Program Executive Office

SHIPS

We Are Ships
From Cradle to Grave

NDIA Expeditionary Warfare Conference: Force Structure Panel

RADM Charles Hamilton, PEO Ships

25 October 2006




CNO Priorities

- **Sustain Combat Readiness**
  - **Right combat capabilities – access, speed, agility, adaptability, persistence, awareness and lethality – for the right cost.**
- **Build a Fleet for the Future**
  - **Balanced, rotational, forward deployed and surge capable**
  - **Proper size and mix of capabilities**
    - **empower enduring and emerging partners**
    - **deter adversaries**
    - **defeat enemies**
- **Develop 21st Century Leaders**
  - **Through a transformed manpower, personnel, training and education organization that better competes for the talent our country produces and creates the conditions in which the full potential of every man and woman in our Navy can be achieved**

Navy Shipbuilding Plan

Ship Class	FY06	FY07	FY08	FY09	FY10	FY11	FY07-11
CVN 21	-	0	1	-	-	-	1
SSN 774	1	1	1	1	1	1	5
DDG 1000	-	2	0	1	1	1	5
CG(X)	-	-	-	-	-	1	1
LCS	3	2	3	6	6	6	23
LPD 17	1	0	1	-	-	-	1
LHA(R)	-	1	0	-	1	-	2
T-AKE	1	1	1	1	1	1	5
MPF(F)	-	-	-	0	0	0	0
MPF Aviation	-	-	-	-	-	1	1
MPF LMSR	-	-	-	-	1	1	2
MPF MLP	-	-	-	0	-	1	2
Intratheater Connectors	-	-	-	1	1	1	3
Sea-Shore Connectors	-	-	-	-	1	4	5
Total New Construction	**6**	**7**	**7**	**11**	**12**	**14**	**51**

- ***Congress authorized and appropriated funding requested in the 2007 President's budget for DDG 1000, LCS, LHA(R), LPD 17 and T-AKE***
  - ***DDG 1000 program received authorization to proceed with Dual Lead Ships strategy***
  - ***Cost caps placed on DDG 1000 (lead ships), LHA(R), LPD 17 ships 22-25***

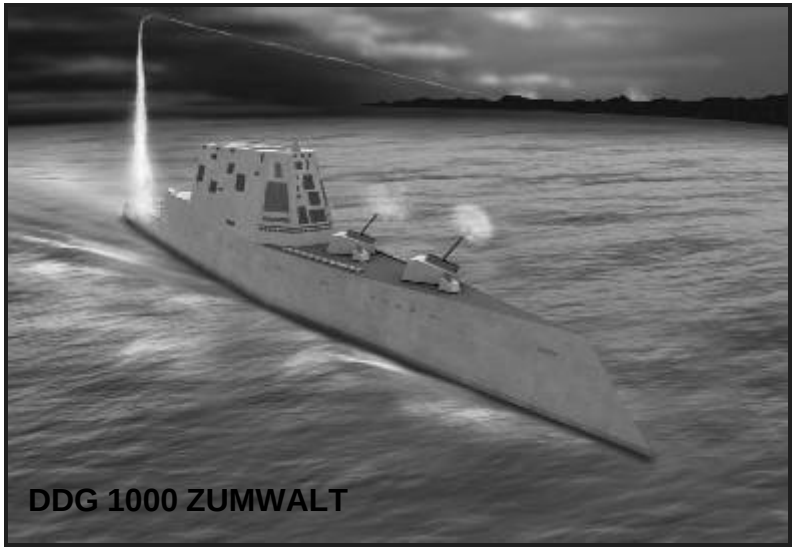
Obstacles to Designing Affordable Ships

- **Getting early, documented, validated requirements, informed by cost**
  - **Analysis of ship cost must include complexity, ship density, degree of warfare system integration and propulsion plan configuration in addition to labor and material costs**
- **Rising costs in combat systems and C4ISR suites, with limited user appetite suppression ("better" is the enemy of "good enough")**
  - **Weapons systems are approximately 40% of total cost on warships in the FYDP**
- **Material demand (global steel market) and vendor base**
  - **Material sourcing by parent shipbuilding corporations could be improved to coordinate leveraged material buys within the shipyards they own**

- **Streamlining the Shipbuilding Acquisition Process**
  - **Technology Maturation Model**
  - **CAIV Model**
  - **Requirements Model**
  - **Producibility Model**
  - **Lifecycle Optimization Model**
  - **Partnering Model**

- **Technology Maturation Model**
  - **Produce Engineering Development Models (EDMs) to elevate Technology Readiness Levels (TRLs) and gain mature cost insights from actual production of representative subsystems**

    Example: DDG 1000 EDMs



DDG 1000 ZUMWALT

DDG 1000 ZUMWALT

DDG 1000 Critical Technologies

Infrared Mockups (IR)

- Land-based suppressor testing complete
- At-sea panel testing complete

Integrated Composite Deckhouse & Apertures (IDHA)

- RCS testing complete
- Co-site testing complete

Advanced Gun System (AGS)

- Initial guided flight testing complete
- Land-based testing complete

Dual Band Radar (DBR)

- MFR land-based testing complete
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Peripheral Vertical Launch System (PVLS) / Advanced VLS

- Two detonation tests conducted
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Integrated Power System (IPS)

- Component factory testing complete
- Critical Test Parameters (CTPs) complete

SMC fly-through

Hull Form Scale Model

- Performance validated by model testing

Autonomic Fire Suppression System (AFSS)

- At-sea weapons effect and autonomic fire suppression testing demonstrated

Total Ship Computing Environment (TSCE)

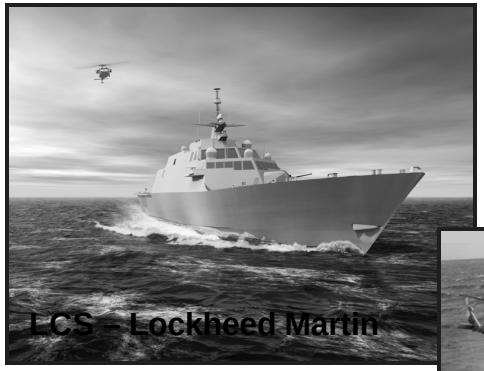
- Software Releases 1, 2, and 3 successfully coded, tested, and authorized by the Government

Integrated Undersea Warfare (IUSW)

- At-sea mine avoidance testing complete
- Automation testing complete

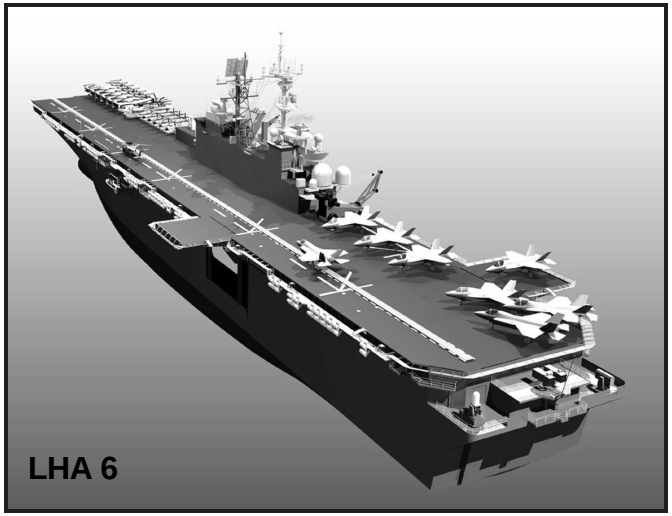
- **CAIV Model**
  - **Establish affordability targets for end item and permit capability trades to achieve desired unit cost**

    Example: LCS, LHA 6



LCS – Lockheed Martin

LCS – General Dynamics



LHA 6

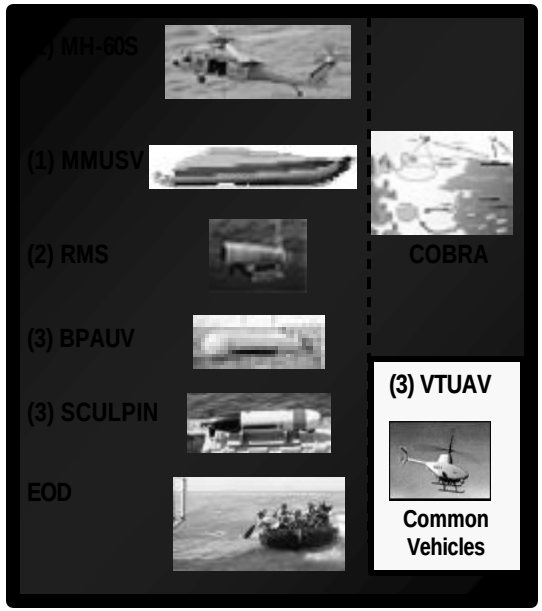
CAIV Target $220M Seaframe

Lockheed Martin

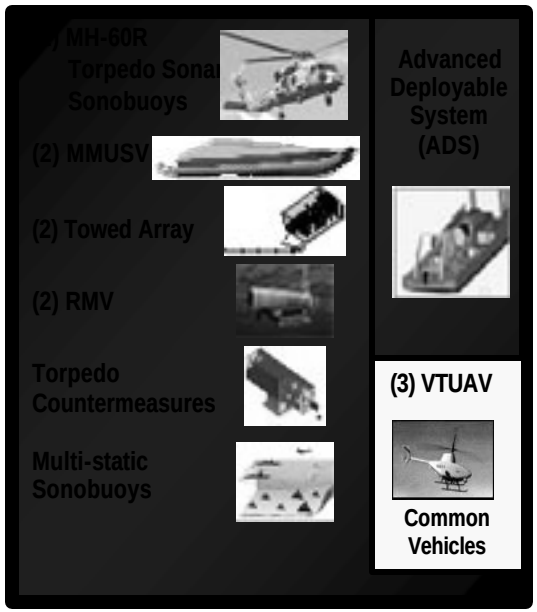
Gibbs & Cox • Marinette Marine • Bollinger Shipyards

General Dynamics

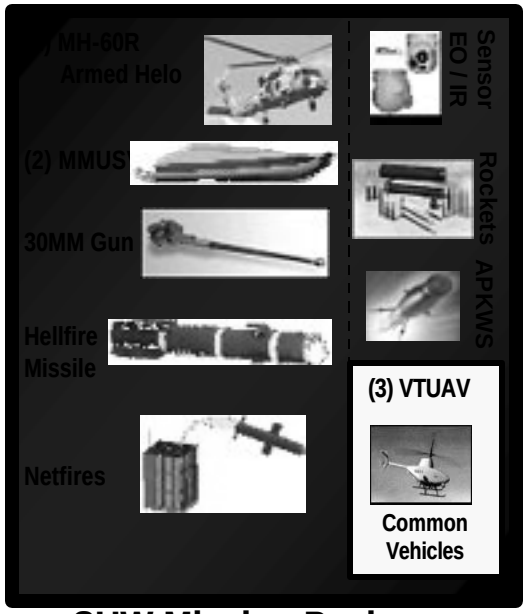
Bath Iron Works • Austal • BAE Systems • CAE • MAPC



