Implementing CAIV through Design, Modularity, and Program Management

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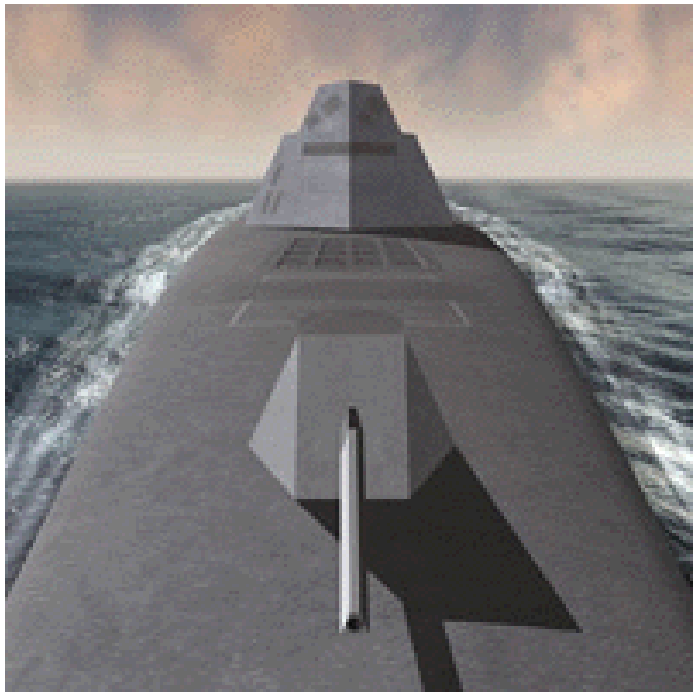
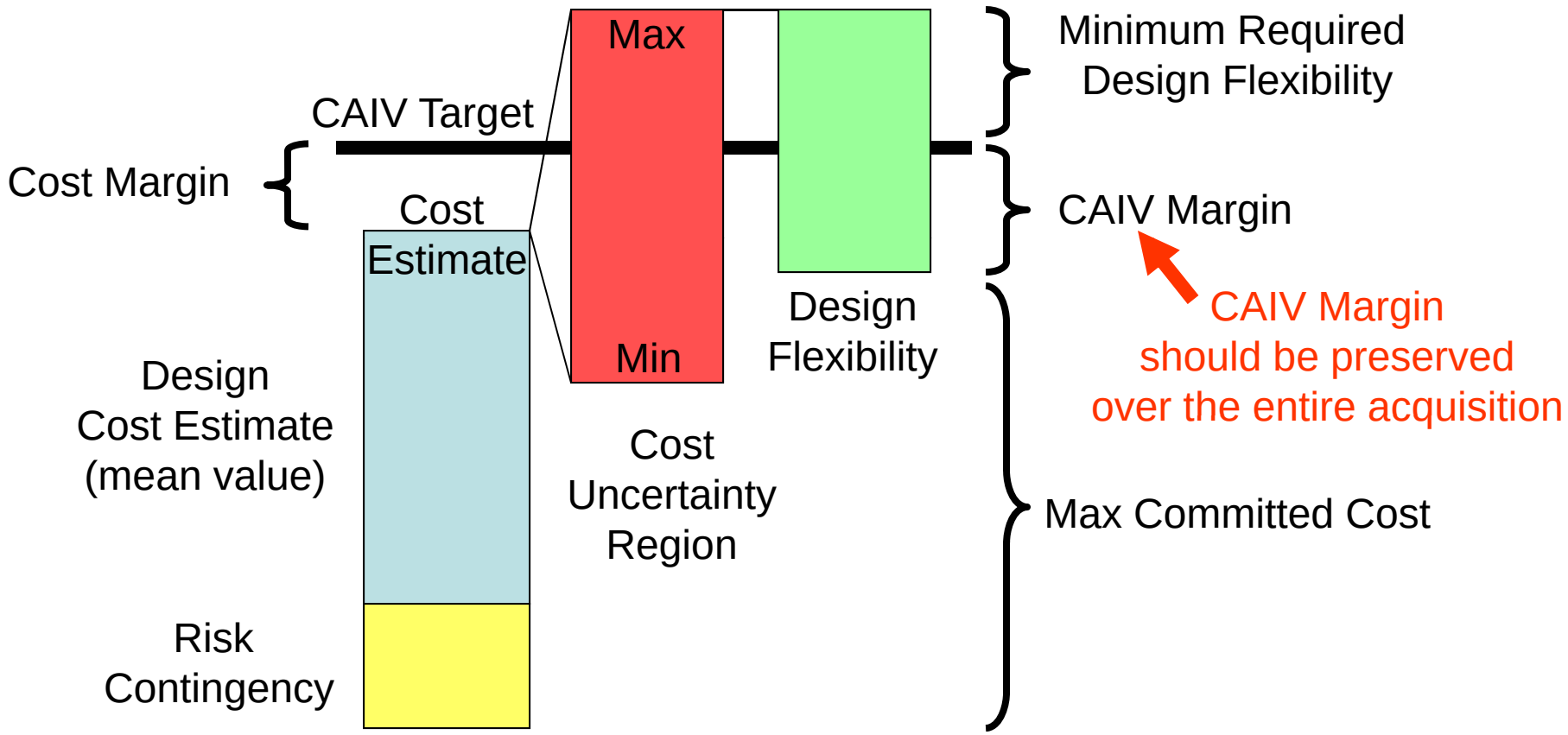
Agenda

