

**Transforming Coalition Naval Operations by
Utilizing Human Systems Integration to
Reduce Warship Manning**
*Lessons Learned from the United States Navy
DDG-51 Class Warship Reduced Manning Study*

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Transforming Coalition Naval Operations by Utilizing Human Systems Integration to Reduce Warship Manning

- Shipboard Manning Challenges – One Perspective
- HSI Discipline – What It Brings to the Table
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“The major institutions of American National Security were designed in a different era to meet different requirements. All of them must be transformed.”

President George W. Bush

“To change anything in the Navy is like punching a feather bed. You punch it with your right and you punch it with your left until you are finally exhausted, and then you find the damn bed just as it was before you started punching.”

President Franklin Delano Roosevelt

Shipboard Manning Challenges One Perspective

“The main focus of my fifth year as CNO, aside from immediate operational actions in the GWOT will be to build a 21st Century human capital/human resource strategy – this is the most important step in Navy transformation.”

**Admiral Vern Clark
Chief of Naval Operations**

Shipboard Manning Challenges One Perspective

- Personnel Costs rising across the U.S. DoD
- Costs for personnel approach 2/3 of DoN budget
- Manning is the “Sweet spot for naval transformation”
- Smaller, more capable crews – transformation agent
- U.S. DoD budget seeking manpower savings
- Desired USN manpower savings well short of goal

Shipboard Manning Challenges

One Perspective - TOC

- Since 1985 the Navy's Total Operating Budget has declined by approximately 40% and ship count by over 45%; however, the Operations and Support (O&S) costs have remained almost constant during this same period. O&S costs include personnel, maintenance, consumables and sustaining support. Navy leaders have determined that the reduction of O&S costs is crucial to recapitalize and modernize the Navy.
- In recent years there has been increased emphasis placed on understanding ownership costs throughout the life cycle of all weapons systems. Total Ownership Cost (TOC) includes all cost associated with research, development, procurement, operating and logistics support, and the ultimate disposal of an individual weapon system.

Shipboard Manning Challenges

One Perspective - TOC

- Reduction of manning on ships is a primary focus of the ownership approach because personnel costs comprise over 50% of O&S costs. In recognition of this, Navy has mandated that future ship Classes will be manned by significantly smaller crews. The projected DD(X) manning levels of 95-175 people will require a ship design process that begins with a zero-based manning concept and uses Human System Integration (HSI) as an integral part of the system design process. It is projected that the final ship design will achieve performance, risk and TOC objectives with an optimally manned crew.

Shipboard Manning Challenges

One Perspective - TOC

- The process to evaluate the Return on Investment (ROI) and the TOC impact for manning reduction initiatives is difficult. This is primarily driven by the stovepipe manner in which funding is provided for procurement and the O&S costs of personnel, maintenance and support.
- Manning reduction initiatives must be evaluated using a TOC approach where “color” of money and traditional funding methods are not an issue. The discriminator must be *total savings to the Navy*.

“Unless the Navy more consistently applies human systems integration early in the acquisition process and establishes meaningful goals for crew size reduction, the Navy may miss opportunities to lower total ownership costs for new ships, which are determined by decisions made early in the acquisition process. For example, the Navy has not clearly defined the human systems integration certification standards for new ships.”

**U.S. General Accounting Office
June 2003**

HSI Discipline

What It Brings to the Table

“You don’t build a ship and then put men on it. You build a ship around the human when you start it. The man/machine interface becomes critical. And at the same time on every program that we are developing with NAVSEA’s arena of influence, we’re going to use this as a gauge to say; is that program properly addressing the human system integration requirement? And so this organization will examine how we have captured the features for human systems integration in whatever we’re doing.”

Vice Admiral Phil Balisle

Commander, Naval Sea Systems Command

HSI Discipline

What It Brings to the Table

- HFE – Human Factors Engineering
- Manpower and personnel
- Training
- Health and safety
- Personnel survivability
- Habitability considerations

HSI Discipline

What It Brings to the Table

- HSI Policy and Process Coordination
- Application of HSI to Total Ownership Costs
- Fleet Support of HSI efforts
- HSI information technology
- Common HSI Functions and Programs
- HSI workforce training

U.S. Navy Shipboard Manning Initiatives

“Failure to incorporate human systems integration approaches can only lead to increasing manpower costs in the future that will threaten the ability of the Department to sustain the transformation, readiness and investment priorities we have established.”

