NDIA Conference: “Design Innovation to Improve DoD Acquisition”

User Executive Plenary Session:

Ready To Design A Warship?

Prove It!

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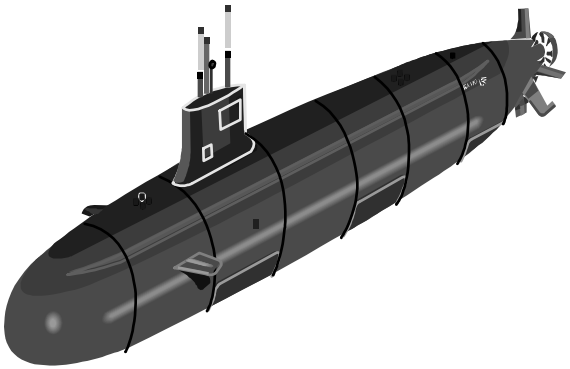
15 November 2011

Opinions are those of the author and not those of any Government agency or program.

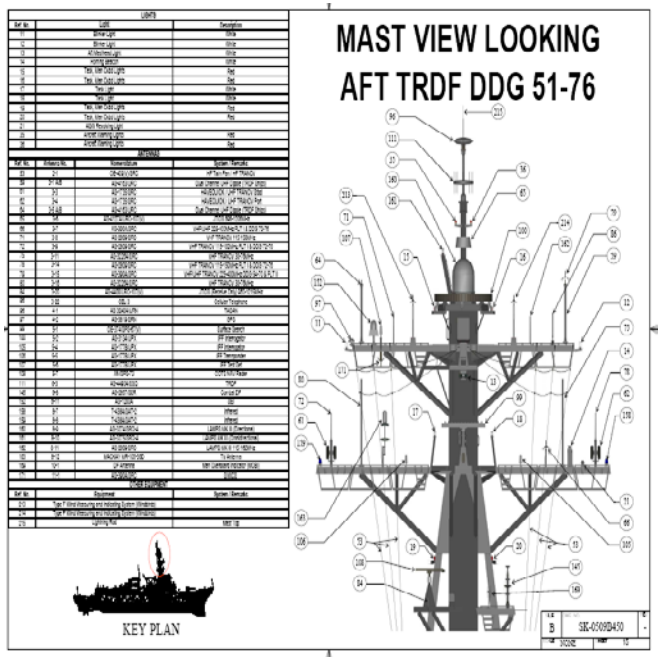
Nature of the Product – A Warship

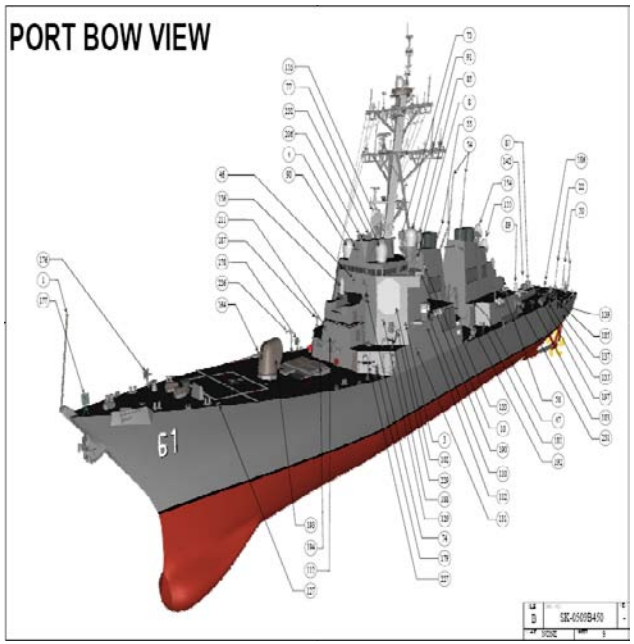


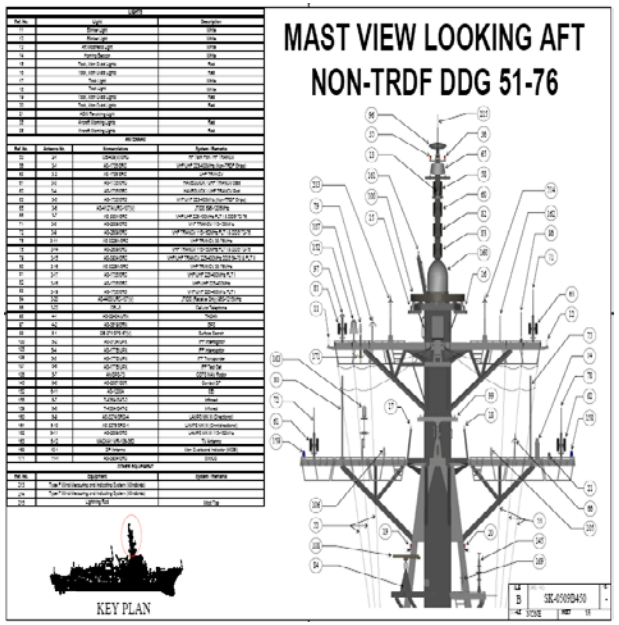
- A “system of systems”: Operate in battle force with older and newer ships
- Very low quantities, high unit cost, long lives
- Extremely complex product: millions of piece parts
- No prototypes, first ship(s) must be fully operational
- Government develops combat/weapons/communications systems
- Government ultimately assumes responsibility for meeting requirements
- Lack of commercial shipbuilding industrial base to build upon
- Intense Congressional oversight

RF Integration Challenges

Our Topside Real Estate Reality







Numerous antennas competing for limited space and coverage result in a complex electromagnetic environment (EME), presenting a challenge for effective topside integration and maintaining the topside baseline.

