Summary of Key Points

● Describe the Design Build Process and its impact on affordability

● Describe actions to facilitate affordability
  ➢ Design Build
  ➢ Collaborative environment

● Examples
  ➢ VIRGINIA – Cost Plus
  ➢ T-AKE – Fixed Price
  ➢ Commercial Ships – Fixed Price
Design-Build Objectives

- Design high quality, low cost, mission-ready ships which meet the operational requirements of the Navy
- Establish a cost effective process that ensures the design is complete, material is available and work packages are developed prior to construction start
- Develop a cost effective ship construction plan
  - Increase Modularization
  - Reduce construction labor and cost – Goal: Achieve 3rd ship learning curve on the lead ship
  - Reduce design changes identified by trades during construction
## Traditional Acquisition Strategy
### Limited Collaboration, Maximum Cost and Schedule Risk

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
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**Phase I Period Characterized By:**
- Competition – Limited Communication & Collaboration
- Limited Funding – Can’t Complete Functional Design
- FFP estimate based on incomplete information – growth likely
- Interruption in Design Flow While Awaiting Competitive Down Select

**Phase II Period Characterized By:**
- End of competition typically results in significant design changes
  - Impacts schedule – causes shipbuilder to revisit early decisions, delays detail design
  - Impacts cost performance – Phase II FFP bid inadequate, shipbuilder financial risk
- Must expedite functional design to start detail design and support LLTM Order
  - World shipbuilding boom – LLTM in excess of 32 months
  - Forces design decisions that fail to optimize total cost
- Significant Overlap between functional and detail design – rework
- Significant Overlap between detail design and start of construction
  - Lack of a mature design at SOC results in poor cost and schedule performance
  - Build strategy is sub-optimized – construction sequence is sacrificed
Design Build Acquisition Strategy
Establishes Potential for Success

- For US Shipbuilding to be affordable, a paradigm shift must take place
  - Create Govt/Shipbuilder partnership early enough to maximize impact of collaboration and design for producibility considerations in future shipbuilding programs

Concept Requirements Definition

Accrue input from all relevant stakeholders and requirement sets

- CFR
- Navy/MIL Std
- Facility Limitations
- Production Suppliers
- EPA
- ABS
- IMO
- SUPSHIP
- USPH/FDA

Functional Design

Build Strategy

Co-located Design Build Teams to complete design prior to start of construction

Integrated Master Schedule

Detail Design

Planning and Production Information

- Procure LLTM for follow ships

Lead Ship Construction

Follow Ship Construction

- Purchase LLTM for lead ship
- Work instructions (detailed work packages) must be substantially complete prior to construction start

Cost Model

Higher Cost
Cost Uncertainty Range
Lower Cost

Cost Reduction Potential
Cost to Change
Specification Engineering Fabrication Delivery
Design Construction

MLP-006

For US Shipbuilding to be affordable, a paradigm shift must take place

- Create Govt/Shipbuilder partnership early enough to maximize impact of collaboration and design for producibility considerations in future shipbuilding programs

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- EPA
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Navy/MIL Std
ABS
SUPSHIP
USPH/FDA

Accrue input from all relevant stakeholders and requirement sets

Navy/MIL Std
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MLP-006

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Procure LLTM for follow ships

Cost Reduction Potential
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MLP-006
### Traditional Versus Design Build Approach

#### Lead Ship at Third Ship Cost

<table>
<thead>
<tr>
<th>Hull</th>
<th>Traditional Approach</th>
<th>Design Build Approach</th>
<th>Potential 3 Ship Class Savings</th>
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#### Area Between Curves:

- Notional 10-ship Class
  - Traditional Approach: 4M Hour Lead Ship
  - Design Build Approach: ~30% Reduction
  - Area Between Curves: > 2M Hours (3-ship Class)
Design Build in Practice
SEAWOLF and VIRGINIA Submarine Programs

![Bar chart showing percent design complete, planning complete, and construction changes for SEAWOLF and VIRGINIA programs.]

- SEAWOLF:
  - Percent Design Complete at SOC: ~1%
  - Percent Planning Complete at SOC: ~6%
  - Number of Trade Identified Construction Changes at Delivery: 68,056

- VIRGINIA:
  - Percent Design Complete at SOC: 73%
  - Percent Planning Complete at SOC: 40%
  - Number of Trade Identified Construction Changes at Delivery: 12,000

Legend:
- Percent Design Complete at SOC
- Percentage of Construction Manhours Comparison
- Percent Planning Complete at SOC
- Number of Trade Identified Construction Changes at Delivery
**Design Maturity at SOC Reduces Cost**

T-AKE 3 Represents a 30% Reduction in Cost
Design Maturity at SOC Reduces Cost
Commercial Shipbuilding Examples

- **TOTE 1**
  - Percent Design Complete at SOC: ~12%
  - Percentage Planning Complete at SOC: 15%
  - Number of Trade Identified Construction Changes at Delivery: 4,920
  - Percentage of Construction Manhours Comparison: 79%

- **BP 1**
  - Percent Design Complete at SOC: ~13%
  - Percentage Planning Complete at SOC: 8%
  - Number of Trade Identified Construction Changes at Delivery: 10,039
  - Percentage of Construction Manhours Comparison: 73%

- **Hull 501 Bid**
  - Hull 501 Performance to Date: ~1,300
Conclusions

- The Government/Shipbuilder Team must Change the Navy Acquisition Strategy to Achieve the Desired Outcome
  - Realistic Cost Estimating
  - Predictable Schedule Performance
  - High Quality, Mission Ready Ships

- Shipbuilder Focus:
  - Early Requirements Definition
  - Early Functional Design Completion
  - Work Paper ready at SOC

- Government Focus:
  - Short Competition for Good Ideas
  - Maximize Opportunities for Collaboration Before the Start of Detail Design

- Design-Build Represents the Way Ahead – Results are Well Established
  - VCS Program – 27% reduction in lead ship labor hours
  - PC-1 Program – Lead ship on schedule, under budget, minimal design change