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LITTORAL COMBAT SHIP MANPOWER, AN OVERVIEW OF OFFICER CHARACTERISTICS AND PLACEMENT

by

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March 2013

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LITTORAL COMBAT SHIP MANPOWER, AN OVERVIEW OF OFFICER CHARACTERISTICS AND PLACEMENT

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The Littoral Combat Ship is intended to be minimally manned and designed to be manned by qualified officers to carry out and operate its multi-faceted mission. This study examines officer manpower and assignment as compared to requirements of ship classes with similar missions that Littoral Combat Ship is intended to replace. A recommendation is made to increase the officer manpower requirement. A new manning metric is presented that accounts for the characteristics of demographic and occupational standards of previous Littoral Combat Ship officers. The research presents a qualitative comparative analysis and provides a model framework for future Littoral Combat Ship manning once a larger inventory of officers have completed tours and more officer data are available.

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LIST OF ACRONYMS AND ABBREVIATIONS

1st	First Lieutenant
3MC	Maintenance Material Management Coordinator
A2/AD	Anti-Access/Area-Denial
AQD	Additional Qualification Designation
ASW	Anti-Submarine Warfare
ASWO	Anti-Submarine Warfare Officer
ATG	Afloat Training Group
AUXO	Auxiliary Officer
AVDET	Aviation Detachment
C4	Command and Control, Communications, and Computers
C4I	Command, Control, Communications, Computers, and Intelligence
CASREP	Casualty Report
CG	Guided Missile Cruiser
CHENG	Chief Engineer
CIC	Combat Information Center
CICO	Combat Information Center Officer
CM	Corrective Maintenance
CNO	Chief of Naval Operations
CO	Commanding Officer
COMMO	Communications Officer
CONOPS	Concept of Operations
CSBA	Center for Strategic and Budgetary Assessments
CSO	Combat Systems Officer
CWO	Chief Warrant Officer
DCA	Damage Control Assistant
DDG	Guided Missile Destroyer
DESIG	Designator
DISBO	Dispersing Officer
DIV/SAL	Diving/Salvage
EMO	Electronic Material Officer

EOD	Explosive Ordinance Disposal
EOM	Expendable Ordinance Management
FAC	Fast Attack Craft
FIAC	Fast Inshore Attack Craft
FFG	Guided Missile Frigate
FY	Fiscal Year
GD	General Dynamics
GUNNO	Gunnery Officer
ISIC	Immediate Superior in Command
ISM-X™	Intelligent System Manager
LCS	Littoral Combat Ship
LCSRON	Littoral Combat Ship Squadron
LDO	Limited Duty Officer
LM	Lockheed Martin
LOGREQ	Logistics Request
LST	Logistics Support Team
LTF	LCS Training Facility
MCM	Mine Countermeasures Ship
MER	Manpower Estimate Report
MHC	Coastal Minehunter Ship
MIW	Anti-Mine Warfare
MM	Mission Module
MP	Mission Package
MPA	Main Propulsion Assistant
MPSF	Mission Package Support Facility
MRB	Maintenance Review Board
MS	Mission System
MST	Maintenance Support Team
NAV	Navigation Officer
NAVSUP	Naval Supply Systems Command
NOBC	Navy Officer Billet Classifications
NOOCS	Navy Officer Occupational Classification System

NPC	Naval Personnel Command
NTDS	Naval Tactical Data Systems
OCONUS	Outside of the Continental United States
OIC	Officer-in-Charge
OPS	Operations Officer
OTA	Officer Trait Average
PB4M	Planning Board for Maintenance
PEO	Program Executive Office
PM	Preventive Maintenance
PSMD	Preliminary Ship Manpower Document
RHIB	Rigid Hull Inflatable Boat
RSCA	Reporting Senior Cumulative Average
SC	Staff Corps
SMD	Ship Manpower Document
SoS	System of Systems
SSP	Subspecialty
SUPPO	Supply Officer
SUW	Anti-Surface Warfare
SWEEP	Minesweeping Officer
SWO	Surface Warfare Officer
T2C	Train to Certify
T2Q	Train to Qualify
TRAINO	Training Officer
UAV	Unmanned Aerial Vehicle
URL	Unrestricted Line
VBSS	Visit, Board, Search, and Seizure
XO	Executive Officer

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I. INTRODUCTION

A. BACKGROUND

In today's Navy, decision makers are familiar and associated with specific warfare missions and capabilities that translate into specific ship design. In general, ships' large sizes and deep drafts have limited the scope of their missions to the open, "blue-water" oceans of the world. The Navy has recognized the need for a more versatile vessel that will allow for in-shore operations that are closer in proximity to the size of a potential in-shore threat. The Littoral Combat Ship (LCS) was developed to be capable of countering multiple threats with a crew that could fit into a single school bus. The proposed crew is only forty personnel, and the ship is designed to operate and fight, if necessary, in the increasingly important "brown-water" areas around the world. These types of missions (Anti-Surface Warfare, Anti-Submarine Warfare, and Anti-Mine Warfare) are typically executed by vessels with crews in the hundreds that cannot operate in the littorals and must do so from a greater stand-off distance. The LCS's design and objective are becoming vogue after decades of planning, trials, and tribulations.

After three different hull types were designed by Lockheed Martin, General Dynamics, and Raytheon, the Freedom-class variant by Lockheed Martin and the *Independence*-class variant by General Dynamics were chosen for future construction. The Mission Packages (MP) that will be embarked on each variant will enable different operational detachments with different missions to operate with the LCS sea-frame crew in an effort to reduce overall manning. Both variants are shorter and have a shallower draft than standard surface ships. The *Freedom*-class measures at 378 feet and drafts 12.8 feet, while the *Independence*-class measures at 419 feet and drafts 14.1 feet. They are both capable of achieving speeds of over 40 knots and launching and recovering small craft and helicopters to include the unmanned Firescout (Navy Fact File-Littoral Combat Ship, 2012).

To date, there are only three commissioned Littoral Combat Ships. The crew members on each ship consist of eight officers and thirty-two enlisted. These manpower

requirements were determined by the design of the LCS and its multiple mission focus that is to be augmented by embarked MPs. As more ships commission, it becomes increasingly important to understand the capabilities of each ship and how those requirements are determined and manned. As officers and enlisted personnel continue to man-the-rails and the Navy brings more of these ships to life, it is crucial to consider why LCS only requires forty personnel and to understand the characteristics of the associated manpower. Furthermore, the minimally manned sea-frame and embarked MP personnel are vital in the plans for the LCS to replace ship classes and assume the roles for the different warfare areas they once encompassed.

The sea-frame will make the design capability of Littoral Combat Ships unique as they operate in near-shore and open-ocean environments. In particular, the ship was designed to have a rotational crew; one crew is relieved by another so that the sea-frame may spend more time in an operational status at sea. Currently, the LCS sea-frame is manned by a rotational Gold and Blue crew that conducts "crew swapping." These crews, responsible for the sea-frame, and embarked MPs will encompass the same missions as the *Oliver Hazard Perry*-class Guided Missile Frigates (FFG), *Avenger*-class Mine Countermeasure (MCM) ships, and *Osprey*-class Coastal Minehunters (MHC). However, minimal manpower is only as effective as the distribution of personnel in place to carry out the actual manpower required work.

The U.S. Navy has already placed orders for LCS 3, 4, 5, 6, 7, and 8 to be delivered by 2015. The mission of the LCS is defined in the littorals. They are capable of traveling fast with embarked operators for various missions that cover a wide spectrum of warfare areas and has the sustainability to do so over an extended period of time (Program Executive Office, 2012). These additional sea-frames, and their complementing MPs, are coming online as operational assets. It is imperative that their manpower characteristics be determined well in advance and with the proper warfare characteristics held in high consideration when formulated.

B. PURPOSE

This purpose of this study is to provide a historical overview that examines manpower requirements and occupational standards across different platforms in an attempt to provide a cross comparison to the LCS. Since the LCS is such a new platform, it is important to provide decision makers the optimal courses of action when determining the officer characteristics and occupational standards required to successfully operate this new ship. Additionally, this thesis will examine different metrics that can be used to assess and determine officer placement such as the "Reporting Senior Cumulative Average," "Promotion Status," and "Member Trait Average" of officers. This will aid in how to apply officer inventory to LCS personnel requirements.

The study will concentrate on the minimal officers assigned to the LCS and what their billets entail while making comparison to their counterparts on other ship classes. It will include a historical overview of the ship characteristics, missions, and the officer complement of the FFGs, MCMs, and MHCs. Several characteristics that make up an officer's personal and professional qualifications will be identified and how these qualifications may affect officer placement. Currently, there is not sufficient LCS officer assignment information available, and therefore, a quantitative analysis determining whether their specific characteristics make them a "good fit" for the LCS billet was not possible. However, the research can be of use for future studies in comparing officer characteristics with how an officer may be assigned and predict performance on a naval vessel. This study will provide guidance on a potential framework that can be used in further quantitative research on LCS manpower.

C. RESEARCH QUESTIONS

The primary objective of this research is to examine the manpower requirements of the LCS Officer corps and its occupational standards. This will be based on historical research into the ship classes that the LCS is replacing.

A secondary focus of this research will be on the process of the manning metric for the assignment of officers to the LCS. This will provide information that can

potentially aid how the Navy uses officer characteristics in regards to occupational standards and their ranking as metrics when assigning personnel to the LCS.

The primary research questions are the following:

- What significant differences exist from the transition of prior ship classes to the LCS in regards to manpower qualifications and characteristics?
- What officer characteristics and rankings may the Navy use when assigning an officer to a LCS platform, based on historical and ship-specific requirements, and how may the assignment be applied?

The secondary research questions are the following:

- How may the process of officer assignment change when an officer's ranking is contained within the manning metric?
- How may additional requirements of officer characteristics be incorporated into the manning metric?

D. SCOPE

The scope will include: (1) a review of LCS and other ship class manpower; (2) occupational standards and watch qualifications for officers based on operational requirements; (3) examination of the current assignment metric; and (4) summary, conclusions, and recommendations.

E. ORGANIZATION

This study is organized into four chapters. Chapter I provides an introduction, and Chapter II a literature review that traces the history of the LCS program. Chapter III takes an in-depth looks at the officer manpower of the LCS and the ship classes it intends to replace. Chapter IV covers the current manning metric and the identified occupational standards and watch qualifications that may prove of importance in future manning metrics. Chapter V includes the conclusions and recommendations to the study.

II. LITERATURE REVIEW

The literature review provides background information on the Littoral Combat Ship. This review traces the Littoral Combat Ship as an initial idea to its actual delivery to the United States Navy. It examines the design specifications for the *Freedom*-class and *Independence*-class variants, as well as the composition of the Mission Packages. The content of each section is directly out of each source annotated in the title section.

A. CENTER FOR STRATEGIC AND BUDGETARY ASSESSMENTS: *LITTORAL COMBAT SHIP, AN EXAMINATION OF ITS POSSIBLE CONCEPTS OF OPERATION*

The importance of this report is that it builds a foundation for understanding how the Littoral Combat Ship (LCS) was conceived and provides extensive background information on the thoughts and dilemmas that were considered by some of the military's highest ranking officers. More importantly, this report provides information on the Mission Packages (MP) that the LCS will embark, the MP's respective capabilities, and how the capabilities were concluded upon (Murphy, 2010).

Martin Murphy writes in this Center for Strategic and Budgetary Assessments (CSBA) report about the origin of the LCS and the possible plans that lie ahead for its use. The report answers the following questions:

- What are the projected missions?
- Where and how could they be employed?
- What do the ships' characteristics enable them to do that other ships cannot?
- What additional missions could they accomplish if certain modifications were made or capabilities added?

He continues with an introduction that unveils some unusual features about the LCS wherein the hull types and designs were planned without passing through the normal requirements process. He states that no formal "*a priori"* understanding of how ships would be operated and their operational requirements were confirmed before the design was decided (Murphy, 2010).

The conception of the LCS extends back into the late 1990s with Vice Admiral Arthur Cebrowski, USN, as the head of the Naval War College and Navy Warfare Development Command. VADM Cebrowski is quoted in advancing four themes for the future of maritime force:

1.) Networks should be the central organizing principle of the fleet, and its sensing and fighting power should be distributed across multiple manned and unmanned platforms;

2.) The fleet sensor component should collect, collate and interpret data faster than any enemy who was not networked to the same degree, giving US forces a major competitive advantage through "speed of command";

3.) The fleet should become the nation's "assured access" force; and

4.) Numbers of hulls count (quantity had its own quality) and consequently the fleet's combat power should be distributed over as many interconnected platforms and systems as the budget allowed (Murphy, 2010).

VADM Cebrowski stated that a small, fast ship was needed to counter anti-access and area-denial strategies (A2/AD) in the littorals. This access, coupled with larger strike capabilities of other naval combatants, would support counter operations to mine and submarine warfare, Fast Attack Craft (FAC) and Fast Inshore Attack Craft (FIAC). Then-Chief of Naval Operations Admiral Vern Clark supported VADM Cebrowski in early 2000s in the belief that the Navy, as quoted in the CSBA:

- Needed to assure access to the world's littoral regions for the Joint Force;
- Navy support the Marine Corps concept of launching operations from a littoral-based "sea base" that would need defending;
- Battle fleet operations would revolve around dense networks of distributed sensors and weapons;
- Distributed networks paved the way for a revised fleet architecture;
- The revised architecture required a revised fleet deployment patter; and
- To discharge these roles effectively the Navy would no longer be able to draw upon an adequate number of intermediate-size multi-purpose ships because these were too expensive to acquire in the numbers needed. Consequently, new, less expensive vessels had to be acquired.

As the Cold War ended there was a shift in emphasis to littoral missions. The new focus moved from the nuclear age and blue-water confrontations to rogue and insurgent nations where an expeditionary force would make brown-water landings that required support and protection. According to Murphy, the Surface Combatant Concept ((SC)-21), which would consist of a new class of Cruisers (CG-21) and Destroyers (DD-21), became the answer to this littoral issue. Nineteen CG-21s and seventeen DD-21s were planned as multi-mission littoral ships that would replace the *Ticonderoga*-class Guided Missile Cruisers. Each was designed to displace approximately 9000 tons, but the number grew to 14,500, too large for the littorals. In addition to the growing displacement, the price tag for each ship grew. Armament and displacement fell to the bottom of the list of priorities in order to reduce costs. In the end, only three DD-21s would be ordered as the newly named *Zumwalt*-class (DDG 1000). The current *Arleigh Burke*-class Destroyers and *Ticonderoga*-class Cruisers would continue service. These ships would be, and currently are, "sufficient in land-attack capability but lack littoral missions" (Murphy, 2010).

In 2001, the initial plan for fifty LCS was proposed to replace the thirty ships of the *Oliver Hazard Perry*-class Frigates (FFG), fourteen ships of the *Avenger*-class Mine Countermeasures (MCM), and twelve *Osprey*-class Coastal Minehunters (MHC). The new LCS would be "plug and fight" because of the capability to trade out MPs, to which the LCS's design was centered on, and not displacement (Murphy, 2010). What drove the size and smaller displacement is summarized in the following:

- Independent Operations: LCS had to be able to operate up to 4000 miles for fourteen to twenty-one days. These requirements drove sea-worthiness, bunker capacity, and habitability.
- Battle-force capability: 3000 tons was lowest practical for a ship operating with carriers.
- Speed: In excess of 40 knots determined size of machinery space.
- Mission Packages: Space to carry MPs that weighed between 180 and 210 metric tons.
- Weapons and Equipment: Two MH-60 helicopters or UAVs, and an 11m RHIB. Stability needed to launch/recover in sea states of three to five.

- Modularity: MPs allows for different configurations based on requirements.

The following advantages were associated with the design:

- Adaptability: Ability to embark different MPs through the course of the ship's life cycle which would increase operability and reduce costs.
- Areas of Influence: LCS will be able to gain access to certain areas of the world where other combatants may not because of the different drafts of the vessels. LCS drafts 15 feet while other surface combatants draft between 28 and 35 feet. This shallow draft opens the LCS to "access 1111 world-wide ports instead of 362" and areas such as the Northern Arabian Gulf (Murphy, 2010).
- Battle Network: Ability to communicate with other assets.
- Flight Deck: Lockheed Martin design is 1.5x larger than other combatants, with General Dynamics being 2x larger.
- Crew Integration and Optimization: According to the CSBA, the crew size is expected to rise to around one-hundred. But it is stressed that this number is still half of FFGs. The LCS will also incorporate rotational crews.

The CSBA covered that LCS operations may be carried out independently or in groups. For independent operations, ideal conditions would consist of low-level risks. This is based on the fact that the LCS would only have itself to rely on for protection. Some of the independent operations are fishery protection, counter-narcotics, and counter-piracy operations, among others (Murphy, 2010). The LCS's speed is an advantageous supplement to its ability to deploy various aircraft in support of these operations.

In group operations with other LCS, Anti-Submarine Warfare (ASW), Anti-Surface Warfare (SUW) and Anti-Mine Warfare (MIW) would be carried out. In ASW, group operations would allow for "optimizing collective resources" (Murphy, 2010). Although there was confidence in the CSBA for the LCS to operate independently in SUW conditions, it was envisioned that they would work in groups in order to repel small boat attacks. For MIW, a MIW-capable LCS would pair with a SUW capable LCS. This would allow for mine neutralization as well as thwart surface threats.

In group operations with other classes of ships the LCS(s) would act as "scout(s) against submarines or small attack craft" (Murphy, 2010). The CSBA states it could

work with Carrier Strike Groups or Expeditionary Strike Groups as an advance party, but only under the air and missile "umbrella" of the Carrier Strike Group or Expeditionary Strike Groups.

