



Sea Basing in Support of Major Combat Operations Ashore Phase II

Assessment of the Ability of Amphibious and Maritime Prepositioning Force (Future) LHD & LHAR Alternative Force Mixes to Respond to Potential Events Across the Spectrum of Expeditionary Operations

Sponsored by

Deputy Chief of Naval Operations, Integration of Capabilities and Resources
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Executive Summary

The Maritime Prepositioning Force (Future) (MPF(F)) Mission Need Statement (MNS), validated by the Joint Requirements Oversight Council (JROC) on February 1, 2000 and signed by the Chief of Naval Operations (CNO) on May 25, 2001, provided the initial program capabilities for MPF(F). The October 2006 draft Capability Development Document (CDD) for Maritime Prepositioning Force Future (MPF(F)) stated:

“MPF(F) will only accomplish forcible entry operations as part of an ESF¹ which includes sufficient escort support to adequately mitigate the threat and secure the environment; at least one ESG or one CSG.”

The 34th Commandant of the Marine Corps (CMC) reviewed Marine Corps warfighting concepts in 2007 and decided that the Marine Corps would conduct forcible entry operations at the Marine Expeditionary Force (MEF) level. This force would include two Marine Expeditionary Brigades (MEB) of assault echelon (AE) amphibious shipping reinforced by the MPF(F) squadron. The force structure to support 2.0 MEB AE was identified as 11 LHAR/LHD, 11 LPD and 11 LSD to generate 10 LHAR/LHD, 10 LPD and 10 LSD operationally available ships. This force structure would require additional investment in two LHAR/LHD and two LPDs. The CMC and Chief of Naval Operations (CNO) discussed the warfighting concept and charged their staffs to further examine the implications for warfighting and force structure recapitalization.

The Deputy Chief of Naval Operations (DCNO), Integration of Capabilities and Resources (N8) and Commanding General, Marine Corps Combat Development Command (MCCDC) conducted a study of Sea Basing in Support of Major Combat Operations from April to September 2007. The intent of that study was to determine how many LHAR/LHD should be included in the thirty year shipbuilding plan and the distribution of those ships between the amphibious force and MPF(F) squadron. The study examined the warfighting success of a Marine Expeditionary Force (MEF) in support of one specific major combat operation (MCO) using the 2.0 MEB AE reinforced by one of three alternative MPF(F) squadron options. The study concluded that there was no compelling justification for including the LHAR/LHD in the MPF(F) squadron when there would be ten of these ships in the AE. The study sponsors decided at the end of the study that it was important to further determine if the number and distribution of LHAR/LHD would impact the ability to execute lesser contingency operations (LCO). This study addresses that question.

The general study approach was to identify a baseline and four force mix alternatives, to assess their ability to meet a selection of LCO demands, and to assess the capability for the amphibious ships to aggregate for an MCO. The LCO scenarios selected were based on the Office of the Secretary of Defense (OSD) Operational Availability 2008 (OA-08)

¹ Expeditionary Strike Force is composed of an Expeditionary Strike Group (ESG) and/or Carrier Strike Group (CSG) and additional groups or forces as required.

Steady State Security Posture, postulated across a two year span of study. Required capabilities were identified for each scenario. The baseline and each alternative amphibious force mix was evaluated to determine how much of each capability could be satisfied. A global posture was developed for each force mix specifying the location and asset availability for tasking over the two year period under evaluation. A linear programming model was developed to determine the best asset(s) to assign to each event based on the global posture. Metrics were assigned to measure LCO demand met, asset utilization, residual capacity, and AE MCO response for each force mix.

The study concluded that all of the specified force mix alternatives were capable of meeting 96% (+/-1%) of the LCO event demands. Unscheduled short notice events outside of the normal deployment patterns accounted for the majority of the demand not met across all of the force mixes. Meeting 100% of the event demand would require new deployment patterns to U.S. Africa Command and U.S. European Command. The Baseline force mix performance was 1% less than Alternatives 1-4. This reflected the use of MPF(F) ships based in Guam to service two Gulf of Guinea events in the Baseline, compared to the use a non-ESG LHD based in Norfolk for Alternatives 1-4. Distributing MPF(F) LHAR/D across the three MPSRONs improved the Baseline response. .

All of the force mix alternatives assumed a total naval force of nine ESGs, which were capable of meeting the CENTCOM and PACOM ESG 1.0 presence objectives. The total number is more important than the distribution of LHAR/D to meeting the LCO demands. This holds true with a force structure of up to 11-12 LHAR/D. Additional force structure does not appear to improve response to LCO demands. Alternative 1 with 14 LHAR/D performed the same as Alternatives 2-4 with 11-12 LHAR/D. Additional AE ships reduce ESG ship time away from homeport and increase the residual capacity to meet evolving deployment requirements.

The Marine Corps amphibious lift requirement of 2.0 MEB AE is based on previous studies and supports forcible entry operations within acceptable risk. The MEB AE closure to the MCO location on average ranged from 1.69 (Baseline) to 2.0 (Alternatives 1, 2, and 3) MEB AE by week nine.

The total life-cycle cost, with particular focus on the procurement costs, was estimated for each force mix alternative in constant FY08\$B. Alternative 1 with 14 LHAR/D and 11 LPDs met all of the stated requirements, but cost roughly \$9.3B more than the Baseline. Alternative 3a with 11 AE LHAR/D, no MPF(F) LHAR/D was essentially cost neutral compared to the Baseline.

The distribution of LHAR/D between the AE and MPF(F) made a difference in the MEB AE that can be closed but did not significantly impact ESG presence and LCO operations. In the absence of additional funding, the decision facing the DoN is where to assign the LHAR/D ships: to mitigate the MEB AE gap or to fill out the MPF(F) Squadron capability as originally envisioned.

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1 INTRODUCTION

1.1 (U) Background

The Maritime Prepositioning Force (Future) (MPF(F)) Mission Need Statement (MNS), validated by the Joint Requirements Oversight Council (JROC) on February 1, 2000 and signed by the Chief of Naval Operations (CNO) on May 25, 2001, identified the initial required capabilities for MPF(F). The 2 October 2006 draft Capability Development Document (CDD) for Maritime Prepositioning Force Future (MPF(F)) stated:

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² Expeditionary Strike Force is composed of an Expeditionary Strike Group (ESG) and/or Carrier Strike Group (CSG) and additional groups or forces as required.

1.2 (U) Objectives

The purpose of this study was to determine the adequacy of various force structure options to meet the requirements of Lesser Contingency Operations (LCOs). The intent was to assess the ability of alternative amphibious and MPF(F) force mixes to respond to potential events across the spectrum of expeditionary operations and aggregate for Major Combat Operations. OPNAV N8 and MCCDC provided the force mix alternatives in Table 1 to evaluate.

- The Baseline force mix is the President's Budget 2008 (PB-08) program of record with a total of 12 LHAR/D.
- Alternative 1 is the Sea Basing Phase I study Option A force mix with two additional LHAR/LHD and two additional LPDs in the amphibious force. There are a total of 14 LHAR/LHD. Alternative 1a keeps the LPDs at the program of record level of 9. This convention is used throughout.
- Alternative 2 contains two less MPF(F) LHAR/LHD for a total of 12 ships.
- Alternative 3 is the Phase I Option B2 with the four additional AE ships but no MPF(F) LHAR/D, for a total of 11 ships. This study assumes eight LHDs and three LHAR.
- Alternative 4 has one additional LHD/LHAR in the AE and two MPF(F) LHAR/D for a total of 12 ships.

Force Mix	Amphibious			MPF(F)				
	LHAR/D	LPD	LSD	LHAR/D	MLP	LMSR	T-AKE	T-AK
Baseline	9	9	12	3	3	3	3	2
Alt 1	11	11	12	3	3	3	3	2
Alt 1a	11	9	12	3	3	3	3	2
Alt 2	11	11	12	1	3	4	3	2
Alt 2a	11	9	12	1	3	4	3	2
Alt 3	11	11	12	0	3	4	3	2
Alt 3a	11	9	12	0	3	4	3	2
Alt 4	10	11	12	2	3	3	3	2
Alt 4a	10	9	12	2	3	3	3	2

Table 1 (U) Force Mix Alternatives

- Alternatives 2 and 3 require a 4th LMSR to replace lift lost due to the reduction in MPF(F) LHAR/LHD. Alternatives 2, 3 and 4 require MLP and LMSR berthing modifications due to the loss of one or more MPF(F) LHAR/LHD.

1.3 (U) Study Approach

The general approach was to identify the LCO demands; assess the ability of the force mix alternatives to meet those demands; and for the amphibious ships to aggregate for an MCO.

Section 2 provides a detailed summary of the study methodology. This includes the scenario selection based on the Office of the Secretary of Defense Operational Availability 2008 (OA-08) Steady State Security Posture; identification of the event-required capabilities using metrics; assessment of the capability of the primary force mix alternatives to satisfy each of the event required capabilities; development of a global posture reflecting the weekly location and availability of each force mix asset; the development of an LCO assignment mode; and the identification of relevant output metrics. Section 3 provides the results of the force mix performance analysis to include LCO demand met, asset utilization, and residual capacity; AE MCO response, and sensitivity analysis. Section 4 provides the force mix alternative life-cycle cost estimates. Section 5 is the synthesis of results to include a force mix cost and performance summary, insights on LHAR/LHD quantity and distribution, and insights on LHAR/LHD distribution related issues. Section 6 provides a summary of the key study findings.

Finally, the execution of the study was accomplished in an open and inclusive fashion between September 2007 and January 2008. This included frequent collaborative meetings with representatives from OPNAV N81 and MCCDC to attain consensus on the assumptions, metrics and modeling.

2 METHODOLOGY

This basic methodology was composed of three major elements. The first was the development of a set of Lesser Contingency Operations (LCO) scenario events and the associated capabilities required to execute the events. The second was the development of the capabilities of each asset (ships and embarked force) and the global posture for each force mix alternative specifying the location and availability of the assets for tasking to events. The third was a goal linear programming model to assign assets to the events and the associated development of metrics to compare the performance of the different force mix alternatives. This section details the methodology and major assumptions for each of these elements.

2.1 (U) Scenario Selection and Event Required Capabilities

2.1.1 (U) Scenario Selection and Events

A set of Lesser Contingency Operation (LCO) scenarios were required to stress the alternative force mixes. OPNAV and MCCDC used the Office of the Secretary of Defense (OSD) Operational Availability 2008 (OA-08) scenarios as the baseline for this study. The Steady State Security Posture (SSSP) events requiring amphibious ships were identified and analyzed, resulting in the selection of 13 event types that generally stress aviation operations. The selected event types are listed in Table 2-1.

Type	Region	Lesser Contingency Operation	Occurrences
1	CENTCOM	Maritime Interdiction Operation (MIO)	8
2	CENTCOM	Humanitarian Assistance / Disaster Relief (HA/DR)	1
3	CENTCOM	Consequence Management (CM)	1
4	PACOM	Counter Terrorism (CT)	2
5	PACOM	Security Institution Building Reform (SIBR)	2
6	NORTHCOM	Counter Drug Ops (CD)	4
7	NORTHCOM	Homeland Defense (HD), (WMD Smuggling)	1
8	SOUTHCOM	Foreign Internal Defense (FID)	2
9	AFRICOM	Non-Combatant Evacuation Operation (NEO)	1
10	AFRICOM	Civil Assistance Programs (CAP)	2
11	AFRICOM	Counter Insurgency (COIN)	2
12	AFRICOM	Expeditionary Operations (EXOPS)	1
13	CENTCOM	Non-Combatant Evacuation Operation (NEO)	1



Scheduled



Unscheduled

Table 2 (U) Lesser Contingency Operations (LCO) Scenarios

The blue entries are Priority 3 events that can be scheduled in advance while the brown entries are Priority 1 or 2 unscheduled events that have warning timelines ranging from one to four weeks. Many of these event types occur multiple times over a 104 week period. There are a total of 28 individual LCO events leading up to Major Combat Operations (MCO).

Figure 2-1 shows the 28 individual events over the 104 week event horizon. Each row is an event type. The filled in rectangles represent the occurrences of the individual events. For example, there are eight scheduled two week duration MIO events. There are a total of 156 event weeks for the 28 individual events.

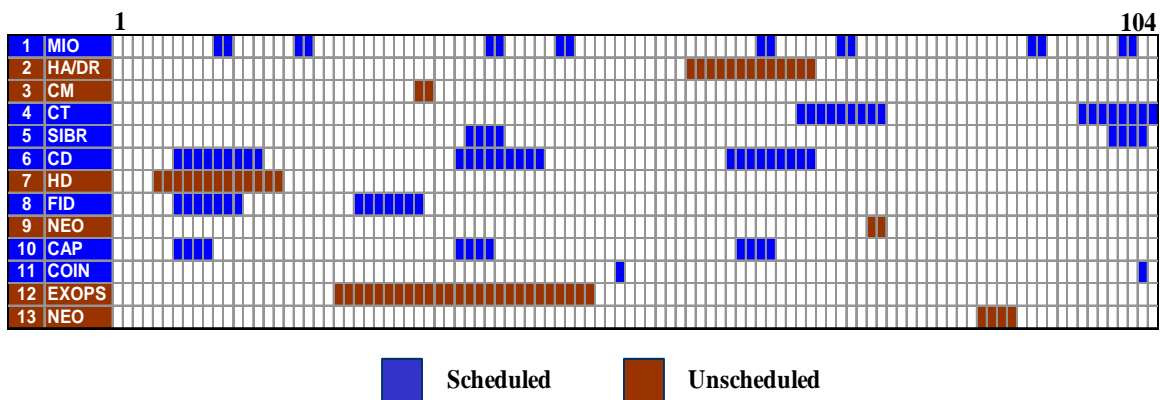


Figure 1 (U) Lesser Contingency Operations 104 Week Event Horizon

2.1.2 (U) Event Required Capabilities

The methodology called for the identification of required capabilities for each event that would map to the capabilities that could be provided by the global posture assets. OPNAV and MCCDC reviewed each of the selected events and identified the high-level required capabilities, resulting in a total of 120 capability statements for the set of events. The capability statements were organized into maneuver, fires, logistics, intelligence, and electronic warfare functional categories and collapsed into 10 capability areas that could be evaluated numerically for the events and assets. The capability areas and the basis for the numerical evaluation are provided below. The equivalent capability indicated was assumed to be 1.0 unless otherwise specified.