MIW Mission Package



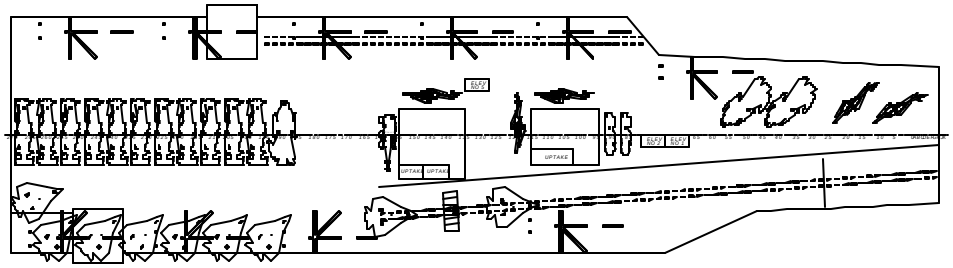
ASW Mission Package



SUW Mission Package

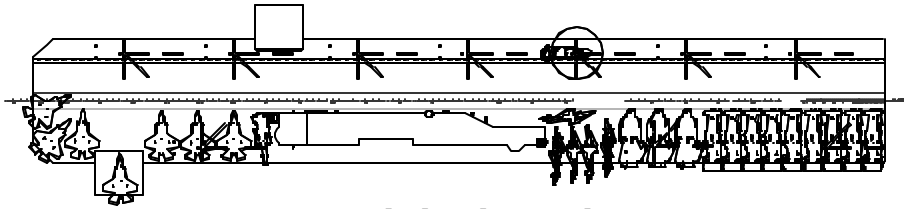
SUW Mission Package

LHA 6 Requirements vs. Cost – Tradeoff history



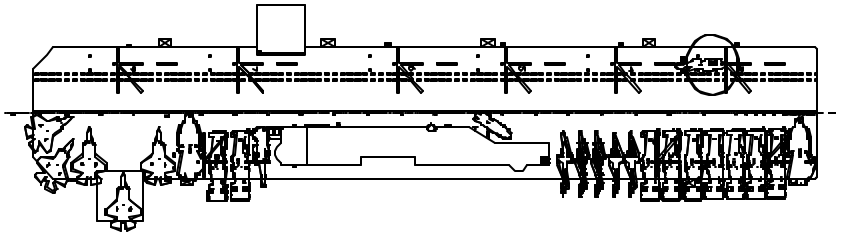
Dual Tram Line

- **Displacement – 69,000 Ltons**
- **Aircraft Capacity**
  - **37 aircraft**
  - **10 CH-53/MV-22 operational spots**
  - **Concurrent flight operations**
- **Cost - $5.1B (ROM) for an FY10 ship**



LHA(R) Plug Plus

- **Displacement – 50,000 Ltons**
- **Aircraft Capacity**
  - **33 aircraft**
  - **10 CH-53/MV-22 operational spots**
  - **Limited concurrent flight operations**
- **Cost - $3,780M for an FY07 ship**



LHA 6

- **Displacement – 45,000 Ltons**
- **Aircraft Capacity**
  - **31 aircraft**
  - **9 CH-53/MV-22 operational spots**
  - **Limited concurrent flight operations**
- **Cost - $2,762M for an FY07 ship**

- **Requirements Model**
  - **In lieu of asking for multi-mission platforms to solve all requirements needs, establish focused mission needs and permit mission swap out by facilitating common interfaces**

    Example: LCS
  - **In the definition of requirements, establish realistic threshold to objective KPPs and resource (execute to the threshold level)**

    Examples: DDG 1000, LCS, MPF(F), LHA 6

- **Designing for Producibility Model**
  - **Insertion of common interfaces in design**

    Example: DDG 1000, LCS
  - **Maximize reconfigurable internal volume**

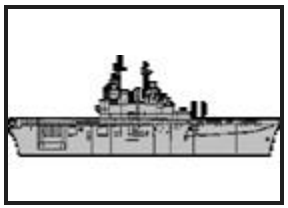
    Example: LCS
  - **Maximum reuse of existing production infrastructure and existing designs to achieve new requirements**

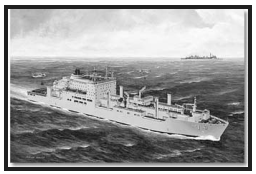
    Example: MPF(F) Squadron

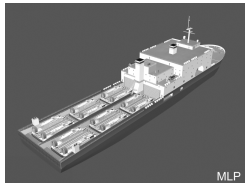
    Example: DDG 1000 hull to CG(X) hull

MPF(F) Decision – Hybrid Legacy Option

- **Meets the basic requirements – preferred option by USMC/USN leaders**
- **Flexible mix of ships and capabilities, transition opportunities**
  - **Provides opportunities for Joint applications**
- **MPF(F) Squadron selected has both low cost and schedule risk overall;**
  - **One new design – fits with industrial base capacity**
  - **Two hot production lines**
    - **Program benefits from non recurring engineering already accomplished and learning curve (LHA(R) and T-AKE)**
    - **Return costs available**
  - **Three existing designs (LHD, T-AKE and LMSR)**
    - **Mitigates cost for non recurring engineering**
    - **Return costs available**
  - **Minimizes workload disruption in shipyards**





MPF(F) Squadron

LHA(R) w/MEB C2

2

- Lightship Displacement: 30,862 MT
- Landing Spots: 9/ship
- Personnel: 3000/ship
- Ship Speed: 22 kts

LHD w Aviation C2

1

- Lightship Displacement: 28,540 MT
- Landing Spots: 9/ship
- Personnel: 3000/ship
- Ship Speed: 22 kts

LMSR

3

- Lightship Displacement: 36,289 MT
- Landing Spots: 2/ship
- Personnel: 345/ship (+500 surge)
- Ship Speed 24 kts

T-AKE

3

- Lightship Displacement: 25,700 MT
- Landing Spots: 2/ship
- Personnel: 194/ship
- Ship Speed 20 kts

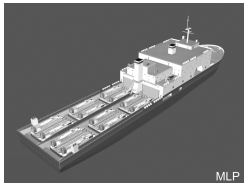
Legacy Dense Pack

2

- Lightship Displacement: 19,900 MT
- Landing Spots: 1/ship
- Personnel: 62/ship
- Ship Speed 18 kts

- Squadron is 14 ships
- 6 hulls: 2 hot production lines, 1 new design
- Full MEB (1 vertical battalion and 2 surface battalions) are selectively offloadable
  - Personnel for second surface battalion are on Sea Base
- 11 of 14 ships built to commercial survivability standards (minor enhancements), 3 ships to military survivability standards
- MLP required for surface interface
- Meets delivery timeline for vertical and surface battalions
- Significant Industrial Base stability

MLP(w/Troops)



3

- Light Ship Displacement: 28,423 MT
- Landing Spots: VERTREP
- Personnel: 1300/ship
- Ship Speed 20 kts

- **Designing for Lifecycle Optimization Model**
  - **Modernization through mission module upgrades**

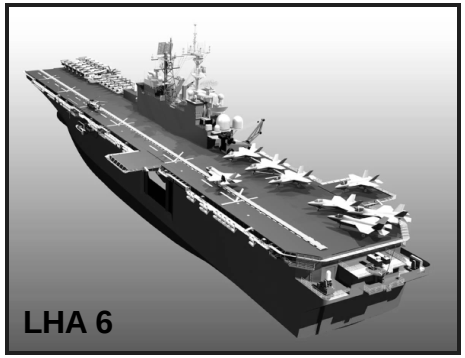
    Example: LCS
  - **Increased reliance on automation, HSI to remove touch labor in maintenance, supply support, watchstanding**

    Example: DDG 1000, LCS, LPD 17, LHA 6


LCS – Lockheed Martin


LCS – General Dynamics


DDG 1000 ZUMWALT


LHA 6


LPD 17 USS SAN ANTONIO

- **Increased partnering across the national and international spectrum model**
  - **Common requirements across services**
    - **Example: Joint High Speed Vessel (Army, Navy, USMC)**
    - **Example: MPF(F) Seabasing**
    - **Example: Potential LCS and USCG Deepwater**
  - **International cooperation**
    - **Example: LCS FMS cases**

Summary

- **CNO's Guidance:**
  - **Sustain Fleet size via stable SCN funding**
  - **Buy the right capability at the right cost**
- **Building the Fleet of the Future**
  - **DDG 1000 *ZUMWALT* class**
  - **LCS 1 *FREEDOM* class**
  - **LPD 17 *SAN ANTONIO* class**
  - **LHA 6 class**
  - **T-AKE 1 *LEWIS AND CLARK* class**
- **A stable shipbuilding plan, coupled with one or more affordability strategies, plus a focused industry push for cost reduction yields affordable platforms**