B. *DEVELOPMENT OF MODULAR MISSION PACKAGES: PROVIDING FOCUSED WARFIGHTING CAPABILITY FOR THE LITTORAL COMBAT SHIP* FROM THE NAVAL ENGINEERS JOURNAL

In the *Development of Modular Mission Packages: Providing Focused Warfighting Capability for the Littoral Combat Ship*, the authors convey the mission of the LCS and how its MPs are procured. The importance of the modularity of the LCS plays directly in to the manpower associated both with the sea-frame and the modules. While the sea-frame houses the core crew to take the vessel to where it is needed, the modules are meant to execute the specific mission whether it is ASW, SUW, or MIW related. These MPs and their specialties allow the sea-frame crew to concentrate on the sea-frame and the MP crew to concentrate on the warfare aspect.

Richard Volkert, Carly Jackson, and Cecil Whitfield cover the LCS design and how the MP augments the minimally manned crew. The LCS is designed to "operate more effectively in the littoral environment by providing enhanced maneuverability through the sea frame's inherent ability to operate at high speeds in shallow waters" (Volkert, Jackson, and Whitfield, 2010). Similar to the CSBA study, the authors give a background on the LCS and how it rose out of the Cold War shift from open-ocean fighting to littoral operations. However, this study also recognizes that there was a decline in escort and mine-hunting and mine-sweeping ships. So while there was a shift in large ships to small ships, there was also an absence of small ships. Those ships that "survived" the downsizing were also subject to further reductions in funding. This continuous decline in size and affordability ushered in a birth to an age of smaller, diverse ships that could be produced with a smaller price tag.

The authors also coin the term "Systems-of-systems" (SoSs) that are made up of mission systems, support equipment, mission crew detachments, and aviation systems (Volkert, Jackson, and Whitfield, 2010). The purpose being that when these are

integrated together they form the MP that delivers the different warfare capabilities to the sea-frame in an embarked module.

The characteristics of the LCS were determined, and certified against hybrid American Bureau of Shipbuilding standards. This resulted in the manning level being unfounded because of how small the sea-frame crew would be compared to other vessels designed in the past. The design supported operations in high-threat areas of the littorals with a requirement for shallow drafts and high speed, something that could not be accomplished by larger vessels (Volkert, Jackson, and Whitfield, 2010).

The authors contend that one of the primary drives to modularity was the ability to upgrade electronics and weapon systems independently from the sea-frame. Typically on surface vessels, systems are meant to last for the duration of the ship's life, with only small alterations to software. The slow rate of change in the features results in classes of ships built in a 10 to 20 year timeframe are built with the same initial design specifications. This is not practical in command and control, communications, and computer (C4) systems and weapons systems. C4 and weapon systems are often obsolete by the end of the timeframe for class building. Updating them is costly and sometimes impractical depending on where the ship is in its life cycle.

The answers to these issues are in the MPs and the LCSs' open architecture. When one system is needed over another, they are simply substituted out. Maintenance, storage, and renovation can be accomplished ashore and does not interfere with the mission workload of the ship's force.

Moving beyond the actual "move to modularity," the focus of the article centers on the actual MP and its specifications (Volkert, Jackson, and Whitfield, 2010). The first portion of the MP is the Mission System (MS). The MS is a single vehicle, communication, sensor, or weapon system. It is sized to fit in International Organization for Standardization support containers that are ten or twenty feet. This allows for simplified shipping, storage, handling, and movement. The Mission Module (MM) is a combination of MSs and support equipment and software. Similar to the CSBA, the MP is a collection of MMs, its mission crew detachments, and Aviation Detachment.

Together they form the MP that has a focused mission that concentrates on SUW, ASW, or MIW.

Reconfiguration of MPs occurs in homeport or inshore overseas. The authors contend that these MPs will be prepositioned or available on other platforms (i.e., transported by air or larger vessel). Figure 1 gives a visual representation of the process.

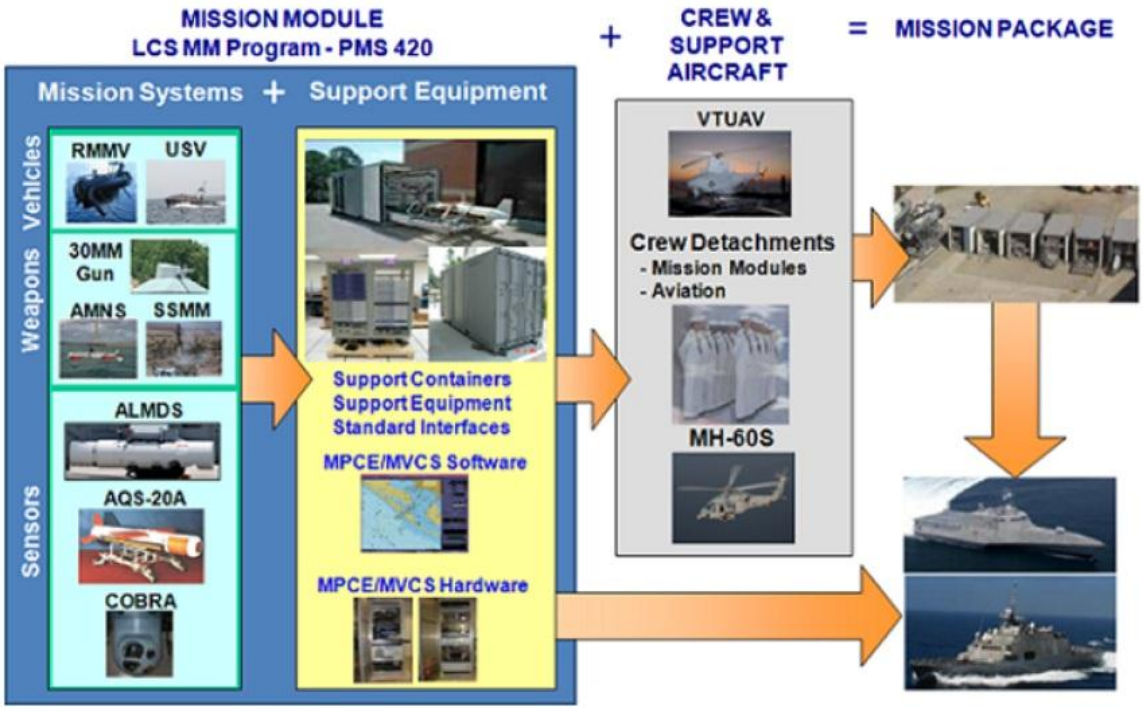

Figure 1. Mission Package Defined (From Volkert, Jackson, and Whitfield, 2010)

C. GENERAL DYNAMICS INDEPENDENCE CLASS LITTORAL COMBAT SHIP: CAPABILITY COUNTS

In their official brochure, General Dynamics and their LCS team lay out the specifics of their *Independence*-class design to include its principle characteristics and specifications (General Dynamics, 2008). This document shows the actual complexity of the LCS and the state-of-the-art systems that went into its design. For the minimal manning concept, it must be understood exactly what the personnel are going to be responsible for in daily operations.

The specifications of the *Independence*-class are centered on a trimaran hull and the vessel is capable of 4300 nautical miles at 18 knots without refueling. Similar to the *Freedom*-class, the *Independence*-class is capable of 40+ knots. The flight deck can support a H-53 or two SH-60 helicopters (which are housed onboard). It may also hold an Unmanned Aerial Vehicle (UAV) inventory. The *Freedom*-class is also a multi-mission platform with a main deck and starboard Roll On / Roll Off for Strykers, armored Humvees, EFVs, and stern launched watercraft (General Dynamics, 2008). Figures 2 and 3 depict the department and capabilities, respectively, of the General Dynamics' design.

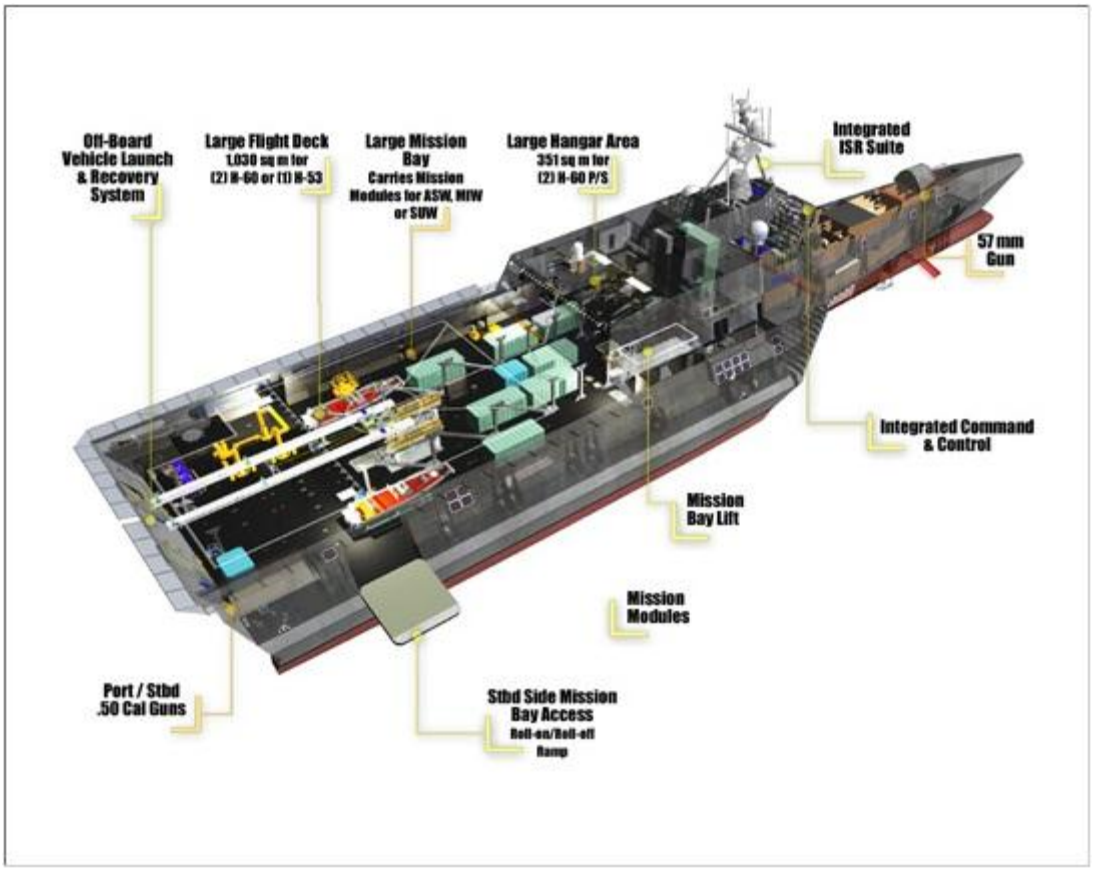

Figure 2. Compartmental View of *Independence*-Class LCS
(From General Dynamics, 2008)

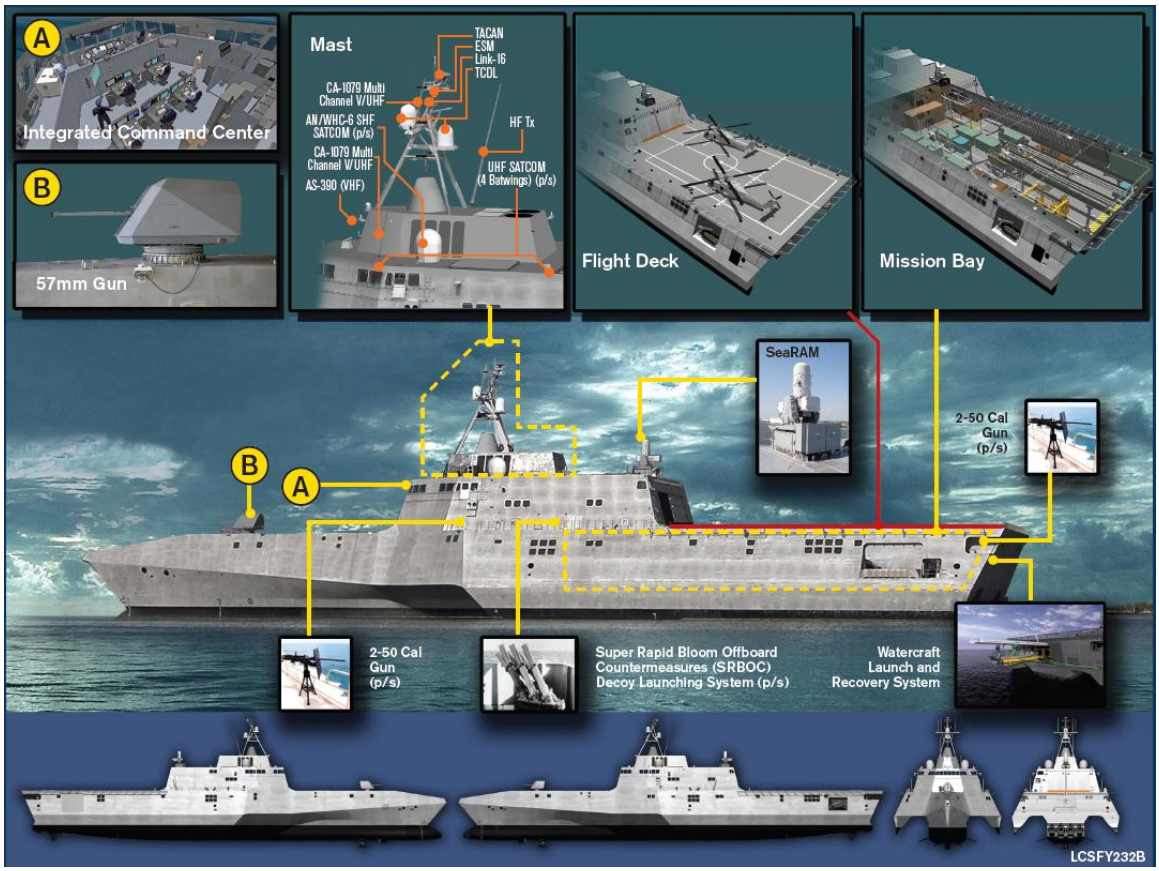

Figure 3. Visual Depiction of *Independence*-Class LCS Capabilities (From General Dynamics, 2008)

D. LOCKHEED MARTIN FREEDOM-CLASS LITTORAL COMBAT SHIP: FULL SPEED AHEAD

The Lockheed Martin (LM) and its LCS team lay out the specifics of their *Freedom*-class design to include its mission, capabilities, interoperability, design features, and overall design specifications. Similar to General Dynamics, and actually in a greater depth, the literature depicts not only the sea-frame and its capabilities, but also the MPs.

According to LM, the mission of the *Freedom*-class LCS is that it is "designed to defeat growing littoral threats and provide assured access and dominance in coastal and open water" (Lockheed Martin, 2012).

The platform capabilities are centered on a monohull frame. The *Freedom*-class LCS defense systems include a Rolling-Airframe Missile Launching System; 57 mm

main gun; mine, torpedo detection; and decoy systems. Figure 4 depicts the characteristics of Lockheed Martin's design.

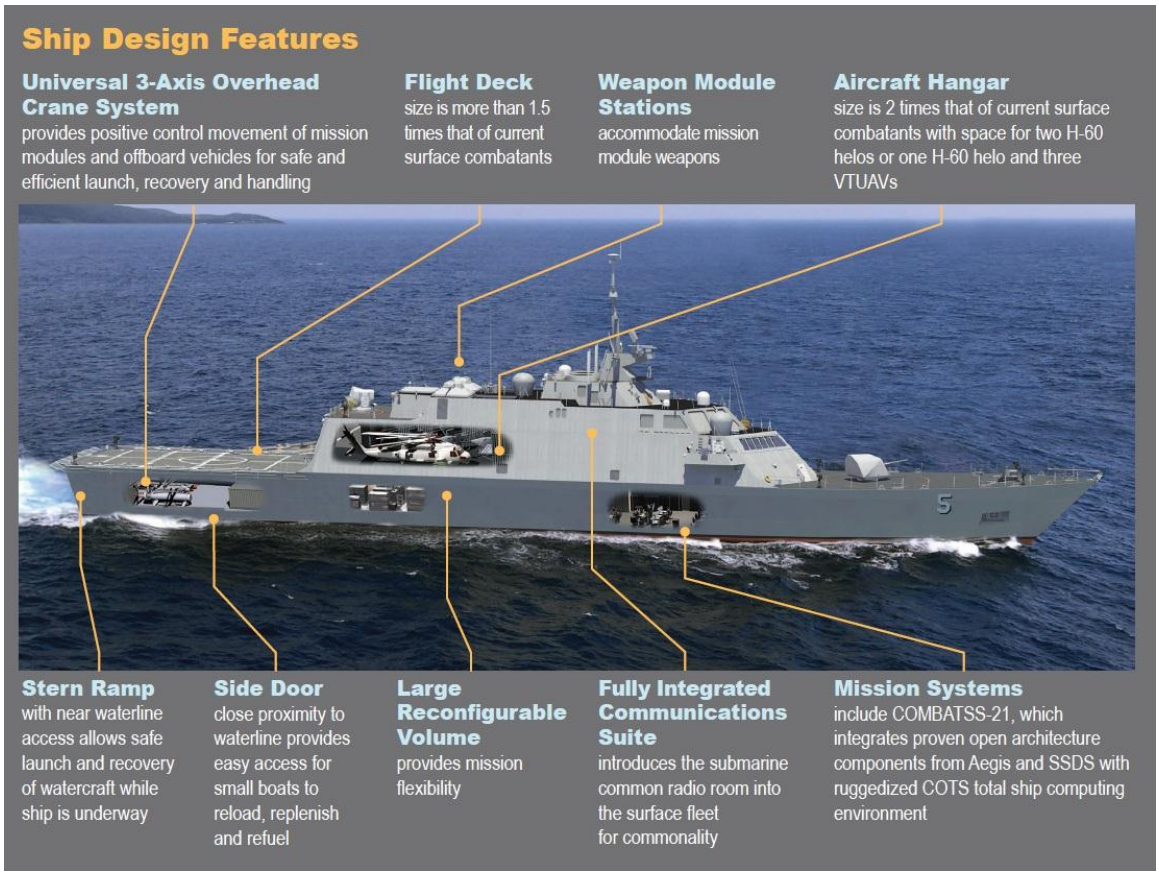

Figure 4. Visual Depiction of *Freedom*-Class Characteristics (From Lockheed Martin, 2012)

The MPs center on the missions that were carried out by the three ship classes that the LCS is replacing. These MPs are for both classes, with the following laid out by the Lockheed Martin LCS team.