- C1: Aviation Rotary Wing (RW) / Tilt Rotor (TR) – assault support company equivalent lift [LHD or LHA equivalent].
- C2: Surface Ship-to-Shore Movement (SSM) – company equivalent lift [well deck equivalent].
- C3: Aviation Rotary Wing (RW) Close Air Support (CAS) – kinetic and escort operations [4 AH-1W detachment equivalent].
- C4: Aviation Fixed Wing (FW) – kinetic; intelligence, surveillance, and reconnaissance (ISR); and electronic warfare (EW) [6 JSF equivalent].

- C5: Aviation Unmanned Aerial Systems (UAS) – EW, ISR, and communications relay [UAS detachment equivalent].
- C6: Intelligence – exploit ISR capabilities and products [LHD or LHA equivalent].
- C7: Medical Afloat – casualty receiving capability with Fleet Surgical Team (FST) or other similar medical augmentation [2 Operating Rooms (OR) equivalent].
- C8: Flight Deck Ops – flight deck sustainable operations [fraction of day].
- C9: Command and Control – decentralized command and control afloat [LHD equivalent].
- C10: Aviation or Surface – combined aviation and surface company equivalent lift.

Table 3 summarizes the amount of each capability required for the 13 event types. Appendix C provides a more detailed cross-walk from the functional category to the numerical evaluation.

Capability	Description	Event Type												
		1	2	3	4	5	6	7	8	9	10	11	12	13
C1	Aviation (RW/TR)	0.50	1.00	0.33	0.67	1.00	0.33	0.33	0.33	1.00	0.33	1.00	0.67	0.67
C2	Surface SSM			1.00	1.00					1.00			1.00	1.00
C3	Aviation (RW CAS)	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C4	Aviation (FW)				1.00	1.00				1.00		1.00		
C5	Aviation (UAS)	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
C6	Intelligence	0.50	1.00	0.25	0.50	1.00	0.25	0.25	0.50	0.50	0.50	0.50	1.00	0.50
C7	Medical Afloat		0.67	0.67	0.67	0.67			0.67	0.67	0.67	0.67	0.67	0.67
C8	Flight Deck Ops									1.00				
C9	Command & Control	0.50	1.00	0.25	1.00	1.00	0.25	0.25	0.50	1.00	0.25	1.00	1.00	1.00
C10 = C1+C2	Aviation or Surface									3.00				3.00

Table 3 (U) Event Required Capabilities

2.2 (U) Asset Capabilities

Section 2.1.2 provided a summary of the methodology used to identify the capabilities required for each event and the resulting event capabilities. Table 4 provides the assessed capabilities of the primary force mix assets using the same numerical scale.

Capability	Description	Assets								
		LHA	LHD	LPD1	LPD2	LPD3	LSD	MLHAR	MLHD	MLP
C1	Aviation (RW/TR)	1.00	1.00	0.33				1.00	1.00	
C2	Surface SSM		1.00	1.00	1.00	1.00	1.00		1.00	1.00
C3	Aviation (RW CAS)	1.00	1.00		1.00			1.00	1.00	
C4	Aviation (FW)	1.00	1.00							
C5	Aviation (UAS)	1.00	1.00			1.00	1.00	1.00	1.00	1.00
C6	Intelligence	1.00	1.00	0.50	0.50	0.50	0.25	1.00	1.00	0.25
C7	Medical Afloat	0.67	1.00	0.67	0.67	0.67		0.67	1.00	
C8	Flight Deck Ops	1.00	0.50	0.50	0.50	0.50	0.33	1.00	0.50	1.00
C9	Command & Control	1.00	1.00	0.50	0.50	0.50	0.25	1.00	1.00	
C10 = C1+C2	Aviation or Surface	1.00	2.00	1.33	1.00	1.00	1.00	1.00	2.00	1.00

Table 4 (U) Asset Capabilities

There are significant differences in the capabilities of the LHA, LHD, MPF(F) LHAR (MLHAR), and MPF(F) LHD (MLHD):

- C2 Surface SSM: LHA / MLHAR lack the surface capability of the LHD / MLHD.
- C4 Aviation (FW): MLHAR / MLHD will not embark fixed wing aircraft.
- C7 Medical Afloat: LHA / MLHAR are designed with a smaller medical suite and casualty receiving throughput than the LHD / MLHD.
- C8 Flight Deck Ops: LHA / LHAR will be capable of 6 spots 12 hours per day sustained or 6 spots 24 hours/day for 6 days surge compared to 10 hours/day for an LHD.³

The LPD is capable of Aviation (RW/TR) (C1), Aviation (RW CAS) (C3), or Aviation (UAS) (C5). The ship was assumed to be capable of embarking one of those capabilities at a time, resulting in the LPD1, LPD2 and LPD3 columns. The MLPs are assumed to bring an LMSR and T-AKE when required, resulting in the ability to support 24x7 flight deck operations (C8 = 1.0) across multiple platforms.

The asset capabilities provided by multiple assets is the sum of the individual asset capabilities. For example, a 3 ship task force composed of an LPD1, LPD2 and LSD would generate a combined capability of C1 = 0.33, C2 = 3, C3=1, C4=0, C5=1, etc. This approach was necessary to support the evaluation of multiple ship asset mixes in satisfying event required capabilities.

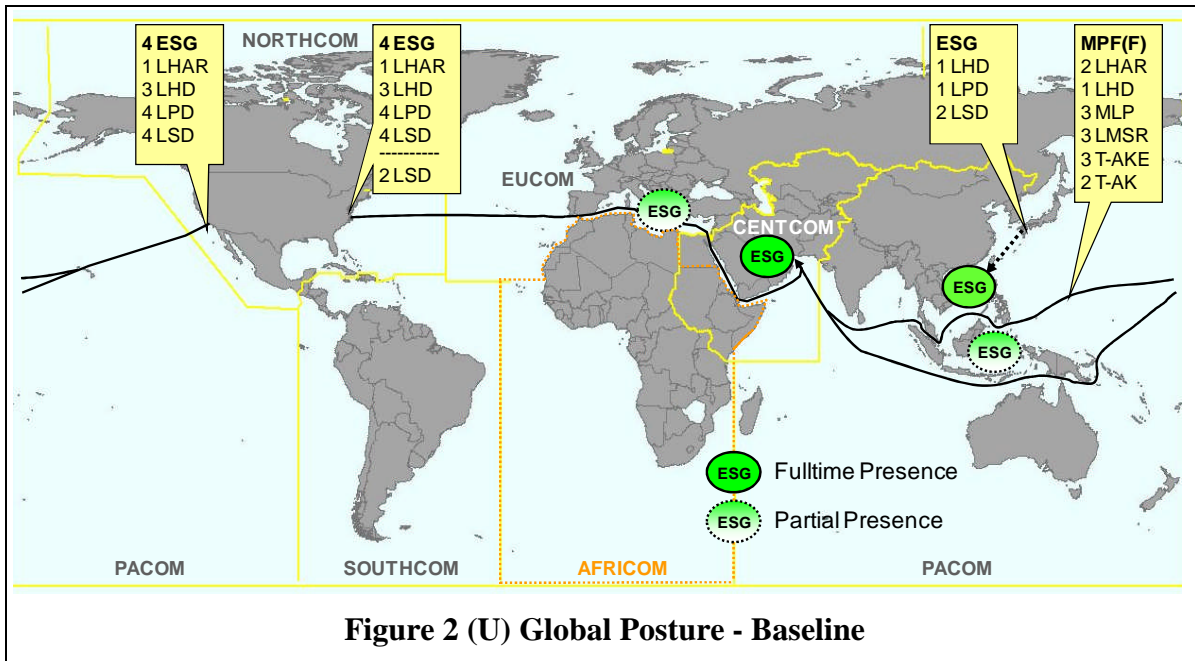
2.3 (U) Global Posture

The previous sections focused on providing a structure for relating event required capabilities to the capabilities that could be provided by one or more assets when available

³ JROCM 272-05 set aviation operations KPP for LHA(R) Flight 0 at 6 spots 12 hours/day sustained and 6 spots 24 hours/day for 6 days (Threshold=Objective). The MPF(F) Capability Development Document (CDD) does not modify this requirement. LHD ROC/POE calls for a 12hour flight window with 10 hours of flight ops. MLHD are assumed to be the same as LHD based on the MPF(F) CDD.

for tasking. This section describes the development of the global posture for each force mix alternative.

The global posture for each alternative shows the force mix, basing locations, and Expeditionary Strike Group (ESG) deployment patterns on a world map depicting the Geographic Combatant Commander (GCC) areas of responsibility (AOR). Figure 2-2 shows a high-level representation of the global posture for the Baseline force mix.



U.S. Africa Command (AFRICOM) was established 1 October 2007 as a sub-unified command under EUROM. AFRICOM will be established as a separate unified command no later than 30 September 2008.⁴ The draft AFRICOM AOR is identified by the orange dotted box.⁵

The complete global posture for each force mix alternative is a matrix that contains the weekly location code and status code over a four year period. A two year slice of the global posture is used as the primary input to the LCO event assignment model. The status codes were designed to document each ship's schedule and readiness for tasking to LCO and MCO events. Status codes include maintenance, basic training, advanced training, local operations, inport periods, and deployments. The implicit assumption is that there are Marine forces available for embarkation when the ships are available.

⁴ U.S. Africa Command (AFRICOM) website www.africom.mil.

⁵ U.S. Africa Command briefing dated 7 February 2007, U.S. Department of Defense (DoD) website www.defenselink.mil/specials/unifiedcommand.

2.3.1 (U) Planning Factors and Scheduling Assumptions

Numerous ESG basing, deployment, maintenance, training, and local operations scheduling factors were used to develop the global postures.

2.3.1.1 (U) Basing

The study assumed that four ESGs are based in Norfolk, Virginia; four ESGs are based in San Diego, California; and one ESG is forward deployed to Japan as a Forward Deployed Naval Force (FDFNF). The Continental United States (CONUS) based ESGs were assumed to be composed of three amphibious ships (LHA/LHD, LPD and LSD). The Japan-based ESG was assumed to have four amphibious ships (LHA/LHD, LPD and 2 LSD). The additional amphibious ships were based at the CONUS ESG locations. The impact of shifting the two additional San Diego ships was examined as an excursion.

The MPF(F) ships were assumed to be based at Apra Harbor, Guam. The impact of distributing an MLHD/MLHAR, MLP, LMSR and T-AKE to each of the three MPFRONS was examined as an excursion.

2.3.1.2 (U) ESG Deployments

ESG deployment schedules were based on Marine Expeditionary Unit (MEU) and Fleet Response Plan (FRP) planning factors.

- 9 ESGs and 7 MEUs for all force mix alternatives. No requirement was identified to establish additional ESGs for the alternatives that had sufficient non-ESG amphibious ships.
- CENTCOM and PACOM are priority deployment locations with objective 1.0 presence in each AOR.
- MEU deployment cycle is six months training, six months deployed and six months off-cycle.
- CENTCOM deployments are scheduled for six months homeport to homeport, followed by a four week post-deployment period.
 - CENTCOM ESGs are assumed to relieve in the vicinity of the Strait of Hormuz.
 - PACOM is filled by the FDFNF ESG, which is not scheduled for out of area deployments. CONUS ESGs provide additional transitory presence, to include a few weeks of additional on-station time when the CENTCOM turnover schedule allows.
 - EUCOM and AFRICOM scheduled coverage is limited to transits and a few weeks of additional on-station time when the CENTCOM turnover schedule allows.

Non-ESG and MPF(F) ships are not scheduled for regular deployments but were available to support LCO and MCO events. The ships could also be used in the future to support emerging Global Fleet Station (GFS), Theater Security Cooperation Plan (TSCP) or other Special Purpose Marine Air Ground Task Force (SPMAGTF) requirements. These types of deployments were beyond the scope of this study.

2.3.1.3 (U) Maintenance and Training

Amphibious ship maintenance and training requirements are well documented in OPNAV Notice 4700 and the Surface Force Training Manual, respectively. The Docking Phased Maintenance Availabilities (DPMA) and Phased Maintenance Availabilities (PMA) were essentially level loaded in the fleet concentration areas. Intermediate and organizational maintenance were assumed to be conducted during some inport periods. Non-ESG ships were scheduled for maintenance and basic training like the ESG ships. Advanced training was scheduled with an ESG.

CONUS-based amphibious ships were scheduled to complete a PMA (2 months) or DPMA (4-8 months), basic training (13/21 weeks following PMA/DPMA), and advanced training (13 weeks) prior to deployment. The advanced training period includes a nominal four week pre-overseas movement (POM) period. Ships were assumed to be underway 7 of 13 or 11 of 21 basic training weeks and 7 of 13 advanced training weeks. The ships were also scheduled for local operations 1 of every 4 weeks outside of these designated training periods. An underway week was assumed to average 5 days underway and 4 nights away from homeport.

The FDNF amphibious ships were scheduled to complete a PMA (2-3 months) or DPMA (4-5 months). The FDNF training was assumed to be conducted continuously during available inport and underway periods. The ships were scheduled for periodic underway periods in the vicinity of Okinawa, Japan to complete required amphibious training and MEU (SOC) certification and periodic exercises in the vicinity of Thailand and Singapore. The ships were also scheduled for local operations 1 of every 4 weeks. An underway week was assumed to average 5 days underway and 4 nights away from homeport.

MPF(F) ship maintenance and training requirements have not been formally established. MCCDC provided the maintenance assumptions for the study. Each ship is off-station and/or not-available for maintenance 2-3 months every 36 months. The MLHD and MLHAR have a relatively small quantity of prepositioned equipment that is either transferred to other ships or brought with the ship when it proceeds to the West Coast for maintenance. The total time off-station is 3 months every 36 months. The MLPs are not loaded with prepositioned equipment and conduct 2 months of maintenance every 36 months. The LMSRs and T-AKEs have a significant amount of prepositioned equipment and material and are assumed to conduct the MPF Maintenance Cycle (MMC) at Blount Island Command (BIC) in Jacksonville, Florida. The ships are assumed to be off-station for 3 months every 36 months.