**Assistant Secretary of the Navy for
Manpower and Reserve Affairs**

U.S. Navy Shipboard Manning Initiatives

- Smart Ship Initiatives
- Sea Swap Initiatives
- DD(X) “Family of Ships” (LCS, DD(X), CG(X))
- DDG-51 Reduced Manning Study

DDG-51 Class Warship Reduced Manning Study

“We will spend whatever it takes to equip and enable our sailors, but we do not want to spend one extra penny for manpower we do not need...We want to leverage technology to improve performance and minimize manpower costs.”

**Admiral Vern Clark
Chief of Naval Operations**

DDG-51 Class Warship Reduced Manning Study

- Commissioned by Naval Sea Systems Command
- Senior investigators with broad navy experience
- Year-long study touched all facets of USN
- Sought “achievable” not just “hypothetical” solutions



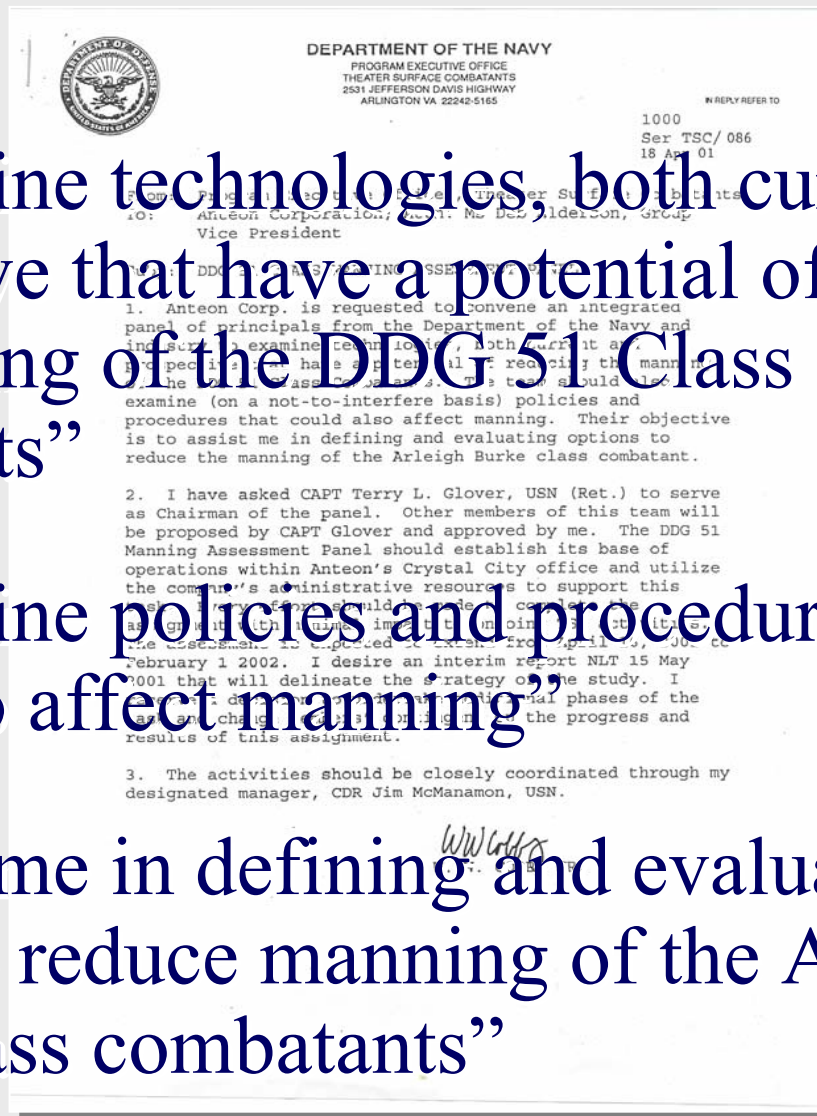
DDG 51 REDUCED MANNING STUDY PHASE I THE CONCEPT



EXECUTIVE ASSESSMENT

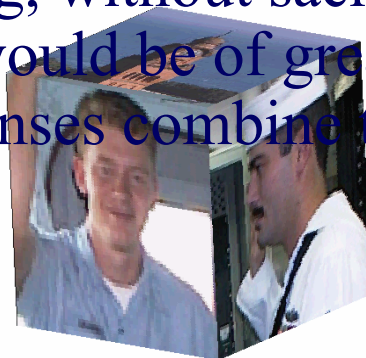
CHARTER

- “... examine technologies, both current and prospective that have a potential of reducing the manning of the DDG 51 Class combatants”
- “... examine policies and procedures that could also affect manning”
- “...assist me in defining and evaluating options to reduce manning of the Arleigh Burke Class combatants”



BACKGROUND

- The manpower authorization for the DDG 51 Class combatant has changed very little since the introduction of the lead ship (USS ARLEIGH BURKE). In the decade since DDG 51 was commissioned, there have been major improvements in several areas that lead one to believe that a reduction in manpower for DDG 51 Class combatants is achievable.
- In the current post-Cold War era of down-sizing and reduced budgets, the Navy, tasked with new and expanded missions, is expected to meet world wide CINC requirements with fewer assets. In this climate, approaches to reduced ship manning, without sacrificing readiness or jeopardizing mission, would be of great benefit inasmuch as manpower-related expenses combine to consume over 50% of the budget.



TASK

...convene an integrated panel of principals from the Department of the Navy and industry to examine technologies, both current and prospective, that have a potential of reducing the manning of the DDG 51 Class combatants. The team should also examine policies and procedures that could also affect manning. Their objective is to assist in defining and evaluating options to reduce the manning of the ARLEIGH BURKE Class combatant.

EXPECTATIONS

- Identification of actions, initiatives, and changes to policy that can be taken today at low cost and result in near term savings.
- There are procedures and technology that need to be prototyped now to ensure preparedness for the introduction of a new generation of warfighting ships that will be manned at unprecedented levels.
- Identification of those technologies that, if fielded, could result in additional manpower savings and technologies that could be prototyped in a new DDG 51 ship design by 2004.