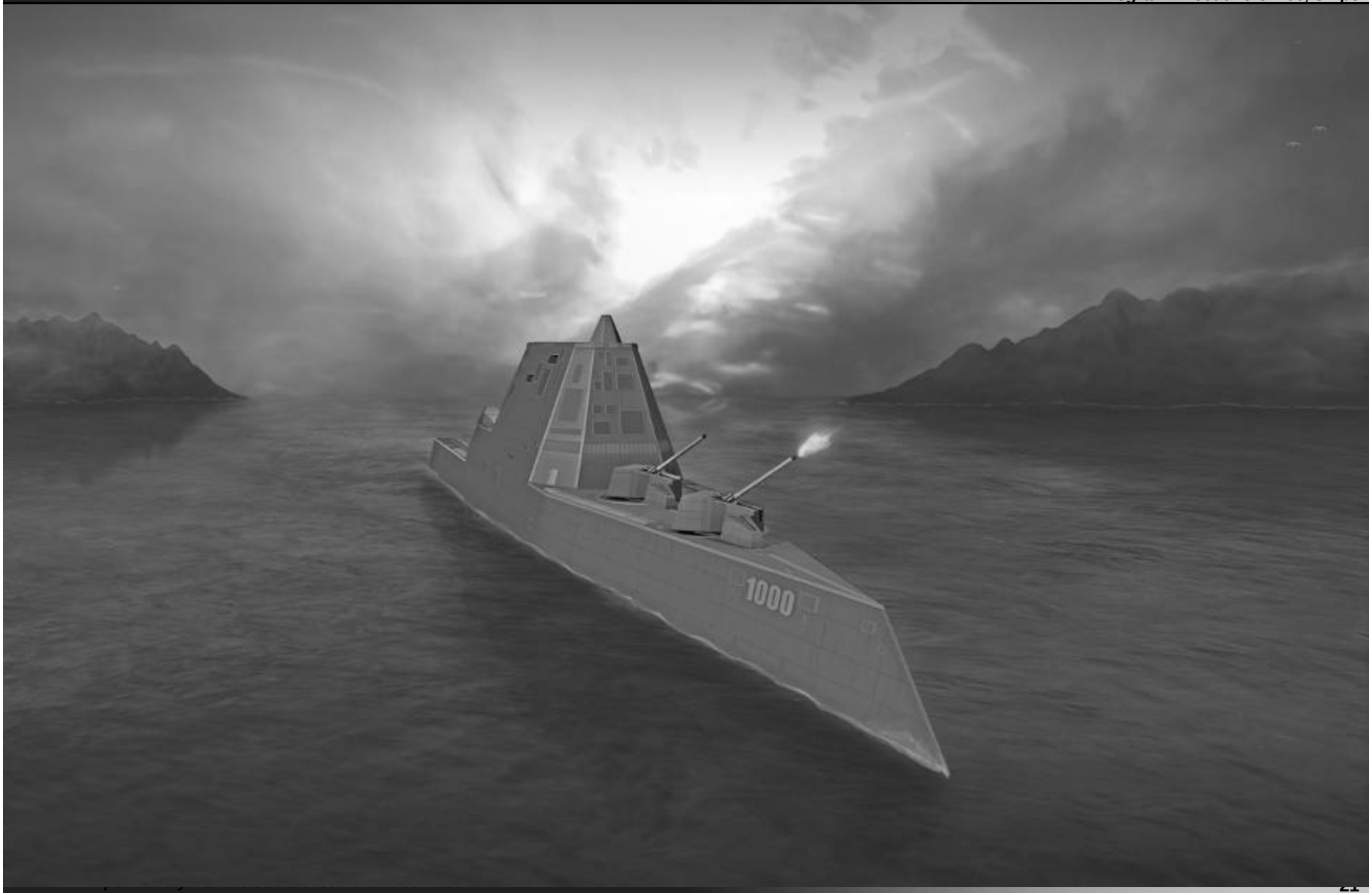
"We need to stop getting smaller… My biggest challenge is to build a fleet for the future… The goal is to have a plan which is stable and industry can build to."

- Admiral Mike Mullen, CNO
7 February 2006

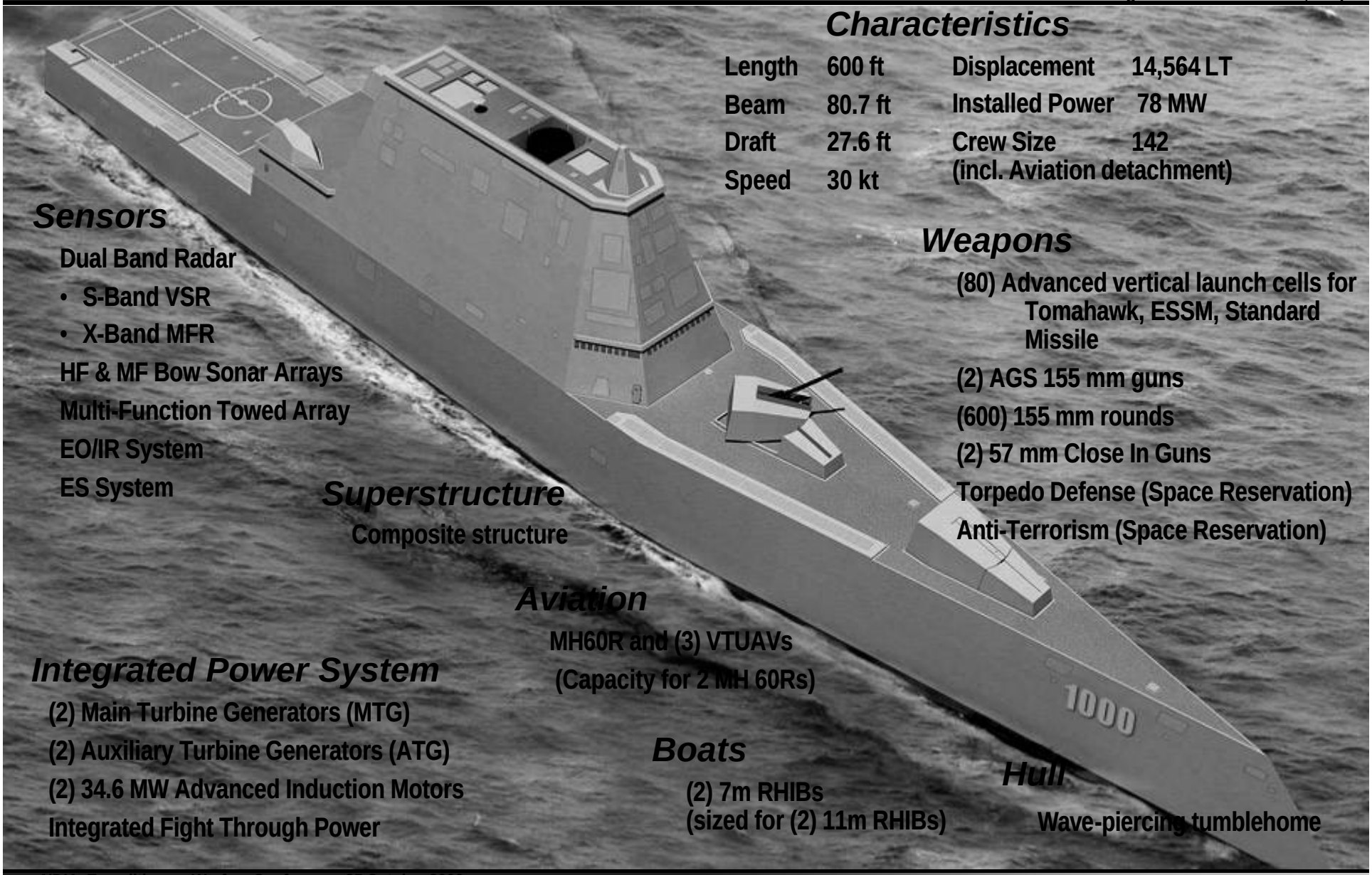
Questions?

- **DDG 1000 ZUMWALT**
- **LCS 1 FREEDOM**
- **LPD 17 SAN ANOTONIO**
- **LHA 6**
- **MPF(F)**
- **T-AKE 1 LEWIS AND CLARK**

DDG 1000 ZUMWALT Class



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 (incl. Aviation detachment)	142
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

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)

Superstructure

Composite structure

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

DDG 1000 Critical Technologies

Infrared Mockups (IR)

- Land-based suppressor testing complete
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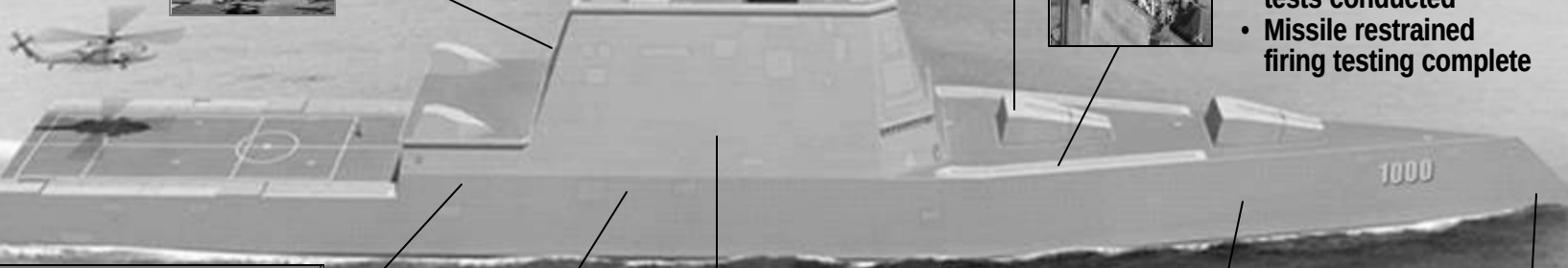

Integrated Power System (IPS)

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Hull Form Scale Model

- Performance validated by model testing
- UNDEX testing

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Autonomic Fire Suppression System (AFSS)

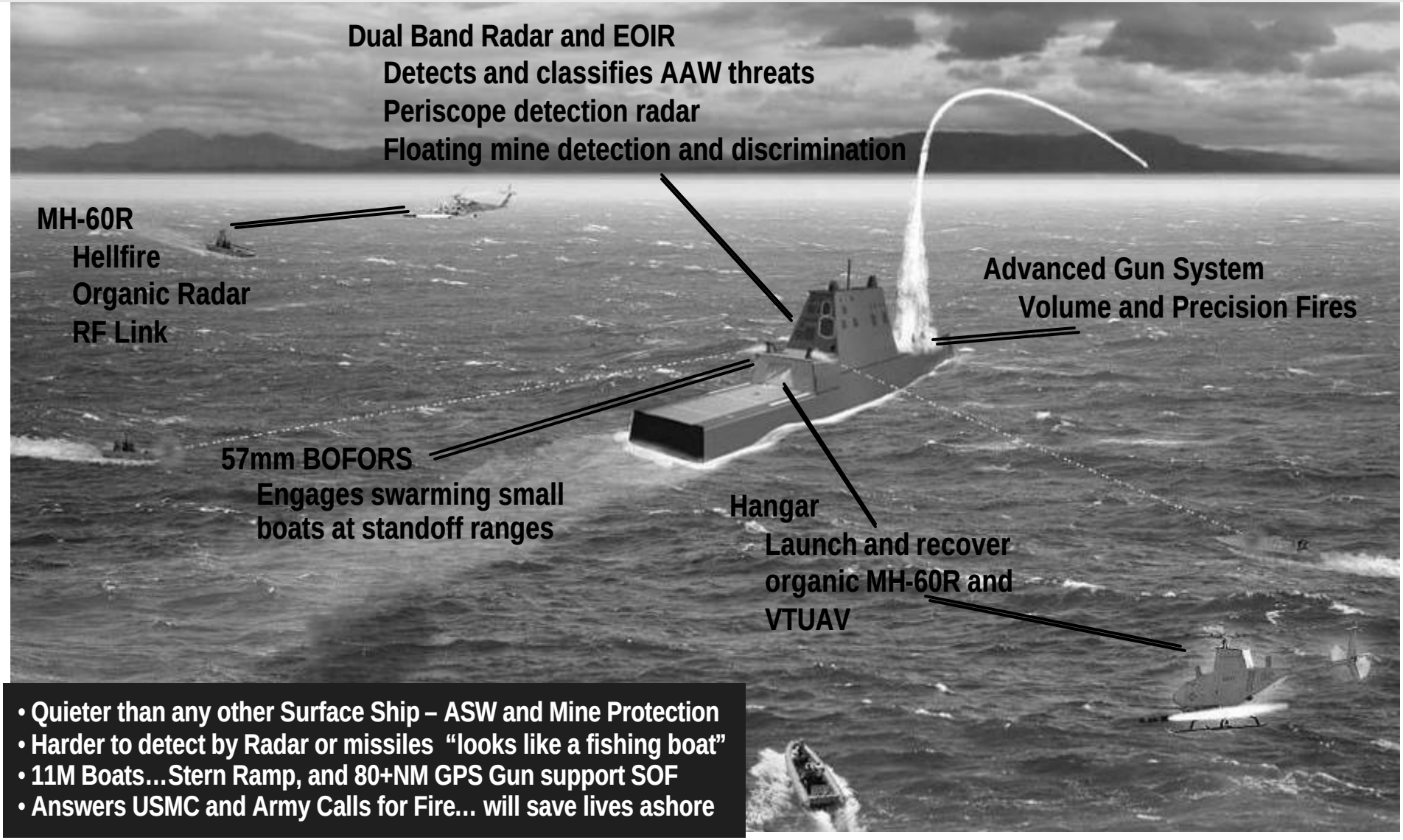
- At-sea weapons effect and autonomic fire suppression testing demonstrated