1. Anti-Submarine Warfare Mission Package (ASW MP):

Provides the capability to "detect, classify, localize and prosecute enemy submarines" with:

- MH-60 Romeo Helicopter with Forward Looking Infrared Radar (FLIR), Laser Rangefinder/ Designator (LRD), Inverse Synthetic Aperture (ISAR), Airborne Low Frequency Sonar (ALFS), sonobuoys, and MK54

Lightweight Hybrid Torpedoes; Vertical Takeoff Unmanned Aerial Vehicle (VTUAV); ASW Escort Module with towed Variable Depth Sonar (VDS) active source, a Multi-Function Towed Array (MFTA) acoustic receiver, and Continuous Active Sonar (CAS) processing and system control; Torpedo Defense Module with an MFTA with Acoustic Intercept (ACI) for alertment and a Light Weight Tow (LWT) for countermeasures (Lockheed Martin, 2012).

2. Mine Countermeasures Mission Package (MCM MP):

Provides the capability to "conduct minehunting (detection, classification, identification and neutralization) and mine sweeping operations for mine threats" with:

- MH-60 Sierra Helicopter; Vertical Takeoff Unmanned Aerial Vehicle (VTUAV); Remote Multi-Mission Vehicles (RMMVs); AN/AQS-20A Mine Hunting Sonars; Airborne Laser Mine Detection System (ALMDS); Airborne Mine Neutralization System (AMNS); Organic Airborne and Surface Influence Sweep (OASIS); Unmanned Surface Vehicle (USV); Unmanned Surface Sweep System (US3); Coastal Battlefield Reconnaissance and Analysis (COBRA); Surface Mine Countermeasures Unmanned Undersea Vehicle (SMCM UUV) (Lockheed Martin, 2012).

3. Surface Warfare Mission Package (SUW MP):

Provides the capability to "conduct enhanced range coordinated detection, tracking, classification, identification and neutralization of groups of attacking, multiple, small boat threats and to conduct maritime security missions" with:

- MH-60 Romeo Helicopter with eight Hellfire missiles, a .50 caliber machine gun, and a 7.62 mm machine gun; Vertical Takeoff Unmanned Aerial Vehicle (VTUAV); Two 30 mm Gun Module that uses the MK 46 MOD (X) Gun Weapon System with MK 44 MOD 2 30 mm Automatic Cannon; Surface-to-Surface Missile Module (SSMM), which will use the Griffin Block IIB missile for Increment I and a yet to be determined missile for Increment II, which will provide extended range neutralization capabilities; Maritime Security Module which uses two 11m Rigid Hull Inflatable Boats (RHIBs); Visit, Board, Search, and Seizure (VBSS) gear; two berthing modules with gear storage; and one head and shower module (Lockheed Martin, 2012).

Interoperability between LCS and other assets centers on open architecture that allows for quick exchanges of required equipment. This interoperability is assisted by COMBATSS-21 and Intelligent System Manager (ISM-X).

COMBATSS-21 allows for quick integration of new capabilities such as weapons, sensors, and communications. It is the backbone of the self-defense suite with integration of RADAR, electro optical/infrared cameras, gun fire control system, countermeasures, and short range anti-air missiles. The system is adaptable for a variety of ships. Characteristics include customizable options that allow for reconfigurations based on specific requests by the operator. Similar to many other features on the LCS, COMBATTS021 is modular, for easy-on, easy-off use (Lockheed Martin, 2012). Figure 5 shows the different components of COMBATSS-21 and the integration with LCS offensive and defensive systems.

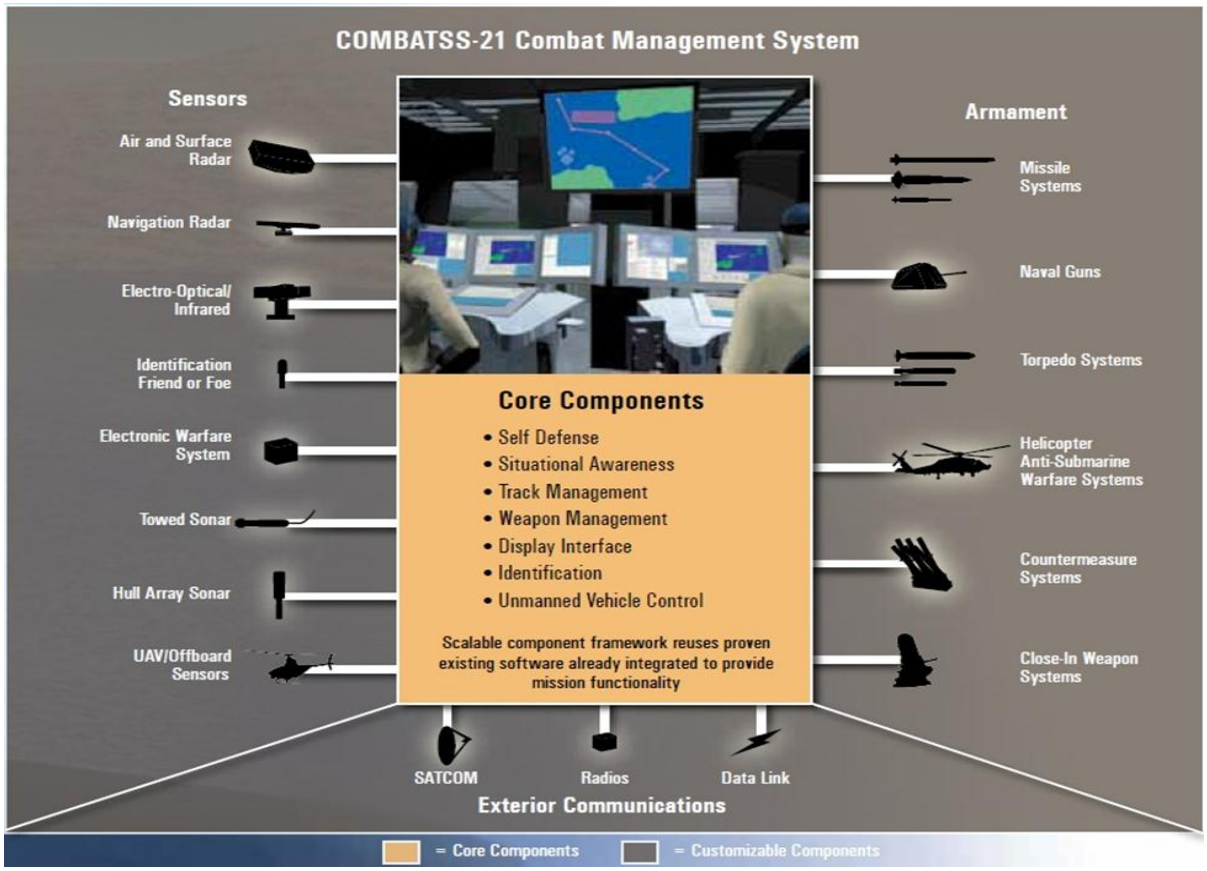

Figure 5. COMBATSS-21 Characteristics and Components
(From Lockheed Martin, 2012)

Intelligent System Manager (ISM-X) provides a fully integrated plant management system for engineering which include propulsion, electrical plant, auxiliaries, and engineering casualty/damage control systems. The ISM-X incorporates research from platforms past and present: DD-963, CG-47, FFG-7, DDG-51 & LCS 1 and DDG 1000 and "employs software architecture and distributed processing to reduce labor and material costs of implementation, while improving overall system performance and survivability" (Lockheed Martin, 2012).

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III. CONTENT ANALYSIS: BREAKDOWN OF OFFICER MANPOWER

Chapter III focuses on a variety of literature reviews that examine the manpower aspect of the Littoral Combat Ship (LCS) and the classes of ships that it is designated to replace. It will define the different aspects of professional characteristics and occupational standards, directed and expected, to be included in the manpower for the officers assigned to a LCS. Additionally, it will make comparisons to the historical characteristics of the *Oliver Hazard Perry*-class Guided Missile Frigates (FFG), *Avenger*-class Mine Countermeasures ships (MCM), and *Osprey*-class Coastal Minehunters (MHC), as these are the ships that the LCS is replacing. The Chapter will report the number of personnel expected to be included throughout the duration of the LCS program as well as the Mission Packages (MP) and all support personnel.

A. MANUAL OF NAVY OFFICER MANPOWER AND PERSONNEL QUALIFICATIONS

The *Manual of Navy Officer Manpower and Personnel Qualifications* is the "principle reference manual for interpretation of coded entries on manpower and personnel documents and reports." The manual's importance in this thesis is the respective definitions of the principle characteristics that are contained in a Ship Manpower Document (SMD). These codes and their definitions will be a primary focus in the comparison of the different ship classes and their SMDs, and how their importance is, and needs to be, incorporated into the LCS SMD. The rest of this literature review will cover the major components of the manual and define the subject areas that are found in the SMD.

The Navy Officer Occupational Classification System (NOOCS) is used by the Navy to "identify skills, education, training, experience and capabilities related to both officer personnel and manpower requirements." The system is coded to form a management basis for the "procurement, training, promotion, distribution, career development and mobilization" of officer manpower management and officer personnel (Military Personnel Plans and Policy Division, 2011).

This manual is published in two volumes that explain the NOOCS codes and other structures. This review will focus on volume one that contains the four subsystems of NOOCS:

- The Designator (DESIG) structure identifies primary specialty qualifications, associated legal and specialty categories and competitive categories for promotion.
- Navy Officer Billet Classifications (NOBC) functionally describes general occupational duties.
- Subspecialty (SSP) identifies postgraduate education (or equivalent training and/or experience) in various fields and disciplines.
- Additional Qualification Designation (AQD): identifies additional qualifications and skills not included in the other code structures.

This analysis attempts to understand why the manpower requirements for each ship differ and how this might impact the metrics that should be used in the future. It relates to manpower, what is considered the most important, and what may be supplemented by another source, whether it is enlisted personnel or shore support. The DESIG codes for officers are important to identify because one of the objectives of this study is to examine the differences in the SMD across ships. Different ship classes require different DESIGs based on the focus of their warfare objective. These codes cover several different types of officers that are in leadership or support positions. As thorough as some of the positions are, and integral to a ship's mission, they are not all necessarily included as a requirement for each ship.

According to the manual, the billet and DESIG codes are categorized in general classifications; however, this study will focus only on Unrestricted Line, Staff Corps, Limited Duty, and Chief Warrant Officers.

The Unrestricted Line (URL) Officers are those who "are not restricted in the performance of duty" (Military Personnel Plans and Policy Division, 2011). The URL Officers are those who command ships, submarines, and squadrons. Staff Corps (SC) Officers are those who directly support the URL Officers in several different roles. Most importantly in the Surface Line Community, Supply Corps Officers are the logistic heads of the ships. They maintain the supply onboard that feeds and clothes the officers and enlisted personnel.

When a Sailor crosses from the enlisted ranks to the officer ranks, they may become any type of officer depending on their education and career path. Two types of officers important to this study and are in the "prior-enlisted turned officer" category are Limited Duty Officers (LDO) and Chief Warrant Officers (CWO). LDOs are "appointed for the performance of duty in the broad occupational fields indicated by their former warrant designators or enlisted rating groups" (Military Personnel Plans and Policy Division, 2011). LDOs begin at the rank of Ensign and work their way through the officer ranks much like other URL and SC officers. However, and as noted in the definition, they usual stay within their occupational fields, even if in a broad manner. An example of this is a prior-enlisted person who was rated as a Gunners Mate or Fire Controlman and commissions as an LDO, they would most likely become a Systems Test Officer who deals primarily with weapons related specialties. CWOs are "appointed to chief warrant officer for the performance of duty in the technical fields indicated by former enlisted rating groups" (Military Personnel Plans and Policy Division, 2011). As the definition eludes, CWOs are more technical and usually stay within their enlisted rate, but in an officer's position. An example of this would be a Sailor who was a Cryptologic Technician and commissioned to be a Signals Warfare Officer (SIGWO). Although an officer, the SIGWO would typically oversee only other Cryptologic Technicians and not general members of that entire department.

Officers are assigned DESIGs within these categories of URL, SC, LDO, and CWO. DESIGs are four-digit numbers that group officers in the same categories in to different job titles. This is accomplished through the first three digits with the fourth digit usually indicating whether the officer is Active Duty or Reserve (Military Personnel Plans and Policy Division, 2011). For example, both Surface Warfare Officers (SWO) and Special Operations Officers (SO) are URL Officers. Their designators reflect their differences. SWOs are designated as 1110, and SOs are designated as 1140. The difference of each is described in the definition of each designator, which will be covered in the following material.

While each warfare area requires its own DESIG, each ship requires an assortment of DESIGs in order for the ship to perform successfully in its intended

function. These DESIGs, how they are implemented, and how they are assigned are important because they are the universal sign of what the officer's specialization. For instance, a SWO is an 1110 DESIG. Although the SWO may serve on a variety of ships (Destroyers, Aircraft Carriers, or Amphibious Ships) and in a variety of different billets (Operations Officer, Combat Systems Officer, Gunnery Officer), the officer will always be an 1110 DESIG. The DESIGs in this thesis will focus on the officers found on the LCS and the ships that it intends to replace.

From the Unrestricted Line Community, 1110 DESIG officers are found on all the ship classes. These are the officers that make up the majority of those on board and include the senior officers. The billet description calls for an "Unrestricted Line Officer billet requiring Surface Warfare qualification or afloat billets leading to such qualification" and the officer description calls for "An Unrestricted Line Officer who is qualified in Surface Warfare" (Military Personnel Plans and Policy Division, 2011). Those officers that are not yet qualified as SWOs are designated as 1160s. Their billet code is defined as "Unrestricted Line Officer billet for an officer in training for Surface Warfare qualification" and the officer description calls for "An Unrestricted Line Officer who is in training for Surface Warfare qualification" (Military Personnel Plans and Policy Division, 2011).

In the review of the SMDs, it is presented that the MHCs actually had officers assigned that were outside the normal designators on surface ships. The Commanding Officer and First Lieutenant / Minesweeping Officer were qualified SOs and SOs-in-training, 1140 and 1190, respectively. The billet and description for 1140 is for an "Unrestricted Line Officer billet requiring a Special Operations officer qualification" and the description of that officer is "an Unrestricted Line Officer who is a Special Operations officer by virtue of training in the Explosive Ordinance Disposal (EOD), Diving/Salvage (DIV/SAL), and Expendable Ordinance Management (EOM) functional areas" (Military Personnel Plans and Policy Division, 2011). The 1190 is an officer in training for an 1140 designation. This difference is important to note because of the mission of the Minehunters, as it is alluded to in the name of the type of ship. Also, in the description of the billet, there was a requirement for the officers to have an

understanding for what their ship was going to encounter, such as possible explosive and dangerous ordinance. The Commanding Officer would have had prior training that could be used in tenure on the Minehunter.

The Staff Corps designator that applies to a majority of the ships, but not the LCS, is for the Supply Corps. Typically on a larger surface ship there will be a Supply Officer (SUPPO), Disbursing Officer, and Food Services Officer, with the SUPPO being a Department Head. The billet description for the 3100 calls for a Staff Corps Officer billet requiring Supply specialty and the officer description simply states "a Supply Corps Officer" (Military Personnel Plans and Policy Division, 2011).

Limited Duty Officers and Chief Warrant Officers also make up a small percentage of those found on surface ships. They are typically assigned in engineering and combat systems roles. The two LDO designations found in the SMDs for this study are 6130 and 6180 for engineering and electronics, respectively. The 6130 billet descriptions calls for a "Limited Duty Officer (Line) billet requiring management in Engineering/Repair specialty (Surface)" with the officer description requiring a "Limited Duty Officer (Engineering/Repair - Surface)" (Military Personnel Plans and Policy Division, 2011). The 6180 billet description calls for a "Limited Duty Officer (Line) billet requiring management in Electronics specialty (Surface)" with an explanation just as simple as the Engineering LDO for the Electronics LDO, "A Limited Duty Officer (Electronics - Surface)" (Military Personnel Plans and Policy Division, 2011). In addition to the Engineering LDO, there is also an Engineering CWO with the designator 7130. The billet description is for a "Warrant Officer (Line) billet requiring supervision in Engineering specialty (Surface)" and the description as an "Engineering Technician (Surface)" (Military Personnel Plans and Policy Division, 2011).

Following the DESIGs, the NOBCs "identify officer billet requirements and officer occupational experience acquired through billet experience or through a combination of education and experience" (Military Personnel Plans and Policy Division, 2011). The NOBC gives a description of general positions that will be needed on board a ship to "carry out missions and operations and the type of training or experience that the officer may have." The NOBC is a four-digit code where the "first digit identifies the

field, the second digit identifies the group within the field and the third and fourth digits indicate the specific billet classification within the group." In its application, the NOBC is a statement, as mentioned above, as a resource that may be used in missions and operations (Military Personnel Plans and Policy Division, 2011).

Like the NOBC, a "Subspecialty" (SSP) is important to individual naval platform because it focuses on "officer requirements for advanced education, functional training, and significant experience in various fields and disciplines" which are tracked by the Navy in order to determine manpower needs and follow-on education for current officers and advanced education requirements for future officers (Military Personnel Plans and Policy Division, 2011). These codes, like NOBCs, are applicable to all officers and are broken up by digit:

- The 1st digit indicates the subspecialty Major Area.
- The 2nd digit indicates Concentration Area.
- The 3rd and 4th digits provide specificity
- The suffix (5th character) indicates the level of education/ training/experience in the subspecialty.

