ESS 2008 Poster Session

Brown field system architecting: Driving commonality across Unmanned Aircraft Systems

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Research Group: Lean Product Development, Lean Advancement Initiative

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Motivation / Problem

- The DoD is making large investments in acquiring combat capability through acquisition of UASs
- In order to meet combatant commanders' requirements for The Long War (Global War on Terrorism), services have increased the quantities and types of UASs fielded
  - Many contractors and program offices have independently developed and fielded systems with overlapping functionality
- The GAO and OSD have directed that commonality be increased so that cost savings are realized
- As more systems are fielded, logistics tails for independent systems must be maintained at costs of inventory, transportation, training, repair, and more
- Literature focus is on developing commonality from "clean sheet" designs for product families instead of the case of existing (brown field) architectures and systems

Key Question(s)

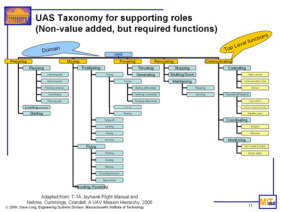
- How can opportunities for commonality be discovered across multiple systems?
- How can decisions be made to determine the application of commodity, commonality, cousinality, or unique modules for implementing functions?
- How do stakeholders impact the implementation of commonality across systems?

Methodology

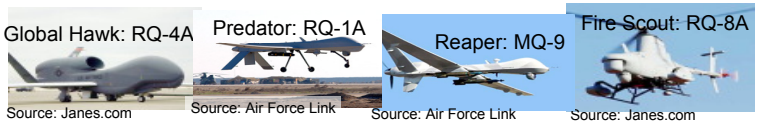
- Develop functional taxonomy for UAS value/non-value delivery
- Perform functional decompositions to identify implementations of functions in UASs
- Produce method to establish sets of correlated physical implementations of functions across arrays of UASs
- Characterize the modular physical instantiations of functions: commodity, common, cousin, unique
- Identify stakeholders for each modular instantiation and their characterize their interests
- Develop process to identify opportunities for commonality

The Research

- Developed taxonomies for identifying functions across systems
  - A common taxonomy or dictionary is required so that systems that were developed by separate groups of people can communicate effectively across cultural boundaries
- Functional decompositions of systems performed and multiple levels compared to find common modules
  - Initial studies included 4 UASs and 4 functions
- System stakeholders identified and mapped to their interests related to commonality

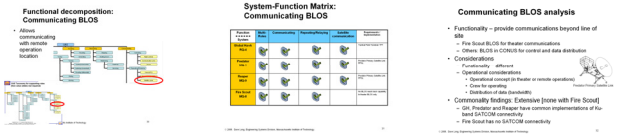


Hypothesis: Driving commonality across complex systems requires a rigorous process to implement and realize the benefits



Preliminary Results

- Functional decompositions can be used to find common sub-functions across independently developed complex systems
- The functional decompositions can be mapped to physical instantiations and compared across systems
  - Specifications can be compared to determine suitability of physical modules into another system



Remaining Research

- Continue performing functional decompositions of additional systems and perform pairwise analysis for multiple systems
- Categorize types of systems and characteristics of common, similar, and unique modules to develop heuristics for where to look for commonality
- Continue interviewing system stakeholders to determine their effect on commonality across systems
- Codify metrics for analyzing findings

Wrap Up

Expected Contributions

- Process to allow DoD system program managers to identify opportunities for commonality with other complex systems
  - Process begins with Unmanned Aircraft Systems but could be extended to other complex system domains
    - Areas for future consideration:
      - Communication systems
      - Ship management
      - Aircraft engines

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