Dynamic Capability Investment for Emerging Missions

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Introduction and Agenda

- The challenge
- Emergent mission space
- Investment
- Architecture Review
- MIL-STD-881E Standard Work Breakdown Structures
- “Smart” System Architecture via MBSE
- Quality Function Deployment
- Analysis and Optimization
- Budgetary Implications

The Challenge

- Extreme pressure on program economics and performance
  - Accelerated acquisition
  - Affordability pressures
  - Skill shortages
- “The largest challenge facing DoD weapon system development is the need to dramatically accelerate the delivery of new capabilities and new technologies to the warfighter.”[1]
- How can we grow system capabilities to support emerging mission needs?

Emergent Mission Space

- Mission needs are dynamic
- They change …
  - Over time …
  - As new opportunities and threats emerge …
  - Faster than the acquisition lifecycle has historically performed

- "If the rate of change on the outside exceeds the rate of change on the inside, the end is near."
  - Attributed to Jack Welch

Investment

- As old(er) systems get (re-)purposed for new missions, the investment strategy for upgraded capabilities becomes ever more complex
- Nonetheless we are saddled with annual funding cycles
- Accommodating emergent mission spaces will require Lean Budgeting[2] on a more frequent cadence than once per year

Smaller, more frequent changes to our investment options

Review – Architecture and Work Breakdown Structure

- INCOSE definition of system architecture – the fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution[3]
- PMI definition of Work Breakdown Structure (WBS) – a deliverable-oriented hierarchical decomposition of the work to be executed by the project team, to accomplish the project objectives and create the required deliverables[4]