Some of the applicable SSP codes are seen on all the SMDs except for the LCS. This is an area for concern as this is important information when it comes to determining the manpower required for the platform.

Focus is what separates the NOBCs and SSPs from the DESIG is the focus. The SSP focuses on a certain aspect of a given area. Every Surface Warfare Officer is an 1110 DESIG, but not every Surface Warfare Officer shares the same NOBC or SSP. These NOBCs and SSPs are assigned based off of the type of mission, platform, or billet that an officer has been assigned to. NOBCs and SSPs are trained and exist as mission focus areas. This is important to the study because the LCS focuses on several different missions that require different specialties.

Last, but not least, are the Additional Qualification Designations (AQD) that are used for specific jobs on naval platforms. The purpose of the AQD is to "enhance billet and officer designator codes by identifying more specifically the qualifications required by a billet or a unique qualification awarded to an incumbent through service in the coded

billet" (Military Personnel Plans and Policy Division, 2011). The AQD identifies these additional requirements and to which billets they should be incorporated with, such as the LF7 AQD, which is for the Tactical Action Officer (TAO), the officer that "fights the ship" from the Combat Information Center. Unlike the NOBC and SSP, the AQDs are alpha-numeric in structure:

- The first character identifies a broad occupational area closely related to the designator.
- The second character specifies the type of qualification within the occupational area.
- The third character further defines the qualification.

AQDs are specific in nature and are dependent on where an officer is assigned and what type of warfare area the assignment will concentrate. NOBCs and SSPs are a little broader in nature and usually pertain to a position on a ship that is coupled with a mission concentration of the ship.

B. LITTORAL COMBAT SHIP ESTIMATED MANPOWER AND OFFICER OCCUPATIONAL STANDARDS

1. Littoral Combat Ship Manpower Estimate Report

The *Littoral Combat Ship Manpower Estimate Report* "describes the manpower requirements for supporting the Littoral Combat Ship program." The executive summary provided by the Program Executive Office (PEO) states that the Manpower Estimate Report (MER) includes core crews, Mission Packages (MP) detachments, and required shore support.

The main purpose of the sea-frame crew is to "carry out core ship functions of self-defense, navigation, and Command, Control, Communications, and Intelligence (C4I)" (Program Manager, Littoral Combat Ship, 2012). Confirmed in the MER, the core crew consists of forty personnel, eight officers and thirty-two enlisted personnel. Alternating "Blue" and "Gold" crews share time on board. The crew embarked in the LCS is operational while the crew ashore is in training for their next rotation on board. As more LCSs become operational, the rotation will be 3:2:1, where three crews will be assigned to two ships with one ship deployed. This multi-crew concept is intended to

support up to 16 months for the sea-frame to be deployed. The main benefit of this type of rotation is that it will allow for the sea-frame to spend more time at sea and in operation. It also benefits the crews because it gives them a period on shore where they can accomplish administrative and training necessities such as personnel transfers and rate specific education.

In addition to the sea-frame crew, an LCS will deploy and operate with the embarked MPs consisting of a nineteen person Mission Module (MM) and an Aviation Detachment of twenty-three personnel. When ashore, a shore support detachment will contain all the personnel required for the ship and MMs; which will include administrative, logistic, training and maintenance support. The coordination between the LCS and shore support will be completed through the LCS Squadron (LCSRON) and the Immediate Superior in Command (ISIC). The Maintenance Support Team (MST), Logistics Support Team (LST) and Mission Package Support Facility (MPSF) will conduct maintenance (Program Manager, Littoral Combat Ship, 2012).

The MER's executive summary concludes that for the 55-ship / 64-MM LCS class, that there will be 4904 people to operate, 3386 people for maintenance, 862 people for support, and 1098 people for training (Program Manager, Littoral Combat Ship, 2012).

Following the Executive Summary, the MER breaks down the unique features of the MPs and shore support. These facts and figures are crucial because they are what dictate the minimal manning of the LCS sea-frame crew, as well as the status of the LCS in readiness.

The MP procurement is, and will continue to be, an incremental acquisition that allows for delivery of already existing systems to be used as soon as they are ready. Remaining systems (referred to as increments) will be brought online as they are completed in development. According to the MER, the MP Baseline is "Full Capability" when the Mine Countermeasures Mission MP is Increment 4, the Surface Warfare MP is Increment 4, and the Anti-Submarine Warfare MP is Increment 2 (Program Manager, Littoral Combat Ship, 2012).

The Mine Countermeasures Mission Package Systems is broken down in to the following increments:

- **Increment 1**: Capability for the detection and neutralization of volume and bottom mines with the use of AQS-20 mine-hunting SONAR, Remote Mine-hunting System (RMS), Airborne Laser Mine Detection System (ALMDS), and Airborne Mine Neutralization System (AMNS).
- **Increment 2**: Inshore detection capability with the Coastal Battlefield Recon and Analysis (COBRA) system.
- **Increment 3**: Neutralize near surface and floating mines with use of Surface Mine Counter-measures (SMCM) Unmanned Underwater Vehicle (UUV) with Low Frequency Broad Band (LFBB) and Increased AMNS capability
- **Increment 4**: Not described

The Surface Warfare Mission Packages/Systems is broken down in to the following increments:

- **Increment 1**: Counter small boat threats with 30mm Gun Mission Module (GMM)
- **Increment 2**: support for Visit, Board, Search, and Seizure (VBSS) or Irregular Warfare with additional Maritime Security Module (MSM) that includes berthing, small boats, and support equipment.
- **Increment 3**: Irregular Warfare Module (IWM) that will include medical trauma unit manned by Naval Hospital personnel with additional capability of Surface-to-Surface Missile Module (SSMM).
- **Increment 4**: Delivery of SSMM missiles

The Anti-Submarine Warfare Mission Package/Systems is broken down in to the following increments:

- **Increment 1**: Capability to detect, classify, and localize enemy submarines (delivered in 2008, placed in lay-up until further development of MP).
- **Increment 2**: Bi-static capability using Continuous Active Sonar Variable Depth Sonar (CAS VDS) and separate Multi-Function Towed Array (MFTA), Light Weight Tow (LWT) Torpedo countermeasures.

The shore support concept covers functions usually performed by crew will be handled by shore-assigned personnel. This includes administrative duties and supply. LSTs and MSTs will carry out the majority of the maintenance.

The LSTs perform work typically carried out by ship's Supply Department. LCSRON will work with LST for logistics, to include Logistic Requests (LOGREQs) which are used to request certain materials when ships require them. The LST will operate out of Naval Supply Systems Command (NAVSUP). NAVSUP will be the single point of contact for the core crew Supply Officer. Keep in mind that there is no Supply Officer on board an LCS, so a core crew Supply Officer will act on behalf of the LCS. This core crew Supply Officer will be assigned ashore and assist with the coordination of logistics. The implication of this is that major logistical issues will be dealt with when the sea-frame is in port; issues arising at sea will be dealt with through available means such as on board inventory and what can be procured through LOGREQs and delivered via underway replenishments. The LST Officer-in-Charge (OIC) will work between LCSRON and NAVSUP by reporting to LCSRON for operations and to NAVSUP for administrative and manning requirements.

The MST plans the LCS maintenance phases that range from initial planning to delivery of the vessel. They conduct maintenance both in and outside of the United States using "fly-away" teams for OCONUS operations. The planning is conducted by the Maintenance Review Board (MRB) which sets "priorities and strategies for maintenance and sustainment" (Program Manager, Littoral Combat Ship, 2012). It is an evolved for of Planning Board for Maintenance (PB4M) which takes places between the ship and MST. For the MPs, the Mission Package Support Facility works in conjunction with the MST OIC.

When the ship is not in its homeport, maintenance afloat must be completed by ship's force and embarked personnel for the MM. Since the LCS is minimally manned, non-critical work will be deferred or emergent repair provided when Distance Support is exhausted. Other than that, Preventive Maintenance (PM) and Corrective Maintenance (CM) are to be completed as scheduled. The PM schedule is made by the ship's Maintenance Material Management Coordinator (3MC) which revolves around the sea-shore rotation and crew. MM PM is restricted to less than monthly checks lasting only two hours. The CM for Ship's Force is limited to troubleshooting and modular replacement of mission critical systems.

When a ship's crew is not conducting maintenance, they are most likely training. The training concepts for the Sailors of the LCS are both focused on common requirements for all Sailors, as well as tailored requirements specific to LCS. Additionally, Sailors on board the LCS must be interchangeable with other Sailors on other LCS platforms. What this equates to is that each billet has the "same requirements for Knowledge, Skills, and Abilities (KSAs) as the corresponding billet on any other crew within the same LCS Hull Type or MM detachment" (Program Manager, Littoral Combat Ship, 2012). While most personnel report to ships ready to serve, they must first be oriented to the platform and trained in specific requirements. What this means for LCS Sailors is that they must report to the ship ready to stand watch and fulfill their duties as they attend a training pipeline for the LCS before ever even setting foot on a LCS.

The LCS training process involves Train to Qualify and Train to Certify. Train to Qualify (T2Q) focuses on the individual and is the process of training in an off-ship environment. Train to Certify (T2C) focuses on the watch team and it is the process of training, both on and off-ship, a watch team (Program Manager, Littoral Combat Ship, 2012).

The off-ship training is collaboration between the Afloat Training Group (ATG) and LCSRON. This collaboration is meant to follow a crew from beginning to end of a training and deployment cycle. ATG focuses on the whole crew while each LCS Sailor, prior to reporting to the crew, is assigned a standard training syllabus. This is billet specific training and takes place at the LCS Training Facility (LTF) and supports T2Q. Once completed and qualified, the Sailor joins the crew during off-hull time. The MM training for its respective Sailors is modeled after the ship training method.

Moving past maintenance and training, the MER covers the actual manpower estimation, beginning with the sea-frame.

The following will focus on the "Sea-frame Projected Student Throughput for Officer Personnel" for LCS crews (Program Manager, Littoral Combat Ship, 2012). An officer's tenure on board will last anywhere from one and a half to two years. This

reflects half of total officer populations. The Commanding Officer and Operations Officer are not included as they will be relieved by fleet up personnel (i.e., The Commanding Officer begins the tour as the Executive Officer and fleets up to the Commanding Officer position). This period of time does not include the initial training that LCS officers will complete prior to their counter starting for their time on board LCS.

According to the MER, the steady state for officers will be reached in Fiscal Year (FY) 31. At this time there will be 249 relief officers. This number is reached by multiplying the number of officer relief required (Six, since the OPS and CO are not included) by the number of crews required two years prior to the date. This number is then divided by two ([6 officer reliefs (OPS and CO not included) x Number of Crew 2 years before] / 2).

This steady state will require 152 training man years. This number was ascertained by multiplying the total number of students in a given year by the average length of the training pipeline, which is .61 years for officers and does not include Department Head School, but does include the LCS pipeline.

Similar to the sea-frame, the "Mission Module Project Student Throughput for Officer Personnel" covers the one officer that is assigned to a module as the OIC for the detachment (Program Manager, Littoral Combat Ship, 2012). According to the MER, the steady state for the OIC officer will be reached in FY26 with 64 officers for 64 modules. This will consist of 43 training man years with the breakdown of training per module as follows: MCM: .58 years; ASW: .94 years; and SUW: .60 years, which includes 54 days for Visit Board Search and Seizure schooling. These numbers also reflect officers reporting to active crews, not crews on Pre-Commissioning Units.

To get a better sense of what the sea-frame and module steady states consist of in relations to the actual sea-frame and module deliveries, the MER lays out the following for expected delivery of the final sea-frames and modules.

The hull delivery schedule dictates that the 55th ship to be delivered in FY35. Lockheed Martin's accountability for twenty-seven hulls, requiring forty-one crews, will

be reached in FY29. General Dynamics' accountability for twenty-eight hulls, requiring forty-two crews, will also be reached in FY29. The first four ships already in commission or construction are manned under the Blue/Gold concept as previously mentioned. The follow-on hulls will be manned with the 3:2:1 set-up where three crews will be assigned to two sea-frames with one sea-frame deployed. The crews are funded or "bought" a year in advance for training and familiarization which is even further in advance that required by T2Q.

The Mission Module delivery follows a delivery that pairs with the delivery of the sea-frames. Similar to the crews, the modules will have a 3:2 ratio, 3 crews for every 2 modules. The steady state for SUW is to be reached in FY24 with 24 MM and 36 crew detachments. The steady state for MIW is to be reached in FY25 with 24 MM and 36 crew detachments. The steady state for ASW is also FY25 with 16 MM and 24 crew detachments.

Regarding manpower, the core crew will have billets bought with time determined for pipeline training. The steady state is expected to be reached in FY28 with 664 officers capable of 83 crews for 55 hulls.

The MER prescribes the layout for ship and module maintenance, as well as shore support:

- Ship Maintenance: Steady State in FY29 with 14 officers (1 per every 4 ships). These officers will be complemented by 224 civilian personnel and 2846 contractor personnel, with 0 enlisted personnel.
- Mission Module Maintenance: Steady state of only 2 officers beginning in FY17, one per Coast. Each officer will have an enlisted representative and they will be complemented by 298 civilian personnel.
- Shore Support: The non-training portion of LCSRON is expected to have 151 officers by FY28 with the total staff being 636. Keep in mind that a Destroyer Squadron staff is only 29. The training portion is expected to have 96 officers with a total staff of 1098.

2. Littoral Combat Ship Austal LCS 2 Hull Type Preliminary Ship Manpower Document

The *Littoral Combat Ship Austal LCS 2 Hull Type Preliminary Ship Manpower Document* provides the layout of the core personnel of the sea-frame. The importance of

this document is that the manpower assessment contained within it is the assigned number of personnel that will initially man the LCS to make it an operational asset. As a Preliminary Ship Manpower Document (PSMD), these numbers are meant to be revised and result in a Ship's Manpower Document (SMD), something that has yet to occur. While focusing on only the officers, and when compared to the ship types it replaced, it will be noticed that certain NOBCs and other qualifications are not included. These NOBCs or qualifications have either been reassigned to enlisted personnel, or not included in the description for the manpower required.

Each officer will have certain designations and qualifications that make them an integral part of the LCS mission. The officers assigned are all designated 1110, with the exception of the Chief Engineer who is designated as 6130. The 1110 designation is for URL SWOs and the 6130 is for LDOs with an engineering background.

Table 1 shows the breakdown of officers assigned to the LCS, as per the PSMD. It should be noted that the only requirements contained are those for designators and NOBCs (Program Executive Office, 2012).

OFFICERS				
Billet Title	**Rank**	**Desig**	**NOBC**	**Other**
CO	CDR	1110	9235	
XO	LCDR	1110	9228	
OPS	LT	1110	9275	
CSO	LT	1110	9261	
CICO	LTJG	1110	9217	
EMO	LTJG	1110	9283	
CHENG	LT	6130	9364	
MPA	LTJG	1110	9336	

Table 1. LCS Officer DESIGs and NOBCs (After PEO, 2012)

The following is a breakdown of the officers and the NOBCs they will be required to hold when being assigned to the LCS, as defined by the *Manual of Navy Officer Manpower and Personnel Qualifications*. These definitions are verbatim as they appear in the manual. Following their explanations, it will be shown how these are the bare

minimum requirements set forth in the PSMD. The SMD's of the ship classes that the LCS is set to replace are far more robust and inclusive of professional characteristics.

a. Commanding Officer: NOBC 9235

Commands, in a commander billet, a ship or unit of the operating forces in accordance with regulations, orders, traditions and customs of the service (p. C-29).

b. Executive Officer: NOBC 9228, Executive Officer Afloat

Administers the organization, performance of duty and good order and discipline of a ship or unit of the operating forces. Acts as direct representative of commanding officer, enforcing command orders and policies, assisting in command operations, and commanding in his absence. Coordinates with department heads for command administration, schedules and inspections, and personnel performance, training, welfare, and morale (p. C-29).

c. Operations Officer: NOBC 9275, Operations Officer, Afloat (Naval Tactical Data Systems)

Coordinates ship's operations, training and tactical planning. Organizes operations department and delegates responsibilities for communications, Combat Information Center (CIC) and sonar activities. Confers periodically with commanding officer and department heads in preparation of ship's operation plans and training schedules. Conducts briefings. Directs underwater, surface and air searches and electronic countermeasures. Evaluates and disseminates operational information, advising command on required tactics and ship movements and controlling airborne aircraft through CIC officer. Supervises electronic equipment repair (p. C-102).

d. Combat Systems Officer: NOBC 9261

Directs activities of ship's combat system's department. Advises commanding officer on combat system's operations, capabilities and problems. Oversees operation and operational maintenance of all weapons and combat systems control equipment. Coordinates the conduct of shipboard combat system's test and evaluation matters. Supervises care, handling, stowage and use of explosives (p. C-101).

e. Combat Information Center Officer: NOBC 9217

Directs Naval Tactical Data System-Combat Information Center (NTDS-CIC) teams. Supervises operators of NTDS-CIC equipment including

radar, sonar, electronic countermeasures (ECM) and communication equipment in collection, display, evaluation and dissemination of information. Performs NTDS-CIC watchstanding duties. Executes combat direction decisions. Operates NTDS consoles. Notifies control stations of pertinent CIC information. Controls airborne aircraft. Coordinates search and rescue. Controls small craft. Assists with special operations requiring CIC information. Corrects tactical computer programs (p. C-98).

f. Electronic Material Officer: NOBC 9283

Administers maintenance and allowance of shipboard electronic equipment. Interprets and carries out systems commands or manufacturers' instructions for equipment, establishing maintenance standards and ensuring readiness. Diagnoses causes of malfunctions and directs repair, modification, alteration and installation of equipment. Directs requisitioning of spare parts and gear. Directs preparation and submittal of work requests, reports and informative data required for tender/yard overhaul of electronic equipment (p. C-102).

g. Chief Engineer: NOBC 9364

Administers ship's engineering department. Directs operation and maintenance of propulsion and auxiliary machinery and electric power equipment. Superintends engineroom, boilerrooms, carpenter shop and electrical and other engineering spaces. Directs maintenance of boat machinery, control of damage, repair of hull and appurtenances and repairs not specifically assigned to other departments. Directs procurement and use of fuel, lubricants, spare parts and other engineering equipage. Maintains comprehensive maintenance program. Directs preparation of required engineering records and reports (p. C-106).

h. Main Propulsion Assistant: NOBC 9336

Assists ship's engineering officer by directing operations and maintenance of main propulsion equipment, including turbogenerators and auxiliary powerplants. Establishes routine and directs operation of machinery. Diagnoses malfunctions and directs maintenance and repair. Maintains fuel consumption records. Operates main engine-room control board, ensuring that men are on station, that telephone contact with bridge is clear and that main engines are in readiness for orders. Reviews logs and reports (p. C-105).