The MPF(F) ships scheduled for local operations 1 of every 8 weeks while not in maintenance or assigned to events. This time could be used for operational equipment checks or training. An underway week was assumed to average 5 days underway and 4 nights away from homeport.

Table 5 summarizes the major maintenance and training planning factors used for each class of ship in developing the global postures.^{6,7}

Platform	Maintenance			Training		
	Availability	Interval (months)	Length (months)	Basic (weeks)	Integrated (weeks)	Advanced (weeks)
CONUS LHD / LHA	DPMA	136	8	21	Various	13
	PMA	21	2	13		
CONUS LPD	DPMA	116	4	21		
	PMA	22	2	13		
CONUS LSD	DPMA	140	4	21		
	PMA	22	2	13		
FDNF LHD / LHA	DPMA	139	5	Continuous		
	PMA	15	3			
FDNF LPD	DPMA	107	4			
	PMA	15	2			
FDNF LSD	DPMA	83	4			
	PMA	15	2			
MPF(F) LHD / LHAR	West Coast	33	3		Not Defined	
MPF(F) MLP	In Theater	34	2			
MPF(F) LMSR / TAKE	East Coast	33	3			

Table 5 (U) Maintenance and Training Cycle Assumptions

2.3.1.4 (U) Transits

Ships are assumed to transit at 15 knots to scheduled deployment and event locations and at 18 knots to unscheduled events. Transit distances were computed primarily using the World Ports Distances Calculator.⁸ The Panama Canal and Suez Canal are assumed to be available for all ship classes.⁹

East/west coast ESG transits to and from CENTCOM are 5/7 weeks duration, including 10 days of quality of life (QOL) port visits during each transit. The required agricultural wash-downs and inspections are conducted during the return trip.

2.3.2 (U) Status and Readiness for Tasking

The global posture provides the location and status of each asset. The three digit status codes were used to identify the major maintenance, training and operations phases:

- Maintenance and maintenance away from homeport.
- Basic training underway and inport.

⁶ Representative Intervals, Durations, Maintenance Cycles, and Repair Mandays for Depot Level Maintenance Availabilities of U.S. Navy Ships, OPNAV Notice 4700, 16 June 2003.

⁷ Surface Force Training Manual, COMNAVSURFORINST 3502.1D, 1 July 2007.

⁸ World Port Distances Calculator, www.distances.com.

⁹ The current 106 foot PANAMAX restriction for LHA, LHD, MLHD, MLHAR and MLP will be eliminated by completion of the Panama Canal Expansion project in the 2015 timeframe.

- Inport periods and local operations underway following completion of maintenance and basic training (CONUS amphibious ships) or following completion of maintenance (FDFNF amphibious ships and MPF(F) ships).
- Advanced training underway and inport.
- POM period underway and inport.
- Deployed (by geographic region).
- LCO event.

The location and status codes are used to determine asset availability for tasking, which will be described in Section 2.4. Each status code corresponds to a readiness for tasking. This is the total time in weeks (or fraction thereof) to get underway (if not already underway), transit to the appropriate location to embark troops (when applicable), load troops, and be ready to commence the transit to an event location. Table 2-5 provides a summary of the readiness for tasking based on status.

Amphibious	MPF(F)	Status	RFT (Weeks) Underway / Inport
X	X	Maintenance	Remaining Duration
X	--	Basic Training	Remaining Duration
--	X	Inport / Local Operations	2.0 / 2.0
X	--	Inport / Local Operations	1.0 / 1.43
X	--	Advanced Training	
X	--	Pre-overseas Movement	
X	--	Deployed	0.14
X	X	LCO Event	0.29

Table 6 (U) Readiness for Tasking Based on Status

The assumption was made that an appropriate Marine force would be available to embark in amphibious or MPF(F) shipping on the same timeline. East coast amphibious ships were assumed to load in the vicinity of Morehead City and Onslow Bay, NC. West coast amphibious ships were assumed to load at Camp Pendleton, CA. FDFNF ships were assumed to load in Okinawa, Japan.

The amphibious ship readiness for tasking following maintenance and basic training was assumed to be 1.0 to 1.43 weeks (7-10 days), depending on whether the ship is underway or inport. Amphibious ships on deployment were assumed to be able to respond in 0.14 weeks (24 hours) based on typical theater deployment requirements.

MPF(F) ships were assumed to embark the flow-in-echelon (FIE) at homeport and be ready to transit in 2 weeks. The Capability Development Document (CDD) for Maritime Prepositioning Squadron (Future) [MPF(F)] requires that the 2015 MEB close in 10-14 days. The study assumed a 2 week RFT based on the complexity of closing the required

Navy and Marine Corps personnel, and the equipment (e.g. aircraft) that is not already repositioned. The sensitivity of the overall force mix performance to this RFT assumption was examined as described in Section 3.3.

2.4 (U) Availability for Tasking

The global posture contains the location and status of each asset over time. When an asset is determined to be available for tasking, the status code indicates how long it will take to commence the transit to the LCO event location. The manual scheduling of assets for events requires numerous decisions that needed to be emulated in the assignment model. This section describes the asset availability for tasking rules that were included in the model.

The Fleet Response Plan (FRP)¹⁰ provides guidance regarding amphibious ship availability for operational employment based on the status of training. Table 7 summarizes the FRP Phases, the ready for tasking status designations, and the associated employment.

Fleet Response Plan		
FRP Phase Status	Ready for Tasking Status	Employment
Basic Phase complete	Independent Unit Ready for Tasking	Independent operations in support of Phase 0 Shaping/Deterrence, Homeland Security, HA/DR, or other specific focused operations
	ATF Surge	Contingency amphibious lift; support SOF, SPMA GTF, adaptive force packages
Integrated Phase focused training complete	Maritime Security Surge	MIO, EMIO, SOF support, anti-piracy ops, TSC ops, and IO
Integrated Phase complete	MCO Surge	Ready for operational employment, assuming operational risk commensurate with level of capability achieve at time of surge
Advanced Integrated Training complete	MCO Ready	Certified for forward deployed ops
Sustainment Phase		

Table 7 (U) Fleet Response Plan

The FRP indicates that ships are in an Independent Unit Ready for Tasking (IURT) or ATF Surge status following completion of basic training and would be capable of conducting LCO type operations within acceptable risk from that point forward in the overall cycle. The study assumed that amphibious ships would be generally available for LCO events following completion of basic training. The major exception was the treatment of advanced training for CONUS ESG ships, since advanced training is necessary for deployment to CENTCOM. ESG ships were assumed to be not available for scheduled (Priority 3) LCO events during the first 9 weeks of advanced training. These ships would be available for unscheduled (Priority 1-2) events or to deploy up to 4 weeks early for scheduled LCO events. The study assumed that CENTCOM deployers in workups or on

¹⁰ Fleet Response Plan CUSFFC/CPFLTINST 3000.15, 21 August 2007.

deployment were not available for SOUTHCOM operations or for LCO events greater than 13 weeks. These assumptions were designed to protect CENTCOM as a priority deployment location. Table 8 provides a summary of the asset availability for tasking to LCO events.

Amphibious		Asset Status	LCO Event Availability ^a
ESG	Non-ESG		
X	X	Maintenance	--
X	X	Basic training	--
X	X	ATF Surge (Inport or Local Operations)	1-3
--	X	ATF Surge – Advanced Training	1-3
X	--	ATF Surge – Advanced Training	1-2
X	X	MCO Ready – Vicinity Homeport	1-3
X	--	Deployed	1-3
X	X	LCO Scheduled Event (Priority 3)	1-2
X	X	LCO Scheduled Event (Priority 2)	1
X	X	LCO Unscheduled Event (Priority 1)	--

a. ESG ships not available for SOUTHCOM events during workups and deployment or for events greater than 13 weeks duration.

Table 8 (U) Amphibious Ship Availability for Tasking to LCO Events

2.5 (U) LCO Assignment Model and Output Metrics

The LCO events and global posture are the primary inputs to the LCO assignment model. The model identifies feasible asset mixes from the global posture, evaluates the ability of those assets to meet LCO event required capabilities, and assigns the asset(s) to the event. The updated location and status codes in the global posture provide the raw data used to compute the output metrics to include: Demand Met, Residual Capacity, Asset Utilization, and Assault Echelon (AE) MCO Response Time.

2.5.1 (U) LCO Assignment Model

The study required a repeatable process to evaluate the ability of each force mix alternative and the associated excursions to meet the demands of the set of LCO events. There were four steps that had to be completed for each event:

- Identify the feasible asset mixes that could be assigned to the event based on the event identification week and asset locations, status, availability for tasking, and readiness for tasking.

- Determine the percentage of the event duration that each feasible asset mix could support based on week the asset mix would be assigned, readiness for tasking and transit time.
- Compare the capabilities that could be provided by each feasible asset mix to the event required capabilities. This requires identifying the capabilities that are under or over the required capabilities.
- Determine the “best” feasible asset mix and assign the assets to the event. The best asset mix generally would be the one that comes the closest to meeting several objectives:
 - Provides all of the required capabilities. No C1 to C10 under-capabilities.
 - Does not significantly exceed the required capabilities. C1 to C10 over-capabilities are not available for other events.
 - Capable of being on-station for the entire event, or for a greater percentage of the event than other feasible mixes.
 - Minimum disruption to initial asset schedules and operational tempo (OPTEMPO). Assign deployed assets when available. Minimize total time assets are diverted for an event: readiness for tasking, transit from initial location to event location, and transit from event location to follow-on scheduled location.

The requirement to identify feasible asset mixes and the “optimal” solution for an event suggested a linear program (LP) approach. The determination of the “best” asset mix based on several diverse objectives suggested a goal LP approach, which evaluates the overall deviation of the objectives (deviation variables) from specified standards.

The LCO assignment model penalty function was constructed using five deviation variables based on the objectives above: under-capability, over-capability, duration, status, and transit. The penalty for each deviation variable was computed by multiplying the unit penalty (P_i) by the deviation of variable (D_i) from the standard (S_i). The total penalty (T) is the weighted sum of the five penalties, where the weights reflect the relative importance of each of the deviation variables.

$$T = \sum_{i=1}^5 W_i P_i (D_i - S_i)$$

**Figure 3 (U) Goal LP
Total Penalty**

The study team concluded that the under-capability and duration objectives were most important and assigned them relatively higher weights. The over-capability, status, and transit weights were scaled to be tie-breakers for feasible asset mixes that met the required capabilities and event duration.

The goal LP was formulated using Mathematical Programming Language (MPL), XA solver, and an Excel input/output interface. The model was designed to iteratively identify feasible asset mixes and solve for the asset mix with the minimum total penalty (T) based on the specified weeks during which assets could be assigned to an event. Scheduled

events used a six week assignment week window while unscheduled events were limited to the number of weeks between the identification and start of an event (1-4 weeks).

The first run of the iterative process was based on the assignment week being the week before the event start week. The non-feasible assets were identified using the availability rules and based on the ability to get on-station. The deviation variable values were computed for each of the feasible assets for use in the solver. The solver identified combinations of feasible assets while attempting to minimize the total penalty (T), resulting in identification of the best asset mix for that specific assignment week. The process was then repeated, working backward through the assignment week window specified for that event (2 weeks before the event start week, 3 weeks, etc.). The overall best solution for the event was the asset mix and assignment week with the minimum total penalty. The global posture location and status matrices were updated to reflect commitment of the asset mix to the event.

2.5.2 (U) Output Metrics

The primary output metrics were computed using the post-model run location and status matrices.

2.5.2.1 (U) Demand-Met

Demand-Met (DM) is a measure of the overall percentage of event capabilities satisfied. The metric is computed for each individual event and for the full set of events. A single metric value was computed across the capabilities through the use of weights that were developed by the Study Advisory Group (SAG) in a decision support session. A set of weights were developed for each of the 13 event types, then averaged and normalized for use with the full set of events. The DM for an individual event is the weighted sum of the percentage of capabilities satisfied. The DM for all of the events is the weighted sum of the percentage of capabilities satisfied across all of the events.

2.5.2.2 (U) Asset Utilization

Event Asset Utilization (EAU) is a measure of total weeks of demand satisfied by each ship class. The metric is computed for each individual event and summed for the full set of events. The EAU is determined by computing the proportional contribution of each ship class to satisfying event required capabilities, then summing across the capabilities using the weights developed by the SAG.

Total Asset Utilization (TAU) is the percentage of time ships are away from homeport across the 104 week period.

2.5.2.3 (U) Residual Capacity

During the progress of the study it became apparent that one of the major differences across the force mix alternatives is the residual capacity for conducting additional LCO events or deployments based on emerging requirements. Figure 4 provides a representative LHD schedule across the 104 weeks. Starting at the top and moving clockwise, there are inport periods for maintenance, training, and other totaling 50% of the total time. Starting at the top and moving counter-clockwise, there are underway periods for training and local operations, deployment, and events.

The Residual Capacity (RC), shown in yellow, is the net number of weeks ships are available for operations subject to a 50% home tempo policy constraint across the 104 week event horizon. RC is 52 minus the number of weeks a ship is away from homeport for training, deployment and events.

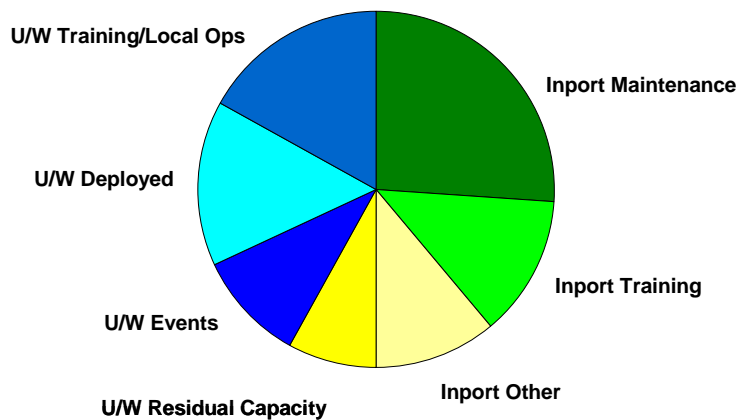


Figure 4 (U) Representative LHD Schedule (104 weeks)

The SAG asked how much of the residual capability would be useable for extended underway periods, leading to development of an additional metric. The Residual Capacity Employment Periods [X] (RCEP[X]) is the total number of X week long periods ships are available for operations subject to a 50% home tempo policy constraint across the 104 week period. The Study Advisory Group (SAG) initially asked that RCEP be computed for a notional 13 week period. The study team examined the LCO events to determine how long RCEP would need to be on average to conduct additional similar events, assuming that CENTCOM deployers cover CENTCOM events and PACOM ships cover half of the PACOM events. The average total time to transit to the embarkation location, load troops and equipment, transit to the event location, conduct the event, transit to the debarkation location, and offload was 11 weeks. RCEP was computed for 10-16 weeks and is provided in Section 3.