- Introduction – CAIV Challenges
- Options
  - Modularity
  - Requirements Stability
  - Trade Space
  - Cost Contingencies
  - Set Based Design
  - Eliminate Sources of Cost Risk



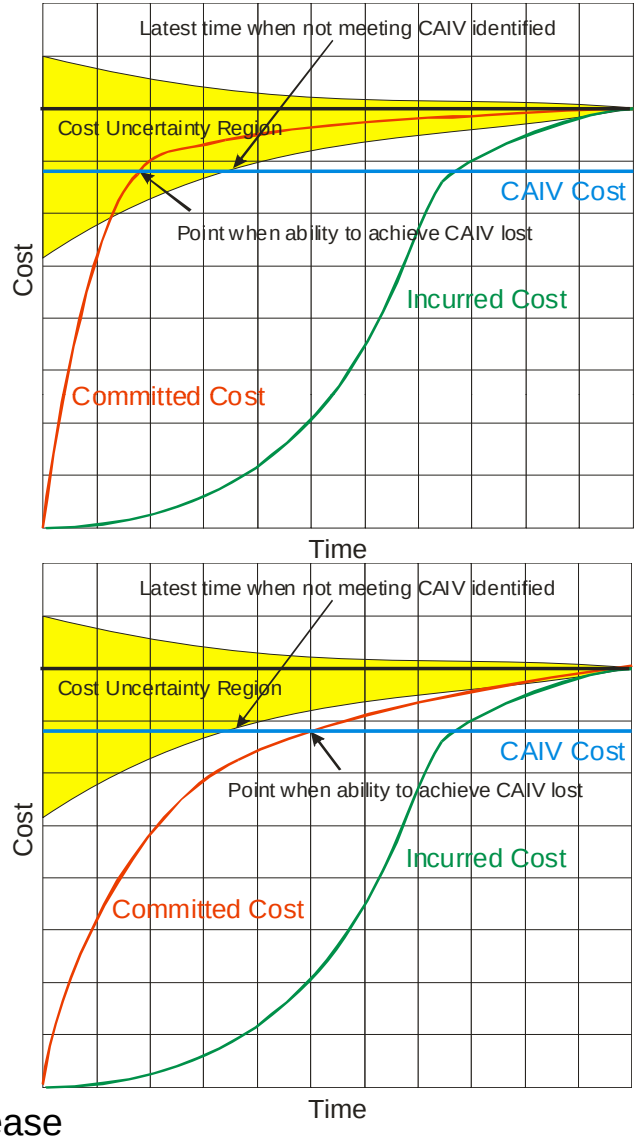
Introduction - CAIV Cost Model



Introduction - Flexibility over time

- Cost As an Independent Variable (CAIV)
  - Requirements given as a range between threshold and objective values
  - Program Manager can trade performance to achieve a cost target.
- Difficulties
  - Predicting cost early on with a high degree of certainty is impossible.
  - Traditional Design practices will “lock in” costs before the costs are known. (Lack of flexibility)
- Goal
  - Keep the “committed cost” out of the uncertainty region of the cost estimate.
