

SYSTEMS ENGINEERING RESEARCH CENTER

RT-155: Assessing Development Disruptions and Dependencies in Analysis of **Alternatives of System-of-Systems**

Navindran Davendralingam, Daniel DeLaurentis, Karen Marais, Zhemei Fang, Cesare Guariniello, Rakshit Chandrahasa



Overview

OBJECTIVE – Test and validate the SoS analytic workbench (AWB) by addressing the "archetypal questions" in a unified naval warfare scenario



Capability

- What combination of systems gives the desired aggregate SoS capabilities?
- What changes to which systems offer the most (performance, resilience, etc.) leverage?
- Which systems are critical to SoS performance? SoS risks?
- Which parts of the SoS have excess or inadequate resilience?
- Which design principles can improve SoS robustness and resilience?
- Development

Computational Methods

Decision Tools: Robust Portfolio Optimization (RPO)

Decision support approach from operations research to identify portfolios of systems by leveraging performance against risk under various types of uncertainty



- How do changes in system properties affect SoS development?
 - How do we optimize multi-stage acquisitions in SoS development?
 - How do we coordinate planning between local and SoS-level stakeholders?
 - How do/should partial capabilities evolve over time?
- **Critical System ID**
- 10. What is the impact of partial/total system failures during operations?
- What is the impact of partial/total failure of a system during development?
- What are the most critical systems in a given operational (or developmental) network?
- What is the impact of development delays in an interdependent network?

Computational Methods

Systems Developmental/Operational Dependency Analysis (SODA/SDDA)

Assessing the impact of developmental schedule and operational dependencies

SDDA shows how development delays in systems propagate in an interdependent network. What systems are critical in three Naval Warfare architectures?



Performance Efficiency Frontiers for Tradespace Analysis



System Importance Measures (SIMs)

Family of measures that rank systems based on their impact on the overall SoS performance. They help in strategically building resilience into an architecture.





More questions can be addressed by SODA and SDDA, for example:

- Which systems are critical to SoS performance? What are the technical risks in the SoS?
- What is the impact of partial/total system failures during operation?

Decision Tools: Multi-Stakeholder Dynamic Optimization (MUSTDO)

External Applications

Transition of AWB software to NSWC Dahlgren Division



How do we coordinate planning between local and SoS-level stakeholders?



• Transition of AWB software to MITRE Corporation

Contacts/References

Investigators:

Dr. Daniel DeLaurentis

Dr. Karen Marais

Dr. Navindran Davendralingam

Center for Integrated Systems in Aerospace

Purdue University

West Lafayette, IN

Contact E-mail: ddelaure@purdue.edu

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