

Bath Iron Works

**A GENERAL DYNAMICS COMPANY**

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**Naval Vessel Rules Relative to High  
Speed Naval Craft Rules**

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# Outline

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- **Introduction/Background**
- **Comparison of NVR and HSNC Organization and Content**
- **Differences between NVR and HSNC in Current Implementation**
- **Additional observations on NVR**
- **Considerations and Opportunities**
- **Conclusion**

# DDG 1000 Physical Design



## Characteristics

Length	600 ft	Displacement	14,564 LT
Beam	80.7 ft	Installed Power	78 MW
Draft	27.6 ft	Crew Size	142 (incl. Aviation detachment)
Speed	30 kt		

## Sensors

- Dual Band Radar
- S-Band VSR
- X-Band MFR
- HF & MF Bow Sonar Arrays
- Multi-Function Towed Array
- EO/IR System
- ES System

## Superstructure

Composite structure

## Weapons

- (80) Advanced vertical launch cells for Tomahawk, ESSM, Standard Missile
- (2) AGS 155 mm guns
- (600) 155 mm rounds
- (2) 57 mm Close In Guns
- Torpedo Defense (Space Reservation)
- Anti-Terrorism (Space Reservation)

## Aviation

MH60R and (3) VTUAVs  
(Capacity for 2 MH 60Rs)

## Integrated Power System

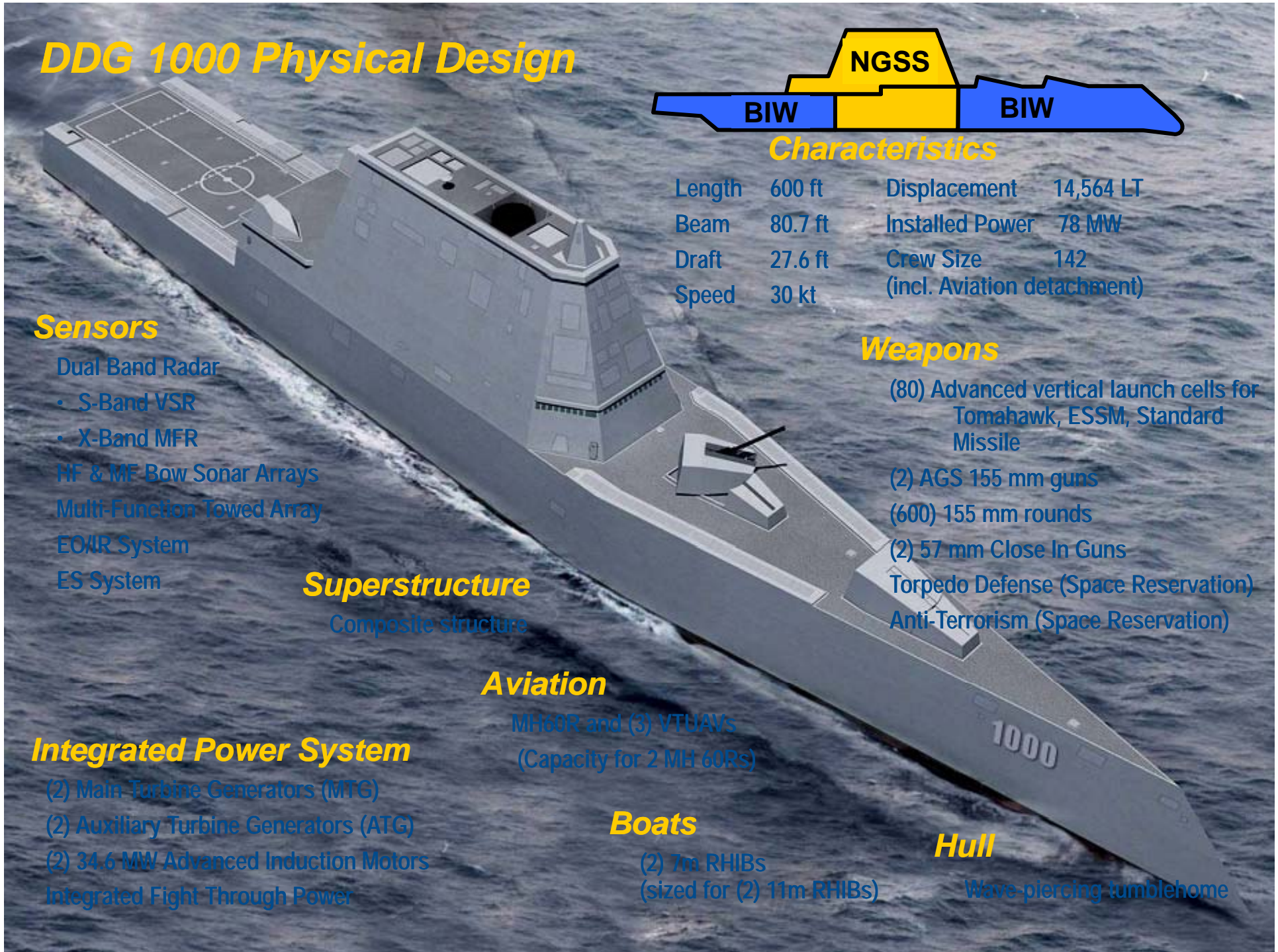
- (2) Main Turbine Generators (MTG)
- (2) Auxiliary Turbine Generators (ATG)
- (2) 34.6 MW Advanced Induction Motors
- Integrated Fight Through Power