Total Ship Computing Environment (TSCE)

- Software Releases 1, 2, and 3 successfully coded, tested, and authorized by the Government

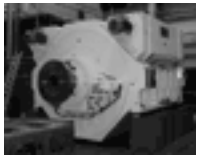
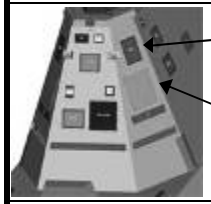
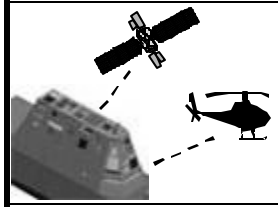
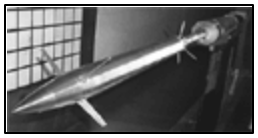
DDG 1000: Built to Dominate the Littoral

Persistent Surveillance, Tracking, and Rapid Engagement



- Quieter than any other Surface Ship – ASW and Mine Protection
- Harder to detect by Radar or missiles "looks like a fishing boat"
- 11M Boats…Stern Ramp, and 80+NM GPS Gun support SOF
- Answers USMC and Army Calls for Fire… will save lives ashore

DDG 1000 Capability Improvements

	Requirement	Technology	Capability Improvement
	**Persistent presence in the littorals, survivability**	**Hull Form and Structures**	**Reduced signatures and vulnerability**
	**Improved acoustic signature, reduced O&S costs, 30 kt sustained speed, survivability**	**Integrated Power System**	**Signatures, fuel efficiency, power continuity and quality, future growth**
	**Cruise missile and small boat defense, periscope and floating mine detection in littorals**	**Dual Band Radar**	**Firm track range against stealthy targets in clutter environment**
	**Interoperability, low Radar Cross Section (RCS), optimal manning, reach-back**	**Command, Control and Communications**	**Fully integrated Command & Control, increased bandwidth, enables FORCEnet, Open Architecture based**
	**Increased rate of fire, improved lethality, and reduced manned**	**Advanced Gun System**	**Increased Fire Support Coverage**
	**Precision strike and volume fires**	**Long Range Land Attack Projectile**	**GPS Accuracy** **155mm sized warhead**

DDG 1000 Program Status

- **Phase III design and development contract (FY02 - FY05) closing out – radar efforts remain to complete (VSR, Wallops construction)**
- **Critical Design Review (CDR) completed 14 Sep 05**
  - **Demonstrated DD(X) is ready to proceed with detail design**
  - **EDMs and other activities sufficiently mitigated technical risk**
- **Phase IV transition design contracts awarded**
- **Milestone B Approved 23 Nov 05**
  - **Authorized entry into System Development and Demonstration (SDD) Phase**
  - **Approved LRIP of 8 ships (7 ships in CNO 313 plan)**
  - **Approved Milestone C exit criteria**
  - **Approved construction award DAB entrance criteria**
  - **Approved DD(X) Acquisition Program Baseline (APB)**
  - **Approved DD(X) Acquisition Strategy Report (ASR) and Dual Lead Ship Strategy**
  - **Directed Navy return to DAB prior to exercise of 2 lead ship construction options**
- **Designated DDG 1000 ZUMWALT Class 07 Apr 06**
- **Detail Design contracts awarded in Aug 06 to NGSS and BIW**
- **Construction contracts to be awarded Dec 06 to NGSS and BIW**

