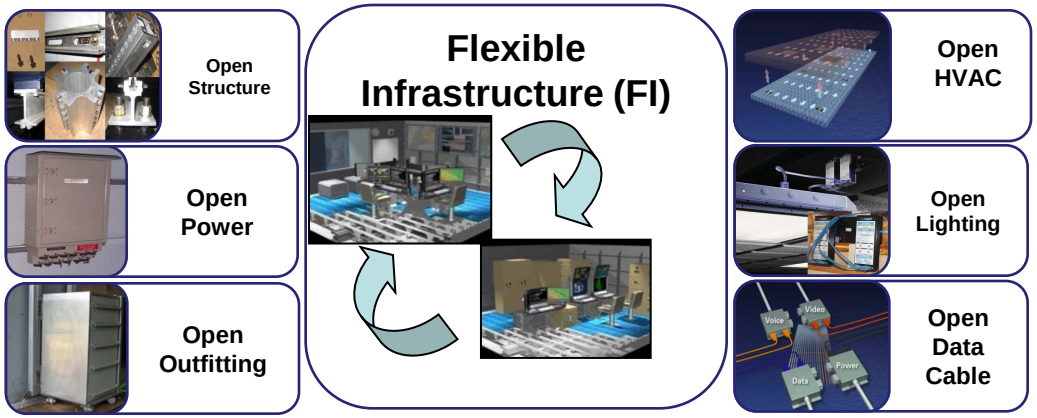
Integrating Modular Adaptable Ship (MAS) Technologies into Ship Design

PEO Council
April 17, 2012

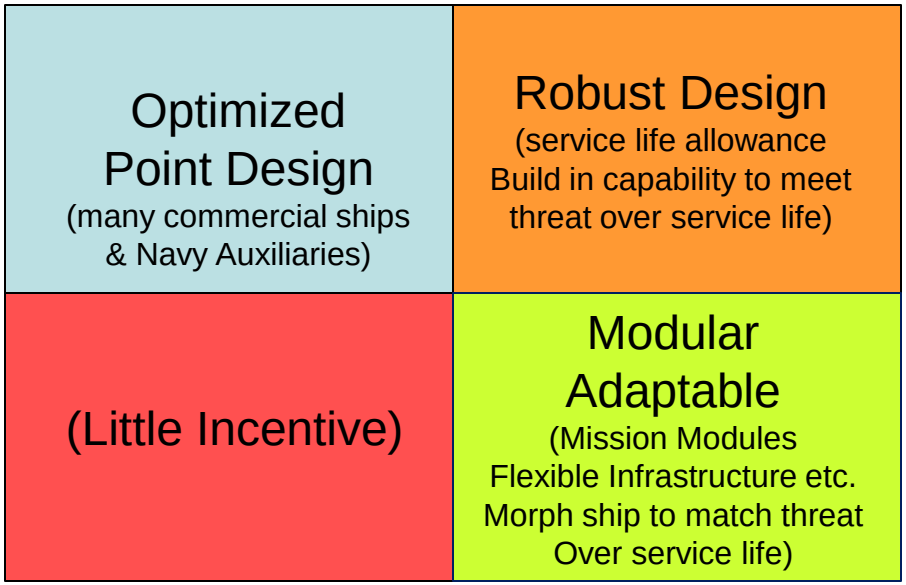
Dr. Norbert Doerry
Technical Director, SEA 05 Technology Group
SEA05TD
Norbert.doerry@navy.mil
202-781-2520

Building an Affordable Future Fleet in an Evolving World

- Face uncertain times
  - The threat is evolving
  - Our technology is evolving
  - Lean times ahead
- Ships and their systems must be robust, flexible and adaptable
  - Design process should anticipate changing requirements
  - MAS technologies can keep ships relevant over their design service life



Design Strategies



Design Fixed

Design Flexible

Requirements Fixed

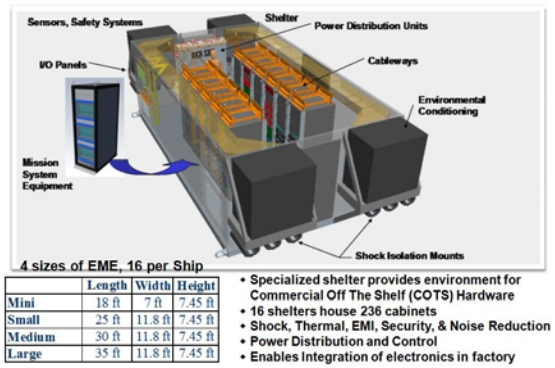
Requirements Changing

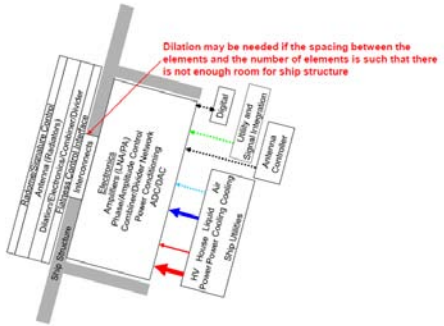
Need to analyze "Requirements Risk"

