

Enterprise Management of Systems-of-Systems in the DoD

Christopher Roberts, PhD in Engineering Systems (expected in 2011)

Committee: Prof. Debbie Nightingale, chair; Prof. Joe Sussman; Dr. Donna Rhodes



Biography

Chris Roberts is currently pursuing a Ph.D. in Engineering Systems. His experience includes four years as a systems engineer and enterprise architect at Booz Allen Hamilton. He holds a B.S. in Engineering Physics from Embry-Riddle Aeronautical University (2001), a Diplôme d'Ingénieur, from EPF (a French engineering school), and a S.M. in Technology and Policy from MIT (2003).

cjr@mit.edu

Publications

Roberts, C.J., Magee, C.L., and Sussman, J.M., "Teaching an Engineering Systems Doctoral Seminar: Concepts and Structure," 2nd International Engineering Systems Symposium, Cambridge, MA, June 2009.
Roberts, C.J., Richards, M.G., Ross, A.M., Rhodes, D.H., and Hastings, D.E., "Scenario Planning in Dynamic Multi-Attribute Tradespace Exploration," 3rd Annual IEEE Systems Conference, Vancouver, Canada, March 2009.
Roberts, C.J., *Architecting Evolutionary Strategies using Spiral Development for Space Based Radar*, Master of Science Thesis, Technology and Policy Program, MIT, June 2003.

Introduction

"Most military systems today were created and then evolved without explicit considerations for their interdependencies with other systems."

"Capabilities-based perspectives are more likely to identify needed relationships among what were previously considered independent systems."

– Brigadier General R. Mark Brown
(Army Systems-of-Systems Workshop, 2009)

Technical interdependencies at the system-level increase enterprise managerial complexity



© 2009 Christopher J. Roberts

Definitions

Enterprise

- Inter-organizational networks with distributed leadership and stakeholders with both common and diverse interests (Stanke 2006)

Program

- Organizational unit tasked with the realization of technical systems using systems engineering processes (DAG 2003)

Systems-of-Systems (SoS) (Maier 1998)

- Managerial independence of constituent systems
- Operational independence of constituent systems
- Evolutionary development
- Emergent behavior
- Geographic distribution

SoS Systems Engineering (SoSSE)

- Deals with planning, analyzing, organizing and integrating a mix of existing and new systems into SoS capability (DoD SoSSE Guidebook 2008)



© 2009 Christopher J. Roberts

Relevant Literature

Enterprise Architecting

- At the enterprise-level information is the most important entity that is flowing (Nightingale 2009)
- SoS must be addressed from an enterprise perspective (Rhodes et. al. 2009)

Organizational Networks

- Open systems theory of adaptation, integration vs. differentiation (Lawrence and Lorsch 1967)
- Power & influence (Krackhardt and Brass 1994)
- Network governance in public service sectors (Goldsmith & Eggers 2004)
- Typology of org. network research (Borgatti and Foster)

Systems-of-Systems

- Useful taxonomy for SoS (Maier 1998)
- Open research areas in SoS (Keating 2005)
- Current state of SoS management and governance practices in DoD SoS (Dahmann and Baldwin 2008)



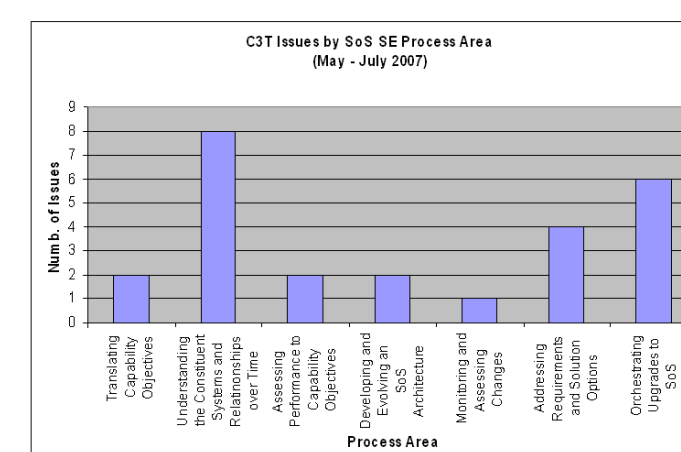
© 2009 Christopher J. Roberts

Gaps in Understanding

- SoS perspective has diffused sufficiently that several DoD organizations have been created to address SoS-level issues
- The most comprehensive empirical study on SoS was conducted by the Office of the Secretary of Defense (OSD) to develop the SoSSE Guidebook (2008)
 - Medium N study (18 cases) to begin the process of understanding and provide initial guidance for SoSSE
 - Identifies common practices for SoSSE and emerging principles for successful SoSSE practices
 - Identifies SoS governance as a major open research area
- Need for more detailed study to test limits and conditions of OSD identified SoSSE practices and principles
- Need to compare alternative governance structures in SoSSE Organizations

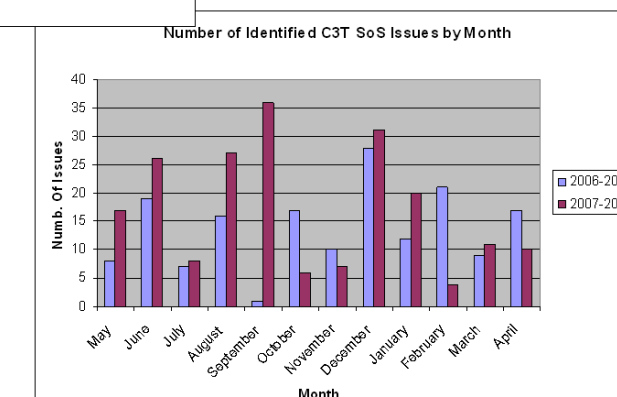


© 2009 Christopher J. Roberts



What is the distribution of SoSSE issues by process area? Are these issues due to poor initial planning or emergent realities?

Are there temporal correlations between program milestones and SoS issue levels? Contextual disturbances?



Expected Contributions

Systematic Observation & Documentation

- There are very few SoS empirical datasets
- No known systematic comparative study of SoSSE organizations

Innovative Modeling & Analysis

- Network representations of SoSSE enterprise stakeholder relations and governance processes
- Bringing an ESD analysis perspective to SoS, which has been primarily been addressed through a technology-lens

Advancing Core Theory

- Testing and refinement of emerging SoSSE theory and principles
- General contribution to distributed socio-technical system management

Impacting Policy and Practice

- Discovery of SoSSE "best practices"
- Engaged with DoD SoSSE policymaking actors



© 2009 Christopher J. Roberts

For more information, please visit:

<http://seari.mit.edu>