## Boats

(2) 7m RHIBs  
(sized for (2) 11m RHIBs)

## Hull

Wave-piercing tumblehome



# GENERAL DYNAMICS Littoral Combat Ship

## Maximum Warfighting Capability Per Dollar



**Off-Board Vehicle Launch & Recovery System**

**Large Flight Deck**  
1,030 sq m for  
(2) H-60 or (1) H-53

**Large Mission Bay**  
Carries Mission Modules for ASW, MIW or SUW

**Large Hangar Area**  
351 sq m for  
(2) H-60 P/S

**Integrated ISR Suite**

**57 mm Gun**

**Mine Detection Sonar**

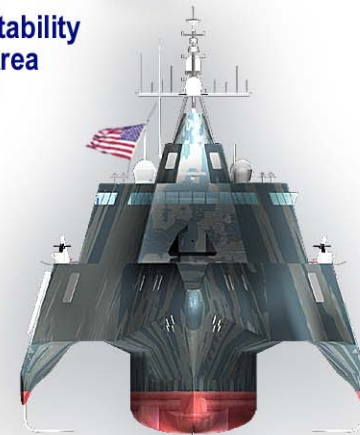
**Integrated Command & Control**

**Habitability Area**

**Mission Bay Lift**

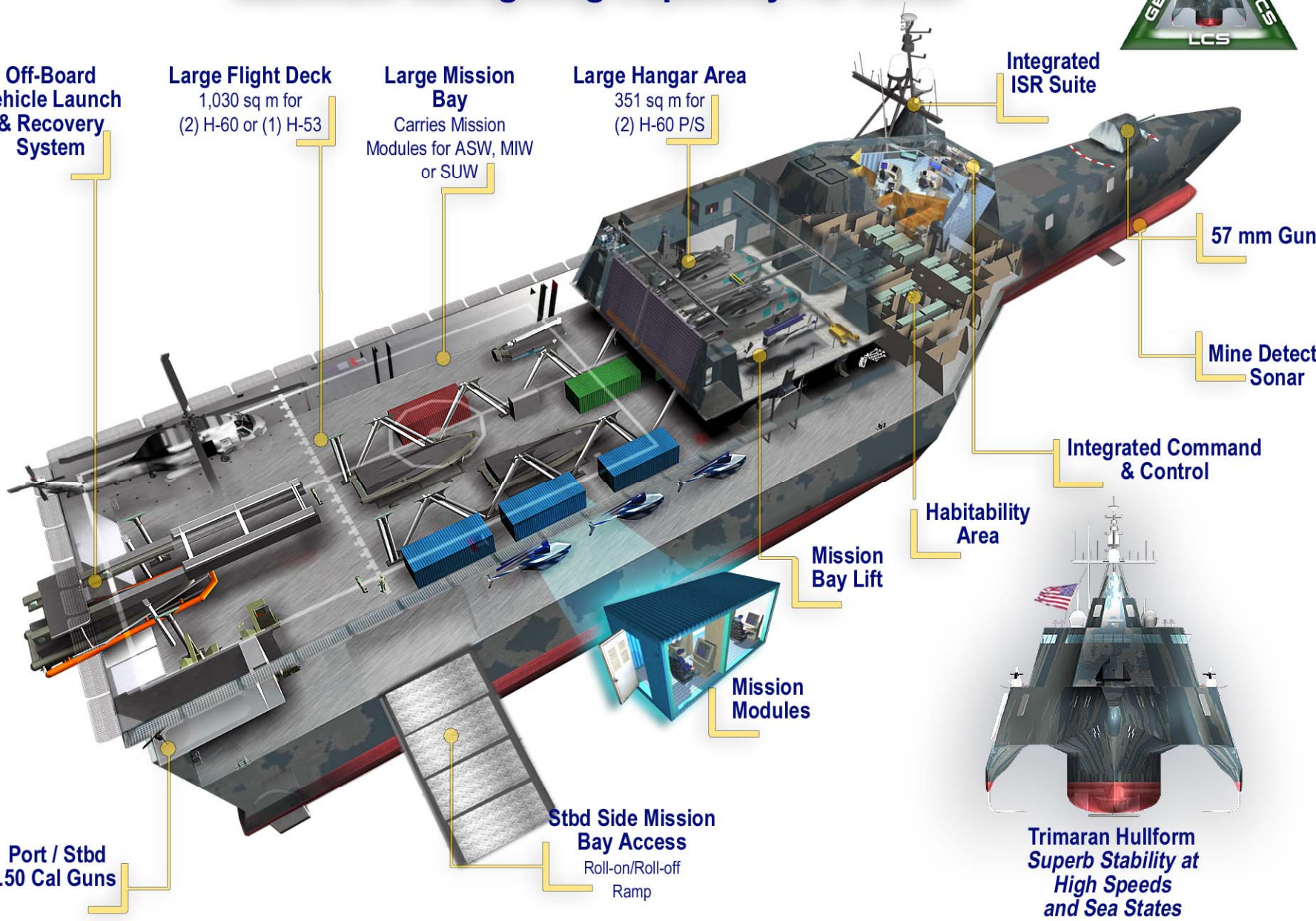
**Mission Modules**

**Stbd Side Mission Bay Access**  
Roll-on/Roll-off Ramp



**Trimaran Hullform**  
*Superb Stability at High Speeds and Sea States*

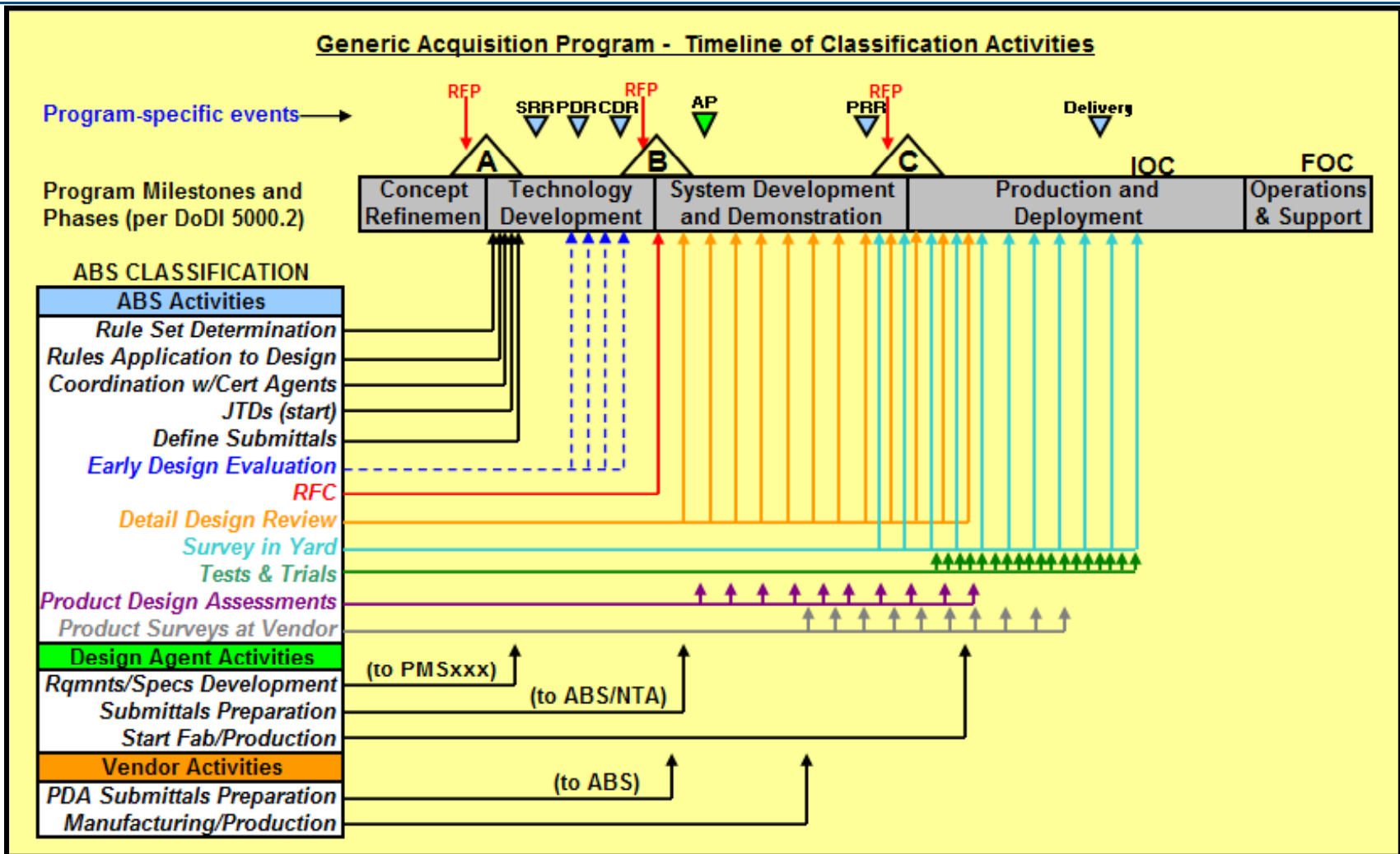
**Port / Stbd .50 Cal Guns**



# LCS Float Off



# Notional Classification Process



# Organization of NVR

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- **NVR Parts cover general provisions, all aspects of hull, mechanical and electrical systems, and materials and welding aboard ship**
- **Correspondence to SWBS**

# Organization of SVR

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- **SVR Organization**

- ▶ Part 1 – Conditions of Classification