2.5.2.4 (U) AE MCO Response Time

The AE MCO Response Time (MCO-RT) is the time to close the amphibious force to a designated location for an MCO. The closure analysis assumes that ships commence an 18 knot transit from the ship's location on C-Day to the MCO location at the end of the readiness for tasking (RFT) time. A two week delay is included to account for reconfiguration and/or a rehearsal en route to the MCO location. The RFT for ships undergoing maintenance with greater than four weeks remaining is assumed to be four weeks plus 50% of the remaining time in maintenance plus the adjusted training time. The RFT for ships undergoing training is assumed to be the lesser of 50% of the remaining training time or two weeks.

The closure analysis assumes that 10 LHD/LHA, 10 LPD, and 10 LSD provide 2.0 MEB AE. LHD/LHAs provide 0.1 MEB AE, LPDs provide 0.6 MEB AE, and LSDs provide 0.4 MEB AE. The output of the closure analysis is a graph showing the build-up of MEB AE at the MCO location over a 10 week period. The number of each type of ship that has arrived is also provided for designated points in time.

3 FORCE MIX PERFORMANCE

This section provides the results of the force mix alternative model runs to include the LCO performance, MCO performance and select sensitivity analysis on the synchronization of the event list and global posture, impact of event simultaneity, and impact of basing location.

3.1 (U) LCO Performance

3.1.1 (U) Demand-Met

Figure 5 provides the number of large deck ships for each alternative, the Demand-Met (DM) for the 28 events, and a visual depiction of the 104 week event horizon. The green

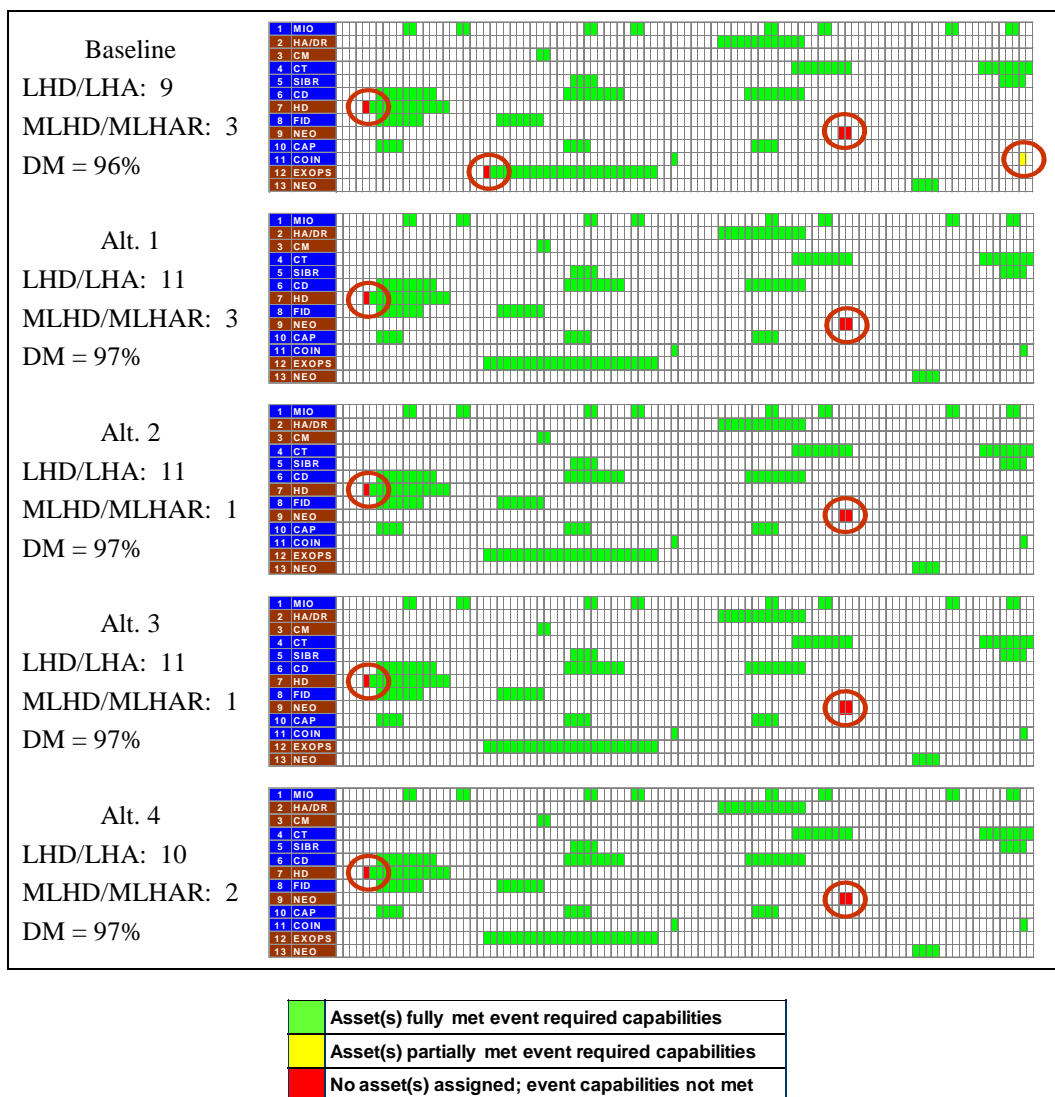


Figure 5 (U) Force Mix Alternative Demand-Met

entries indicate the asset(s) fully met the required capabilities. Yellow entries indicate the asset(s) partially met the required capabilities. Red entries indicate that no assets were assigned, so the event capabilities were not met. The red circles simply mark the events that are not green.

The Baseline DM was 96% with four event issues compared to 97% for Alternatives 1-4, with two of the four event issues. Table 9 provides the details for each of the events that were not fully met. Baseline event type 7 is a Homeland Defense event for which 12 of 13 weeks were met. The first week was gapped because no assets were in range (readiness for tasking plus transit time). The event demand-met, which is the percentage of event capabilities satisfied, was 92 percent. Event types 9 and 12 were gapped due to no assets in range. Event type 11 was serviced by an MPF(F) LHAR, which did not have the required fixed capabilities.

Force Mix Alternative	Event Type & Location			Weeks Met	Demand-Met	Comments
Baseline	7	HD	NORTHCOM	12 of 13	92%	No assets in range first week
	9	NEO	AFRICOM	0 of 2	0%	No assets in range
	11	COIN	AFRICOM	1	90%	MPF(F) LHAR FW CAS shortfall
	12	EXOPS	AFRICOM	25 of 26	96%	No assets in range first week
Alts 1-4	7	HD	NORTHCOM	12 of 13	92%	No assets in range first week
	9	NEO	AFRICOM	0 of 2	0%	No assets in range

Table 9 (U) Events Not Fully Satisfied

The primary difference in performance was that event types 11 and 12 were serviced by MPF(F) ships based in Guam for the Baseline, compared to the use of a non-ESG LHD based in Norfolk for Alternatives 1-4 as shown in Table 10 in the next section.

The challenges associated with satisfying the AFRICOM events are not surprising since two of the three are unscheduled events and all of them are outside typical ESG deployment patterns.

3.1.2 (U) Asset Utilization

This section provides a summary of the model run output and the associated Event Asset Utilization (EAU) and Total Asset Utilization (TAU) metrics.

Table 10 shows the scheduled and unscheduled events, sorted by event start week. The assets assigned by the model for each primary run are color-coded to indicate the extent to which the event required capabilities were met. The green, yellow, and red color-codes are the same as Figure 5. The green with red stripe indicates that the asset(s) missed the first week of the event, but met all of the capabilities once on station. The event issues

identified in Figure 5 and Table 9 are also shown in Table 10. The individual events were assigned a single large deck ship with three exceptions.

- CM event type 12 – the required capabilities could be satisfied by an LPD.
- NEO event type 9 – the model could not find a solution due to the location and the identification of the event requirement one week before the event start week.
- NEO event type 13 – the event required the capability to lift three company equivalents by air and/or surface means. The Baseline deployed ESG was capable of doing this with the LHD and LSD so only those ships were assigned. The deployed ESG for Alternatives 1-4 had an LHA on this deployment requiring all three amphibious ships to meet the full lift requirement.

Of note, the two additional AE LPDs in Alternatives 1-4 were not selected by any of the primary runs. The results for Alternatives 1a, 2a, 3a, and 4a would be identical.

Scheduled and Unscheduled Events						Baseline	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Type	Event Type	PRI	ID Week	Start Week	End Week					
HD	7	1	4	5	17	LHA 6	LHA 6	LHA 6	LHA 6	LHA 6
CD	6	3	1	7	15	LHD 7	LHD 7	LHD 7	LHD 7	LHD 7
FID	8	3	1	7	13	LHD 3	LHA 9	LHA 9	LHA 9	LHD 3
CD	6	3	1	7	10	LHA 7	LHA 7	LHA 7	LHA 7	LHA 7
MIO	1	3	1	11	12	LHD 6	LHD 6	LHD 6	LHD 6	LHD 6
MIO	1	3	1	19	20	LHD 5	LHD 5	LHD 5	LHD 5	LHD 5
EXOPS	12	2	19	23	48	MLHD 8	LHD 1	LHD 1	LHD 1	LHD 1
FID	8	3	1	25	31	LHD 3	LHA 9	LHA 9	LHA 9	LHD 3
CM	3	2	30	31	32	LPD 21	LPD 21	LPD 21	LPD 21	LPD 21
CD	6	3	1	35	43	LHD 4	LHD 3	LHD 3	LHD 3	LHD 4
CAP	10	3	1	35	38	LHD 5	LHD 5	LHD 5	LHD 5	LHD 5
SIBR	5	3	1	36	39	LHD 2	LHD 2	LHD 2	LHD 2	LHD 2
MIO	1	3	1	38	39	LHA 6	LHA 6	LHA 6	LHA 6	LHA 6
MIO	1	3	1	45	46	LHD 7	LHD 7	LHD 7	LHD 7	LHD 7
COIN	11	3	1	51	51	LHA 6	LHA 6	LHA 6	LHA 6	LHA 6
HA/DR	2	2	57	58	70	LHD 3	LHA 9	LHA 9	LHA 9	LHD 3
CD	6	3	1	62	70	LHA 7	LHA 7	LHA 7	LHA 7	LHA 7
CAP	10	3	1	63	66	LHD 1	LHA 8	LHA 8	LHA 8	LHA 8
MIO	1	3	1	65	66	MLHAR 1	MLHAR 1	LHD 1	LHD 1	MLHAR 1
CT	4	3	1	69	77	LHD 6	LHD 6	LHD 6	LHD 6	LHD 6
MIO	1	3	1	73	74	LHD 1	LHA 8	LHA 8	LHA 8	LHA 8
NEO	9	1	75	76	77	****	****	****	****	****
NEO	13	1	86	87	90	LHD 1, LSD 51	LHA 8, LPD 17, LSD 51	LHA 8, LPD 17, LSD 51	LHA 8, LPD 17, LSD 51	LHA 8, LPD 17, LSD 51
MIO	1	3	1	92	93	LHD 4	LHD 4	LHD 4	LHD 4	LHD 4
CT	4	3	1	97	104	LHD 2	LHD 2	LHD 2	LHD 2	LHD 2
SIBR	5	3	1	100	103	LHD 4	LHD 4	LHD 4	LHD 4	LHD 4
MIO	1	3	1	101	102	LHA 7	LHA 7	LHA 7	LHA 7	LHA 7
COIN	11	3	1	103	103	MLHAR 1	LHD 1	LHD 1	LHD 1	LHD 1

Green	Asset(s) fully met event required capabilities
Yellow	Asset(s) partially met event required capabilities
Light Green	Asset(s) not assigned for 1 week of event
Red	No asset(s) assigned; event required capabilities not met

Table 10 (U) Asset Assignment to Events

Figure 6 provides the EAU, which is a measure of the number of weeks of demand satisfied by each type of ship. The bar chart shows the event coverage in ship-weeks over

the 104 week event horizon. The gold represents the MPF(F) LHD/LHAR, which were used in the Baseline and Alternatives 1 and 4. The blue represents the AE LHD/LHAR, which were used in all of the force mix alternatives. The gray represents the LPD, LSD, and MPF(F) MLP assets. LPDs and LSDs were used in all of the force mix alternatives, but at a much lower level than the large decks since the events were designed to stress aviation operations. The red represents weeks that were not satisfied from a capability perspective.