  - Give the Program Manager the ability to successfully react to a cost estimate exceeding the CAIV target.
  - Keep the remaining Design Flexibility greater than the cost uncertainty

PRESERVE DESIGN FLEXIBILITY AND LOCK IN COSTS AS LATE AS POSSIBLE

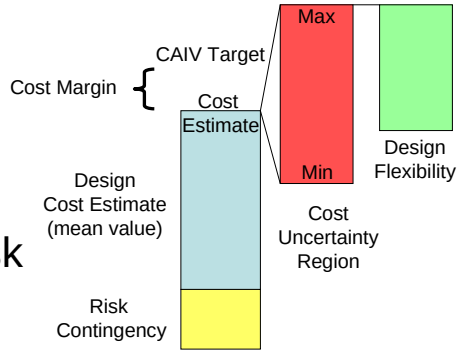


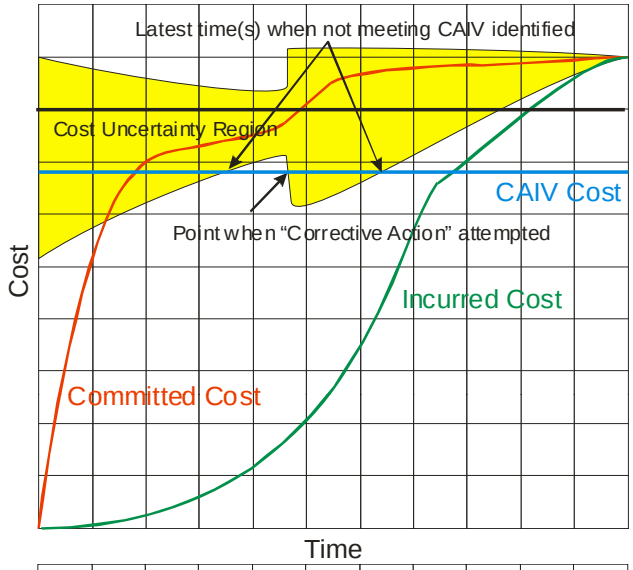
What happens when costs are projected to exceed the CAIV targets?

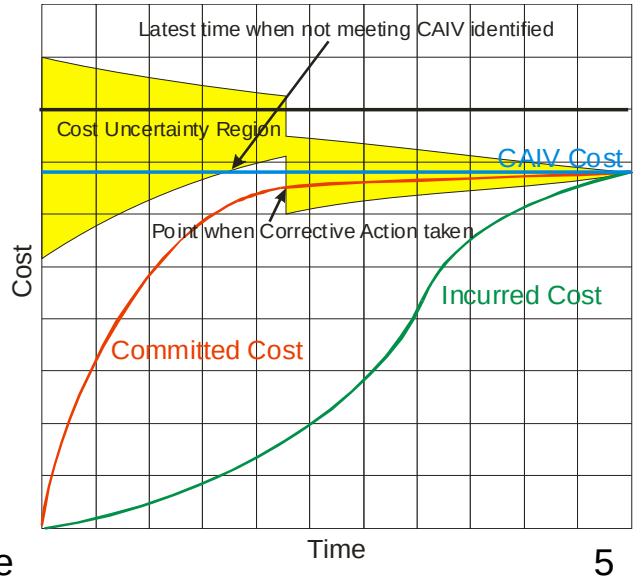
- Traditional Ways of "cutting costs" are often Counter-Productive
  - "Peanut Butter" spreading of cuts across cost accounts
  - Cutting the funding to "overfunded" cost accounts
  - Deferring Work
  - Cutting Engineering, Analysis, and oversight activities
  - Descoping Capabilities that will likely be later rescoped

Increase Risk!

