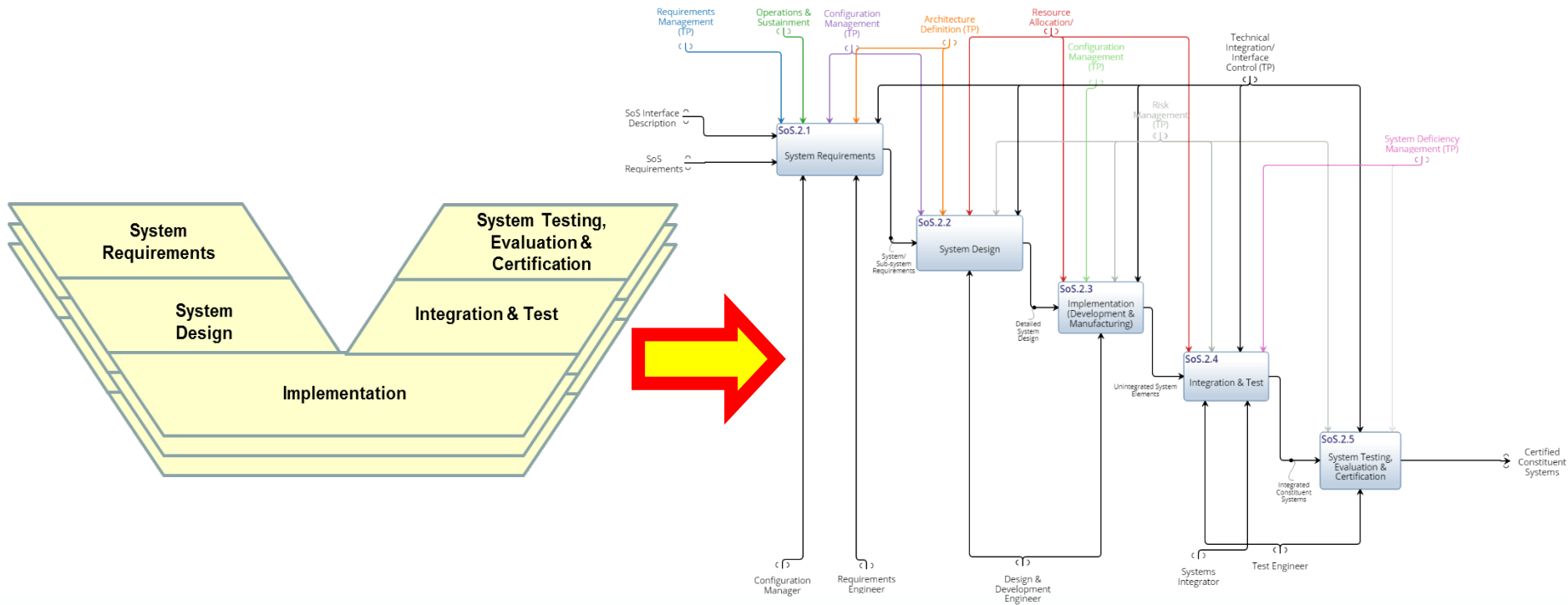


## Benefits

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



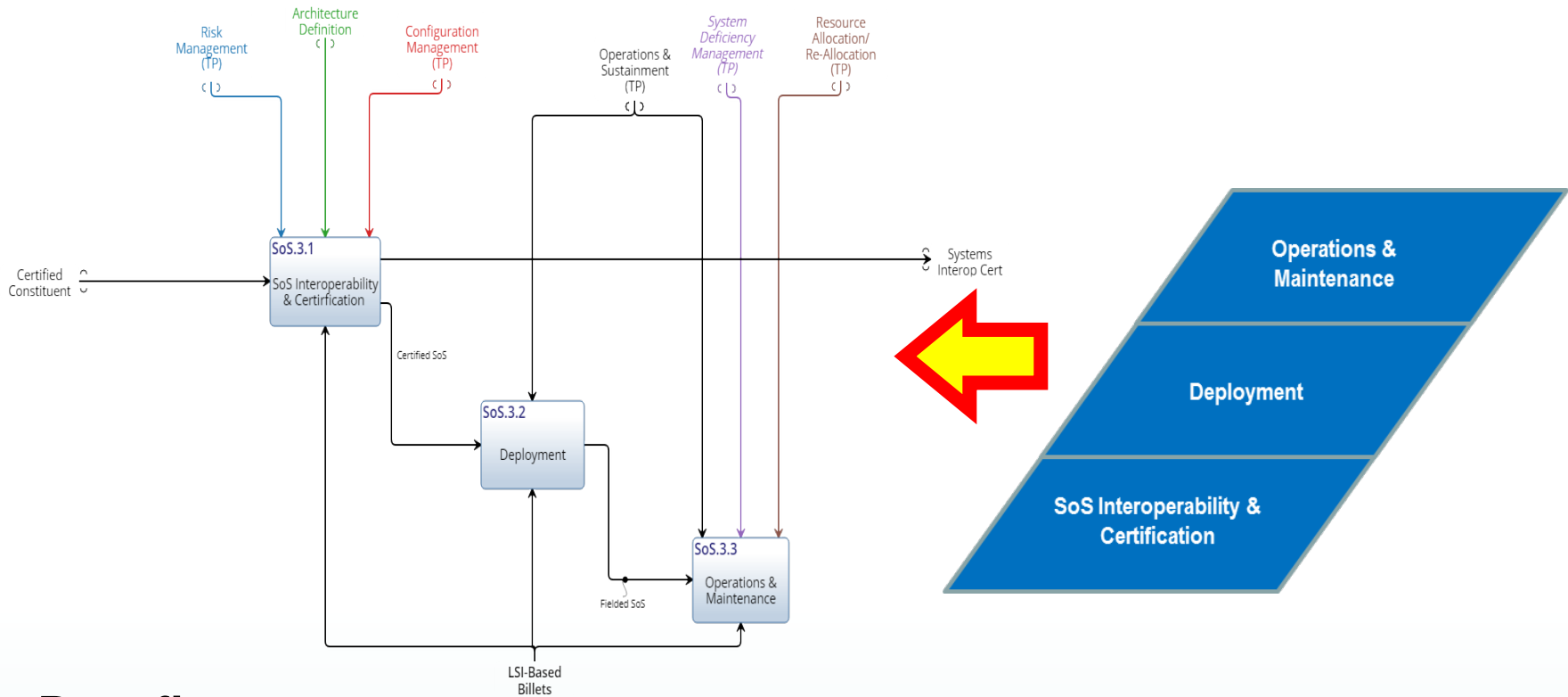
# System Design and Development



## Benefits

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

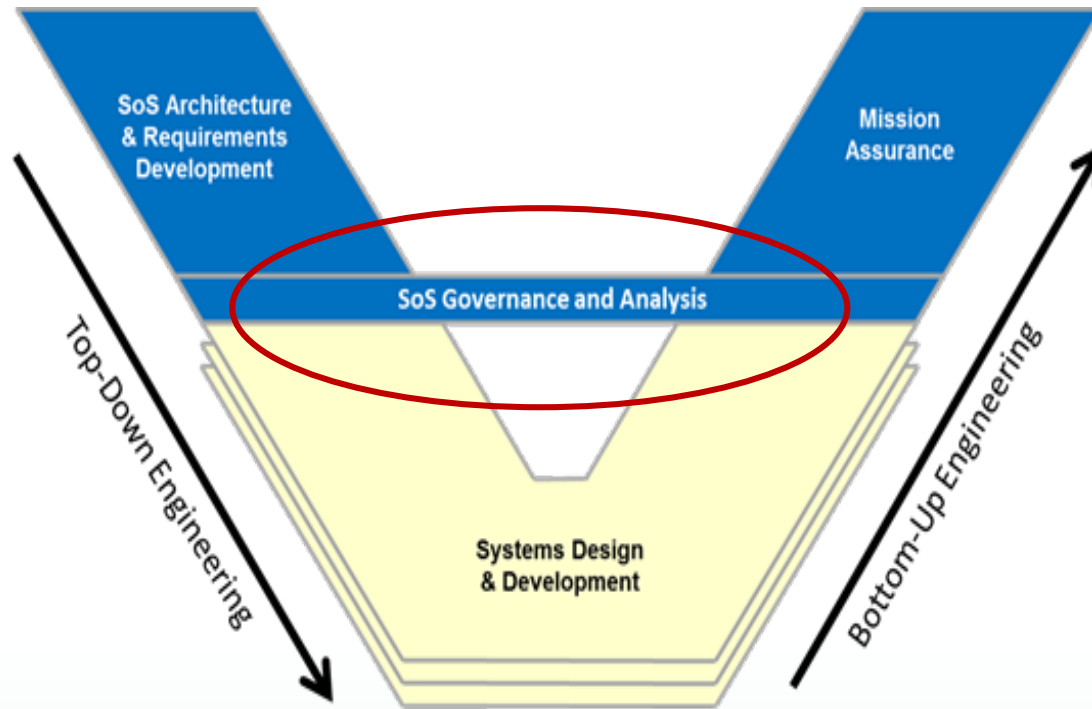
# Mission Assurance



## Benefits

- Understanding of SoS performance in context of mission success to shape acquisition planning.
- Develops comprehensive operations and maintenance to better align constituent system operations within the SoS.

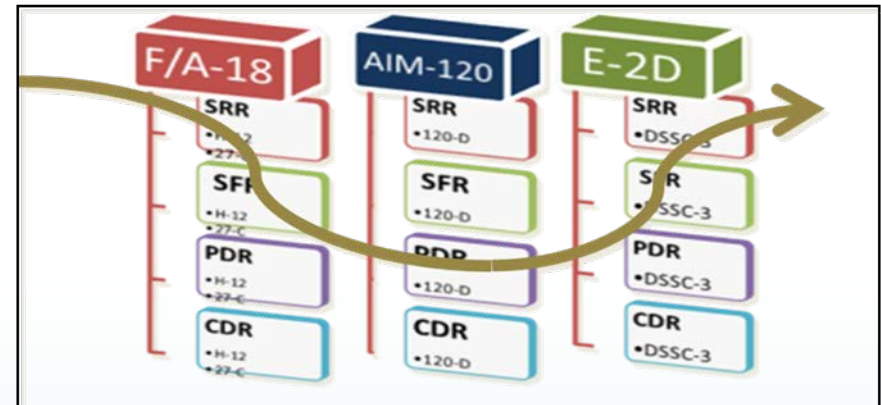
# Governance and Analysis



- Review of instructions revealed that there was no clear direction or additional guidance given on governance or analysis of system of systems.

# Conclusions

- Created Model is useful but not complete.
  - LSI and I&I provide a blueprint for more complete SoS governance approach
- The Enhanced framework provides a useful set of tools and concepts
- Navy should increase SE and SoSE&I technical and management depth and breadth across workforce
- Need a directly universal approach to SoS management, common top-down guidance





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## SYSTEMS ENGINEERING

EST. 2002





# Questions