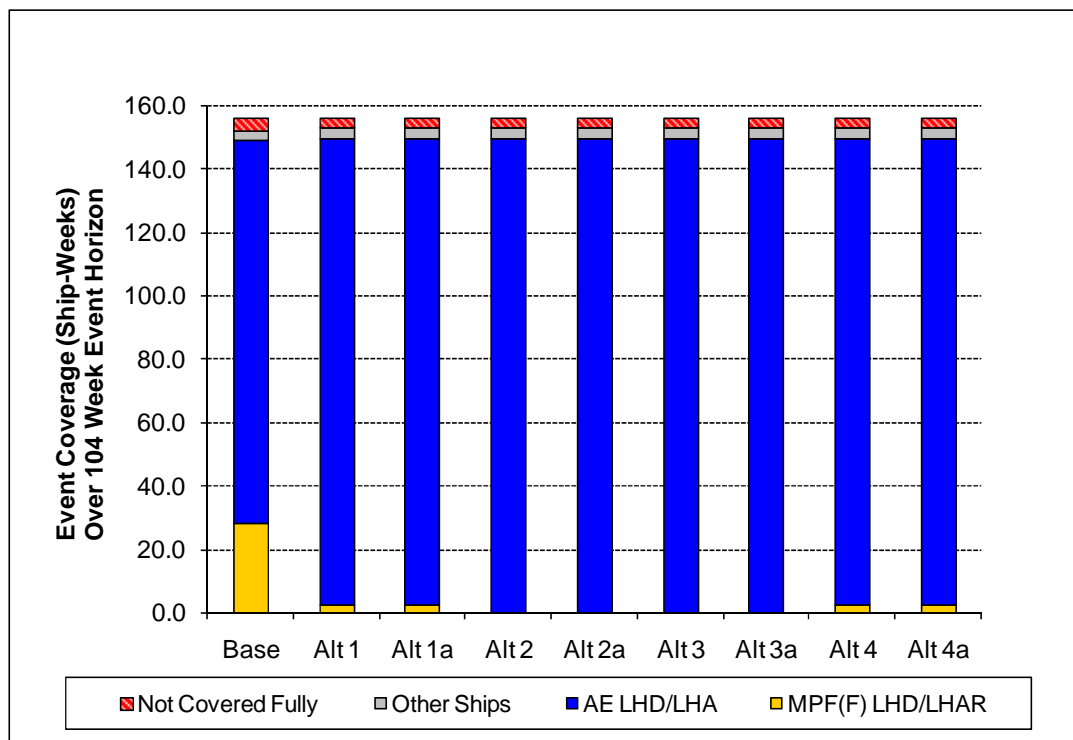


Figure 6 (U) LCO Event Asset Utilization

The TAU is the percentage of time ships are away from homeport for training, local operations, presence deployments, and LCO events. NAVADMIN 051/07 reaffirmed the Navy 50% in homeport policy in 2007.¹¹ The new metric is Homeport Tempo (HOMETEMPO), which is the percentage of time a unit is inport within the employment cycle. The NAVADMIN does not specifically address Military Sealift Command (MSC) ships. The study assumes that MSC will adhere to Navy guidelines when possible for ships such as the LHAR/LHD that have large naval support element (NSE) augmentation. Figure 7 shows the average time away from homeport for the AE and MPF(F) LHD/LHAR. One or two AE assets in each force mix alternative exceeded the 50% time away from homeport: Baseline (55%), Alternative 1 (54%), Alternative 2 (52%, 54%),

¹¹ NAVADMIN 051/07, Deployability and Employability, CNO Washington DC 271709Z FEB 07.

Alternative 3 (52%, 54%) and Alternative 4 (55%). Each percentage point over 50% equates to roughly 1 week of “excess” underway time in a 104 week period.

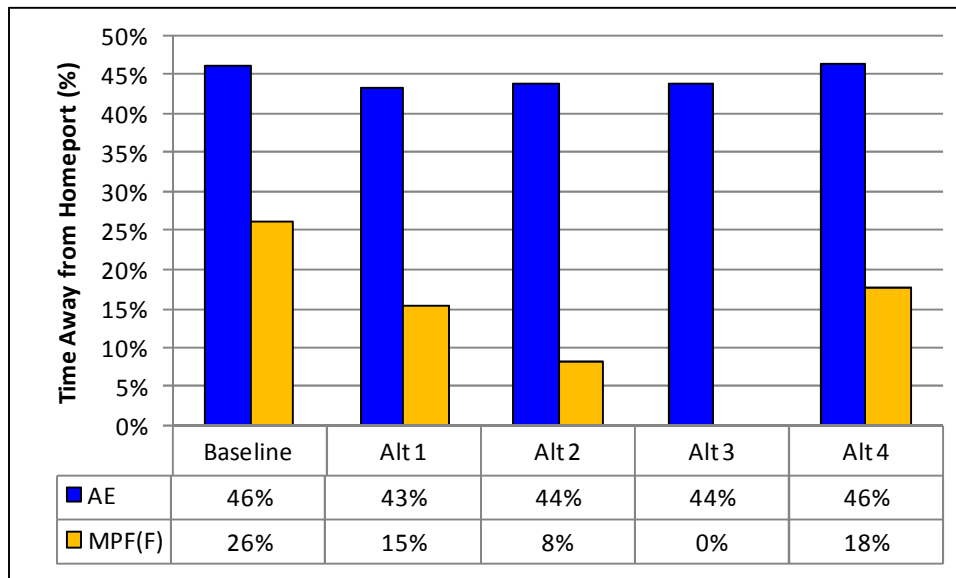


Figure 7 (U) AE and MPF(F) LHD/LHAR Total Asset Utilization

3.1.3 (U) Residual Capacity

The Residual Capacity (RC) is the net number of weeks ships are available for operations subject to a 50 percent HOMETEMPO policy constraint across the 104 week event horizon. Figure 8 shows there are 34 to 75 ship weeks RC for the AE and 43 to 108 ship weeks for the force mix alternatives with MPF(F) LHD/LHAR.

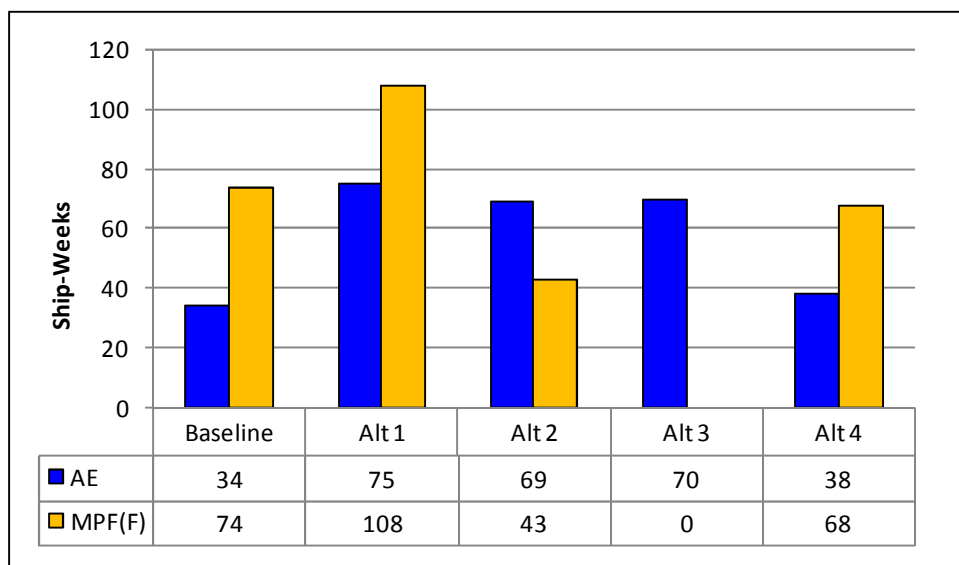


Figure 8 (U) AE and MPF(F) LHD/LHAR Residual Capacity (RC) Based on a 50% Homeport Tempo

The Baseline, Alternative 2 and Alternative 4 (12 LHD/LHAR) have total RC ranging from 106 to 112 ship-weeks. Alternative 1 (14 LHD/LHAR) has a significantly greater RC of 183 ship-weeks while Alternative 3 (11 LHD/LHAR) is roughly two-thirds of the 12 ship alternatives.

The range of RC across the alternatives is 70 to 183 ship-weeks. How much of this time would actually be available to conduct meaningful additional LCO events or mini-deployments? The Residual Capacity Employment Periods (X) [RCEP(X)] is the total number of X week long periods ships are available for operations subject to a 50% HOMETEMPO policy constraint across the 104 week period.

The RCEP was computed for each LHD/LHAR individually based on availability status. Starting at week 1, the first available week was identified and the total number of contiguous weeks of availability up to the prescribed employment period X was counted (inport and underway periods). An adjusted RC was computed as RC minus the weeks in that period the ship was already scheduled underway. If the contiguous period was at least X weeks long and less than or equal to the adjusted RC, it was counted as an available period and the RC was decremented to reflect the additional underway time. The process was repeated for all available periods across the 104 weeks for each ship. The employment period length was varied from 10 to 16 weeks. Figure 9 provides a table with RCEP profile for each force mix and the associated trend lines. The 12 LHD/LHAR force mixes are grouped relatively tightly between the 14 ship (Alternative 1) and 11 ship (Alternative 4) force mixes. A review of the underlying data revealed that the non-ESG and MPF(F) ship generated the majority of these additional employment periods.

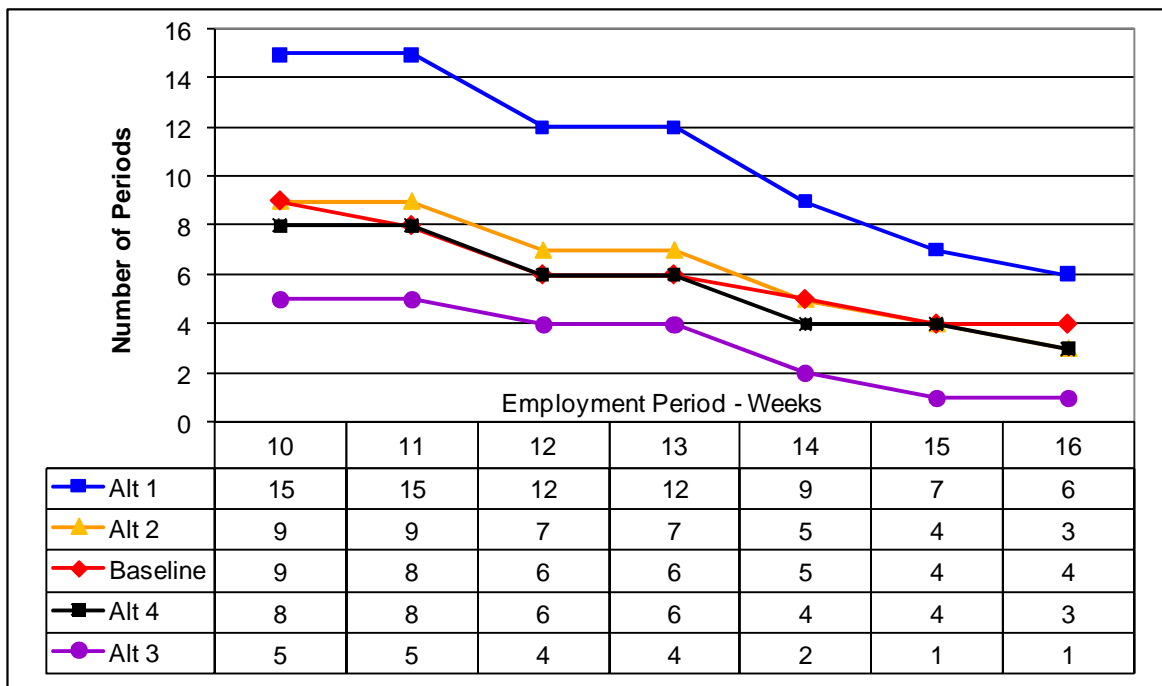


Figure 9 (U) AE and MPF(F) LHD/LHAR Residual Capacity Employment Periods (RCEP) Based on 50% Homeport Tempo

3.2 (U) AE MCO Response

The Assault Echelon (AE) MCO Response Time (MCO-RT) is the time to close the amphibious force to a designated location for an MCO based on the assumptions detailed in Section 2.5.2.4. The AE MEB lift closure timeline was computed for each of the 104 weeks in the global posture and averaged. Figure 10 shows the average closure timeline for each of the five force mixes. All of the alternatives close a minimum of 1.0 MEB AE between weeks 6 and 7. The Marine Corps requirement for amphibious lift is 2.0 MEB AE, requiring roughly 10 LHD/LHAR, 10 LPD, and 10 LSD operationally available ships. Alternatives 1, 2, and 3 have sufficient amphibious force structure to close 2.0 MEB AE between weeks 8 and 9. The Baseline provides a maximum of roughly 1.7 MEB AE on the same timeline while Alternative 4 provides 1.8 MEB AE lift. Figure 10 (U) Average AE MEB Lift Closure to MCO Location

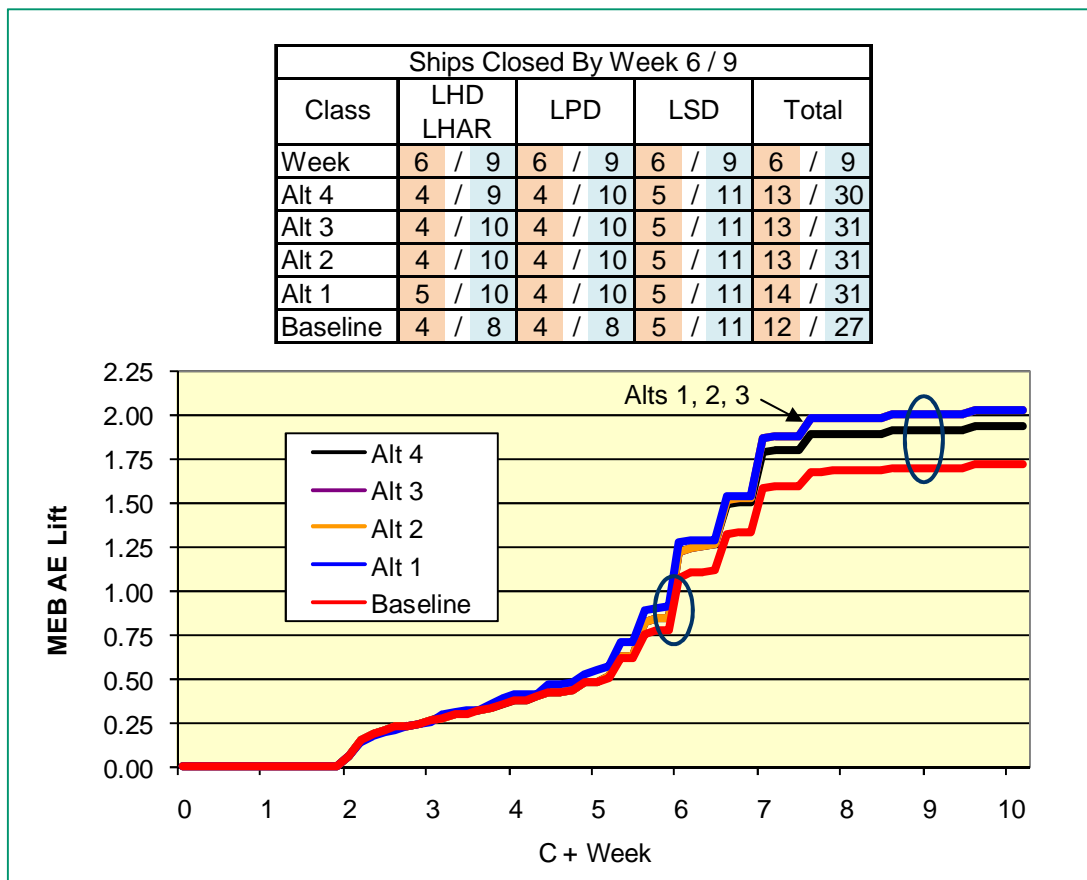


Figure 10 (U) Average AE MEB Lift Closure to MCO Location

3.3 (U) Sensitivity Analysis

The study team was concerned early on about the potential force mix performance sensitivity to key model inputs, to include the synchronization of the event list with the

global posture, the number of simultaneous events, and the basing assumptions for MPF(F) and the additional AE ships.