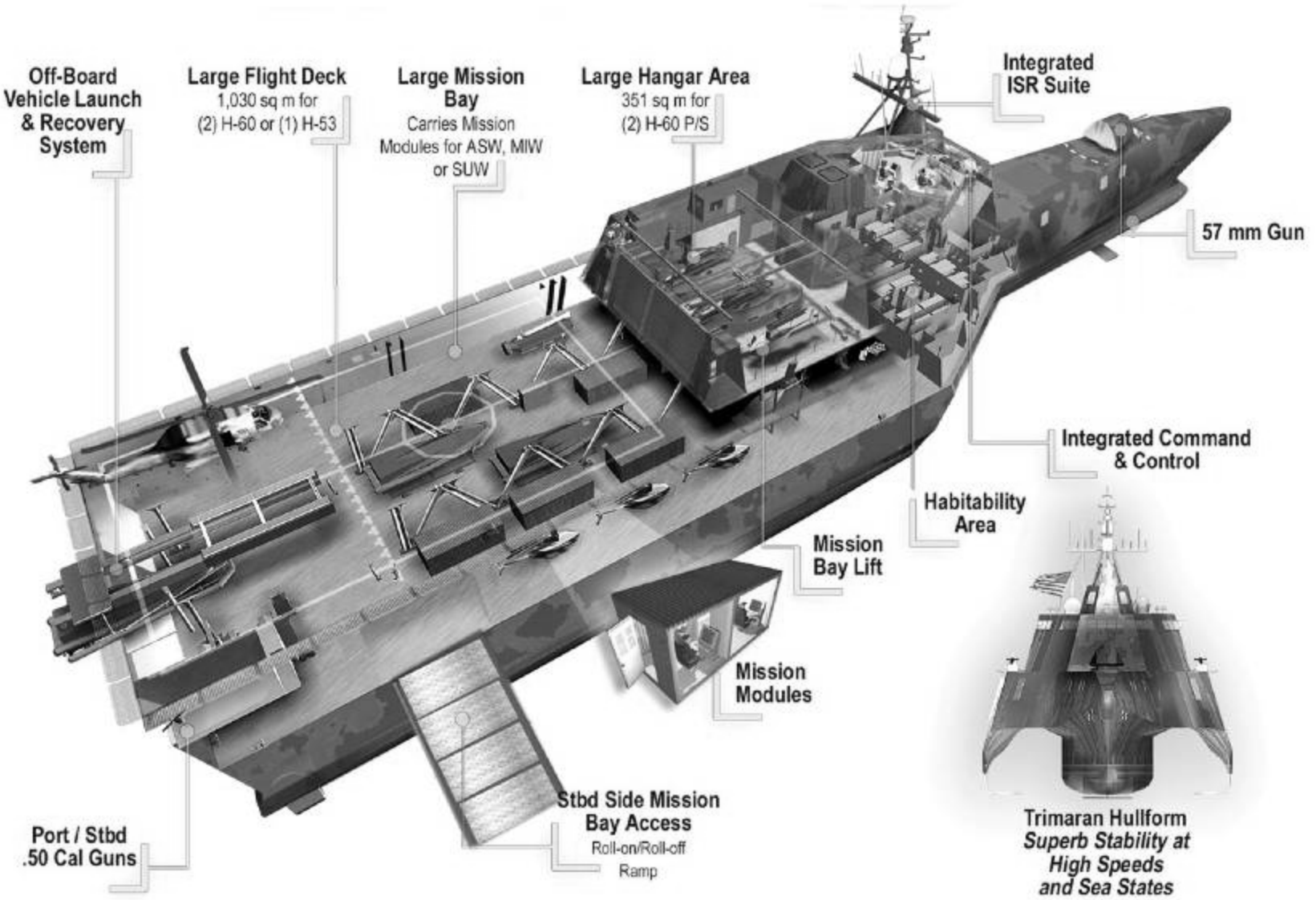
LCS 1 FREEDOM Class

INDEPENDENCE (LCS 2)
General Dynamics
Bath Iron Works
Austal USA
BAE Systems

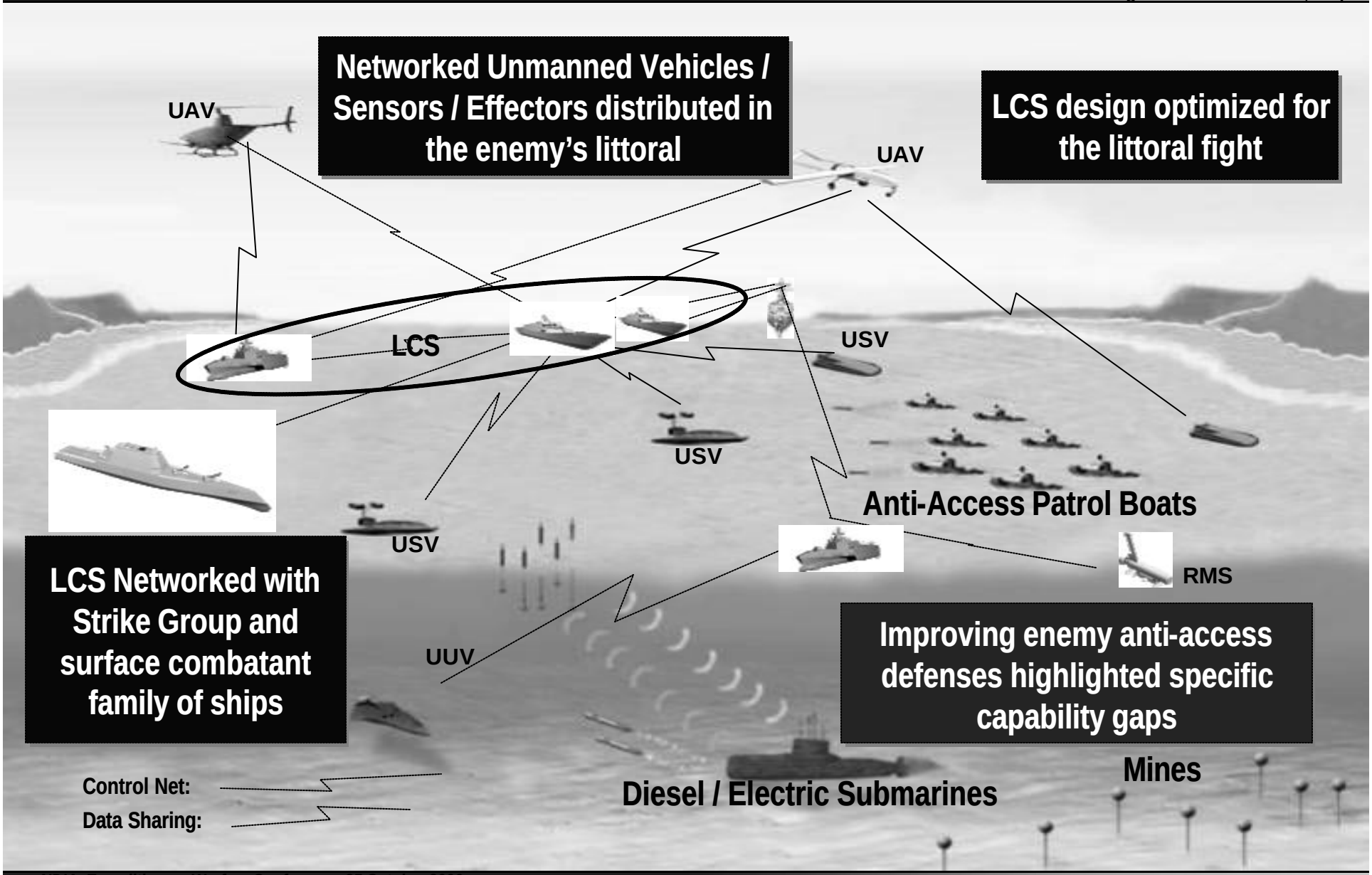
FREEDOM (LCS 1)
Lockheed Martin
Gibbs & Cox
Marinette Marine
Bollinger Shipyards

FREEDOM (LCS 1): Semi-Planing Monohull

INDEPENDENCE (LCS 2): Trimaran Hull



LCS Concept of Operations



LCS Mission Package Development

- **Mission Package Computing Environment**
  - MPDL connectivity demonstrated between NSWC PC and LM/GD facilities – Oct 2005
  - MIW Software build 0.2 delivered and testing completed – May 2006
  - MIW Software build 1.0 delivered and testing in progress – Sep 2006
- **Mine Warfare Mission Package**
  - First Mine Warfare Mission Package Support Modules Delivered to NSWC PC
  - Three support modules outfitted
    - AQS-20A
    - AMNS / ALMDS / AMNS
    - RMS
  - RMS cradle FAT and 200% load test
- **Anti-Submarine Warfare Mission Package**
  - Sea Talon ACTD transitioned to POR
  - USV Based Bi-Static sonar operations demonstrated in SOCAL
    - MS OBS (Active Source)
    - UTAS (Passive Array)
- **Surface Warfare Mission Package**
  - NLOS-LS
    - Successful PAM Seeker Captive flight test
    - Successful BTV launch from motion simulator (Sea State 3)
  - MK-46 Mod 01 30MM gun Structural Test Firing

- **Mission Package Integrator contract awarded – Jan 2006**
- **LCS Interface Control Document (ICD) Complete**
- **4 mission Package Crews onboard and training**
  - MIW Blue & Gold
  - ASW Blue & Gold

FREEDOM (LCS 1) Christening – 23 Sept 06

LCS Program Status

- **23 Feb 02** — ASN(RDA) directed establishment of LCS Program
- **08 Jul 02** — N76 letter: initiates exploratory studies for Family of Ships concept
- **14 Aug 02** — RFP released for Ship Concept Studies
- **17 Sep 02** — LCS Program Office Established (under PEO(S))
- **08 Nov 02** — Contract award for Family of Ships Concept Studies (FMHSS)
- **02 Dec 02** — Defense Authorization Act (Public Law 107-314) provided Congressional New Start authorization for the Littoral Combat Ship
- **28 Feb 03** — Solicitation for LCS Flight 0 Preliminary Designs
- **17 Jul 03** — Preliminary Design Contracts (3) Awarded

4 years

- **27 May 04** — DAB: Milestone A / Program Initiation
- **28 May 04** — Down select to two for final design
- **15 Dec 04** — Exercised 1st Detail Design & Construction option
- **02 Jun 05** — Lay Keel for USS FREEDOM (LCS 1)
- **14 Oct 05** — Exercised 2nd Detail Design & Construction option
- **19 Jan 06** — Lay Keel for USS INDEPENDENCE (LCS 2)
- **26 Jun 06** — Exercised construction option for third ship
- **23 Sep 06** — Launch USS FREEDOM (LCS 1)

LPD 17 SAN ANTONIO Class

LPD 17 SAN ANTONIO Class Capability

- **Functionally replace LPD 4, LSD 36, LKA 113, and LST 1179 Ship classes**
  - **Provide Increased**
  - **Lift**
  - **Survivability**
  - **Mission Flexibility**
  - **Service Life**
  - **Improved Quality of Life**
  - **Reduced Total Ownership Cost**

Ship Characteristics

Displacement	**24,900 lt**
Speed	**22 + kts**
Length	**684 ft**
Beam	**105 ft**
Draft	**23.0 ft**
Crew	**360 Sailors / 3 Marines**
Troop Lift	**699 Marines (800 surge)**
Med Capability	**2 Med / 2 Dental Operating Rooms**

Key Performance Parameters

Lift	Threshold		Objective
Troops	650	720 ◆	750
Vehicle Sq Ft	22K	23.6K ◆	25K
Cargo Cubic Ft	22K		25K 34K ◆
LCAC Spots	1 (+1)	2 ◆	2
VTOL Spots (CH-46/53/MV-22)	4/2/2 ◆	4/2/2	4/3/2

◆ = PM Current Estimate

LPD 17 Class Construction Status

NEW ORLEANS (LPD 18)
94% Complete

MESA VERDE (LPD 19)
89% Complete

GREEN BAY (LPD 20)
72% Complete

LPD 17 Class Construction Status (cont'd)

NEW YORK (LPD 21)
51% Complete

SAN DIEGO (LPD 22)

ANCHORAGE (LPD 23)
Start of Fabrication in 2007

ARLINGTON (LPD 24)
Start of Fabrication in 2007

SOMERSET (LPD 25)
Start of Fabrication in 2008

USS SAN ANTONIO (LPD 17) Status

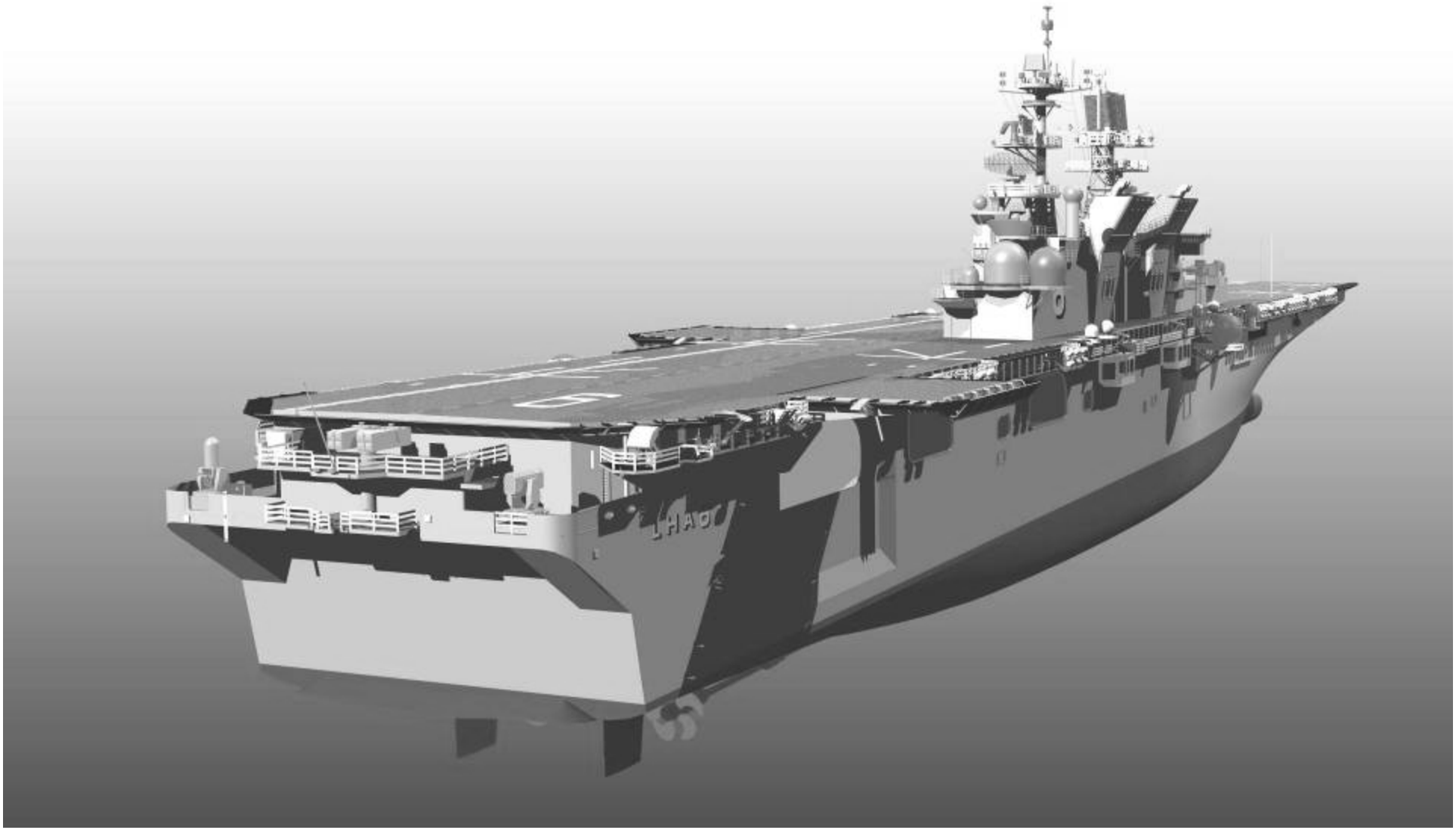
✍ Christened/Launched	Jul 03
✍ Builders Sea Trial	Apr 05
✍ Acceptance Trial	Jun 05
✍ Delivery	Jul 05
✍ Crew Move Aboard	Aug 05
✍ Sail Away Trial	Nov 05
✍ Sail Away	Dec 05
✍ Commissioned	14 Jan 06
✍ Fitting Out Availability	30 Jan 06 – 30 Mar 06
✍ Post Shakedown Availability	Mar 07