- Better to plan for change affordably
  - Modularity
  - Requirements Stability
  - Trade Space
  - Cost Contingencies
  - Set Based Design
  - Eliminate Sources of Risk



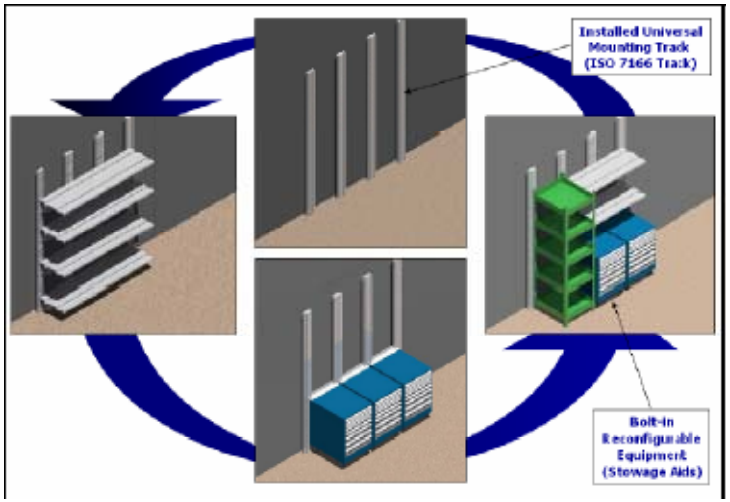




Modularity

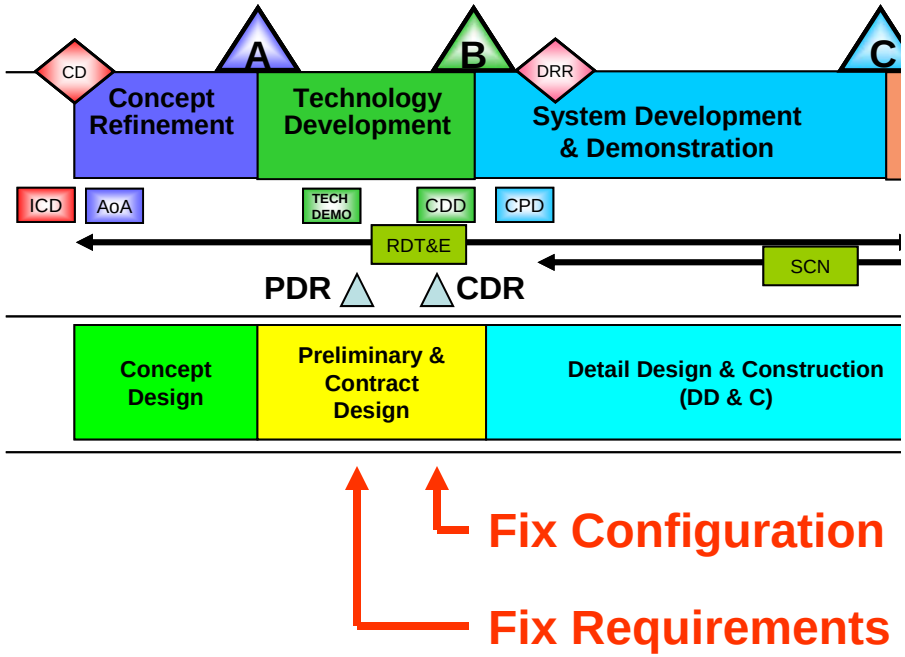
- Provide scalable performance at scalable cost
- Must enable cost effective change in system capability late in the design / construction process
  - Partially populating modular array radars with transmitter / receiver elements
  - Creating a modular work space, but outfitting it to the degree one can afford.
  - Scalable Distributed System Architectures
  - Appropriate Design and Construction Margins