3.3.1 (U) Synchronization of Events and Global Posture

The events list specifies the start and end week of each event over a 104 week period. At what point in the future ESG deployment pattern do these events start? Would it make a difference if the events started at some other point in the ESG cycle?

The global posture was designed to support sensitivity analysis to address these questions by expanding it from 104 to 208 weeks and making the global posture start week one of the model inputs. The development of a specific 104 week period global posture model input required 130 weeks of data to allow for the computation of the return to homeport week for assets deployed at the end of the 104 week period. The result was that the global posture start week could range from week 1 to 78 of the 208 week global posture. Figure 11 illustrates the alignment of the event list to the global posture.

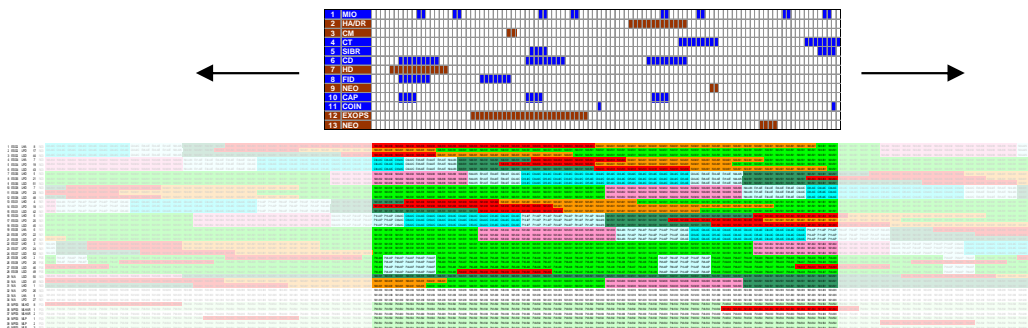


Figure 11 (U) Synchronization of Event List and Global Posture

The sensitivity of force mix performance to the global posture start week was assessed by conducting model runs each force mix alternative with multiple global posture start weeks. The result was a variation in the Demand-Met of up to one percent and the variations were consistent across the force mix alternatives.

3.3.2 (U) Event Simultaneity

The standard event list contains 28 individual events over the 104 week period, with a maximum of five simultaneous events. Would it make a difference if the timing of some events shifted, resulting in more simultaneous events? A higher density event list was created by shifting several events, resulting in six simultaneous events in the first quarter and seven simultaneous events in the third quarter as illustrated in Figure 12.

The sensitivity of the force mix performance to the density of the event lists was assessed by conducting model runs with both the standard and high density event lists. The result was a variation in the Demand-Met of up to one percent.

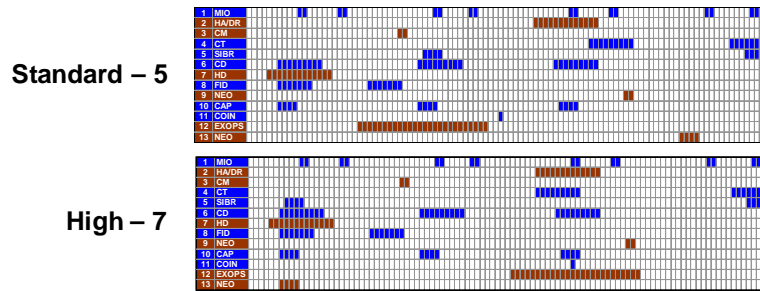


Figure 12 (U) Standard and High Density Event Maps

3.3.3 (U) Basing Location

The MPF(F) squadron is assumed to be based at Apra Harbor, Guam. Given the distances between Guam and many of the LCO event locations it was reasonable to assess the impact of distributing the MPF(F) capabilities across the three MPSRONS. The study team assumed that one LHD/LHAR, MLP, LMSR, and T-AKE would be based in Rota, Spain; Diego Garcia and Guam. The result was an improvement in the Baseline force mix Demand-Met of one percent and reliance on the Spain-based LHD for many of the AFRICOM events.

Alternatives 1-3 contain four additional amphibious ships (2 LHD/LHAR and 2 LPD) while alternative 4 contained three additional amphibious ships (1 LHD/LHAR and 2 LPD). The study assumed that the non-ESG big deck would be an LHD due to the increased flexibility of air and surface capabilities. The assumption was that one LHD/LPD was based in Norfolk, VA with the remaining one or two ships based in San Diego, CA. Initial model runs revealed that the Norfolk based non-ESG LHD was assigned to LCO events more frequently than the one in San Diego. Limited model excursions were conducted to determine if there was any advantage to relocating the additional LHD/LPD from San Diego to Hawaii. The result was no change in Demand-Met, but increased use of other platforms (not the LHD shifted to Hawaii) for major SOUTHCOM events.

4 LIFE-CYCLE COST

4.1 (U) Assumptions

The following general assumptions were made in the development of the life-cycle cost estimates (LCCE):

- All costs are in constant FY 2008 billions of dollars (FY08\$B), unless otherwise specified. The Office of the Secretary of Defense (OSD) approved inflation indices for 2007 were used to convert between constant and then-year dollars.
- FY 2008 and beyond costs were considered in the study. The FY 2008 LPD 17 and ships procured in FY 2007 and earlier are considered to be sunk costs and are not included.
- The ship counts depicted in Table 1 were assumed for the LCCE. Ship procurement costs were projected for FY 2009 to 2045 to account for the force mix alternatives and to replace the LHA 1, LHD 1, LSD 41/49 and LPD 17 ships that reach the end of service life during FY 2016-2045 operating and support (O&S) cost time horizon. This includes the 7 LHA7/LHDX and 12 LSDX ships included in the FY 2008 annual long-range shipbuilding report to Congress¹² and 6 LPDX that must be awarded during 2040-2045 to replace LPD 17s approaching the end of service life.
- The non-aviation capabilities resident within the MPF(F) LHAR/D platforms that are not included in applicable alternatives must be accommodated within the MPF(F) squadron.

4.2 (U) Research, Development, Test, & Evaluation, Navy (RDT&E'N)

4.2.1 (U) Methodology

OPNAV N853 provided President's Budget 2008 (PB08) data for FY09 to FY13. Part of the RDT&E can be allocated to individual platforms (MLP and T-AKR), while there is also a general MPF(F) National Defense Sealift Fund (NDSF) to support multiple platforms. No RDT&E cost projections were included for the 7 LHA7/LHDX, 12 LSDX and 6 LPDX. These costs would affect each alternative equally.

4.2.2 (U) Cost Estimates

The RDT&E'N projected costs range from \$0.486B to \$0.511B as shown Table 11. RDT&E'N does not appear to be a major cost discriminator across the alternatives.

¹² Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY 2008, Director, Warfare Integration (OPNAV N8F), Office of the Chief of Naval Operations, February 2007.

RDT&E'N (FY08\$B)	Baseline (PB08)	Alt 1	Alt 1a	Alt 2	Alt 2a	Alt 3	Alt 3a	Alt 4	Alt 4a
Total	\$0.477	\$0.511	\$0.503	\$0.494	\$0.486	\$0.494	\$0.486	\$0.511	\$0.503
Amphibious		\$0.035	\$0.026	\$0.035	\$0.026	\$0.035	\$0.026	\$0.035	\$0.026
MPF(F)	\$0.477	\$0.477	\$0.477	\$0.460	\$0.460	\$0.460	\$0.460	\$0.477	\$0.477

Table 11 (U) Force Mix Alternative RDT&E'N Costs (FY08\$B)

4.3 (U) Procurement

4.3.1 (U) Methodology

The average unit procurement costs (APUC) for most ship classes were derived from OPNAV N81 briefing materials¹³, OPNAV N85 life-cycle cost data¹⁴, Department of the Navy Fiscal Year (FY) 2008/2009 Ship Construction Navy (SCN) budget justification materials¹⁵, and the FY 2008 annual long-range shipbuilding report to Congress.¹⁶ The derivation of the APUC for each platform is provided in Table 18 in Appendix D. The study used PB08 cost data for consistency. PB09 data reflects an increase in MPF(F) LHAR unit cost from \$2.2B to \$3.3B, resulting in increased cost for applicable force mix alternatives. The impact of removing one to three MPF(F) LHAR/D in Alternatives 2, 3 and 4 is reflected in the cost estimates. This includes an additional LMSR for Alternatives 2 and 3, MEB C2 for Alternatives 2 and 3, and MLP and/or LMSR berthing modifications for Alternatives 2, 3 and 4.

The seven LHA7LHDX, 12 LSDX and six LPDX identified in the general assumptions are also included in the projected procurement costs. The APUC for the LHA7/LHDX was assumed to be the same as the amphibious LHA 6. The APUC for the LSDX was assumed to be 80% of the LPD 17. The APUC for the LPDX was assumed to be the same as the LPD 17.

The total procurement quantities for each force mix alternative are provided in Table 19 in Appendix D.

4.3.2 (U) Cost Estimates

Two cost tables are presented. Table 12 includes only the platforms that vary across the force mix alternatives. Table 13 shows the total projected cost to include the LHA7/LHDX, LSDX, and LPDX. The number of each type of ship was the primary cost driver. Alternative 1 meets all of the stated requirements, but costs roughly \$9.3B more

¹³ Sea Basing Capabilities Synthesis briefing to MPF(F) Sea Basing in Support of Major Combat Operations Executive Steering Group, 21 September 2007.

¹⁴ MPF(F) Life-cycle Cost Spreadsheet, 12 February 2007.

¹⁵ Department of the Navy Fiscal Year (FY) 2008/2009 Biennial Budget Justification of Estimates for SCN, February 2007.

¹⁶ Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY 2008, Director, Warfare Integration (OPNAV N8F), Office of the Chief of Naval Operations, February 2007.

than the Baseline. Alternative 3a with eleven AE LHAR/D and no MPF(F) LHAR/D is essentially cost neutral compared to the Baseline.

SCN&NDSF (FY08\$B)	Baseline (PB08)	Alt 1	Alt 1a	Alt 2	Alt 2a	Alt 3	Alt 3a	Alt 4	Alt 4a
Total	\$11.6	\$20.9	\$17.3	\$17.7	\$14.1	\$15.0	\$11.5	\$15.9	\$12.3
Amphibious		\$9.3	\$5.7	\$9.3	\$5.7	\$6.5	\$2.9	\$6.5	\$2.9
MPF(F)	\$11.6	\$11.6	\$11.6	\$8.3	\$8.3	\$8.5	\$8.6	\$9.4	\$9.4

Table 12 (U) Force Mix Alternative Variable Procurement Costs (FY08\$B)

SCN&NDSF (FY08\$B)	Baseline (PB08)	Alt 1	Alt 1a	Alt 2	Alt 2a	Alt 3	Alt 3a	Alt 4	Alt 4a
Total	\$59.8	\$69.1	\$65.5	\$65.8	\$62.2	\$63.2	\$59.7	\$64.1	\$60.5
Amphibious	\$48.2	\$57.5	\$53.9	\$57.5	\$53.9	\$54.6	\$51.0	\$54.6	\$51.0
MPF(F)	\$11.6	\$11.6	\$11.6	\$8.3	\$8.3	\$8.5	\$8.6	\$9.4	\$9.4

Table 13 (U) Force Mix Alternative Total Procurement Costs (FY08\$B)

4.4 (U) Operating and Support (O&S)

4.4.1 (U) Methodology

The O&S average cost per ship includes Operations and Maintenance (O&M) and Military Personnel, Navy (MPN). The individual ship cost estimates are provided in Table 20 in Appendix D. The LHA7/LHDX and LSDX O&S were assumed to be the same as the predecessor class ships. The O&M for the MPF(F) includes the manpower cost for the MSC crewing. Although the MPF(F) ships are expected to have permanent detachments of Sailors and Marines, the manning plans have not yet been approved so the associated MPN and Military Personnel, Marine Corps costs have not been included.

4.4.2 (U) Cost Estimates

Table 14 provides a summary of the projected O&S costs over a 30 year period (2016-2045) for each alternative.

O&M& MPN (FY08\$B)	Baseline (PB08)	Alt 1	Alt 1a	Alt 2	Alt 2a	Alt 3	Alt 3a	Alt 4	Alt 4a
Total	\$74.9	\$85.9	\$83.7	\$82.0	\$79.8	\$77.6	\$75.4	\$79.1	\$77.0
Amphibious	\$57.2	\$68.1	\$65.9	\$68.1	\$65.9	\$67.2	\$65.1	\$63.7	\$61.5
MPF(F)	\$17.8	\$17.8	\$17.8	\$13.9	\$13.9	\$10.4	\$10.4	\$15.4	\$15.4

Table 14 (U) Force Mix Alternative Operating and Support Costs (FY08\$B)

4.5 (U) Total Life Cycle Costs

4.5.1 (U) Cost Estimates

The total LCCE for each force mix alternative is summarized in Table 15 and Figure 13. Procurement costs account for approximately two-thirds of the total cost.