Figure 6 shows a breakdown of the officer and crew for the LCS. Similar to other surface ships, the CO, XO, and Senior Enlisted Leader do not belong to a specific department. However, each department only has two officer, where many surface ships have anywhere from two to six or more.

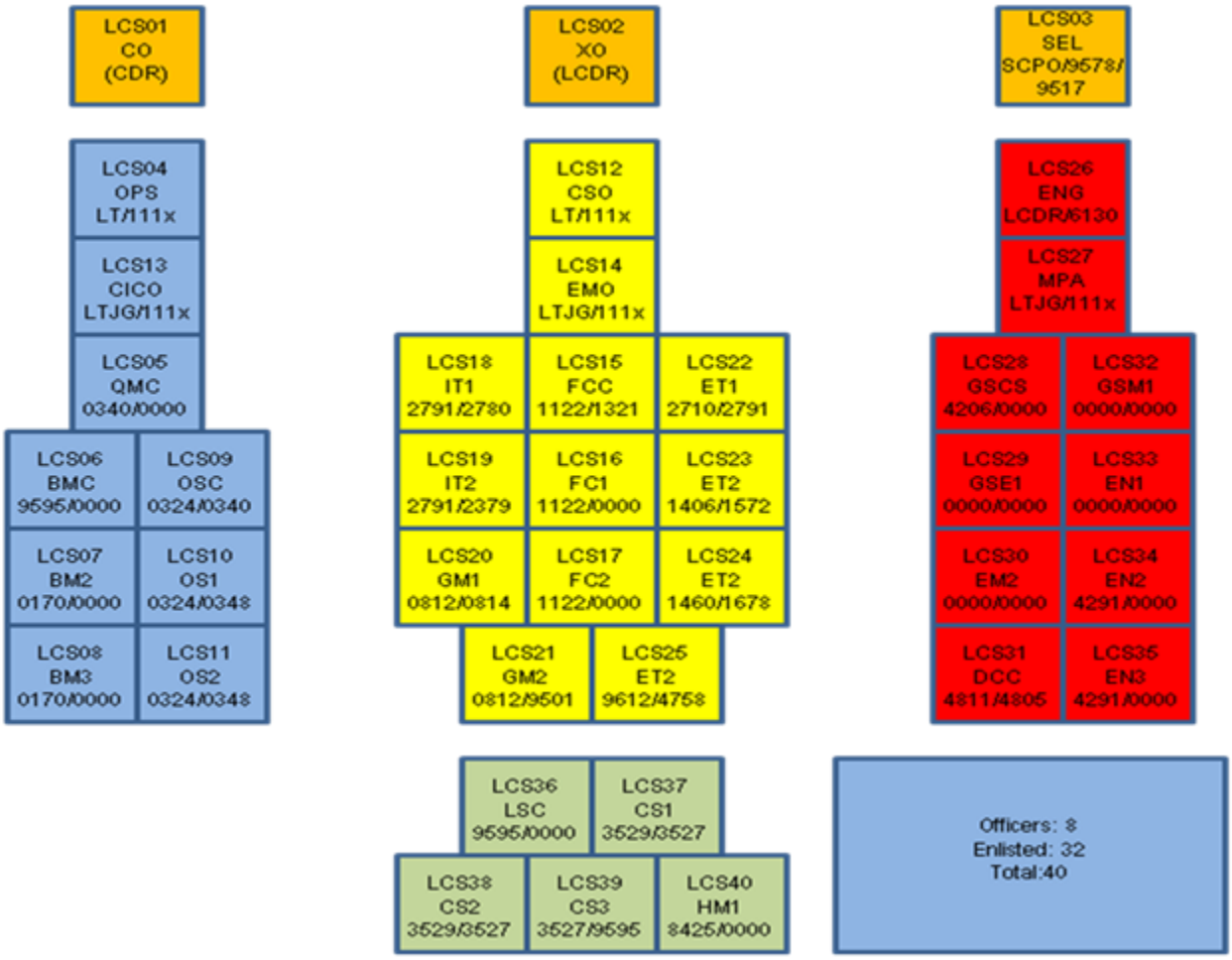

Figure 6. LCS Sea-frame Chain of Command (After PEO, 2012)

C. OFFICER MANPOWER AND OCCUPATIONAL STANDARDS AND CHARACTERISTICS OF THE FFG, MCM, AND MHC SHIP CLASSES

1. Ship Manpower Document (SMD) for FFG 7 Class

The *Ship Manpower Document for FFG 7 Class* provides the layout for the personnel on the *Oliver Hazard Perry*-class FFG platform. This is the largest platform that the LCS is set to replace. Notably, the officer concept contains more manpower and a wider variety of qualifications and requirements. Additionally, those officer billets that are present on both LCS and FFG (i.e., Operations Officer and Combat Systems Officer) have different requirements. While this looks at manning and manpower it can be ascertained from SMD comparisons that the FFG SMD contains additional DESIGs, NOBCs, as well as SSPs and AQD codes.

While the core officer crew of the LCS is eight, the FFG has seventeen officers with multiple DESIGs. In addition to 1110 and 7130 DESIGs found on LCS, the FFGs also have 1160 designated officers that are Non-Qualified SWOs; a 6180 DESIG officer who is a LDO with an electronics specialty; a 7130 DESIG CWO with an engineering specialty; and Supply Officers that carry the 3100 designator.

Table 2 shows the breakdown of officers assigned to the FFG, as per the SMD. This SMD is much more robust as it contains not only designators and NOBCs, but also SSPs and AQDs (Navy Manpower Analysis Center, 2008).

OFFICERS						
Billet Title	**Rank**	**Desig**	**PNOBC**	**SNOBC**	**SUB SPEC**	**AQD**
CO	CDR	1110	9235		6301P	
XO	LCDR	1110	9228	9284		
TRAINO	LTJG	1110	3292			
OPS	LT	1100	9274			LF7
NAV	LTJG	1110	9284			
COMMO	ENS	1160	9582	9535		VX1
CICO	ENS	1160	9217	9640		
CSO	LT	1100	9261		5700S	LF7
GUNNO	LTJG	1110	9202			
EMO	ENS	6180	9283			VX1
ASWO	ENS	1160	9206			
CHENG	LT	1100	9364		5600S	LF7
AUXO	LTJG	1110	9302			
DCA	ENS	1160	9308			
MPA	CWO2	7130	9337			
SUPPO	LT	3100	1918		1300H	
DISBO	ENS	3100	1045			

Table 2. FFG Officer DESIGs, NOBCs, SSPS, and AQDs
(After NAVMAC, 2008)

The following is the breakdown of the FFG SMD and how it differs from the LCS. Similarly, definitions for DESIGs, NOBCs, SSPs, and AQDs are sourced from the *Manual of Navy Officer Manpower and Personnel Qualifications*. The importance of these differences showcases the change from the FFG platform and its requirements to the LCS platform and their respective requirements.

Commanding Officer (CO): The CO's NOBC of 9235 is the same as the LCS CO, however, it is defined in the FFG SMD that the FFG CO will also carry the 6301 SSP for Undersea Warfare. For the LCS, an embarked Undersea Warfare module is expected to cover this requirement, again returning to the fact that the LCS crew is

responsible for the sea-frame, and not necessarily, the manpower requirements for a mission. However, the exact specifics of the module manpower are yet to be published.

Executive Officer (XO): The XO's NOBC of 9228 is the same as the LCS XO. However, the FFG XO also holds a second NOBC of 9284 which is for the Ship's Navigator who:

> Directs activities of navigation department. Maintains accurate plot of ship's position by means of celestial navigation, piloting, electronic devices and navigational tables and formulas. Establishes ship's position in pilot waters by fathometer readings and ranges and bearings on land objects. Operates Loran, radio direction finder and fathometer. Evaluates radar data in determining ranges and bearings. Advises commanding officer of course and location. Plots course to be steered. Maintains all navigation equipment (p. C-99).

Training Officer (TRAINO): The TRAINO NOBC of 3292 is not contained in the LCS PSMD. This is a position that is to be covered by the support staff (LCS Squadron) to the LCS platforms. The LCS Squadron will theoretically plan the training requirements typically coordinated by the Training Officer, which include:

> Coordinating a comprehensive shipboard/squadron training program and de-conflicts training requirements during Planning Board for Training. Trains and supervises all department/division training coordinators. Develops and maintains Required Schools Master List. Actively liaisons with off-ship training providers, in particular, the AFLOATRAGRU Training Liaison Officer. Coordinates training orders, student clearances and training TADTAR budget. Reports ship/squadron training status using the Status of Resources and Training System (p. C-44).

Operations Officer (OPS): The FFG OPS requires the NOBC of 9274 that is the General, Operations Officer, Afloat code. The LCS OPS requires the NOBC of 9275. The difference being that the 9275 is Naval Tactical Data System (NTDS) and 9274 is not. However, the FFG SMD requires the OPS to have the AQD of LF7 which is for the qualification of Tactical Action Officer (TAO).

Navigator (NAV): As explained above, this NOBC of 9284 is for the ship's navigation. The NAV will be responsible for the majority of navigational evolutions, with the XO as a supervisor and the CO being ultimately responsible for the safe navigation of the ship.

Communications Officer (COMMO): The COMMO is an Ensign and non-qualified Surface Warfare Officer. Generally, these are officers that have just commissioned out of college or Officer Candidate School, or enlisted personnel who have gone through a commissioning process. As it is explained, this non-qualified officer is required to obtain multiple billet specific qualifications, even when junior to the rest of the officer corps on the FFG.

Primary NOBC: 9582, as Information Systems Officer:

> Directs communication activities of command. Supervises security of classified information; operation security (OPSEC/COMSEC), administrative directives, communications management, and organization, signals officer management, and organization; message drafting and communications equipment, and systems (conventional, automated and satellite). Information Systems Officer manages all information exchange systems external to the command (p. C-113).

Secondary NOBC: 9535, as Custodian of CMS Material:

> Serves as custodian of Communications Security Material System (CMS) material distributed to command or activity. Procures material in accordance with allowance list, maintaining secure stowage. Makes, or supervises making of, corrections as required by appropriate directives. Reissues material on local custody as necessary. Takes periodic inventories. Disposes of material as authorized or directed. Reports any actual or suspected loss or compromise (p. C-112).

The COMMO also holds the VX1 AQD:

> Foundation for naval C4 expertise development. Provides experience in operational naval C4 to include tactical and strategic C4, LANS/WANS, data base management, GCCS, JMCIS, software development, and information architectures. Code is assigned to officer after completion of 1 year in this qualifying billet (p. D-207).

Combat Information Center Officer (CICO): The FFG CICO holds the same NOBC (9217) as the LCS CICO. However, the FFG CICO also holds a secondary NOBC of 9640 (Operational Intelligence Officer) which entails the following:

> Supervises the collection, processing and dissemination of intelligence of tactical and strategic value in naval and/or joint operations. Supervises the intelligence input to target programs and provides advice on mission planning and weapon selection. Supervises the preparation of intelligence estimates and intelligence annexes to operation orders and plans. Supervises maintenance of the order of battle information, intelligence plots and data handling systems. Supervises the production of intelligence reports. Coordinates reconnaissance missions and interrogations of prisoners (p. C-115).

Combat Systems Officer (CSO): Similar to the FFG OPS, the FFG CSO holds the same primary NOBC (9261) as the LCS OPS. Also similar to the FFG OPS, the FFG CSO has several additional duties that include a subspecialty and an AQD. The subspecialty is 5700S which requires significant experience in Combat Systems and the AQD of LF7 for TAO.

Gunnery Officer (GUNNO): The GUNNO is an 1160, non-qualified SWO that holds the NOBC of 9202:

> Assists weapons officer by directing all gunnery/ordnance activities. Directs employment, operation and maintenance of all gunnery equipment and related fire control equipment. Directs procurement, handling, stowage and restowage, maintenance and issue of ammunition. As appropriate, provides conventional and guided missile aviation ordnance to embarked carrier air wing. Ensures operational readiness of personnel and equipment. Enforces safety regulations (p. C-97).

Electronic Materials Officer (EMO): The EMO on both the FFG and LCS hold the NOBC of 9283. The EMO is a 6180 designated officer who is a LDO with an electronics specialty. Additionally, the FFG EMO holds the VX1 AQD that the COMMO also holds.

Anti-Submarine Weapons Officer (ASWO): Considering the primary mission of the FFG is Undersea Warfare, it is no surprise that there is a specific officer assigned to that warfare area. It is surprising that the officer is an 1160, a non-qualified SWO.

However, this position, and its NOBC, is not contained in the LCS PSMD for Officers. The NOBC of 9206 entails the following:

> Directs employment, operation and maintenance of all weapons department antisubmarine (A/S) equipment. Conducts underwater A/S search and attack. Directs operation, care and maintenance of all A/S equipment, including search and attack sonar, fire control equipment, weapons, assorted ordnance, attack aids, torpedo countermeasures and underwater communications equipment used in identification and classification of submarines (p. C-97).

Chief Engineer (CHENG): The FFG CHENG holds the same 9364 NOBC as the LCS CHENG. However, and similar to the FFG Department Head counterparts of OPS and CSO, the CHENG holds a SSP of 5600S requiring significant experience in General Mechanical Engineering and the LF7 AQD for TAO.

Auxiliary Officer (AUXO): The AUXO on the FFG is a Second Tour Division Officer and a qualified SWO. The AUXO holds the NOBC of 9302:

> Administers ship's engineering division in operations and maintenance of heating and air-conditioning equipment, diesel engines, boat engines, and electrohydraulic and other auxiliary machinery. Establishes and maintains standards and procedures for operating and maintaining machinery and equipment. Investigates causes of equipment malfunctions and determines methods of repair of unusual or difficult cases. Initiates requisitioning of repair parts and fuel for auxiliaries. Supervises preparation of machinery logs and records (p. C-104).

Damage Control Assistant (DCA): The DCA holds the 9308 NOBC, which is not present on the LCS and entails the following:

> Plans and directs shipboard damage control activities. Directs all actions required to maintain watertight integrity, stability, mobility and maneuverability and control of list, trim and draft. Evaluates potential hazards and takes necessary action to minimize them, placing special emphasis on fire and explosion prevention. Establishes escape systems and personnel rescue procedures. Directs confinement and extinguishment of fires, including dewatering operations and ventilation control. Accomplishes rapid repairs (p. C-104).

Main Propulsion Assistant (MPA): The FFG MPA and LCS MPA hold the NOBC of 9337 (Gas Turbine) and 9336 (Diesel), respectively. The definition of the

NOBC is the same. However, the most notable difference is that the FFG MPA is a LDO and the LCS MPA is an 1110 SWO.

The following two billets for the FFG are not found on the LCS PSMD. The billets for Supply Department on the LCS are only included in the enlisted section and are to be augmented by onshore support.

Supply Officer (SUPPO): NOBC 1918

> Directs supply department activities. Applies supply policies to operation of department. Determines demand in accordance with mission and standard allowance lists. Approves requisitions, balance sheets and summaries. Directs receiving, storage, inventory control, issue and salvage of material. Oversees procurement and sale of goods and services. Administers operation of general mess, including procurement, storage, issue and inventory of provisions. Conducts disbursing activities in connection with property accountability and transfer, payroll and personal accounts. The SUPPO also holds the 1300 subspecialty for material distribution (p. C-23).

Disbursing Officer (DISBO): NOBC 1045

> Directs procurement, custody, transfer and issue of funds for payrolls and allowances. Issues savings bonds on payroll deductions. Prepares military pay records and makes payments to military and civilian payrolls. Prepares and pays public vouchers. Receives collections for credit to appropriations and other accounts. Maintains accountability for United States Treasury checks. Issues transportation requests. Prepares required financial returns and special reports. Assists in installation of new disbursing procedures (p. C-19).

Table 3 takes the differences between the LCS PSMD and the FFG SMD. The major differences, which will be seen in the MCM and MHC SMDs as well, are the additional requirements that are assigned to the billets for each officer. Some of the requirements are vital for the ship's mission, such as the 6301 SSP for Undersea Warfare found on the FFG SMD. This SSP, along with several NOBCs, other SSPs, and AQDs are recommended to be included on the final SMD for the LCS because of their importance to the ship class and the manpower assigned to it.