From Computer Desktop Encyclopedia



Requirements Stability

- Unless unavoidable ..
  - Fix Requirements at the Preliminary Design Review (PDR)
  - Fix the configuration at the Critical Design Review (CDR)
- If Unavoidable …
  - Use modular and scalable architectures in the area of the potentially changing requirement to provide flexibility late in the design / construction process
  - Requires constant evaluation of "Requirements Risks" (a.k.a. Market Risk)



Requirement Risks should guide where to apply Modular Open Systems

Trade Space

- CAIV won't work if you design for the threshold requirement.
- CAIV won't work if you budget for the threshold requirement.
- CAIV requires sufficient budget and scalable architectures to enable trading off cost and capability as cost uncertainty is reduced over time.

CAIV is not the Solution to Underfunding a Program

Cost Contingencies

- Technical Risks have an associated cost that is often ignored.
- Cost Estimates should include Cost Contingencies that act as insurance policies for each risk in the Risk Register.
- The Return on Investment of risk reduction activity can be calculated based on the anticipated reduction in the insurance premium (Cost Contingency).
- Cost Contingencies must be carefully managed to avoid “Money Allocated is Money Spent”

http://24sis.com/Insurance.html

http://www.looklocally.com/11318.htm

Set Based Design

Understand the design space

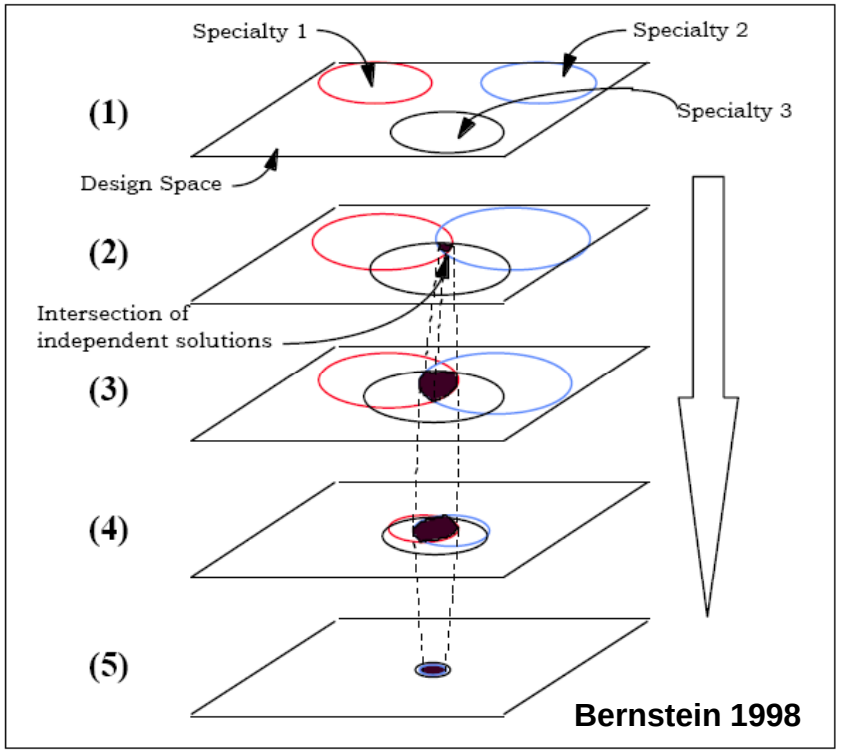
- Define feasible regions
- Explore tradeoffs by designing multiple alternatives
- Communicate sets of possibilities

Integrate by intersection

- Look for intersection of feasible sets
- Impose minimum (maximum) constraint
- Seek conceptual robustness

Establish feasibility before commitment

- Narrow sets gradually while increasing detail
- Stay within set once committed
- Control by managing uncertainty at process gates