- FOA / PSA contract awarded to BAE SR (Norshipco)

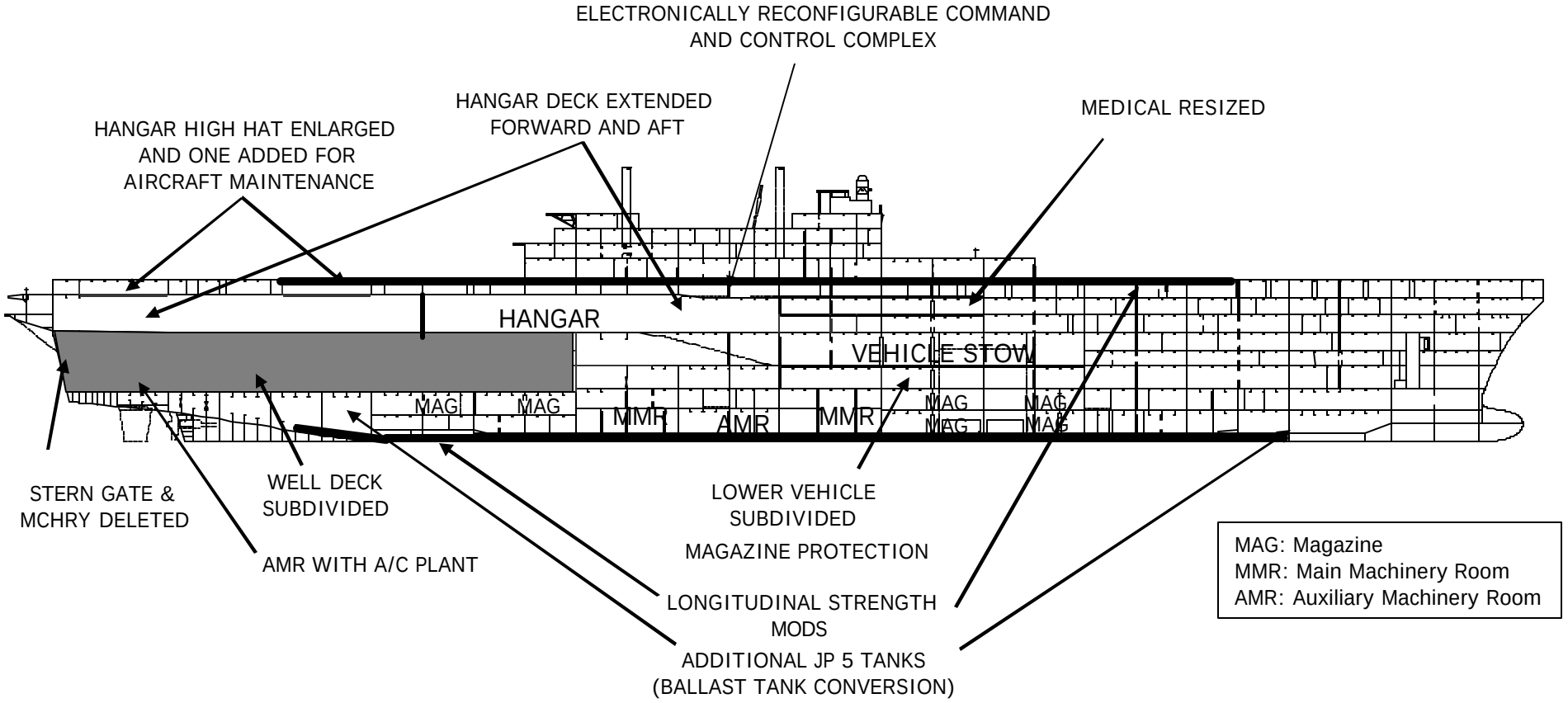
Post Delivery Test & Trials

- First of Class Trials/Certifications
- Combat System Ship Qualification Testing (CSSQT)
- Developmental Testing (DT)
- Crew Basic Phase Training
- Final Contract Trial
- OPEVAL
- Total Ship Survivability Test
- LCAC Interface Trials
- Post Shakedown Availability
- Intermediate/Advance Phase Training

LHA 6 Amphibious Assault Ship



LHA 6 Design: Optimized for Aviation



- Increased aircraft spotting factors for future Marine Corps aircraft as well as larger logistic footprint required hangar deck expansion and subsequent relocation of AVCAL (aviation test equipment, tools, parts etc.) and maintenance shops to the former well deck area
- Removal of well deck allowed for increased aviation fuel capacity through conversion of ballast tanks to JP-5 tanks

Capability Comparison: LHA 1 vs. LHD 1 vs. LHA 6

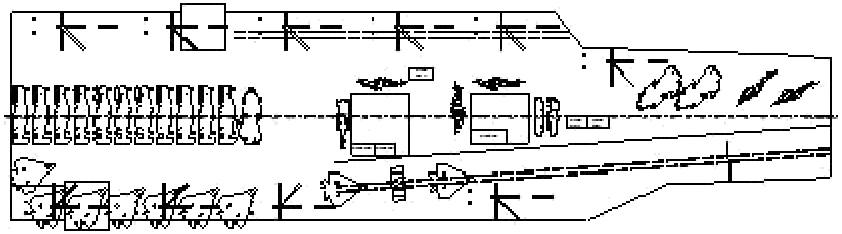
Requirements	LHA	LHD	LHA 6
Aviation (JSF)	0	19	23
Aviation Maint (MV22)	Limited	Limited	Full (2 MV22)
Cargo (K cubic ft)	109	125	160
Vehicle (K square ft)	25.4	20.9	11.6
Troops	1,713	1,686	1,686
Well Deck (LCAC)	1	3	0
JP-5 (K gallons)	400	617	1,300
Sustained Speed (kts)	22	22	22
Service Life Allowance:			
Disp	None	2.5%	>5%
KG	remains	+0.5 ft	>+1.0 ft
Survivability (armor)	None	Limited	Add'l

CAPABILITY VALIDATED BY JROC ON 8 FEBRUARY 2005

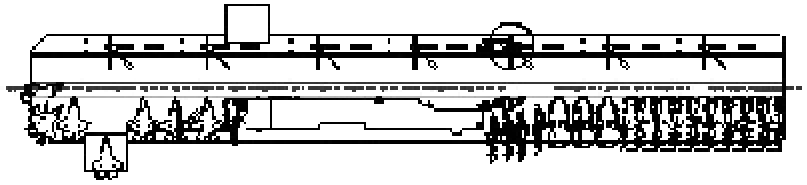
JROCM validated revised aviation, survivability and force protection KPPs on 19 December 2005

LHA 6 Program Status

- **Replace LHA Class Amphibious Assault Ship**
- **Milestone A completed Jul 2001**
- **Program redirected by DoN leadership Capabilities Letter, Apr 2004**
- **Restructured to "aviation variant"**
- **Procurement funding for lead ship, FY07 (PB06)**
- **Received Milestone B approval 11 January 2006**
- **Construction contract to NGSS anticipated in early FY07**



Dual Tram Line
$5.1B (ROM) for an FY10 ship



LHA(R) Plug Plus
$3,780M for an FY07 ship

LHA 6
$2,762M for an FY07 ship

T-AKE 1 LEWIS AND CLARK Class

T-AKE 1 Class Capability

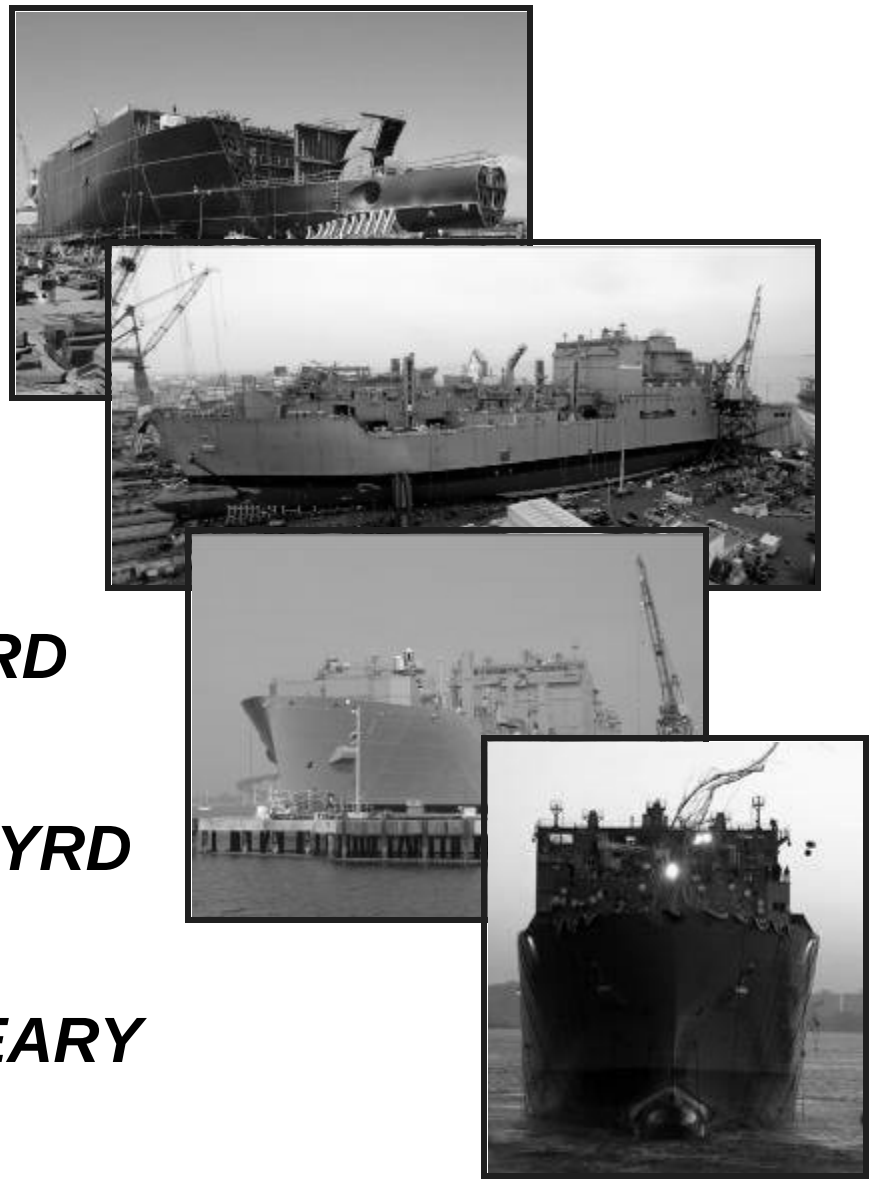
- **Primary Mission: Provide Logistic Lift Capability as a Shuttle Ship from sources of supply for transfer at sea to Station Ships and other Naval Warfare Forces**
  - **Ammunition**
  - **Food**
  - **Repair parts**
  - **Expendable supplies and material**
  - **Limited quantities of fuel**