COMPARISON OF OCCUPATIONAL STANDARDS											
LITTORAL COMBAT SHIP					*Oliver Hazard Perry* -class GUIDED MISSILE FRIGATE						
OFFICERS					OFFICERS						
Billet Title	Rank	Desig	NOBC	Other	Billet Title	Rank	Desig	PNOBC	SNOBC	SUB SPEC	AQD
CO	CDR	1110	9235		CO	CDR	1110	9235		6301P	
XO	LCDR	1110	9228								
OPS	LT	1110	9275		XO	LCDR	1110	9228	9284		
CSO	LT	1110	9261		TRAINO	LTJG	1110	3292			
CICO	LTJG	1110	9217								
EMO	LTJG	1110	9283		OPS	LT	1100	9274			LF7
CHENG	LT	6130	9364		NAV	LTJG	1110	9284			
MPA	LTJG	1110	9336		COMMO	ENS	1160	9582	9535		VX1
					CICO	ENS	1160	9217	9640		
GREEN	Standard Match				CSO	LT	1100	9261		5700S	LF7
YELLOW	Standard Recommended				GUNNO	LTJG	1110	9202			
RED	Standard Should be Required				EMO	ENS	6180	9283			VX1
					ASWO	ENS	1160	9206			
					CHENG	LT	1100	9364		5600S	LF7
					AUXO	LTJG	1110	9302			
					DCA	ENS	1160	9308			
					MPA	CWO2	7130	9337			
					SUPPO	LT	3100	1918		1300H	
					DISBO	ENS	3100	1045			

Table 3. Compared Occupational Standards Between LCS and FFG (After NAVMAC, 2008)

2. Ship Manpower Document for the Avenger-class Mine Countermeasure (MCM) Ship

The SMD for the *Avenger*-class MCMs provides the layout for the personnel assigned to the MCM platform. Similar to the mission of the FFGs, the MCM mission is set to be replaced by the Littoral Combat Ship (LCS). While the FFG concentrated more on ASW, the MCM, as the name implies, is for MIW. Accordingly, some officer billets will entail different characteristics than that of the FFG or LCS.

The following is the breakdown of the MCM SMD and how it differs from the LCS. Similarly, definitions for DESIGs, NOBCs, sub-specialties, and AQDs are sourced from the *Manual of Navy Officer Manpower and Personnel Qualifications*. The

importance of these differences is to show the change from the MCM platform and its requirements to the LCS platform and its requirements.

Table 4 shows the breakdown of officers assigned to the MCM, as per the SMD (Navy Manpower Analysis Center, 2011). The LCS officer corps is smaller than the FFG and the MCM. The MCM requirements include additional NOBCs, SSPs and AQDs. The number of officers is much closer to that of the LCS, which shows that with smaller/minimal manning, it is important to have thorough requirements.

OFFICERS						
Billet Title	**Rank**	**Desig**	**PNOBC**	**SNOBC**	**SUB SPEC**	**AQD**
CO	LCDR	1110	9234			
XO	LT	1110	9228			VX2
OPS	LT	1100	9274		6201S	VX1
NAV	LTJG	1110	9284			
1ST/SWEEP	ENS	1160	9242	9268		VX1
CICO	ENS	1160	9216			
CHENG	LT	6130	9363			
DCA	ENS	1160	9308			
SUPPO	LT	3100	1918			

Table 4. MCM Officer DESIGs, NOBCs, SSPs, and AQDs
(After NAVMAC, 2011)

Commanding Officer (CO): The CO's NOBC of 9234 is the same as the LCS, with the only difference being that the MCM CO is a Lieutenant Commander (O-4), wherein the LCS CO is a Commander (O-5).

Executive Officer (XO): The MCM XO holds the same NOBC (9228) as the LCS XO. Additionally, the MCM XO holds the VX2 AQD which entails the following: Mid-management operations or staff position in a naval C4 billet on fleet, numbered fleet, battle group staff, ship/squadron, or NCTAMS that requires an officer with the VX1

code. Officer is coded upon successful completion of 1 or more years in this qualifying billet.

Operations Officer (OPS): The MCM OPS holds the NOBC code 9274 which is for Non-Naval Tactical Data Systems (Non-NTDS), while the LCS OPS holds the 9275 which is for Naval Tactical Data Systems (NTDS). Largely, the definition for the NOBC remains the same. Also of note, the MCM and FFG OPS hold the same NOBC. Similar to the FFG OPS, the MCM OPS holds a sub-specialty and an AQD. The sub-specialty is 6201S for significant experience in "Information Systems and Technology" and the AQD is VX1 for Tactical Action Officer (TAO).

Ship's Navigator (NAV): Although not included in the LCS PSMD, the MCM NAV holds the same NOBC (9284) as the FFG NAV.

Combat Information Center Officer (CICO): The MCM CICO holds the NOBC 9216, which is different than the LCS CICO NOBC 9217 when it comes to Non-NTDS and NTDS systems:

> Directs collection, display, evaluation, and dissemination of operational and combat information. Supervises Combat Information Center (CIC) personnel operating radar, sonar, electronic countermeasures, communication, and plotting equipment. Provides information to control stations regarding navigation, movement of friendly and enemy ships and aircraft, and current combat information. Directs the care, operation and maintenance of CIC equipment. Assists in target designation, piloting, antisubmarine operations and tactical deception (p. C-98).

First Lieutenant (1st) / Minesweeping (Sweep): This position includes some of the most focused requirements when it comes to the mission of the MCM, deck work and minesweeping. These two concentrations would account for a significant portion of the operations to take place on the MCM. The Officer-In-Charge of these operations, for the MCM, is a non-qualified Surface Warfare Officer, Ensign. Similar to the Communications Officer described in the FFG SMD review, this officer is also fresh to report to the MCM, but is also responsible for the "bread and butter" of the MCM mission. The NOBC code 9242 for the 1st billet entails the following:

> Supervises deck force in performance of seamanship functions and evolutions. Prepares work schedules. Directs mooring, docking, anchoring, fueling, towing and transferring of personnel and cargo at sea. Directs operation and maintenance of deck machinery. Arranges for cargo handling. Assigns boats and boat crews. Maintains readiness of boats and survival equipage. Directs cleaning and preservation of weather decks, ship's exterior, running gear, ground tackle and boatswain's stores. Approves watch, quarter and station assignments (p. C-100).

Additionally, the secondary NOBC code (9268) for the Minesweeping Officer description is:

> Directs operation and afloat maintenance of minesweeping and minehunting equipment including magnetic, high-speed, moored and acoustic gear. Directs minesweeping and minehunting personnel, including explosive ordnance disposal personnel. Controls streaming, energizing and recovery of gear, observing safety precautions. Reconstructs plot of swept area and supervises planting of buoys. Directs use of non-sweeping mine countermeasures techniques. Schedules maintenance and repair of gear (p. C-101).

Chief Engineer (CHENG): Similar to the LCS, the CHENG is a 6130 designated Limited Duty Officer and holds the NOBC code of 9363 (Diesel):

> Administers ship's engineering department. Directs operation and maintenance of propulsion and auxiliary machinery and electric power equipment. Superintends engineroom, boilerrooms, carpenter shop and electrical and other engineering spaces. Directs maintenance of boat machinery, control of damage, repair of hull and appurtenances and repairs not specifically assigned to other departments. Directs procurement and use of fuel, lubricants, spare parts and other engineering equipage. Maintains comprehensive maintenance program. Directs preparation of required engineering records and reports (p. C-106).

Damage Control Assistant (DCA): The DCA holds the NOBC code 9308 which is the same as the FFG DCA. Again, the DCA is not an officer billet on LCS.

Supply Officer (SUPPO): The MCM SUPPO holds the NOBC code of 1918. Like the DCA billet, this code is the same as the FFG SUPPO and is not an officer billet on the LCS.

Table 5 takes the differences between the LCS PSMD and the MCM SMD. The major differences, similar to the FFG SMDs, are the additional requirements, the most

notable quite possibly being the NOBCs for the 1st/SWEEP. These two NOBCs, 9242 and 9268, deal directly with Mine Warfare and the support of it. These are the types of requirements that could be included on the LCS SMD and expected of the officers assigned to the LCS.

COMPARISON OF OCCUPATIONAL STANDARDS											
LITTORAL COMBAT SHIP					*Avenger*-class MINECOUNTERMEASURES SHIP						
OFFICERS					OFFICERS						
Billet Title	Rank	Desig	NOBC	Other	Billet Title	Rank	Desig	PNOBC	SNOBC	SUB SPEC	AQD
CO	CDR	1110	9235		CO	LCDR	1110	9234			
XO	LCDR	1110	9228		XO	LT	1110	9228			VX2
OPS	LT	1110	9275								
CSO	LT	1110	9261		OPS	LT	1100	9274		6201S	VX1
CICO	LTJG	1110	9217		NAV	LTJG	1110	9284			
EMO	LTJG	1110	9283		1ST/SWEEI	ENS	1160	9242	9268		VX1
CHENG	LT	6130	9364		CICO	ENS	1160	9216			
MPA	LTJG	1110	9336								
					CHENG	LT	6130	9363			
GREEN	Standard Match				DCA	ENS	1160	9308			
YELLOW	Standard Recommended										
RED	Standard Should be Required				SUPPO	LT	3100	1918			

Table 5. Compared Occupational Standards Between LCS and MCM (After NAVMAC, 2011)

3. Ship Manpower Document for the Osprey-class Coastal Minehunter

The *Osprey*-class MHCs are the first class of ship to be commissioned that the LCS is set to replace. The ship was the smallest of these ships and contained the smallest, yet possibly most diverse crew. The SMD for the MHC portrays the adaptability sought for a specific-mission themed ship, with its concentration on Mine Warfare. The following notes will cover the MHCs comparison to the LCS, but may also contain reference to the FFG and MCM vessels. Definitions for DESIGs, NOBCs, SSPs, and AQDs are sourced from the *Manual of Navy Officer Manpower and Personnel Qualifications*.

Table 6 shows the breakdown of officers assigned to the MHC, as per the SMD (Navy Manpower Analysis Center, 2000). The MHC had a smaller officer corps than the FFG, MCM, or LCS, and was tasked with the extremely important mission of locating

mines. Without knowing the location of mines and/or minefields, other ships would be unable to maneuver, let alone operate in their mission function area. This aspect alone made them a crucial component to large-scale operations involving the rest of the surface fleet.

OFFICERS						
Billet Title	Rank	Desig	PNOBC	SNOBC	SUB SPEC	AQD
CO	LCDR	1140	9234			
XO/NAV	LT	1110	9228	9284		VX2
OPS	LTJG	1100	9274	9967	0089S	VX1
1ST/SWEEP	ENS	1190	9242	9268		
CHENG	LTJG	1110	9363	9308		

Table 6. MHC Officer DESIGs, NOBCs, SSPs, and AQDs (After NAVMAC, 2000)

Commanding Officer (CO): The CO for the MHC is quite different from not only the LCS, but also from the FFG and MCM. The designator calls for a 1140, which is a qualified Special Operations Officer (an Unrestricted Line Officer who is a Special Operations Officer by virtue of training in the EOD, DIV/SAL, and EOM functional areas), versus the typical 1110 that is a qualified Surface Warfare Officer. However, this only applied for half of the MHC class. Hulls 51 through 56 were with 1140 designated COs and hulls 57 through 62 were 1110 designated Surface Warfare Officers. Beyond the designator, the NOBC code of 9234 is the same for MHCs and MCMs, and only differs from LCS and FFG in the fact that the CO is a Lieutenant Commander (O-4), vice a Commander (O-5).

Executive Officer (XO): The XO carries the same NOBC code as the other platforms. The XO also holds the Navigator NOBC code (9284) and VX2 AQD for naval C4.

Operations Officer (OPS): The OPS holds the same NOBC code as the other Non-NTDS platforms. A noticeable difference between the MHC OPS and other OPS is that the MHC OPS is a Lieutenant Junior Grade (LTJG), which is junior than the other

OPS. Typically, an OPS is a Department Head acting in a Department Head's position. In the case of the MHC, the OPS is a Second Tour Division Officer action in a Department Head's position. The MHC OPS also holds a secondary NOBC code for Safety Officer (9967) which entails the following: Represents squadron or group commander or ship commanding officer in conduct of surface safety program. Maintains inter-command and interdepartmental liaison to further surface safety effort. Informs higher authority on findings of investigations, surveys and studies. Analyzes methods, practices, criteria and regulations to discover unsafe areas and recommend corrective actions. If two NOBC codes were not enough, this Junior Officer position also includes a sub-specialty of 0089 (now 6201) for Information System and Technology and the VX1 AQD for foundation in naval C4.

First Lieutenant (1st) / Mine Sweeping Officer (Sweep): The primary and secondary NOBC codes for the MHC are the same as the MCM. The difference is in the officer designation. On the MHC, the officer is designated as an 1190 which is an Unrestricted Line Officer who is in training for Special Operations qualification.

Chief Engineer (CHENG): Similar to the MHC OPS, and different from the other platforms, the MHC CHENG is also a LTJG. The CHENG carries the typical diesel NOBC code 9363, but also has the DCA NOBC code 9308.

Table 7 displays the differences between the LCS PSMD and the MHC SMD. Similar to Table 5, the MCMs had a small officer corps, but it also included the hugely important 1st/Sweep NOBCs of 9242 and 9268 for Mine Warfare. The Chief Engineer also requires two NOBCs, one of which is typically held by another officer. An interesting difference is the inclusion of a Special Operations qualified officer in the Commanding Officer billet. Although this was only included for half of the MHCs, it is perfectly practical and logical to include an officer with type of background to command and direct a ship whose main mission function is to prosecute mines, an operation that sometimes require assets other than surface vessels, such as diving personnel and Explosive Ordinance Disposal personnel.

COMPARISON OF OCCUPATIONAL STANDARDS											
LITTORAL COMBAT SHIP					*Osprey* -class MINECOUNTERMEASURES SHIP						
OFFICERS					OFFICERS						
Billet Title	Rank	Desig	NOBC	Other	Billet Title	Rank	Desig	PNOBC	SNOBC	SUB SPEC	AQD
CO	CDR	1110	9235		CO	LCDR	1140	9234			
XO	LCDR	1110	9228		XO/NAV	LT	1110	9228	9284		VX2
OPS	LT	1110	9275		OPS	LTJG	1100	9274	9967	0089S	VX1
CSO	LT	1110	9261		1ST/SWEEP	ENS	1190	9242	9268		
CICO	LTJG	1110	9217		CHENG	LTJG	1110	9363	9308		
EMO	LTJG	1110	9283								
CHENG	LT	6130	9364								
MPA	LTJG	1110	9336								
GREEN	Standard Match										
YELLOW	Standard Recommended										
RED	Standard Should be Required										

Table 7. Compared Occupational Standard between LCS and MHC
(After NAVMAC, 2000)

IV. NAVAL OFFICER MANNING METRIC AND OCCUPATIONAL STANDARDS

This Chapter will introduce the current manning metric used by the United States Navy to place officers into billets on board navy vessels. The Chapter summarizes the similarities and differences of officer manpower requirements, based on Littoral Combat Ship (LCS) manpower guidance and Guided Missile Frigate, Mine Countermeasures Ship, and Coastal Minehunter Ship Manpower Documents (SMD). Once the metric is defined and the ship class comparisons are made, a series of occupational standards and personal demographics will be developed to address the utility of the manning metric used when assigning Naval Officers to at-sea billets.

The characteristics presented will provide a framework for a future quantitative analysis using the new manning metric for determining assignments. This section examine a variety of characteristics that could be used as a metric to assign officers to LCS and other ships. The following demographics and occupational standards are applicable to both officers enlisted personnel. These types of personal characteristics and how they relate to one another should have measurable effects on how well individuals perform on the job.

A. CURRENT MANNNING METRIC

The manning metric used in this research deals primarily with the allocation portion of the distribution process. The allocation portion centers on the Total Force Manpower Management System (TFMMS) and Officer Master File (OMF). TFMMS allows for automatic data processing for manpower planning and the OMF contains occupational standards and historical information on an individual officer's performance. TFMMS and the OMF combined provide an extensive database to preview future officer requirements. This is done by comparing future Officer Program Authorizations (OPA) programmed billets with future officer inventory. This projection is a key research element because the occupational standards and personal demographics detailed in this

Chapter are linked to the OMF as a source for future sourcing of data in a revised manpower metric.

In addition to the allocation portion of the process, the distribution triad includes Assignment and Placement, as indicated in Figure 7. Assignment involves the slating process of officers through use of their Detailers, and is based on what billets are available. The Placement portion involves an officer being present in an actual billet.