LCCE (FY08\$B)	Baseline (PB08)	Alt 1	Alt 1a	Alt 2	Alt 2a	Alt 3	Alt 3a	Alt 4	Alt 4a
LCCE	\$87.0	\$107.3	\$101.6	\$100.1	\$94.4	\$93.1	\$87.4	\$95.6	\$89.8
RDT&E	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5
Amphibious	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
MPF(F)	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5
Procurement	\$59.8	\$69.1	\$65.5	\$65.8	\$62.2	\$63.2	\$59.7	\$64.1	\$60.5
Amphibious	\$48.2	\$57.5	\$53.9	\$57.5	\$53.9	\$54.6	\$51.0	\$54.6	\$51.0
MPF(F)	\$11.6	\$11.6	\$11.6	\$8.3	\$8.3	\$8.5	\$8.6	\$9.4	\$9.4
O&S	\$74.9	\$85.9	\$83.7	\$82.0	\$79.8	\$77.6	\$75.4	\$79.1	\$77.0
Amphibious	\$57.2	\$68.1	\$65.9	\$68.1	\$65.9	\$67.2	\$65.1	\$63.7	\$61.5
MPF(F)	\$17.8	\$17.8	\$17.8	\$13.9	\$13.9	\$10.4	\$10.4	\$15.4	\$15.4

Table 15 (U) Force Mix Alternative Life-Cycle Costs (FY08\$B)

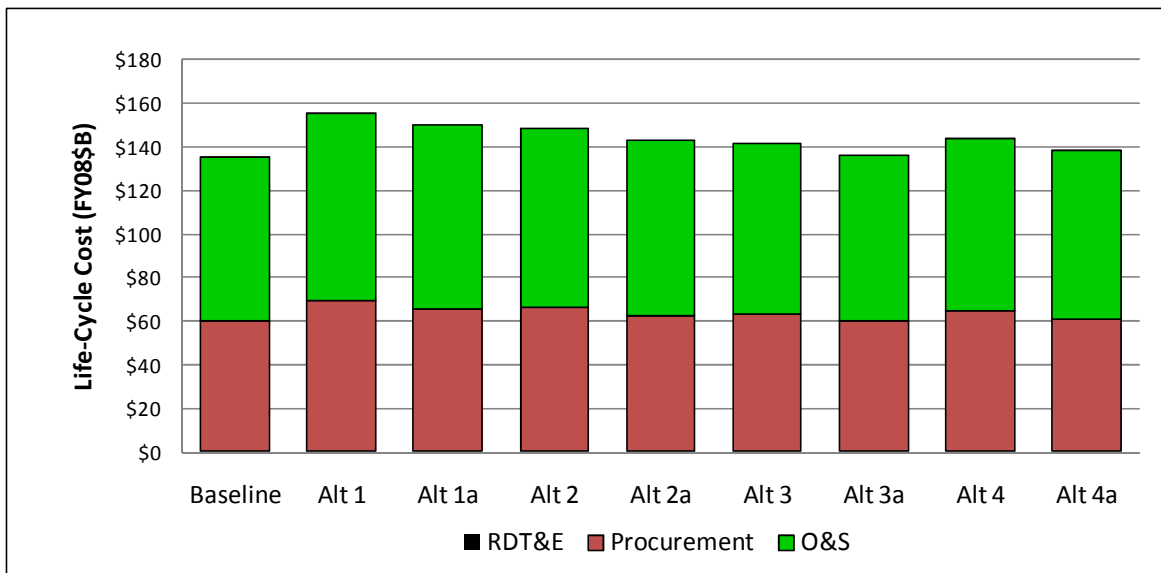


Figure 13 (U) Force Mix Alternative Life-Cycle Cost (FY08\$B)

5 SYNTHESIS OF RESULTS

Section 3 provided the results of the force mix performance analysis and Section 4 provided an assessment of the associated force mix costs. This section presents a synthesis of the cost and performance analyses.

5.1 (U) Force Mix Cost and Performance Summary

Table 16 summarizes the force mix alternatives, variable ship class procurement delta to the baseline, and performance. The assault echelon (AE) force structure ranges from 30 to 33 ships while MPF(F) ranges from 12 to 14 ships. The primary cost driver is the number of large deck ships in the AE and MPF(F), ranging from 11 to 14 across the alternatives. Alternatives with costs that are at least \$1B greater than the baseline are highlighted in gold. The procurement delta ranges from \$0.1B under to \$9.5B over the baseline.

Force Mix	Baseline	Alt 1	Alt 1a	Alt 2	Alt 2a	Alt 3	Alt 3a	Alt 4	Alt 4a
AE LHAR/D	9	11		11		11		10	
AE LPD 17	9	11	9	11	9	11	9	11	9
AE LSD	12	12		12		12		12	
MPF(F) LHAR/D	3	3		1		0		2	
MPF(F) MLP	3	3		3		3		3	
MPF(F) LMSR	3	3		4		4		3	
MPF(F) T-AKE	3	3		3		3		3	
MPF(F) T-AK	2	2		2		2		2	
AE + MPF(F) LHAR/D	12	14		12		11		12	
Procurement Delta to Baseline (FY08\$B)	--	+9.3	+5.7	+6.1	+2.5	+3.4	-0.1	+4.3	+0.7
Performance¹	Baseline	Alt 1	Alt 1a	Alt 2	Alt 2a	Alt 3	Alt 3a	Alt 4	Alt 4a
Presence (CENTCOM/PACOM)	1.0/1.0	1.0/1.0		1.0/1.0		1.0/1.0		1.0/1.0	
LCO Demand-Met	96%	97%		97%		97%		97%	
Total Asset Utilization	41%	37%		41%		44%		42%	
Residual Capacity (Weeks)	108	183		112		70		106	
Residual Capacity (Periods)	8	15		9		5		8	
MEB AE Closed Week 9	1.69	2.00	1.88	2.00	1.88	2.00	1.88	1.91	1.79

1. Total Asset Utilization and Residual Capacity are for LHAR/LHD only.

Above Baseline \$1B+
 Above Baseline 10%+
 Below Baseline 10%+

Table 16 (U) Force Mix Cost and Performance Summary

The bottom portion of Table 16 provides a summary of the key performance metrics. Force mix alternative performance metrics that were at least 10% better than the Baseline are highlighted in green. Alternatives that are at least 10% worse than the Baseline are highlighted in red.

All force mixes were assessed as being capable of meeting the CENTCOM and PACOM ESG 1.0 objective. All force mixes were capable of meeting 96% (+/- 1%) of the LCO event demands. AE and MPF(F) Total Asset Utilization ranged from 37% to 42%, all within 10% of the Baseline. The primary distinguishing performance metrics were the Residual Capacity (RC) and MEB AE that could close within 9 weeks. The 12 LHAR/D options (Baseline, Alternative 2 and Alternative 4) had roughly equivalent RC. Alternative 1 with 14 LHAR/D had 70-87% percent greater RC than the Baseline while Alternative 2 with 11 LHAR/D had 62-65% less RC than the Baseline. The two additional AE LHAR/LHDs and two additional LPDs are required to generate 2.0 MEB AE of operationally available ships. Alternatives 1, 2 and 3 satisfy this USMC requirement.

5.2 (U) LHD/LHAR Quantity and Distribution

The study assumes nine ESGs to support forward presence requirements. Eight of the ESGs are based in the continental United States (CONUS) and conduct CENTCOM rotational deployments. One ESG is a forward deployed naval force (FDNF) in Japan. Figure 14 shows the LHAR/D total asset utilization and the number of LCO events serviced by AE and MPF(F). AE LHAR/D serviced 23-26 (of 28) LCO events while MPF(F) LHAR/D serviced 0-3 (of 28) events.

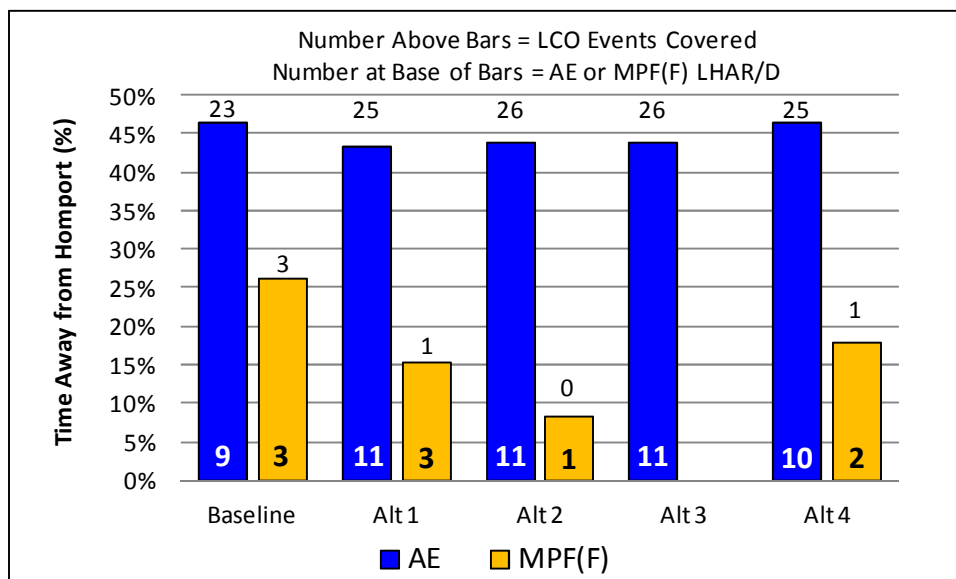


Figure 14 (U) LHAR/LHD Total Asset Utilization

The performance analysis revealed that 11-12 total AE and MPF(F) LHAR/D would satisfy 96% (+/- 1%) of the LCO event demands. Meeting 100% of the event demand

would require new deployment patterns in AFRICOM and EUCOM. Eleven LHAR/LHD are required to generate 10 operationally available ships for MCO MEB AE. Table 17 shows the ESG presence, LCO and MCO MEB AE force structure drivers. The table suggests that 11 amphibious LHAR/LHD and 0-1 MPF(F) LHAR/LHD are required to satisfy all three elements.

LHAR/D	ESG Presence	LCO	MCO MEB AE
Amphibious	9	11-12	11
MPF(F)	--		--

Table 17 (U) LHAR/D Number and Distribution

Alternative 3a contains 11 AE and 0 MPF(F) LHAR/LHD and is essentially procurement cost neutral compared to the baseline. Alternative 2a with 11 AE and 1 MPF(F) LHAR/LHD would cost \$2.5B more than the Baseline or Alternative 3.

5.3 (U) LHAR/D Distribution Related Issues

The analysis suggests that Alternative 3 meets more of the capability objectives than the Baseline for essentially equal cost. There are several other issues to consider:

- LHAR/D operations – The naval force has three decades of experience operating large deck amphibious ships (LHA 1 and LHD). The manning and training requirements for the MPF(F) version of these ships have not yet been formally established. Generating combat capability comparable to amphibious ships on a compressed timeline will be challenging.
- Residual capacity (RC) – Alternative 3 has roughly 62-65% less RC than the Baseline, based on the maintenance and training assumptions.
- MPF(F) squadron ship impact – The removal of LHAR/D from MPF(F) would necessitate the accommodation of the LHAR/D non-aviation capabilities (e.g. Vertical Battalion Landing Team personnel and equipment) in the other squadron ships. Phase I of this study revealed that the following squadron modifications would be required:
 - Mobile Landing Platform (MLP) – add 500 berths.
 - Large Medium Speed Roll-On/Roll-Off (LMSR) – Add 300 berths to each ship and add a fourth LMSR.
 - Two MEB C2 sets of equipment and space.
- MPF(F) operational impact – The removal of LHAR/D from MPF(F) increases the reliance and complexity of the surface operations. The Vertical BLT must be loaded in the MLPs and cross-decked to amphibious LHAR/D for vertical landing or transported ashore by surface connector.
- MPF(F) logistics impact – An MPF(F) squadron composed of 3 MLP, 4 LMSR, 3 T-AKE and 2 T-AK would be short water and JP-5, requiring other sources to be put into place.

6 FINDINGS

The purpose of this study was to:

Assess the ability of alternative amphibious and MPF(F) force mixes to respond to potential events across the spectrum of expeditionary operations and aggregate for MCO.”

6.1 (U) Findings

6.1.1 (U) Expeditionary Strike Group (ESG) Presence

All of the force mixes consisted of nine ESGs, which were capable of meeting the CENTCOM and PACOM ESG 1.0 presence objectives.

6.1.2 (U) Lesser Contingency Operations (LCO)

All of the specified force mixes were capable of meeting 96% (+/-1%) of the LCO event demands.

- The Baseline force mix performance was 1% less than Alternatives 1-4. The primary difference was the use of MPF(F) ships based in Guam to service two Gulf of Guinea events in the Baseline, compared to the use a non-ESG LHD based in Norfolk for Alternatives 1-4. Distributing MPF(F) LHAR/D across the three MPSRONS improved the Baseline response.
- Unscheduled short notice events outside of the normal deployment patterns accounted for the majority of the demand not met across all of the force mixes. Meeting 100% of the event demand would require new deployment patterns to AFRICOM and EUCOM.
- Assuming nine ESGs, the total number of LHAR/D is more important to meeting the LCO demands than the assault echelon (AE) and MPF(F) distribution. Alternative 1 with 14 LHAR/D performed the same as Alternatives 2-4 with 11-12 LHAR/D. The greater the number of LHAR/D, the greater the amount of residual capacity to meet additional LCO events or evolving deployment requirements.
- The Norfolk, VA based non-ESG LHD in Alternatives 1-4 was frequently tasked to support AFRICOM events.
- The two additional LPDs in Alternatives 1, 2, 3 and 4 were not assigned to events. This was not unexpected since the LCO events were generally structured to stress aviation operations.

6.1.3 (U) Major Combat Operations (MCO)

The Marine Corps amphibious lift requirement of 2.0 MEB AE is based on acceptable risk. This requires 33 ships (11 LHAR/D, 11 LPD and 11 LSD) to generate 30 operationally available ships (10 LHAR/D, 10 LPD and 10 LSD). The MEB AE closure to the MCO location on average ranged from 1.69 (Baseline) to 2.0 (Alternatives 1, 2, and 3) MEB AE by week 9.

6.1.4 (U) Force Mix Alternative Costs

The total life-cycle cost in constant FY08\$B was estimated for each force mix alternative. The primary focus was on the procurement costs due to the implications for the shipbuilding plan. The procurement costs were driven by the total number of AE and MPF(F) LHAR/D and AE LPD 17s but also included the impact of fewer or no LHAR/D in the MPF(F) squadron (MLP and LMSR berthing modifications; additional LMSR and MEB C2). Alternative 1 meets all of the stated requirements, but costs roughly \$9.3B more than the Baseline. Alternative 3a with 11 AE LHAR/D and no MPF(F) LHAR/D is essentially cost neutral compared to the Baseline.