- ▶ Part 2 – Materials and Welding
- ▶ Part 3 – Hull Construction and Equipment
- ▶ Part 4 – Vessel Systems and Machinery
- ▶ Part 5 – Specific Vessel Types
- ▶ Part 6 – Optional Items and Systems
- ▶ Part 7 – Survey after Construction

- **Vessels classed as Naval Support or Coast Guard allowed to comply with SVR for designated systems**

# Organization of HSNC

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- **HSNC Organization**

- ▶ Part 1 – Conditions of Classification
- ▶ Part 2 – Materials and Welding
  - “Base” Rules
  - Supplementary Requirements for Naval Vessels
  - Aluminum and FRP
- ▶ Part 3 – Hull Construction and Equipment
- ▶ Part 4 – Craft Systems and Machinery
- ▶ Part 7 – Survey after Construction

- **Corresponds to Steel Vessel Rules Organization**

- ▶ Part 4 essentially SVR with minor applicable changes
- ▶ Part 3 (Structure) specific to HSNC
- ▶ No Part 5 (Vessel Types) or 6 (Optional Items and Systems)
- ▶ Parts 2 (Base) and 7 are common Rules across ABS (less NVR)

# General Observations on NVR – Format, Content and Implementation

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- **Single, consolidated, relatively well organized rule set**
  - ▶ Updates / maintains applicable MIL-STDs / DDSs
- **2004 Rules sometimes lack clarity with regard to technical criteria and submittal requirements or do not reflect current Navy policy**
  - ▶ 2006 – 2008 NVR are significantly improved
- **Rules are oriented towards experience with Naval combatant design over the last 20 years – Some tendency towards legacy point solutions rather than establishing “minimum acceptable criteria**
  - ▶ Always options for JTD
- **Large number of dual ABS/NTA approvals**
  - ▶ Coordination of ABS and NTA reviews sometimes challenging
- **Tailoring Process (JTD) cumbersome even with recent improvements**
  - ▶ Large number of JTDs
  - ▶ Reconciliation of Spec Language and description of technical alternative proposed in JTD
- **ALCON still “learning the game” – Growing pains**
  - ▶ Understanding of process and Roles and Responsibilities still evolving

# General Observations on HSNC – Format, Content and Implementation

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- **Single, consolidated, well organized rule set**
- **Quasi-commercial in nature**
  - ▶ Use of common criteria for welding and Survey after Construction
- **Technical and Submittal requirements generally clear**
- **HSNC Rules generally provide more trade space than NVR**
  - ▶ More first principle calculations and analysis required to establish compliance
- **Essentially no NTA approvals for Class**