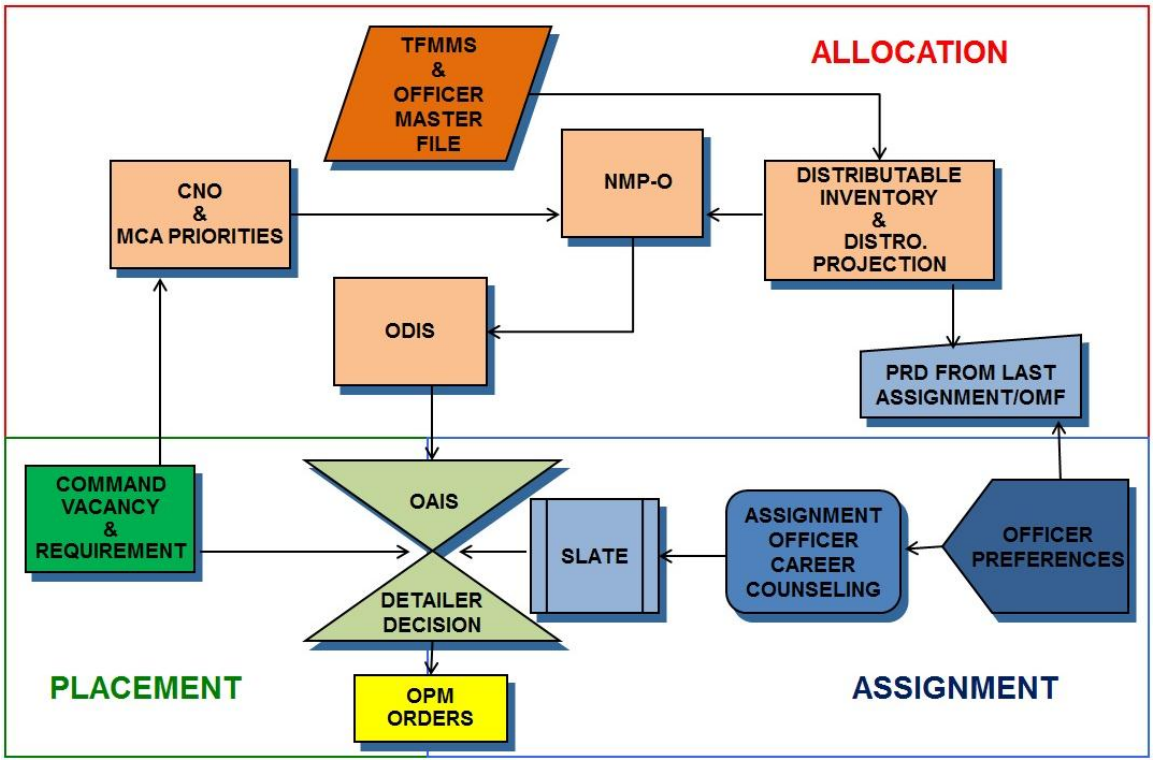

Figure 7. Officer Distribution Process (After CNO, 2007)

1. Officer Assignment Process

The officer assignment process is conducted through multiple, unofficial telephone conversations and emails with officer "Detailers" assigned to the Navy's Personnel Command (PERS) in Millington, Tennessee. The process begins when an officer enters their "slating window." The slating window is when the officer is within a predetermined time period, known as the Projected Rotation Date (PRD), from finishing their current assignment and assuming their new assignment. During the slating window

the officer is presented with a list of billets coming available throughout the Navy for the officer's rank and designator (DESIG).

When a Surface Warfare Officer (SWO) is near the PRD of their First Division Officer or First Department Head tour, they come in to the slating window for deciding a Second Division Officer or Second Department Head tour. The slate lists the billets available to the officer. Once the slate is available, an officer makes their preferences know to the Detailer. This is done through a list that priority ranks jobs (i.e., Operations Officer, Chief Engineer, etc.), locations (i.e., San Diego, Norfolk, etc.), and platforms (i.e., Cruiser, Destroyer, etc.). Once the Detailer's list is complete, it is compared to the other officers in the slating window and they are ranked amongst their peers for available jobs.

This ranking is based on several factors. One of the most important factors, as explained through the conversations with the Detailers, is whether the officer is "Tac Plus" or "Tac Plus Plus." The distinction is dependent on the officer's career path during the slating process. An officer is considered Tac Plus if all the required qualifications (Officer of the Deck letter and Surface Warfare Qualification) and either an Engineering Officer of the Watch (EOOW) letter or a Tactical Action Officer (TAO) letter is obtained in their first tour. In addition, the officer must possess an above average Reporting Senior Cumulative Average (RSCA) and Fitness Report (FITREP) inputs that include hard and soft breakouts. An officer is considered Tac Plus Plus if they have met all the requirements for Tac Plus and have both the EOOW and TAO letters. These are the main qualifications that are evaluated and accessed during the slating process, though other factors may be considered as well. Simply stated, those officers who have more qualifications are ranked higher than those officers who do not have as many qualifications. The Tac Plus consideration in the detailing process for LCS officers in comparison to officers being assigned to standard ships is shown in Figure 8.

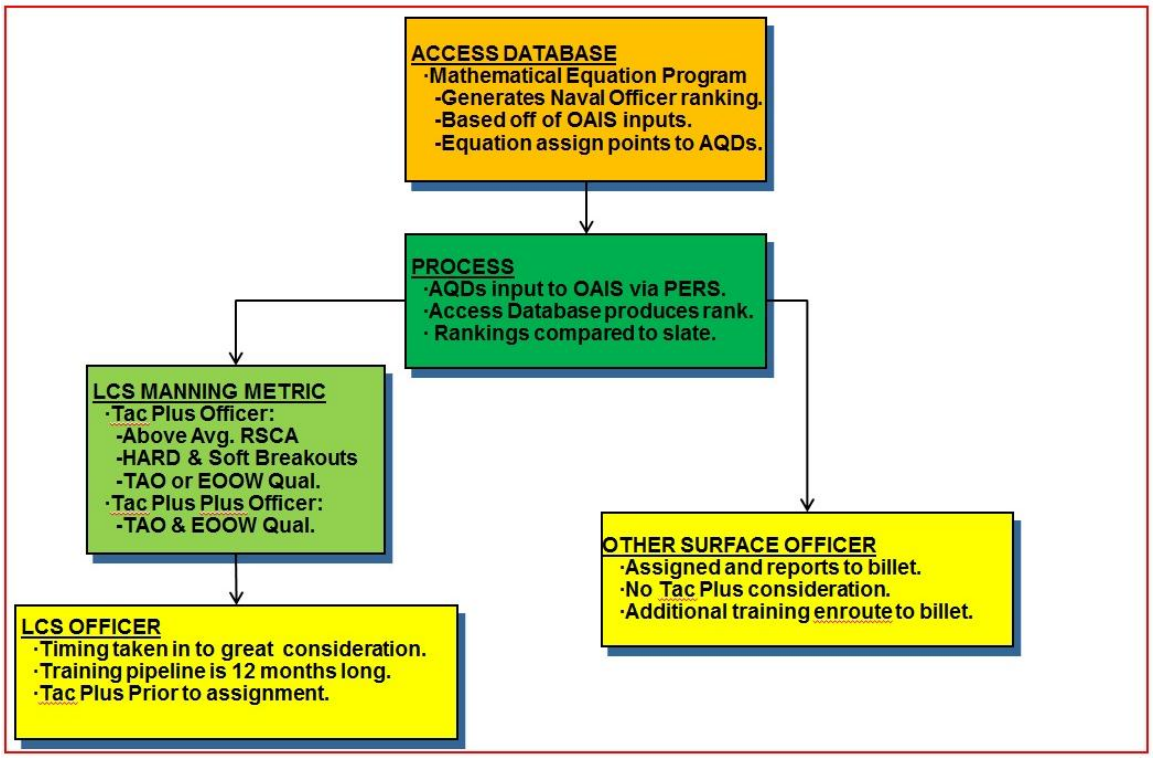

Figure 8. LCS Officer Detailing Process (After CNO, 2007)

Once the officer's qualities are tabulated, a ranking process is conducted for those officers that are in the same slating window. The officer's ranking is matched against their preference so that the "best fit" is made when matching the officer to a billet. Needless to say, not every officer gets their choice of assignments. The detailing process is prioritized in a manner where officers are ranked differently than other officers causing their preferences may work to both of their advantages.

Initially, LCS assignments were conducted on a volunteer basis and only Tac Plus Plus officers were accepted. Now, all officers who want to be assigned to LCS go through the same detailing process as those wanting to go to a Destroyer or Cruiser. Assignment depends on what is available during the slating window, where the officer ranks among their peers, and their preferences.

2. Manpower Composition and Comparison

The quantity of officers required onboard LCS, as prescribed in the Preliminary Ship Manpower Document (PSMD) is eight. These eight officers comprise the entire LCS command and control component while underway and operate its various designed mission states. Once these eight LCS officers have been screened, they are assigned to a Navy Officer Billet Classifications (NOBC) specified in the PSMD. While the PSMD summary is for the sea-frame, it does not include occupational requirements for the various Mission Packages (MP). The ramification of such limited requirements is that there is no consolidation of the specifications required by the LCS sea-frame crew who should be familiar and capable of the multi-faceted missions of the LCS.

It should be understood that a PSMD is not a finalized version of LCS manpower requirements, and that a revised Ship Manpower Document (SMD) should be produced approximately one year after commissioning when major revisions have already occurred (CNO, 2007). The Littoral Combat Ships have been built, tested, commissioned, tested again, and ready to deploy. USS *Freedom* and USS *Independence* have been in commission for more than a year and typically by this time NAVMAC would have completed an analysis and published a final SMD; but so far there has been little official change to the LCS manpower requirements. Currently, no officer requirement exists that is associated with Anti-Surface (SUW), Anti-Submarine (ASW), or Mine Warfare (MIW). While specific occupational standards may not be required because of the embarked personnel in the MP, it remains of major importance that officers, who are ultimately responsible for the sea-frame and its operations, be ready to conduct all primary missions. The more refined the occupational standards, the better prepared the sea-frame and its crew will be to execute its designed capabilities.

In comparison, the SMDs of the Guided Missile Frigates (FFG), Minecountermeasure ships (MCM), and Coastal Minehunters (MHC), the LCS PSMD appears deficient. The issue arises because the nature of the LCS's mission when it assumes the missions of the decommissioning ship classes. Research showed each ship class had manpower requirements that directly related to its assigned missions, which is not reflected in LCS's PSMD.

The FFG includes several primary and secondary NOBCs. Most notably, the FFG requires a Navigator and an Anti-Submarine Warfare Officer (ASWO). In addition to these billets, their respective NOBCs for Navigation and ASW, are not included in the LCS PSMD. Proper navigation is a critical occupational skill on all naval platforms and makes up the very backbone of the surface navy. Similarly, ASW is one of the MPs LCS is to embark. Although it may embark a MP that is geared towards a specific warfare mission, it is important to have sea-frame personnel that understand the mission. This involves the Designators (DESIG), NOBCs, Subspecialties (SSP), and Additional Qualification Designations (AQD) associated with the eight officers that comprise the sea-frame.

In addition to the NOBCs, the FFG SMD lists SSPs and AQDs that are not included in the LCS PSMD. An important SSP is held by the Commanding Officer (CO), 6301 for Undersea Warfare, which is directly related to the Undersea Warfare mission of the FFG. Since the CO is responsible for the ship and its operations, the CO is required to be well versed in the specialty that is a primary mission of the vessel. The CO should be able to rely on the other officers to have the occupational standards that are associated with these missions.

The Combat Systems Officer (CSO) and Chief Engineer (CHENG) also are assigned SSPs for their related fields. The CSO is assigned the 5700 SSP for experience in Combat Systems and the CHENG the 5600 SSP for experience in Mechanical Engineering. The SSPs assigned to these officers is commensurate with the position of authority and responsibility they hold. These SSPs are not directly related to warfare areas, but to the overall operation of the vessel; which is the most integral part of completing any mission.

While the officer complement of the MCMs and MHCs is smaller than the FFG, both classes require NOBCs that are associated with their mission, as well as LCS. These NOBCs are not listed in the LCS PSMD. These NOBCs are for the Navigator, similar to the FFG, but also the First Lieutenant / Minesweeping Officer. The NOBC for this position is similar to the ASWO on the FFG. The mission of the Mine Countermeasure Ships and Coastal Minehunters is Mine Warfare. Particular qualifications are required

for officers who must specialize in more than one warfare area. The same is suitable for LCS where a sea-frame officer would hold an NOBC associated with the MP they represent or embark.

B. CHARACTERISTICS AND OCCUPATIONAL STANDARDS

This section provides individual characteristics and occupational standards used to form a metric to assign officers to the Littoral Combat Ship. These characteristics and standards may also be used to predict officer performance.

1. *Marital Status*

The marital status characteristic may consist of "married," "single," or "other," where "other" is defined to include separated, divorced, or widowed/widower. Marital status can have a perceived effect on overall performance or motivation of the officer. If an officer is happily married, the officer may be more productive in a variety of ways. Conversely, if the officer is not happily married, then performance may deteriorate. Controlling for marital status is important because it can either directly impact productivity or be correlated with other officer characteristics or job characteristics that may impact productivity and success on the ship.

2. Children

Similar to marital status, having children may influence the performance of an officer. The effect may be positive or negative depending on how children affect the officer's performance. While having a child is considered a joyful event by society, it does not mean that parents do not have their own trials and tribulations with children. Newborns require around the clock attention which may result in fatigue. Fatigue can greatly hamper performance in the work place. If parents are having a difficult time with their children then it can cause a person to refocus their priorities. Conversely, people may work even harder to make sure they perform well which will help ensure job security that directly benefits a child. This characteristic would allow a researcher to determine whether the existence of a dependent has an effect on performance after controlling for other variables.

3. Race

Another demographic characteristic that should be used as a control variable in an analysis is race. It is possible that performance, motivation, or other measures of success may vary with race. Race is a frequently examined variable in the military that needs to be examined to determine the diversity by service. A statistical analysis would show what race percentages comprise the Surface Warfare community and the distribution of where these officers serve. This information would allow decision makers to gather important insights in how to incentivize officers to join and future career paths.

4. Education

The education characteristic may distinguish between those who have received a Bachelor of Arts and Bachelor of Science degree. Type of degree is important to observe in order to determine if performance of a particular job on the ship differs across disciplines. It could provide information on which type of educational degree may be more sought after for a Surface Warfare Officer being assigned to LCS. Midshipman, regardless of academic major are required to take courses in Calculus and Calculus-based Physics. This requirement alone exhibits a strong preference for mathematics and science skills as they pertain to the naval service.

Additionally, it would be useful to observe if the officer has continued their education in the form of a Master's degree or any other type of follow-on education. One might expect that the physical degree does not have a large effect on officer performance in the division officer tours, but may be more important as an officer advances in seniority. However, the importance may only be prominent depending on what billet the officer is assigned. For example, a Chief Engineer may fair better with a technical background, while an Operations Officer may be indifferent to type of background. The purpose of including additional educational variables is to determine if higher education should be a requirement for future officers. One might expect that a Master's Degree or other type of education beyond undergraduate degree will assist an officer in performance because education is being advanced past what is initially required.

5. Commissioning Source

The commissioning source characteristic was chosen to determine if there is a difference in officer performance. The sources of commissioning are the United States Naval Academy (USNA), Reserve Officer Training Course (ROTC), or Officer Candidate School (OCS).

Officers graduating from the Naval Academy have typically gone through a rigorous four years of naval indoctrination and advanced studies that incorporate a basic understanding in mathematics, physics, naval history, and maritime principles. Naval Academy graduates are typically 22 to 23 years of age, indicating that they advanced straight from high school in to the rigors of Annapolis. However, as evident in recent years, there has been an increase of prior service members commissioning from the Academy, meaning that they served as an enlisted person before seeking an officer's commission.

Graduates from ROTC are similar to USNA graduates wherein the majority are 22 to 23 years old. What separates ROTC from the Academy is that the USNA students live a "normal" college life where their only obligation to the military, during their college tenure, is to where a uniform once or twice a week and take part in Naval Science courses, which builds the foundation for their military service. ROTC students are physically and mentally trained in to the maritime lifestyle, but not to the extent of Academy students. Additionally, a larger percentage of ROTC graduates may have been prior service, or be older in age when graduating. OCS graduates vary in age and background. Some have spent time as enlisted service members and are commissioned through various programs such as OCS. Others are college aged students that had a standard college experience that did not include ROTC or any type of military training or orientation. These graduates only know what they learn at OCS before being sent to their first assignment and may have a relatively high learning curve than those that had been enlisted, graduated ROTC, or graduated from the Naval Academy.

There could be varied expectations when it comes to the commissioning source characteristic. Graduates from the Naval Academy will have received the most training

when it comes to the basics of being an officer, as well as an introduction to navigation and seamanship. For four years they will have learned the ins and outs of naval heritage. They will be expected to rise above their peers once commissioned and to be able to functionally perform when first reporting to their duty station. It would not be surprising if those who were commissioned through the Naval Academy are stronger performers on the ship in comparison to ROTC and OCS graduates. However, ROTC carries a wide-variety of commissioned persons that can have certain attributes that are more favorable than Academy graduates. Additionally, OCS graduates may have years of experience in enlisted service that serves as a vital guide to a newly commissioned officer. Therefore it would be important to distinguish how the commissioning source impacts performance.

6. Prior Tours

The prior tours characteristic could provide information on how the differences in previous assignment to Weapons, Combat Systems, Engineering, Operations, and Executive Departments has an effect on future performance on the LCS. This is an extremely important characteristic because an officer would, theoretically, perform better in a billet that the officer is already familiar. If an officer had served as a Strike Warfare Officer (which is in Combat Systems Department) during a First Tour Division Officer billet, then it may be wise to assign that officer to a Fire Control Officer (Combat Systems Department) billet during a Second Tour Division Officer billet. This would allow for continuity between assignments in the same warfare area which would hopefully help with performance. Conversely, if an officer did not perform well in an earlier billet, it may be wise to transfer them from one department in to a billet in a different department.

The LCS officer billets are Commanding and Executive Officers, Department Head (Operations, Combat Systems, and Engineering), and Division Officer (composed of Junior Officers). All of these Department Head billets are held on other platforms with a wide variety of billets occurring at the Junior Officer level across the multiple ship classes.

For Weapons and Combat Systems Departments, an officer may have served in a variety of related billets such as Gunnery Officer, Anti-Submarine Warfare Officer, Minesweeping Officer, or as the lead in the department as the Weapons Officer or Combat Systems Officer. The weapon systems found on the LCS are quite advanced in comparison to the ships it is replacing. The other platform that is most similar in technology to the LCS are the AEGIS Cruisers and Destroyers.

Engineering department revolves around the type of engineering plant. The LCS has a combined gas turbine and diesel engine propulsion. These types of propulsion systems are also found on other platforms which provide a smooth transition among similar systems.

Similar to Engineering, Operations and Executive Departments play similar roles on the other types of platforms in the Navy. Operations tends to deal with the day to day scheduling of the ship while Executive Department will make up the administrative portion of a ships day to day operation.

7. Prior Platform

The prior platform variable is examined because of the different responsibilities and abilities that each class possesses and what they are expected to retain in regards to technologies and capabilities. It would be useful to determine whether prior platforms predict success of an officer on the LCS. Furthermore, it is important to understand how demographic and job characteristics of officers on prior platforms contributed to their past success and how that success might transfer over to the LCS.