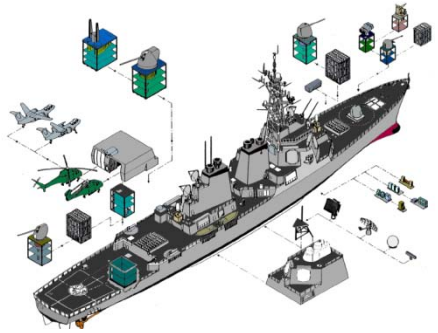
A combination of strategies is likely optimal

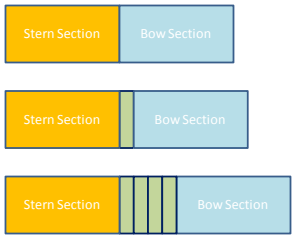
Modular Adaptable Ship Technology Examples

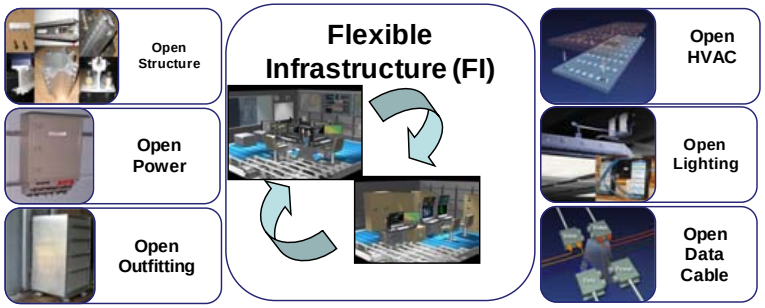
- "Modular Hull Ship" (bow, stern, variable Parallel Mid-Body)
- "Mission Bay" (like LCS)
- Container Stacks/Slots/Interfaces
- Weapon/Electronics Modules / zones
- Aperture Station
- Aircraft, boats, UUV, UAV, USV
- Electronic Modular Enclosures (EME)
- Flexible Infrastructure











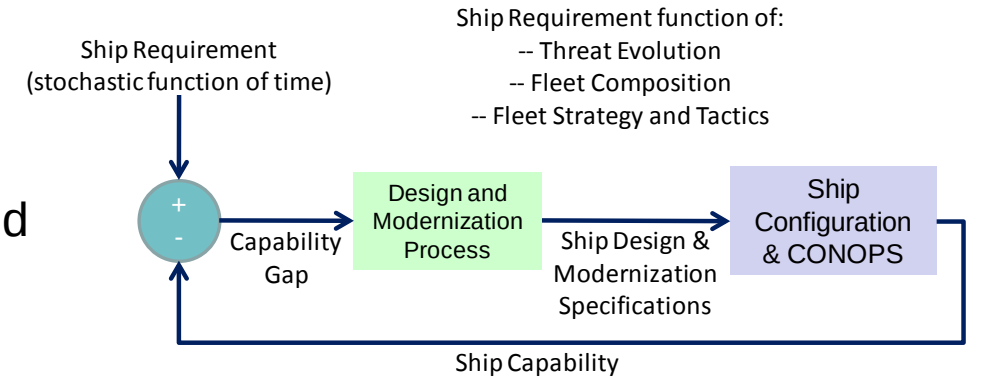
Technology / Product Maturity Goal for Ship Integration

- TRL 7 achieved
  - Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle or space. Examples include testing the prototype in a test bed aircraft.
- Industrial Base ready to produce the product
- Approved Specifications / Standard Drawings exist
- Approved Design Guidance / Handbooks exist
- Ability of Government and industry/shipyards to accurately and promptly predict work and costs
- Ability to accurately and promptly evaluate Value and Cost Benefit over the life of a ship/ship class including an understanding of the impact of changing requirements

Timing with respect to ship acquisitions depends on risk

Valuing Modularity and Flexibility

- How are requirements likely to change over the life of the ship?
- How are capability gaps measured and addressed in the Design and Modernization process?
- How do individual technologies and associated CONOPS facilitate adaptation to changing requirements?
- In performing a Cost Benefit Analysis, how are costs compared with the ability to adapt to changing requirements
  - Possibly use Real Options Theory