AV Integration Challenges

- **Dynamic Interfaces between ship and aircraft**

Examples of Effective Designs Using Physics-Based Modeling

- **Improved “Seakeeping Performance” Hull Form for DDG 51 Class Ships**
- **Active Fin Roll Stabilization System for Increased Operational Envelopes of Helos on FFG 7 Class Ships**
- **Reduced Radar Cross-Section Signatures of Surface Combatants**
- **Reduced signature of ship/submarine propellers/propulsors**
- **Expanded Safe Operating Envelopes of submerged submarines**

LPD 17

- ***First amphibious ship designed to specific survivability and vulnerability requirements:***
  - **greatly reduced signatures,**
  - **hardened structure,**
  - **improved separation/redundancy,**
  - **significantly enhanced self defense systems, and**
  - **cooperative engagement capability.**
- ***First surface ship designed for a 40-year service-life***

GEOMETRY

CAD SYSTEMS

3-D PRODUCT MODEL

BEHAVIOR

CAE CODES

PHYSICS-BASED MODELS

SMART PRODUCT MODEL

INTERACTION

VIRTUAL PROTOTYPE

REAL-TIME VISUALIZATION SYSTEMS

VIRTUAL ENVIRONMENT

MANU-FACTURING MODELS

FINANCIAL MODELS

LOGISTICS MODELS

OTHER CHARACTERISTICS

SMART PRODUCT MODEL

LEAPS Universe

ASSET Ship

ASSET Sub

CAD — T — STEP (203, 214) IGES — T

FORAN — T

TRIBON — T

FASTSHIP — T

SHIP AP's
STEP (216) (215) — T

HLA Federate(s) — T

LEAPS Product Model

- Generic Class Structure
- Product Model Schema
  - NAVSEA Ship Focus Object Model
- Product Model Data

Presentation Mgr

LEAPS/Editor

Excel | STEP/IGES

DOORS

T — SDWE — TSD

T — NCCM — SSF

T — EXCEL — VERES

T — TSSM — FKS

T — SMP — SWPE

T — ASAP Lite — GMULT/GCPL

T — EMENG — RTC

BAM

SHCP/L

ISA

EMAT

IHDE

CONTAM

CFX

AEGIR

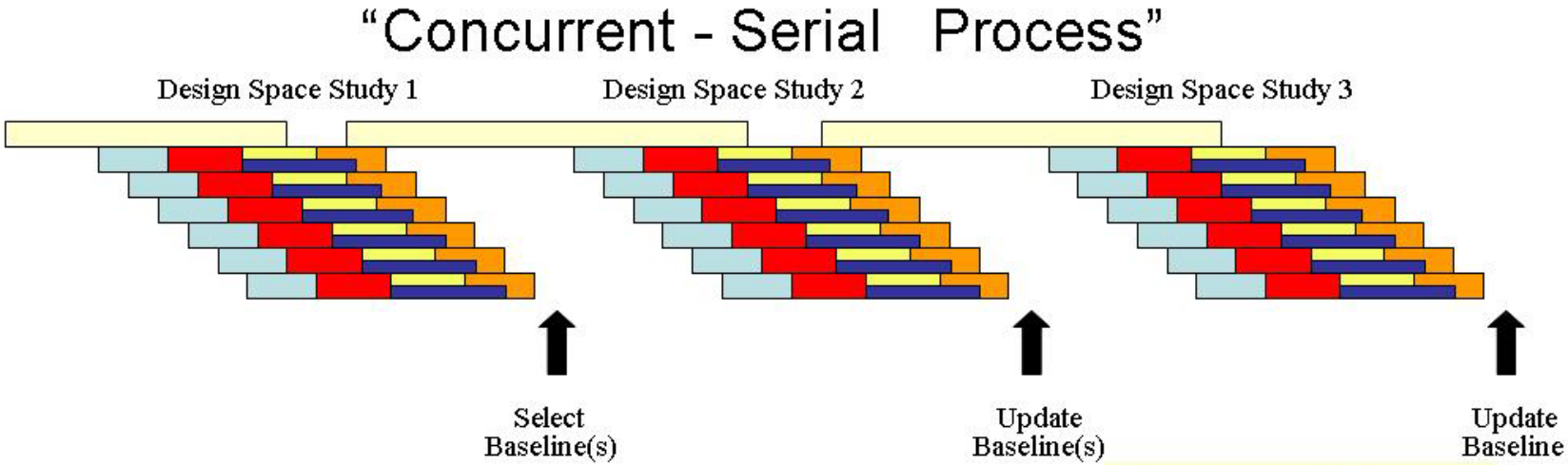
In Development | Beta Code | Existing | Planned

Integrated Tools: “We Shape Our Tools And Our Tools Shape Us”

- Accelerate use of physics-based models by design engineers in early design
- Achieve an Integrated Design Environment (IDE) for early stage design
- Implement a design analysis product model - LEAPS (Leading Edge Architecture for Prototyping Systems)
- Integrate Design, Production and Support
- Capitalize on 3-D Product Model Technology

Structure IDE to Design-Build Process

Process Improvements: Set-Based Design



Planning
Requirements
Design
Costing
Performance
CONOPS

Explore Different Dimensions of Design Space in Succession.

Likely Faster Convergence to a near optimal design

END