6.1.5 (U) Overall

The distribution of LHAR/D between the AE and MPF(F) made a difference in the MEB AE that can be closed but did not significantly impact ESG presence and LCO operations. In the absence of additional funding, the Navy and Marine Corps must decide if the LHAR/D ships are more important to mitigate the MEB AE gap or to fill out the MPF(F) Squadron capability as originally envisioned.

In the absence of additional funding, the Navy and Marine Corps must decide if the LHAR/D are more important to mitigate the MEB AE gap or to fill out the MPF(F) Squadron capability as originally envisioned.

Appendix A – Acronyms and Abbreviations

AE	Assault Echelon
AFRICOM	United States African Command
AOR	Area of Responsibility
APUC	Average Procurement Unit Cost
CAP	Civil Assistance Programs
CAS	Close Air Support
CD	Counter Drug Operations
CDD	Capability Development Document
CENTCOM	United States Central Command
CM	Consequence Management
CMC	Commandant of the Marine Corps
CNO	Chief of Naval Operations
COIN	Counter Insurgency
CONUS	Continental United States
CSG	Carrier Strike Group
CT	Counter Terrorism
DCNO	Deputy Chief of Naval Operations
DoD	Department of Defense
DM	Demand Met
DPMA	Docking Phased Maintenance Availability
DR	Disaster Relief
EAU	Event Asset Utilization
ESF	Expeditionary Strike Force
ESG	Expeditionary Strike Group
EUCOM	United States European Command
EW	Electronic Warfare
EXOPS	Expeditionary Operations
FID	Foreign Internal Defense

UNCLASSIFIED

Sea Basing Support of Major Combat Operations Ashore – Phase II

Appendix A

Acronyms

FDNF	Forward Deployed Naval Force
FIE	Flow-in-Echelon
FRP	Fleet Response Plan
FST	Fleet Surgical Team
FW	Fixed Wing
FY08\$B	FY 2008 Billions of Dollars
GFS	Global Fleet Stations
GCC	Geographical Combatant Commander
HA/DR	Humanitarian Assistance / Disaster Relief
HD	Homeland Defense
HOMETEMPO	Homeport Tempo
JROC	Joint Requirements Oversight Council
LCCE	Life-Cycle Cost Estimate
LHA	Amphibious Assault Ship (General Purpose)
LHAR	Amphibious Assault Ship (General Purpose) Replacement
LHD	Amphibious Assault Ship (Multi-Purpose)
LCO	Lesser Contingency Operations
LP	Linear Program
LPD	Amphibious Transport Dock
LSD	Dock Landing Ship
MCCDC	Marine Corps Combat Development Command
MEB	Marine Expeditionary Brigade
MEF	Marine Expeditionary Force
MEU (SOC)	Marine Expeditionary Unit (Special Operations Capable)
MCO	Major Combat Operations
MCO-RT	AE MCO Response Time
MIO	Maritime Interdiction Operations
MMC	MPF Maintenance Cycle
MPMN	Military Personnel, Marine Corps

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Sea Basing Support of Major Combat Operations Ashore – Phase II

Appendix A

Acronyms

MPN	Military Personnel, Navy
MPSRON	Maritime Preposition Ship Squadron
MSC	Military Sealift Command
MPF(F)	Maritime Prepositioning Force (Future)
NDSF	National Defense Sealift Fund
NM	Nautical Mile
NEO	Non-combatant Evacuation Operations
NSE	Naval Support Element
NORTHCOM	United States Northern Command
O&S	Operating and Support
OPNAV	Office of the Chief of Naval Operations
OPTEMPO	Operations Tempo
OR	Operating Room
OSD	Office of the Secretary of Defense
PACOM	United States Pacific Command
PB08	President's Budget FY 2008
PMA	Phased Maintenance Availability
POM	Pre-overseas Movement Period
POR	Program of Record
QOL	Quality of Life
RC	Residual Capacity
RDT&E, N	Research, Development Test & Evaluation, Navy
RFT	Readiness for Tasking
RW	Rotary Wing
SAG	Study Advisory Group
SCN	Ship Construction Navy
SIBR	Security Institution Building Reform
SOF	Special Operations Forces
SOUTHCOM	United States Southern Command
SPMAGTF	Special Purpose Marine Air Ground Task Force

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Sea Basing Support of Major Combat Operations Ashore – Phase II

Appendix A

Acronyms

SSM	Ship-to-Shore Movement
SSSP	Steady State Security Posture
SAG	Study Advisory Group
TAU	Total Asset Utilization
TR	Tilt Rotor
TSCP	Theater Security Cooperation Program

Appendix B – References

The following references were used in this study.

1. Draft Capability Development Document for the Maritime Prepositioning Force (Future) [MPF(F)] Squadron, 2 October 2006.
2. U.S. Africa Command website, www.africom.mil.
3. U.S. Department of Defense (DoD) website, www.defenselink.mil.
4. Fleet Response Plan CUSFFC/CPFLTINST 3000.15, 21 August 2007.
5. Representative Intervals, Durations, Maintenance Cycles, and Repair Mandays for Depot Level Maintenance Availabilities of U.S. Navy Ships, OPNAV Notice 4700, 16 June 2003.
6. Surface Force Training Manual, COMNAVSURFORINST 3502.1D, 1 July 2007.
7. World Ports Distances Calculator website, www.distances.com.
8. NAVADMIN 051/07, Deployability and Employability, CNO Washington DC 271709Z FEB 07.
9. CNO Washington DC 271709Z FEB 07, Deployability and Employability.
10. Sea Basing Capabilities Synthesis Brief to Executive Steering Group, 21 September 2007.
11. MPF(F) Life Cycle Cost Spreadsheet from OPNAV N853, 12 February 2007.
12. Department of the Navy Fiscal Year (FY) 2008/2009 Biennial Budget Justification of Estimates February 2007 (Shipbuilding and Conversion, Navy)
13. Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY 2008, Director, Warfare Integration (OPNAV N8F), Office of the Chief of Naval Operations, February 2007.

Appendix C – Event Capabilities

This appendix provides the event category, capability description, and cross-reference to the event capability required and numerical evaluation.

Events													Category	Capability Description	Capability	Description	Value
1	2	3	4	5	6	7	8	9	10	11	12	13					
	X		X	X				X		X	X	X	C2	Capability to provide decentralized C2 afloat that supports distributed operations from seabased platforms located OTH. LARGE = 1	C9	Command & Control	1.00
X							X						C2	Capability to provide decentralized C2 afloat that supports distributed operations from seabased platforms located OTH. Medium = .50	C9	Command & Control	0.50
		X			X	X			X				C2	Capability to provide decentralized C2 afloat that supports distributed operations from seabased platforms located OTH. SMALL = .25	C9	Command & Control	0.25
			X	X				X		X			Fires	Sea based fires in support of employed forces LARGE = F/W + R/W + NSFS	C3	Aviation (RW CAS)	1.00
			X	X				X		X			Fires	Sea based fires in support of employed forces LARGE = F/W + R/W + NSFS	C4	Aviation (FW)	1.00
X	X				X	X	X		X		X	X	Fires	Sea based fires in support of employed forces MEDIUM = R/W + NSFS	C3	Aviation (RW CAS)	1.00
		X											Fires	Sea based fires in support of employed forces SMALL = NSFS or none required (permissive environment)	N/A	N/A	0.00
	X			X								X	Intelligence	Exploitation of all ISR capabilities/products LARGE = Generate, Process, Synthesize, and Disseminate	C6	Intelligence	1.00
X			X				X	X	X	X		X	Intelligence	Exploitation of all ISR capabilities/products MEDIUM = Generate, Process, and Disseminate	C6	Intelligence	0.50
		X			X	X							Intelligence	Exploitation of all ISR capabilities/products SMALL = Disseminate	C6	Intelligence	0.25
X	X		X	X	X		X	X	X	X	X	X	Intelligence/EW	UAS up to Tier 3 (intel gathering and/or EW capabilities)	C5	Aviation (UAS)	1.00
	X												Logistics	Vertically sustain employed forces LARGE = Larger than a Battalion	C1	Aviation (RW/TR)	1.00
			X	X				X		X	X		Logistics	Vertically Sustain employed forces MEDIUM = Up to a battalion	C1	Aviation (RW/TR)	0.67
X							X		X	X			Logistics	Vertically Sustain employed forces SMALL = Up to a company	C1	Aviation (RW/TR)	0.33
	X	X	X	X			X	X	X	X	X	X	Logistics	Medical Capability Afloat Casualty Receiving Capability (2 operating rooms = 0.67)	C7	Medical Afloat	0.67
								X				X	Logistics	Support multiple extraction / evacuation sites throughout JOA	C1+C2	Aviation or Surface	1.33
		X	X					X			X	X	Logistics	Capability for Surface Movement (LCAC, LCU, etc.)	C2	Surface SSM	1.00
	X			X				X		X			Maneuver	Vertical lift in 1 lift LARGE = 1 company, reinforced	C1	Aviation (RW/TR)	1.00
X			X									X	Maneuver	Vertical lift in 1 lift MEDIUM = Approx 1/2 of a company	C1	Aviation (RW/TR)	0.50
		X					X		X		X		Maneuver	Vertical lift in 1 lift SMALL = 1 Platoon	C1	Aviation (RW/TR)	0.33
X			X	X	X	X	X	X	X	X	X	X	Maneuver	Employ vertical QRF (Sparrowhawk) with two hour string	C1	Aviation (RW/TR)	0.33
X			X	X			X	X	X	X	X	X	Maneuver	Conduct hot/cold vertical extracts (e.g. teams, TRAP)	C1	Aviation (RW/TR)	0.33
X			X	X			X	X	X	X	X	X	Maneuver	Conduct hot/cold vertical extracts (e.g. teams, TRAP)	C3	Aviation (RW CAS)	1.00
					X	X	X						Maneuver	Employ up to 2 near-simultaneous, non-compliant intercept/VBSS teams with up to 12-15 pax (surface) and 20-24 pax (vert)	C1	Aviation (RW/TR)	0.33
								X				X	Maneuver	Sequentially lift up to 3 companies within 24 hours	C1+C2	Aviation or Surface	3.00
					X	X	X						Maneuver	Employ up to 2 near-simultaneous, non-compliant intercept/VBSS teams with up to 12-15 pax (surface) and 20-24 pax (vert)	C3	Aviation (RW CAS)	1.00
							X						Maneuver	Surge & conduct 24 hour flight ops 2 of 7 days (or 2 times)	C8	Flight Deck Ops	1.00

APPENDIX D – LIFE CYCLE COST INFORMATION

Platform	Average Procurement Unit Costs (APUC) FY08\$B	Derivation of APUC
		Source
Amphibious		
LHA6/LHAR	\$2.87	Reference (10)
LHD	\$1.17	Reference (12)
LHDX	\$2.87	Assumes LHA(R) cost
LPD 17	\$1.80	Reference (10)
LPDX	\$1.80	Assumes LPD 17 cost
LSDX	\$1.44	Assumes 80% LPD 17 cost
MPF(F)		
LHA(R)	\$2.28	Total of \$4.566B for two ships. Reference (13)
MLP	\$0.90	Total of \$2.697B for three ships. Reference (13)
LMSR	\$0.97	Total of \$2.894B for three ships. Reference (13)
T-AKE	\$0.48	Total of \$1.447B for three ships. Reference (13)

Table 18 (U) Average Procurement Unit Cost (APUC)

WBS	Baseline	Alt 1	Alt 1a	Alt 2	Alt 2a	Alt 3	Alt 3a	Alt 4	Alt 4a
*Quantities									
**Procured									
**Amphibious									
LHA(R) Amphib Version		2	2	2	2	1	1	1	1
LHDX	7	7	7	7	7	7	7	7	7
LPD 17		2		2		2		2	
LPDX	6	6	6	6	6	6	6	6	6
LSDX	12	12	12	12	12	12	12	12	12
**MPF(F)									
LHA(R) MPF(F) Version	2	2	2					1	1
LHD MPF(F)									
MLP	3	3	3	3	3	3	3	3	3
LMSR	3	3	3	4	4	4	4	3	3
T-AKE	3	3	3	3	3	3	3	3	3
T-AK									

Table 19 (U) Procurement Quantities for Each Alternative

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Appendix D

Life Cycle Cost Information

Costs in FY08\$B									
WBS	Baseline	Alt 1	Alt 1a	Alt 2	Alt 2a	Alt 3	Alt 3a	Alt 4	Alt 4a
*Operating & Support									
**Total Operating & Support									
***Amphibious									
LHA(R) Amphib Version	\$0.146	\$0.146	\$0.146	\$0.146	\$0.146	\$0.146	\$0.146	\$0.146	\$0.146
LHD	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118
LHDX	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118	\$0.118
LPD 17	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036
LPDX	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036	\$0.036
LSD	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039
LSDX	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039	\$0.039
***MPF(F)									
LHA(R) MPF(F) Version	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078
MLP	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025
LMSR	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026
T-AKE	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040
T-AK	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023
**Operations & Maintenance									
***Amphibious									
LHA(R) Amphib Version	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078
LHD	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052
LHDX	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052	\$0.052
LPD 17	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021
LPDX	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021
LSD	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021
LSDX	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021	\$0.021
***MPF(F)									
LHA(R) MPF(F) Version	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078	\$0.078
MLP	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025	\$0.025
LMSR	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026	\$0.026
T-AKE	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040	\$0.040
T-AK	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023	\$0.023
**Manning									
***Amphibious									
LHA(R) Amphib Version	\$0.068	\$0.068	\$0.068	\$0.068	\$0.068	\$0.068	\$0.068	\$0.068	\$0.068
LHD	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065
LHDX	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065	\$0.065
LPD 17	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015
LPDX	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015	\$0.015
LSD	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018
LSDX	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018	\$0.018
***MPF(F)									
LHA(R) MPF(F) Version									
MLP									
LMSR									
T-AKE									
T-AK									

Table 20 (U) Average O&S Costs for Each Alternative (FY08\$B)