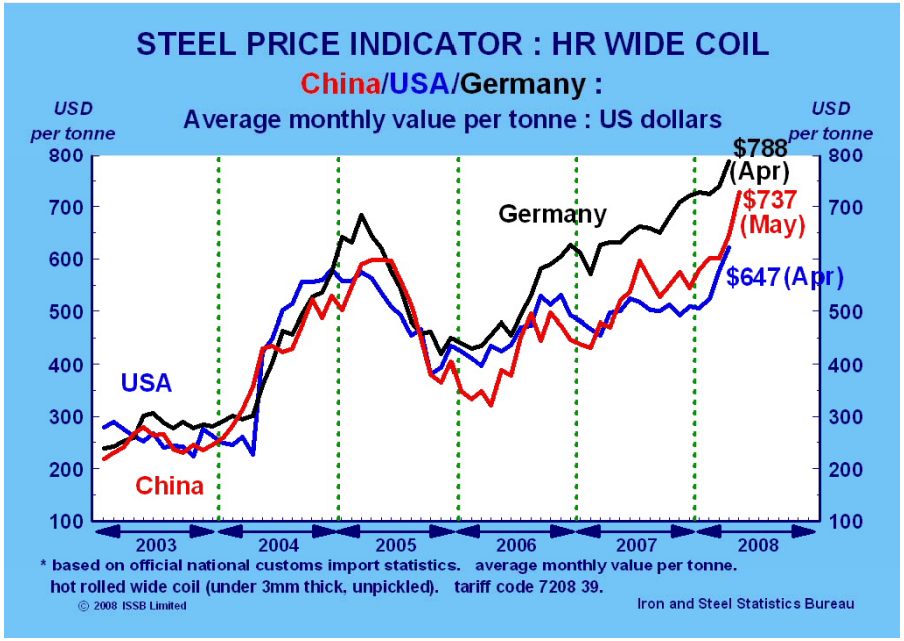


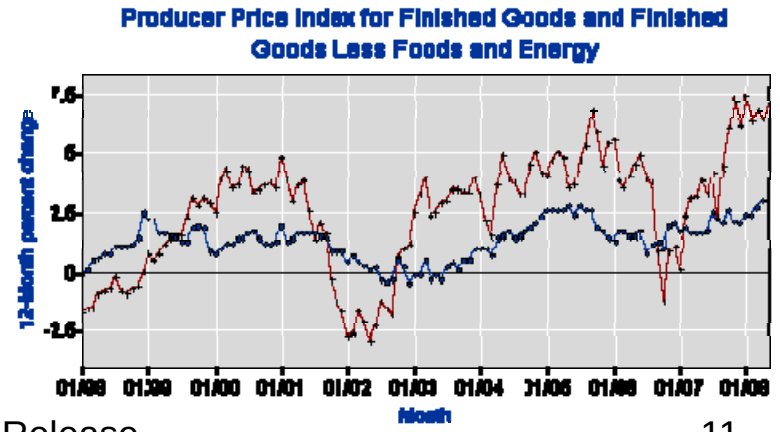
Enables Design Team to delay commitments while uncertainty is being reduced.

Bernstein, Joshua, "Design Methods in the Aerospace Industry: Looking for Evidence of Set-Based Practices," Thesis for the degree of Master of Science at the Massachusetts Institute of Technology, Technology and Policy Program, May, 1998.

Eliminate Sources of Cost Risk

- Certain costs are outside the span of control of a program manager.
  - May consume all flexibility to manage costs.
- Bureau of Labor Statistics indices can be used to adjust CAIV targets to account for fluctuating material and workforce costs.
  - Ship Acquisition Programs have used Escalation Payments in the past





http://data.bls.gov/PDQ/servlet/SurveyOutputServlet?request_action=wh&graph_name=WP_ppibrief

Summary

- Acquisition Strategy, Requirements Risk Analysis, and Systems Architectures must be aligned.
- For CAIV to work, flexibility to trade cost and capability must be preserved as long as possible.