



## COACTIVE DESIGN IN SYSTEMS ENGINEERING: HUMAN-MACHINE TEAMING IN SEARCH AND RESCUE (SAR) OPERATIONS

Author: Tai Jia En Marcus (ST Engineering Land Systems)

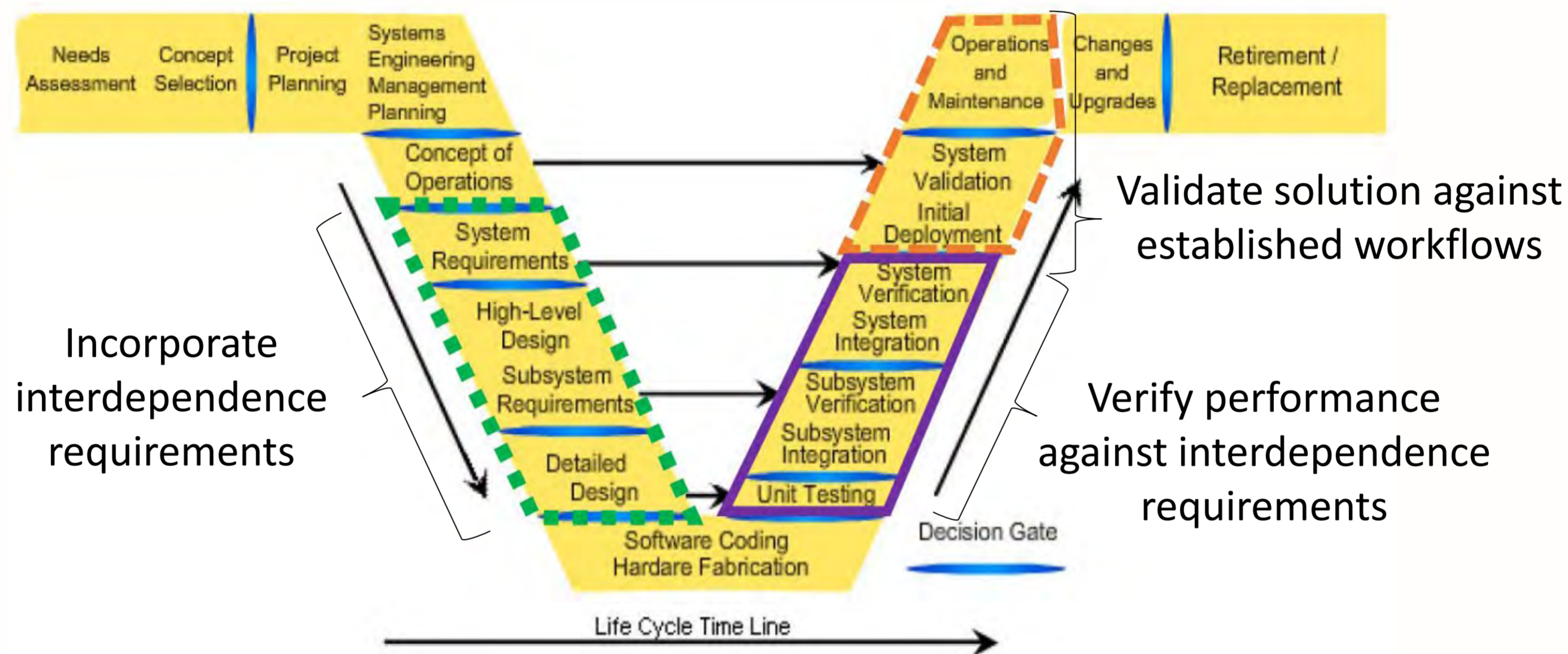
Thesis Advisors:

- 1) John M. Green (Systems Engineering)
- 2) Scot A. Miller (Information Science)

### Objectives:

1. Propose an integrated Coactive Systems Engineering Design (COSEED) process, incorporating the Coactive Design Method which utilizes the Interdependence Analysis (IA) Table to generate interdependence requirements.
2. Demonstrate potential use of the COSEED process through a Search and Rescue human-machine teaming (HMT) development case study using elements from the US Department of Defence Architecture Framework (DoDAF).

### Main Research Ideas:



### Research Results:

1. The Coactive Design Method serves as an effective enabler for HMT system design within the systems engineering framework as it promotes the proactive and detailed analysis of tasks that the HMT system is required to execute.
2. The iterative nature of the coactive design method is introduced into the COSEED model, better reflecting the realities of system design and requirement management.
3. DoDAF operational models would benefit designers if it also incorporated HMT robots into its models as an operational node, to more accurately reflect the collaborative nature of the HMT system.

### Benefits/Potential Applications:

1. Optimised interdependence requirements for HMT systems as automated and unmanned systems become more capable and amalgamated in both commercial and military operations across different domains.

### Follow-up Research Activities:

1. Systems Engineering – update SysML and MBSE frameworks to accurately capture the importance of encouraging and sustaining teamwork in systems involving the use of automated unmanned robots and HMT.
2. Coactive Design – assess if IA table can offer non-colour dependent categorisation, and include required specification for the respective capacities.
3. SAR Community – continue to exploit HMT technologies to decrease rescue times and risk to rescuers.

Tai, Jia En Marcus. 2021. "Coactive Design in Systems Engineering: Human-Machine Teaming in Search and Rescue (SAR) Operations." Master's thesis, Monterey, CA: Naval Postgraduate School.