# Differences – Current Implementation

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- **Organization and Content**

- ▶ NVR: Parts generally correspond to SWBS
- ▶ HSNC: Organization similar to Steel Vessel Rules (SVR)
  - No explicit Habitability and HSI requirements as in NVR
  - Less onerous criteria for Control and Monitoring systems

- **Rule interpretation**

- ▶ NVR: Formal Rule interpretation via RCIA - process adjudicated by Navy: ABS indicates concurrence
- ▶ HSNC: Formal Rule interpretation by ABS

- **Formal Tailoring of Rules**

- ▶ NVR: Tailored by JTD – NTA Approves/ABS indicates concurrence
  - Depending upon the program, JTDs may be submitted to NTA to a process administered by NTA, or process may be facilitated by ABS
- ▶ HSNC: Tailored by agreement with ABS

# Differences – Current Implementation

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- **Approvals during Plan Review**

- ▶ NVR: Mix of ABS, NTA and ABS/NTA (dual) approvals required
- ▶ HSNC: ABS is approval authority for items addressed in HSNC Rules

- **Survey During Construction**

- ▶ NVR:ABS has authority for Class decisions
  - Close coordination with SUPSHIP essential to ensure consensus between ABS and SUPSHIP
- ▶ HSNC: ABS has full cognizance over Class issues
  - Scope of SUPSHIP technical oversight role as directed by the Navy
  - ABS expected to exercise technical cognizance over HM&E except for mission systems and other items specifically under the cognizance of the Government
  - Still need coordination with SUPSHIP for cognizant items interfacing with Class

# Considerations and Opportunities

- **Use “Approval in Principal”/”Early Design Evaluation” to address major issues early**
- **Allow appropriate design trade space in both Rules and contract specs to avoid proliferation of JTDs to align contract requirements and NVR criteria**
  - ▶ Understand Rules are minimum acceptable technical criteria and not detailed spec language
- **Give consideration to the principles described in the ABS Guide for Review and Approval of Novel Concepts vice multiple JTDs**
- **For items totally within ABS cognizance to approve, allow for adjudication during plan review vice processing of JTD**
- **Further clarify the oversight and coordination Roles and Responsibilities for Class activities (specifically for Class to NVR); Look for appropriate opportunities to reduce number of dual approvals required by NVR**
  - ▶ Navy – ABS Business Rules for LCS
  - ▶ Navy Omnibus SOW for ABS Class activities
  - ▶ NVIC 10-82 “Acceptance of Plan Review and Inspection Tasks Performed by the American Bureau of Shipping (ABS) for New Construction or Major Modification of U.S Flag Vessels
  - ▶ NVIC 2-93 – USCG Alternate Compliance Program

# More Considerations and Opportunities, or Lessons Learned

- **Understand where contract requirements overlap, exceed, or conflict with ABS Class requirements**
  - ▶ Adjudicate issues up front
- **Develop a “Master Certification Matrix”**
  - ▶ ABS may be tasked to provide an initial draft
- **Develop a draft “comprehensive submittal list” that addresses both prime contractor and sub-contractor/vendor submittal expectations**
  - ▶ Review with ABS for completeness
  - ▶ “Map” to requirements in Rule Parts and by system
- **Develop functional system level certification/compliance plans where needed**
  - ▶ Address tailoring of criteria through survey, test and trials
  - ▶ Address compliance responsibilities, as well as required coordination and sequencing between design and engineering artifacts – including vendor/sub-contractor developed items
- **Establish requirement area Coordinators/Champions/Owners**
  - ▶ Responsible for managing compliance issues that cross organizational boundaries

# Even More Considerations and Opportunities, or Lessons Learned

- **Convey program needs and expectations related to Plan Review cycle time**
  - ▶ Ensure ABS has visibility into submittal plan/schedule
- **Develop plan for coordination of vendor compliance issues**
  - ▶ Consider ABS' Vendor Coordination Program
- **Understand what is considered an acceptable means of obtaining NTA approvals where required (NVR)**
- **Obtain agreement on Rule tailoring process (JTD) if not already conveyed in contract**
  - ▶ Primarily for NVR since NTA and ABS are both involved, but should be formalized with ABS PM even for HSNC
- **Understand relationships with other regulatory bodies, requirements e.g. USCG, NAVAIR, IMO etc.**
- **Consider pilots to assess feasibility for processes that deviate from standard process e.g. review of design products in 3D models vice via standard drawings**