The WBS describes the architecting activities yielding a systems architecture

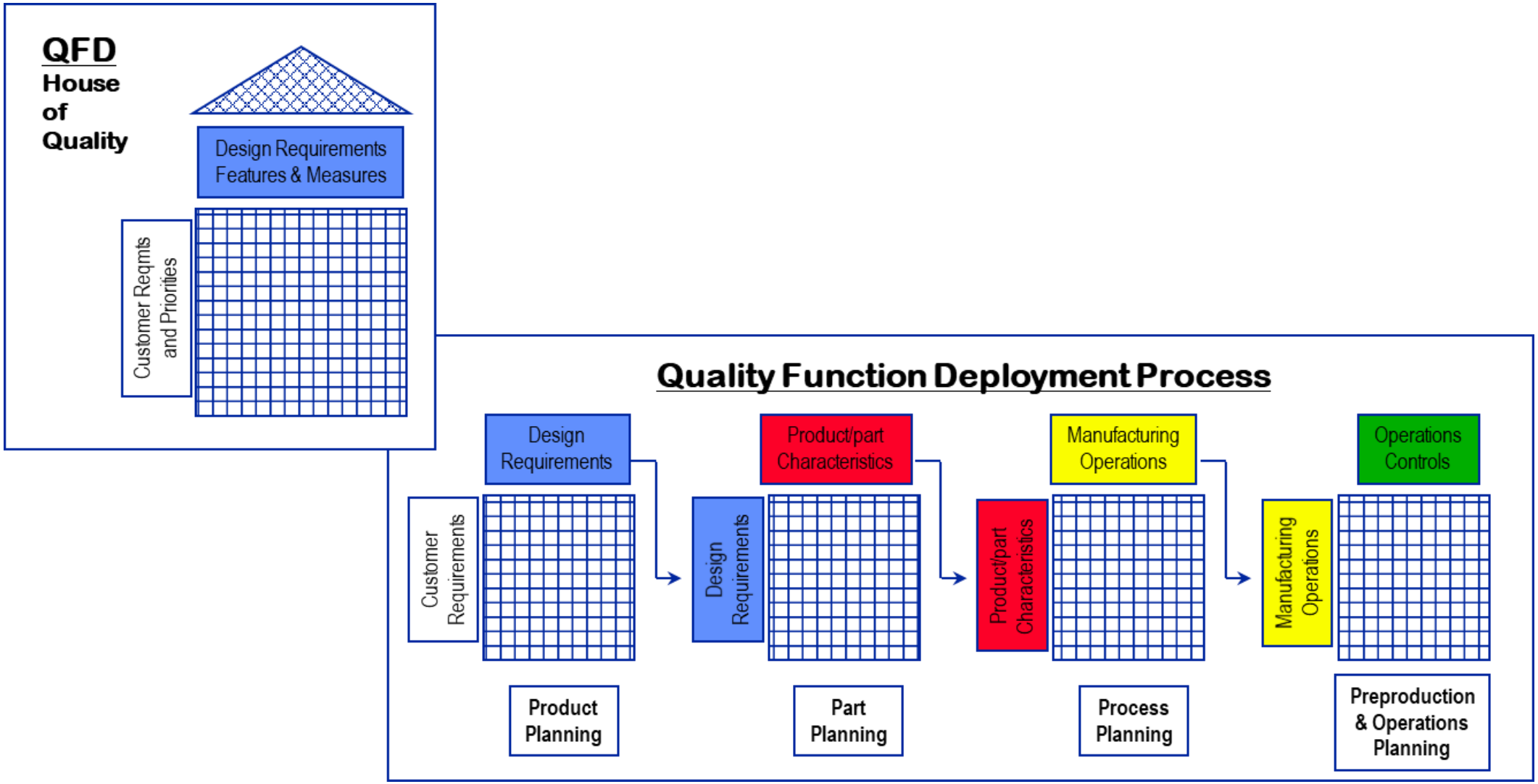
MIL-STD-881E

- The primary objective of [MIL-STD-881E] is to achieve a consistent application of the WBS for all programmatic needs
  - Aircraft Systems
  - Electronics/Avionics/Generic Systems
  - Missile/Ordnance Systems
  - Strategic Missile Systems
  - Sea Systems
  - Space Systems
  - Ground Vehicle Systems
  - Unmanned Maritime Systems
  - Launch Vehicle Systems
  - Information Systems/Defense Business Systems

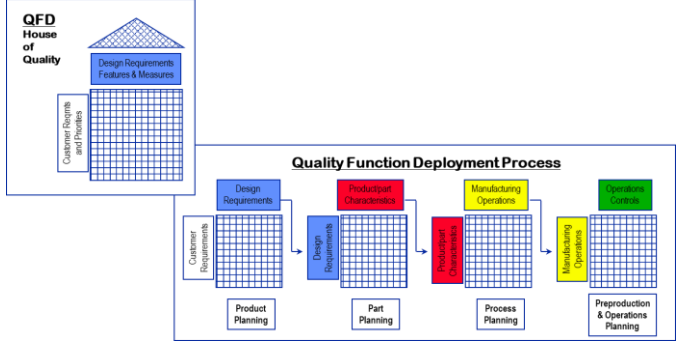
“Smart” System Architecture via MBSE

- Model-Based Systems Engineering (MBSE)
  - INCOSE definition – The formalized application of modeling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases[5]
- By establishing and preserving relationships among architectural elements, changes in relative priority can flow through a given architecture
  - “Smart” product breakdown structure

Quality Function Deployment (QFD)



QFD[6]



- A model for product development and production popularized in Japan in the 1960s
- Aids in translating customer needs and expectations into technical requirements
  - Voice of the Customer
  - Voice of the System
- Has itself been updated and modernized over time

Analytical Methods

- Already-developed product breakdown structures provide a baseline for future upgrades
- Optimize for changing needs/opportunities
  - Linear programming
  - Network optimization
  - Integer programming
- Enable a more frequent, iterative approach to capability enhancement
  - Frequency
  - Sensitivity

Budgetary Implications

- New missions emerge and customer needs change
  - Preserved relationships among architectural elements
  - Enable changes in relative priority
  - Translate into changes to the budget those architectural elements depict
  - Drive continued overall program value

Conclusion(s)

- Emerging mission needs are dynamic
- Our investment cadence for new/updated capabilities needs to speed up
- Cost-effectiveness optimization of standard architectural parameters provides a framework for making investment decisions

Questions?

Sources

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