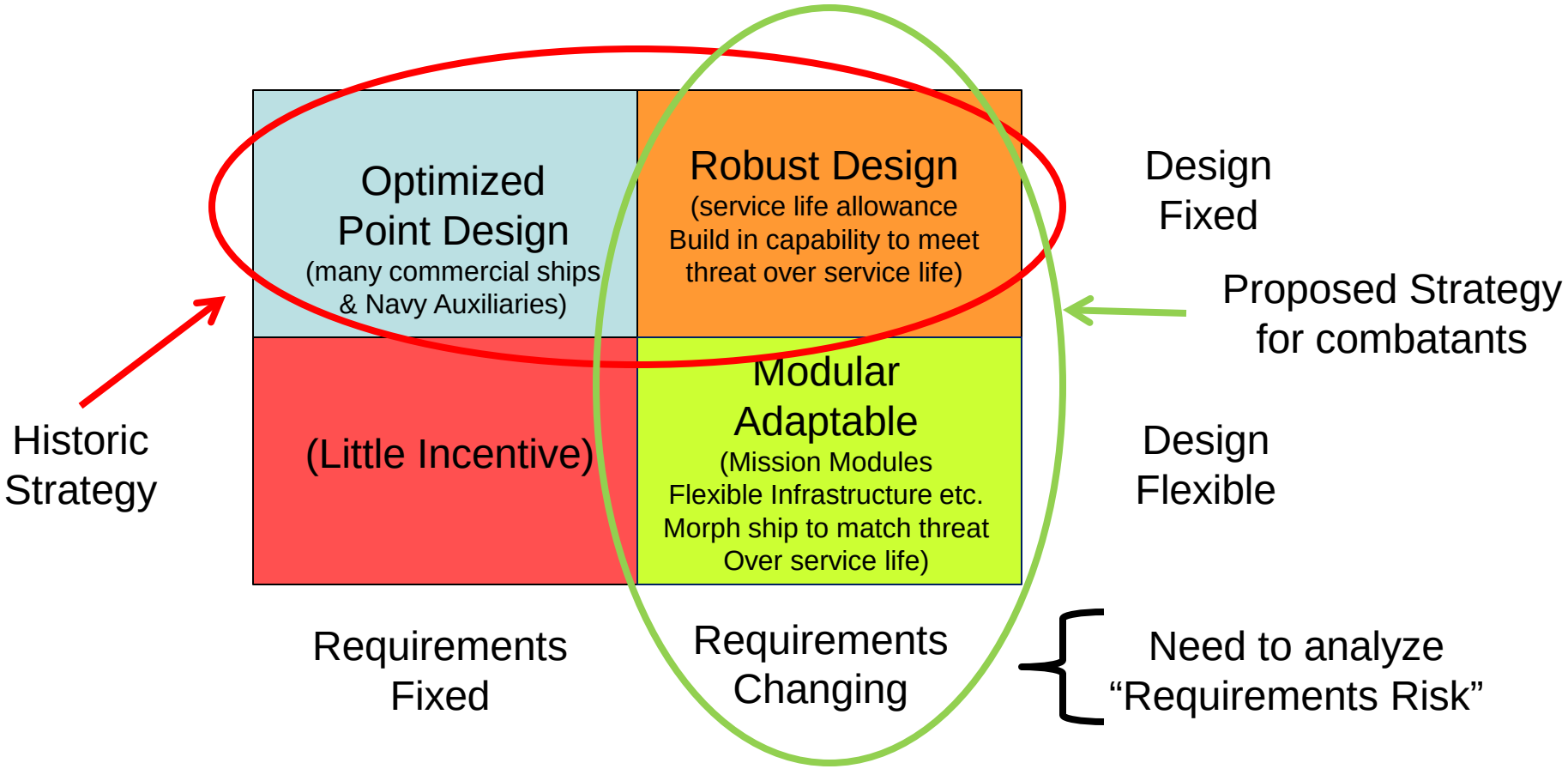


Flexibility Goal: Minimize Acquisition and Modernization Cost while also minimizing positive Capability Gap during the design service life.

Consider the Design and Modernization Process as a MIMO controller for the Ship Configuration & CONOPS. The latter must provide sufficient "control authority" or "control bandwidth" to provide acceptable performance.

How much of what type of modularity should a ship design incorporate?

Design Strategies



Keep Robust Design, but shift to Modular Adaptable Design