- **Secondary Mission: Operate in concert with a T-AO 187 Class Ship (Fleet Oiler) as a Substitute Station Ship to provide direct Logistics Support to the ships within a Battle Group**

- **Description: Dry Cargo/Ammunition Ship**

T-AKE 1 LEWIS AND CLARK Program Status

- **T-AKE 1 USNS *LEWIS AND CLARK***
  - **construction started, Sept 2003**
  - **Christened 21 May 2005**
  - **Delivered, Jun 2006**
- **T-AKE 2 USNS SACAGAWEA**
  - **Christened, 2006**
- **T-AKE 3 USNS *ALAN SHEPARD***
  - **Keel Laid, Feb 2006**
- **T-AKE 4 USNS *RICHARD E. BYRD***
  - **Keel Laid, Aug 2006**
- **T-AKE 5 USNS *ROBERT E. PEARY***



DDG 51 Christenings and Commissionings

- **2006 Christenings:**
  - **GRIDLEY (DDG 101)**
  - **SAMPSON (DDG 102)**
- **2006 Commissionings:**
  - **USS FORREST SHERMAN (DDG 98)**
  - **USS FARRAGUT (DDG 99)**
- **2007 Christenings:**
  - **STERETT (DDG 104)**
  - **TRUXTUN (DDG 103)**
  - **DEWEY (DDG 105)**
- **2007 Commissionings:**
  - **USS GRIDLEY (DDG 101)**
  - **USS SAMPSON (DDG 102)**

Alongside operations (also called skin-to-skin) permits the USNS Red Cloud to lower the ramp and transfer vehicles to the Dockwise Mighty Servant 3, for further loading onto LCACs. This simulates the assembly and offload of up to 1/3 of a surface Battalion Landing Team.

- **MPF(F) Squadron Composition**
- **PMS 325 MPF(F) R&D Program FY06 At-Sea Test**
  - **Arrival and Assembly Tests**
  - **Amphibious Assault Vehicle (AAV) Testing**
  - **Mooring and Vehicle Transfer**
  - **Vehicle Selective Offload**
  - **Omni-Directional Vehicles**
  - **Transfer Unit and Storage Rack**
  - **LCAC Operations**
  - **Pallet and JMIC ASRS**
  - **Multi-Directional Material Handling System**
  - **Displacement Craft Interface**

MPF(F) Squadron

LHA(R) w/MEB C2

2

- Lightship Displacement: 30,862 MT
- Landing Spots: 9/ship
- Personnel: 3000/ship
- Ship Speed: 22 kts

LHD w Aviation C2

1

- Lightship Displacement: 28,540 MT
- Landing Spots: 9/ship
- Personnel: 3000/ship
- Ship Speed: 22 kts

LMSR

3

- Lightship Displacement: 36,289 MT
- Landing Spots: 2/ship
- Personnel: 345/ship (+500 surge)
- Ship Speed 24 kts

T-AKE

3

- Lightship Displacement: 25,700 MT
- Landing Spots: 2/ship
- Personnel: 194/ship
- Ship Speed 20 kts

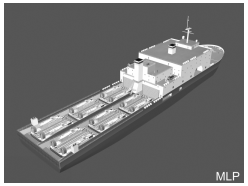
Legacy Dense Pack

2

- Lightship Displacement: 19,900 MT
- Landing Spots: 1/ship
- Personnel: 62/ship
- Ship Speed 18 kts

- Squadron is 14 ships
- 6 hulls: 2 hot production lines, 1 new design
- Full MEB (1 vertical battalion and 2 surface battalions) are selectively offloadable
  - Personnel for second surface battalion are on Sea Base
- 11 of 14 ships built to commercial survivability standards (minor enhancements), 3 ships to military survivability standards
- MLP required for surface interface
- Meets delivery timeline for vertical and surface battalions
- Significant Industrial Base stability

MLP(w/Troops)



3

- Light Ship Displacement: 28,423 MT
- Landing Spots: VERTREP
- Personnel: 1300/ship
- Ship Speed 20 kts

Arrival and Assembly Tests

Prepositioned vehicles are assembled as part of the MPF(F) mission. Timing data was collected to support discrete event modeling of assembly area operations. These simulations will be used to support LMSR assembly space sizing, arrangement and procedure development efforts.

Vehicles park in assembly bays and forklifts pick up pallets at the ready service/elevator area.



Food, water, ammo and fuel for a vehicle is loaded by hand from a pre-mixed pallet.




Pallets are moved to the assembly bays by following a one way traffic circle. Returning forklifts wait until needed. All movements are controlled by traffic directors.

Pallets are placed in vehicles from one side or from the rear while keeping traffic lanes to other bays clear.

Vehicles depart assembly area.


Amphibious Assault Vehicle (AAV) transits to bay where Marines with packs load in the stern door.

Oxy-acetylene tanks are loaded into the AAV Recovery variant.

Amphibious Assault Vehicle (AAV) Testing

AAV swim onto Mighty Servant 3

AAV launch from Mighty Servant 3

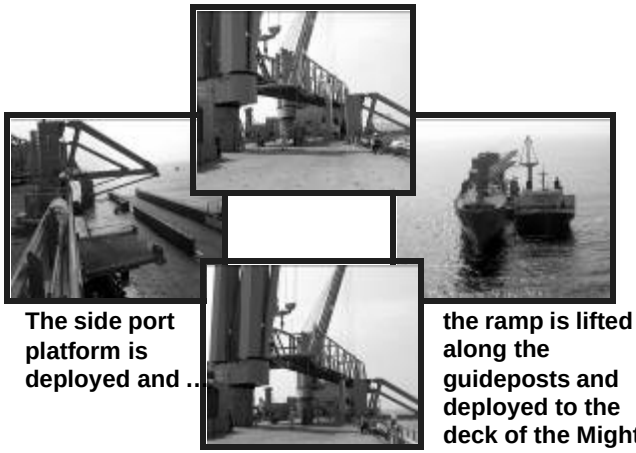
AAV arrive on LCAC

AAV lifted by crane onto the Red Cloud

Simulating disabled AAV recovery by ship's winch line

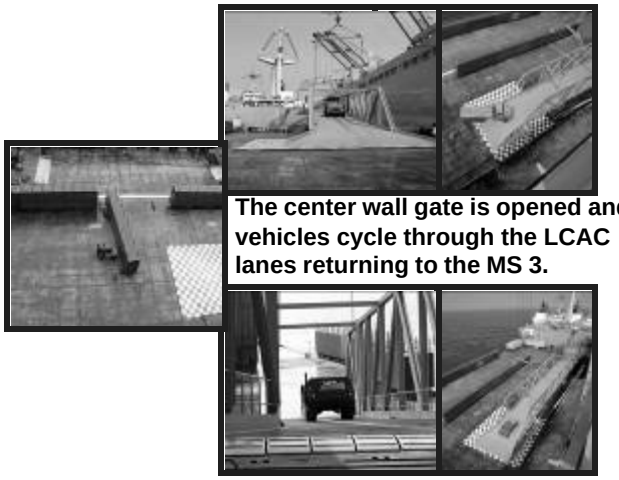
Mooring and Vehicle Transfer

Red Cloud and Mighty Servant 3 approach and moor skin-to-skin at 4 kts.

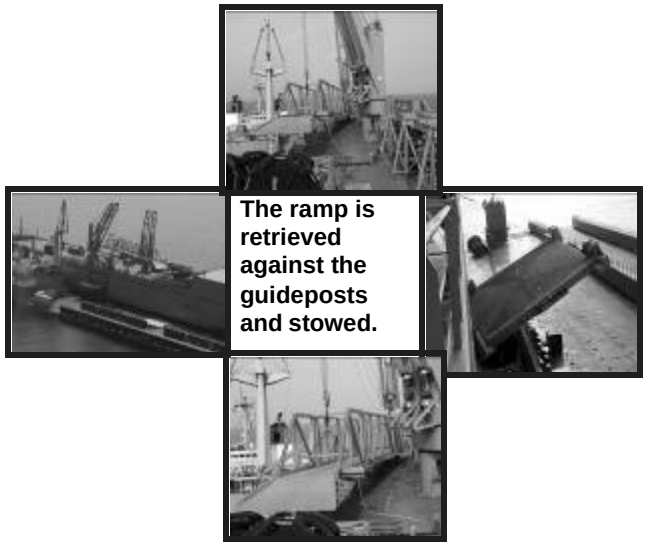


The side port platform is deployed and ..

the ramp is lifted along the guideposts and deployed to the deck of the Mighty Servant 3.



The center wall gate is opened and vehicles cycle through the LCAC lanes returning to the MS 3.



The ramp is retrieved against the guideposts and stowed.

Vehicle Selective Offload


MTVR Handling

Vehicle maneuvering tests were conducted at pier, anchor and underway with AIR SKIDS and GOJACKS. This capability would improve stow procedures and selective offload capability.


HMMWV on GOJACKS

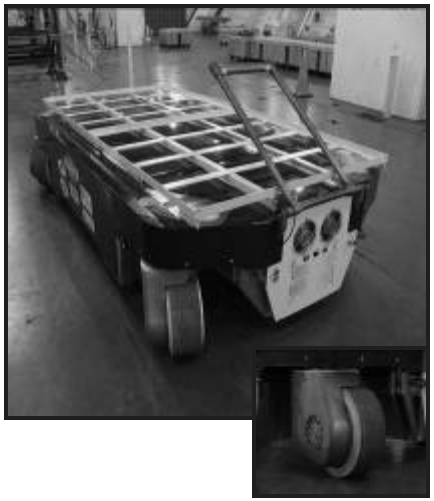

HMMWV indexing test

20 Foot Container Movement


Single and Double Air Skids

Omni-Directional Vehicles

Sidewinder, Airtrax Inc.