The most advanced ships that officers may have served on prior to the LCS are the *Nimitz*-class aircraft carriers and the AEGIS platforms that include the *Ticonderoga*-class cruisers and *Arleigh Burke*-class destroyers. These ships contain the most sophisticated technology in the modern day fleet; they also have the largest roles for naval seapower. Some officers may have previously served on the platforms that the LCS is set to replace. These include the *Oliver Hazard Perry*-class guided missile frigates, *Osprey*-class Coastal Minehunters, and *Avenger*-class Mine Countermeasures ship. These officers will have been exposed to the missions that the LCS is designed to

execute: surface warfare, submarine warfare, and mine warfare. Similar to these classes in size, maneuverability, and mission is the *Cyclone*-class Patrol Coastal (PC). Like MCMs and PCs, it is envisioned that hull swapping will be at the core of LCS manpower.

Other Surface Warfare platforms are the amphibious ships, or commonly referred to as "Gators." Gators encompass different missions than those previously mentioned. These missions mainly include support to Marine Corps operations, as well as humanitarian aid and non-combat evacuations. The main types of ships are Amphibious Assault Ships (LHA/LHD), Amphibious Command Ships (LCC), Amphibious Transport Docks (LPD), and Dock Landing Ships (LSD). The LHA/LHD resemble smaller carriers and are used for transport of helicopters and vertical take-off aircraft such as Harrier jets. The LCC are used for just as the name implies, command and control. LPDs and LSDs are used to transport larger quantities of vehicles. All of these amphibious ships have large crews and bear little resemblance to the LCS or any of the ship classes the LCS is set to replace.

8. Service Area (Homeport)

Similar to the differences between ship platforms, the location of where an officer served may affect their level of experience. This job characteristic may provide insight into different levels of operational capacity or speed of operational tempo that an officer may be associated.

Officers that have served on ships home-ported in Japan and Hawaii are accustomed to a very high operational tempo. The majority of their operations support regional security in the vicinity of China and North Korea.

Conversely, the areas of San Diego/Washington and Norfolk/Mayport, the respective west coast and east coasts bases, are used to a more structured operational tempo where their ships are only underway for training cycles and the regularly scheduled deployment. These officers may have only short-noticed sortied for a hurricane or natural disaster relief, wherein officers from Japan/Hawaii expect and/or are sortied regularly. The differences between these areas may be important depending upon the type of operational tempo the LCS is going to be assigned. The LCS optempo may be

based on where the ships are located, as well as what type of demand there is for their platform capabilities. Those officers that are used to a high operational tempo may be better suited on an LCS of similar tempo, as would an officer who is use to a structured optempo on a similarly assigned LCS.

9. Naval Officer Qualifications

Naval Officer Billet Classifications (NOBC), Subspecialties, and Additional Qualification Designation (AQD) are possible variables that cover the universal qualifications that are associated with all Naval Officers. They are defined in the *Manual of Navy Officer Manpower and Personnel Qualifications* and are annotated in a Ship's Manpower Document as to what is expected of the officers to have as qualifications when assigned to the platform. It is these qualifications and how officers function in them that may have a large impact on how successful and competent they are during their assignments to billets. These are the types of characteristics and how the officers handle them that need significant consideration when an officer is considered for future assignments.

10. Officer Performance and Measurement

The following information is in regards to those systems used to measure Officers performance against their peers. These three different variables may be useful when it comes to assigning officers to a billet, especially on LCS, because it can possibly be seen as to how successful and officer may have been when the information was reported. This is what is to be focused on if the manning metric is changed from its current format in to one that takes in to consideration the past performances and rankings of themselves, by their superiors, amongst their peers. These variables are the "Officer Trait Average," and "Reporting Senior Cumulative Average."

a. Officer Trait Average

The Officer Trait Average (OTA) refers to the Member Trait Average section of the Fitness Report. This is where the different rankings that the Reporting Senior has assigned to the officer and are averaged to be compared against the other

officers. The average may fall anywhere between 1 and 5, with 1 signifying the lowest grade and 5 signifying the best grade. According to the Bureau of Personnel (BUPERS) Instruction 1610.10C: Navy Performance Evaluation System, "the performance trait grade of 3.0 represents performance to full Navy standards" (2011). The importance of this average is that it shows where the officer stands in performance capabilities and accomplishments in comparison the officer's peer.

b. Reporting Senior Cumulative Average

The OTA is coupled with the Reporting Senior Cumulative Average (RSCA) because the RCSA is what the OTA is compared to. Every reporting senior has an RSCA that "travels" with them throughout their reporting career. So, the OTA is not only compared to current peers, but also all those in that rank that the reporting senior has rated in the average. This RSCA can be compared to a unit of measurement as what they reporting senior believes to be his or her performance bar. If the rated officer is performing above the RSCA, than he or she is performing above the average, and vice versa rated below the average.

c. Promotion Status

The Promotion Status of an officer is decided by the Reporting Senior and annotated on the FITREP. This status allows for a review board to see if the officer has been regarded and recommend for promotion, an important aspect of the FITREP. The Promotion Status on the FITREP consists of a five grade range. The first two are the most un-desirable and are for those that are underperforming. The third is for officers that are deemed "Promotable." They are considered to be right in the middle of the population, and for Junior Officers, this is the only rating they will receive in their first four years of commissioned service. The next two ratings, "Must Promote" and "Early Promote," are the most sought after as these are for the top performers. Only a certain amount of the officer may receive one of these two ratings. Receiving one is based on the cumulative power of everything else on the FITREP, including the Member Trait Average in comparison to the Reporting Senior Cumulative Average.

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

The Littoral Combat Ship (LCS) was developed to be capable of countering multiple near shore threats with a proposed sea-frame crew of only forty personnel and an embarked Mission Package (MP). The LCS's design and brown-water objectives are becoming main-stream after decades of open-ocean operations.

The ship's sea-frame crew has a rotational crew; one crew is relieved by another so that the sea-frame may spend more time in an operational status. The MPs that will be embarked on each variant will enable different detachments with different missions to operate in the realms of Anti-Submarine, Anti-Surface, and Mine Warfare. These single-ship operators will encompass the same missions as the *Oliver Hazard Perry*-class Guided Missile Frigates (FFG), *Avenger*-class Mine Countermeasure (MCM) ships, and *Osprey*-class Coastal Minehunters (MHC).

A thorough literature review and a historical overview examined the manpower requirements and occupational standards across these different platforms and provided a cross comparison to LCS. Concurrently, the manning metric used to assess and determine officer placement was reviewed.

The LCS Preliminary Ship Manpower Document (PSMD) was compared to the Ship Manpower Document (SMD) of the Guided Missile Frigates (FFG), Minecountermeasures ships (MCM), and Coastal Minehunters (MHC). The comparison examined Navy Officer Billet Classifications (NOBC), Subspecialties (SSP), and Additional Qualification Designations (AQD) from the SMDs of the FFGs, MCMs, and MHCs.

Several variables outside of occupational standards such as marital status, children, and race, were examined to better understand their effect on future performance. Occupational standards were examined because some of them are the actual characteristics that are used to determine success; and some are those that should be included in future models.

The detailing process was examined although a standard operating procedure did not exist. The process involved a simple procedure that was explained in Chapter IV and included a ranking of officers compared to open officer billets, at a given time. While LCS had certain resources reserved for it in its initial stages, it has become similar to other combatants to when it comes to the assignment of officer manpower.

B. CONCLUSIONS AND RECOMMENDATIONS

1. What significant differences exist from the transition of prior ship classes to the LCS in regards to manpower qualifications and characteristics?

a. Conclusion

The qualitative analysis of the manpower assigned to the Littoral Combat Ship (LCS) confirms a shortage of officers. Eight officers stand the Command and Control watches and support a watch rotation of five hours on and ten hours off, or "five and dime." The Surface Navy is accustom to overworking officer watch standers IAW policy, as evidenced by the increasingly smaller crew sizes across all surface ships.

The current officer requirements does not support vertical mentorship or increase fleet experience, meaning that those Junior Officers who stand the Officer of the Deck watch will only have time for that watch and their administrative duties.

These differences in manpower from the FFGs, MCMs, and MHCs are quite significant from the Littoral Combat Ship. Some of these differences are to be expected because of monetary pressure to decrease manpower. Nevertheless, this decrease should not come at the cost of experience and reliability. The LCS should incorporate the mission focus areas from the previous ship classes. This should be conducted through the NOBCs, SSPs, and AQDs. These may be assigned to the officer complement already on board, or to new officer that may become an addition in future SMDs. Regardless, the number of officers will remain smaller than a FFG and be comparable to the MCMs and MHCs.

b. Recommendation

Increase the number of 1110 officer requirements on LCS. Additional officers should be placed on the Littoral Combat Ship and be annotated on the SMD whenever it occurs. The Program Executive Office and PERS-41 in the Bureau of Personnel is responsible for the initial billets and assignments to them. The Navy Manpower Analysis Center (NAVMAC) is responsible for the SMD.

2. What officer characteristics and rankings may the Navy use when assigning an officer to a LCS platform, based on historical and ship-specific requirements, and how may the assignment be applied?

a. Conclusion

The NOBCs, SSPs, and AQDs are the occupational standards that define the officers of the vessels. Additionally, how an officer performs in prior billets presents a forecast of how they may perform in future assignments. The Officer Trait Average, Reporting Senior Cumulative Average, and Promotion Status also provide a review of the officer and their professional characteristics and performance. These averages and status are important attributes that are tracked in the same format throughout the Navy and provide level comparisons.

The current manning metric does not consider many of the characteristics when assigning officers to billets. Yet, these characteristics may yield important information when comparing the officer profile to the billet requiring a qualified officer.

The officer characteristics and occupational standards contained in this thesis are meant to provide an alternative way to look at what can be included in the officer assigning metric. In order to determine whether these characteristics and standards are significant, a quantitative study needs to be conducted.

Access to both personal and professional files for the officers that have served on the LCS would have to be granted through the Bureau of Personnel in Millington, TN.

b. Recommendation

Have PERS-41 assemble characteristic data as examined in this research to develop a more refined approach to placement and assignment of officer onboard LCS.

3. When were LCS manpower requirements last reviewed by Navy Manpower Analysis Center?

a. Conclusion

This research concludes neither officer or enlisted requirements have been reviewed in a manner customary with other deployable forces IAW OPNAVINST 1000.16K.

b. Recommendation

Recommend CNO N1 direct manpower review to develop first SMD.

C. FURTHER RESEARCH

This study has been mainly qualitative in nature. Quantitative study should be conducted that includes data on the variables described in Chapter IV. A quantitative study would provide empirical evidence on which job characteristics or personal demographics are important to consider when assigning officers to the LCS. This information could prove vital in the assignment of officers and how well they will perform on a given platform.

This type of research does not have to be necessarily conducted on officers or LCS. It may be altered to include any other type of naval platform or group of personnel. The organizations who determine the manpower for these types of platforms and the interests of those who operate these platforms would be essential in order to conduct a more rigorous quantitative analysis. Information must be made available so that proper research can be conducted in a timely and efficient manner. The Naval Postgraduate School could work more closely with the Navy's Personnel Command in Millington, Tennessee and search out Surface Warfare stakeholders.

APPENDIX A. LOCKHEED MARTIN LCS 1 HULL TYPE EQUIPMENT DESCRIPTION

Power	Equipment
Generation	Isotta Fraschini Diesel Generator (4)
Propulsion	Rolls Royce Gas Turbine MT-30 (2) FM 16 PA6BSTC Diesel Engine (2) Kamewa Propulsor LJ146 Series Waterjet (4)
Communication/Sensors	Equipment
Exterior Communications	HF, VHF, TCDL, Link 16, CBSP (LCS 1 only), UHF, TACAN, JTIDS, WSC-6 SHF SATCOM (LCS 3 and follow-on hulls)
Command & Control	Total Ship Computing Environment (TSCE), COMBATSS-21
Above Water Sensors	EADS TRS-3D/16 Radar, UPX-29 IFF, DORNA Integrated Gun Fire Control System (GFCS)/ Electro Optical (EO) Sight System, (BAE FCS-57 GFCS for LCS 5 and follow on Hulls) WBR-2000
Navigation Sensors	Global Positioning System (GPS), X/S Band Navigation Radar, BridgeMaster E ARPA
Weapons and Ordnance	Equipment
Armament	Rolling Airframe Missile Guided Missile Weapon System, Bofors MK 110 57 mm Gun, Terma Soft Kill Weapon System (SKWS) Decoy Launching System (ALEX Decoy Launching System for LCS 5 and follow-on hulls)
Crew	General Outfitting
Accommodations-Permanent	76
Characteristic	Dimension
Length Overall	115.3 m
Beam Overall	17.5 m
Draft	4.1 m
Displacement	3292 MT
Sprint Speed	~40 KTS
Range at Sprint	<900 NM
Range at Economical	~3500 NM

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APPENDIX B. GENERAL DYNAMICS LCS 2 HULL TYPE EQUIPMENT DESCRIPTION

Power	Equipment
Generation	MTU 8V396TE54 Diesel Generator (4)
Propulsion	LM2500 Gas Turbine (2) MTU 20V8000M71 Diesel (2) Wartsila-LIPS LJ150E (2) & LJ160E (2) Waterjets Thrustmaster Diesel/Hydraulic Retractable Thruster with MTU 8V396TE54 Diesel
Communication/Sensors	Equipment
Exterior Communications	HF, SHF, UHF,VHF, TCDL, Link 11/16
Command and Control	Integrated Combat Management System (ICMS)
Above Water Sensors	Sea Giraffe Radar, Sperry Marine BridgeMaster E, EDO ES 3601, Sea Star SAFIRE III EO/IR
Navigation Sensors	Global Positioning System
Weapons and Ordnance	Equipment
Armament	SeaRAM, Bofors MK 110 57 mm Gun, ALEX Decoy Launching System
Crew	General Outfitting
Accommodations-Permanent	76
Characteristic	Dimension
Length Overall	127.6 m
Beam Overall	31.6 m
Draft	4.3 m
Displacement	3104 MT
Sprint Speed	~40 KTS
Range at Sprint	1117 NM
Range at Economical	3500 NM

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APPENDIX C. NAVY FACT FILE FOR *OLIVER HAZARD PERRY*-CLASS GUIDED MISSILE FRIGATE

Description

Frigates fulfill a Protection of Shipping mission as Anti-Submarine Warfare combatants for amphibious expeditionary forces, underway replenishment groups and merchant convoys.

Background

Guided missile frigates are short range anti-air warfare capable using their Phalanx Close-In Weapon System. Designed as cost efficient surface combatants, they lack the multi-mission capability necessary for modern surface combatants faced with multiple, high-technology threats. They also offer limited capacity for growth. The Surface Combatant Force Requirement Study does not define any need for a single mission ship such as the frigate and there are no frigates planned in the Navy's five-year shipbuilding plan.

General Characteristics

- Date Deployed: 17 December 1977 (USS Oliver Hazard Perry)
- Propulsion: Two General Electric LM 2500 gas turbine engines; 1 shaft, 41,000 shaft horsepower total.
- Length: 445 feet (133.5 meters); 453 feet (135.9 meters) with LAMPS III modification.
- Beam: 45 feet (13.5 meters).
- Displacement: 4100 to 4,300 long tons full load (4165. 8 to 4,369 metric tons)
- Armament: Six MK-46 torpedoes(from two triple mounts); One 76 mm (3-inch)/62 caliber MK 75 rapid fire gun; One Phalanx close-in-weapons system
- Speed: 29+ knots
- Crew: 17 officers and 198 Enlisted
- Aircraft: Two SH-60 (LAMPS III) or One SH-2 (Lamps Mk-I) in FFG 9-19, 30, 31.

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APPENDIX D. NAVY FACT FILE FOR *AVENGER*-CLASS MINE COUNTERMEASURES SHIP

Description

Ships designed to clear mines from vital waterways.

Background

Avenger-class ships are designed as mine sweepers/hunter-killers capable of finding, classifying and destroying moored and bottom mines. These ships use sonar and video systems, cable cutters and a mine detonating device that can be released and detonated by remote control. They are also capable of conventional sweeping measures. The ships are of fiberglass sheathed, wooden hull construction.

General Characteristics

- Date Deployed: Sept. 12, 1987 (USS Avenger)
- Propulsion: Four diesels (600 horsepower each), two shafts with controllable pitch propellers.
- Length: 224 feet (68.28 meters).
- Beam: 39 feet (11.89 meters).
- Displacement: 1,312 tons (1,333.06 metric tons) full load.
- Speed: 14 knots (16.1 mph, 25.76 kmph).
- Crew: 8 officers, 76 enlisted.
- Armament: Mine neutralization system. Two .50 caliber machine guns.

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APPENDIX E. NAVY FACT FILE FOR *OSPREY*-CLASS COASTAL MINEHUNTER SHIP

Description

Ships designed to clear mines from vital waterways.

Background

Osprey-class ships were mine hunter-killers capable of finding, classifying and destroying moored and bottom mines. The MHC 51 had a 15-day endurance and depends on a support ship or shore based facilities for resupply. These ships use sonar and video systems, cable cutters and a mine detonating device that can be released and detonated by remote control. They are also capable of conventional sweeping measures. The ships' hulls are made of glass-reinforced plastic fiberglass. They were the first large mine countermeasures ships built in the United States in nearly 27 years.

General Characteristics

- Date Deployed: 20 Nov 1993 (USS Osprey)
- Propulsion: Two diesels (800 hp each); two Voith-Schneider (cycloidal) propulsion systems
- Length: 188 feet (57.3 meters)
- Beam: 36 feet (11 meters)
- Displacement: 893 tons (907.33 metric tons) full load
- Speed: 10 knots (18.4 kmph)
- Crew: 5 officers, 46 enlisted
- Armament: Two .50 caliber machine guns, Mine Neutralization System and other mine countermeasures systems

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