Compact Agile Material Mover (CAMM), Oak Ridge National Lab, Operated by NSWC Philadelphia

Hybrid Omni-wheeled Shipboard Sideloader (HOSS), NSWC Panama City

Omni-Directional Transporter (ODT), NSWC Panama City

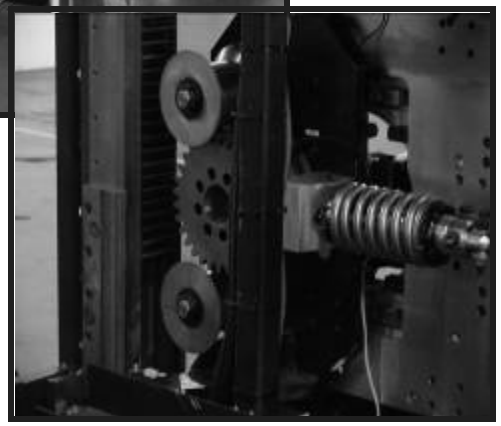
BEC Transport Unit (both an ODV and part of pallet stowage system), Benedict Engineering Co.

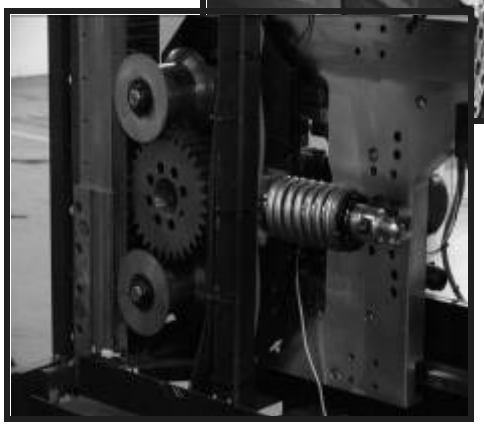
Various Omni-Directional Vehicles (ODV) demonstrated their ability to function in a shipboard environment. Their different stages of development and intended purpose does not allow a head to head comparison. All demonstrated the maneuverability that is an "omni" characteristic that provides easy cargo manipulation to enable dense packing and selective offload of cargo.

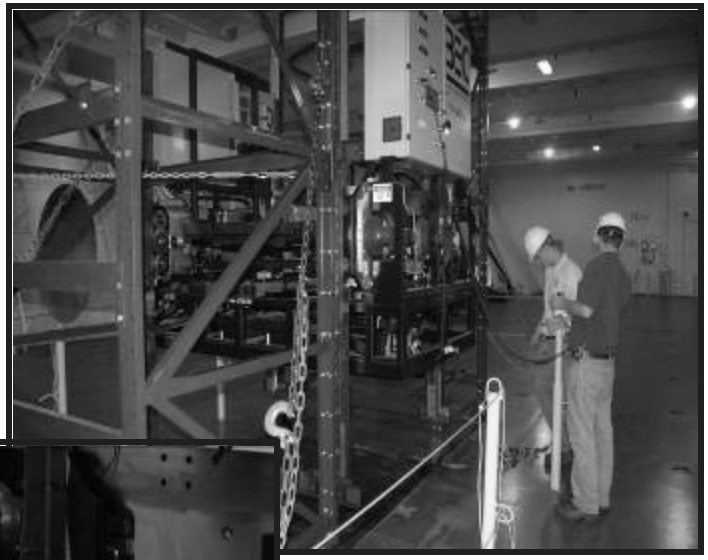
Transfer Unit and Storage Rack

Transfer Unit enters shaft in pallet storage rack…

… aligns and engages the climbing system…







… and climbs up the shaft to store pallet In the rack.

The Benedict Engineering pallet stowage demonstrator consists of a Transfer Unit and a unique stowage rack with a vertical shaft. The Transfer Unit can climb the shaft and deposit a pallet in the rack or conceptually, climb a shaft between decks and drive out of the shaft to a different delivery point.

LCAC Operations

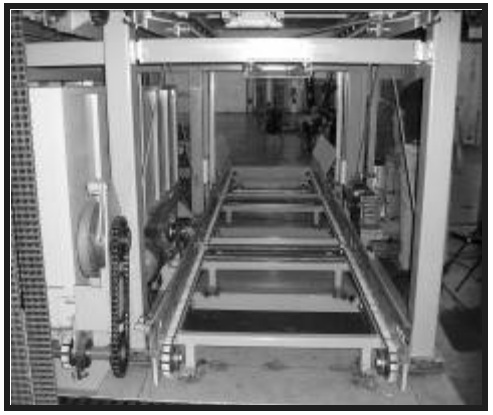
Night operations:
LCAC landing, vehicles backing on, vehicles being lashed down, and LCAC departing

LCAC operations were conducted in a variety of sea states, ship headings, ship speeds and an alternate side wall configuration. This information will support the MLP design and operational procedures. LCAC night operations were conducted including vehicle transfer to support the MPF(F) goal of movement of vehicles to the shore in a period of darkness. The feasibility of damaged LCAC recovery was also demonstrated.

Pallet and JMIC ASRS

JMIC (left) and Pallet (right)
Pick and Deliver Stations

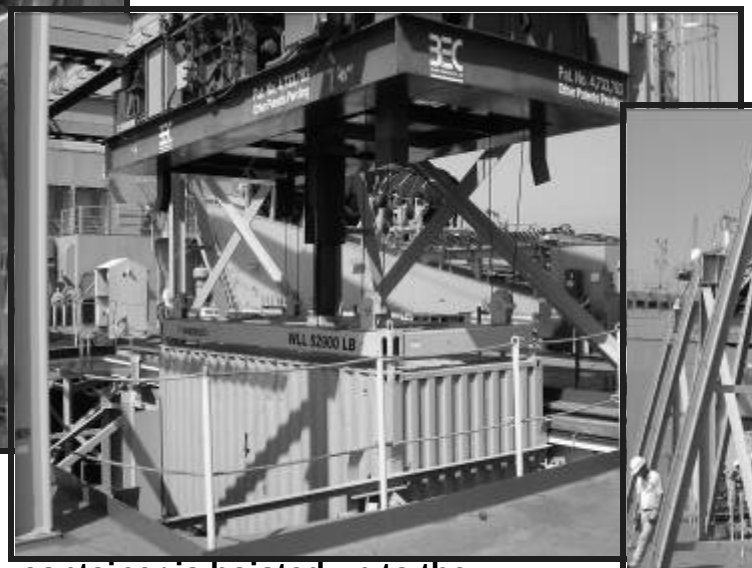
Storage Racks and Storage/Retrieval Machine



The ATI/General Dynamics/Siemens Shipboard Automated Stowage and Retrieval System (ASRS) demonstrates the feasibility of modifying a warehouse ASRS design to enable it to function at sea. This ONR funded prototype handles fully loaded pallets and JMIC boxes. It is designed to operate safely through sea state 5 .

Multi-Directional Material Handling System

Standard spreader bar is connected to a container within the cell guides,

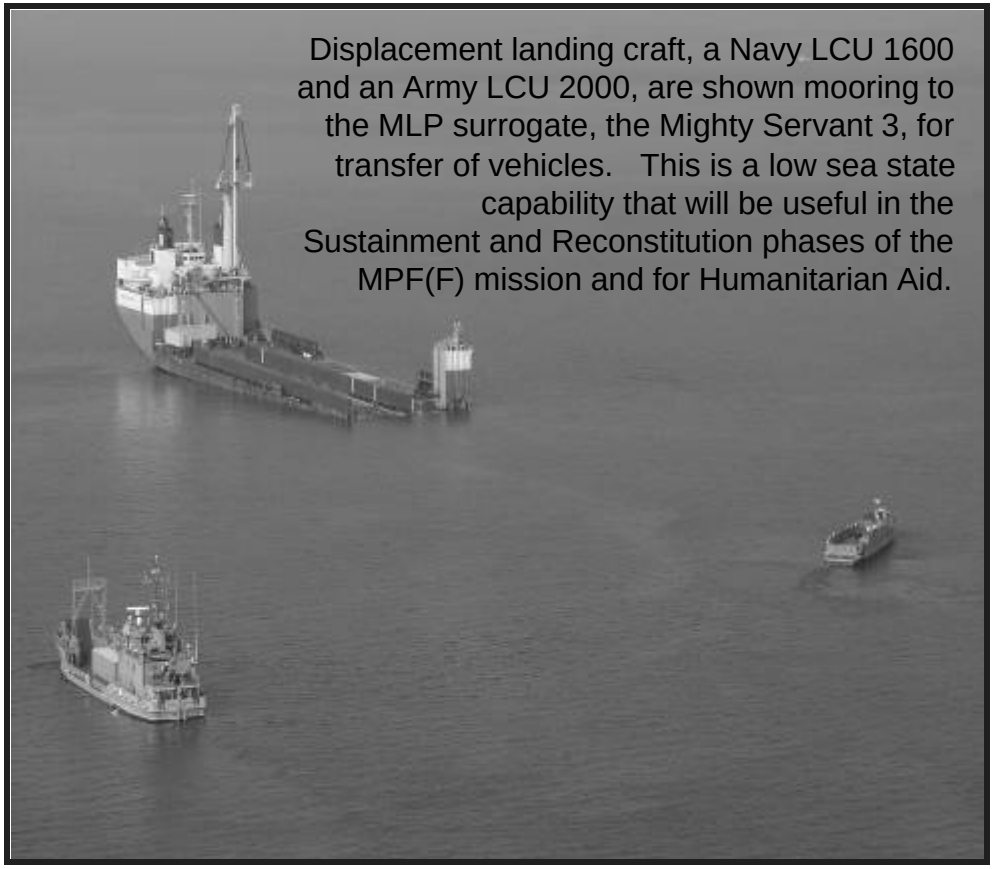


container is hoisted up to the Transfer Unit,

and Transfer Unit moves the container to any location in the grid.

The Benedict Engineering MDMHS was tested pierside, at anchor and underway to demonstrate the feasibility of a shipboard selective stowage and retrieval capability for 20 foot ISO shipping containers (funded by MSC/ USTRANSCOM).

Displacement Craft Interface



Displacement landing craft, a Navy LCU 1600 and an Army LCU 2000, are shown mooring to the MLP surrogate, the Mighty Servant 3, for transfer of vehicles. This is a low sea state capability that will be useful in the Sustainment and Reconstitution phases of the MPF(F) mission and for Humanitarian Aid.

Navy ACU 2 LCU-1600 transferring HMMWV

Army 7TH Transportation Group LCU-2000