CURRENT MANPOWER AUTHORIZATION

DDG 51... AS IS

ENGINEERING
68

SUPPLY
60

COMBAT SYSTEMS
93

MEDICAL
3

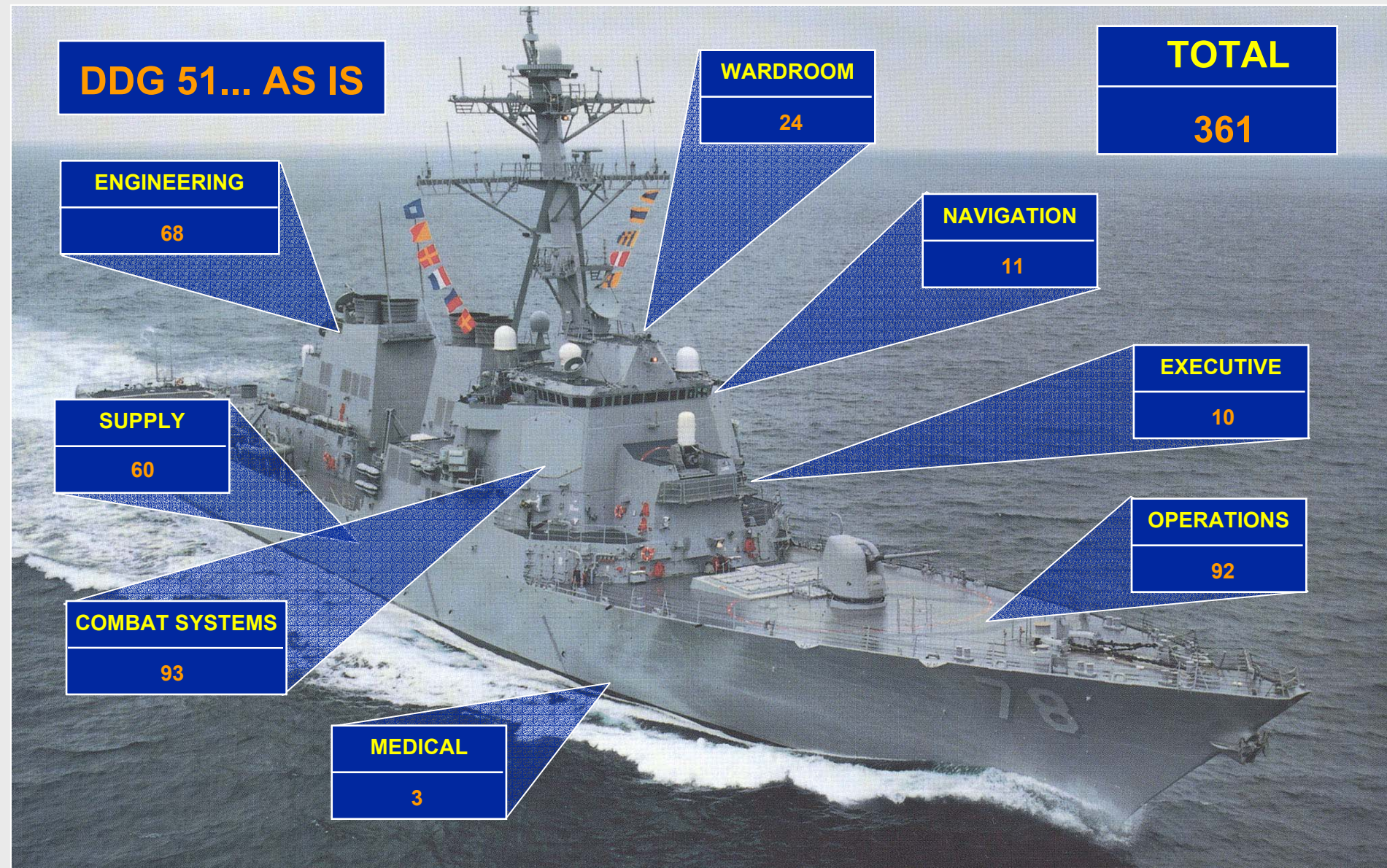
WARDROOM
24

NAVIGATION
11

EXECUTIVE
10

OPERATIONS
92

TOTAL
361



CONCEPT



- Numerous, prestigious studies have repeatedly struck the same common chords:
 - Change requires strong top down leadership to effect
 - Shore support must supplement reduced manned crews
 - Multiple, overlapping watch stations need to be eliminated
 - The approach to Damage Control is critical to any significant reductions
 - Policy and culture changes are necessary to implement significant reductions
 - Personnel distribution system must be able to provide 100% of required manning
 - Training infrastructure must be able to provide fully ready or nearly so personnel/teams
 - In port workload largely not captured/understood
 - Bandwidth funding limitations must be solved to provide distance support

- Human Systems Integration is a recognized analysis and design methodology used to optimize ship manning at lowest total ownership cost (TOC). HSI requires human centered man / machine interface consideration during the entire design process. HSI is a keel-up process.
- Billets are determined by a zero-based review of workload, captured through a functional human / machine decomposition of relevant tasks and functions. HSI task / function analysis enables an accurate accounting of total ship workload that is assigned to machines, crew and shore support.

POSSIBLE MANNING REDUCTIONS

CURRENT STATUS
NEAR TERM – LOW COST/LOW RISK
MID TERM – HIGHER RISK
LONG TERM – FUTURE TECHNOLOGY INVESTMENT

TOTAL

361/256/234/217

WARDROOM

24/22/22/22

NAVIGATION

11/5/4/4

EXECUTIVE

10/1/1/1

OPERATIONS

92/56/49/40

ENGINEERING

68/55/52/49

SUPPLY

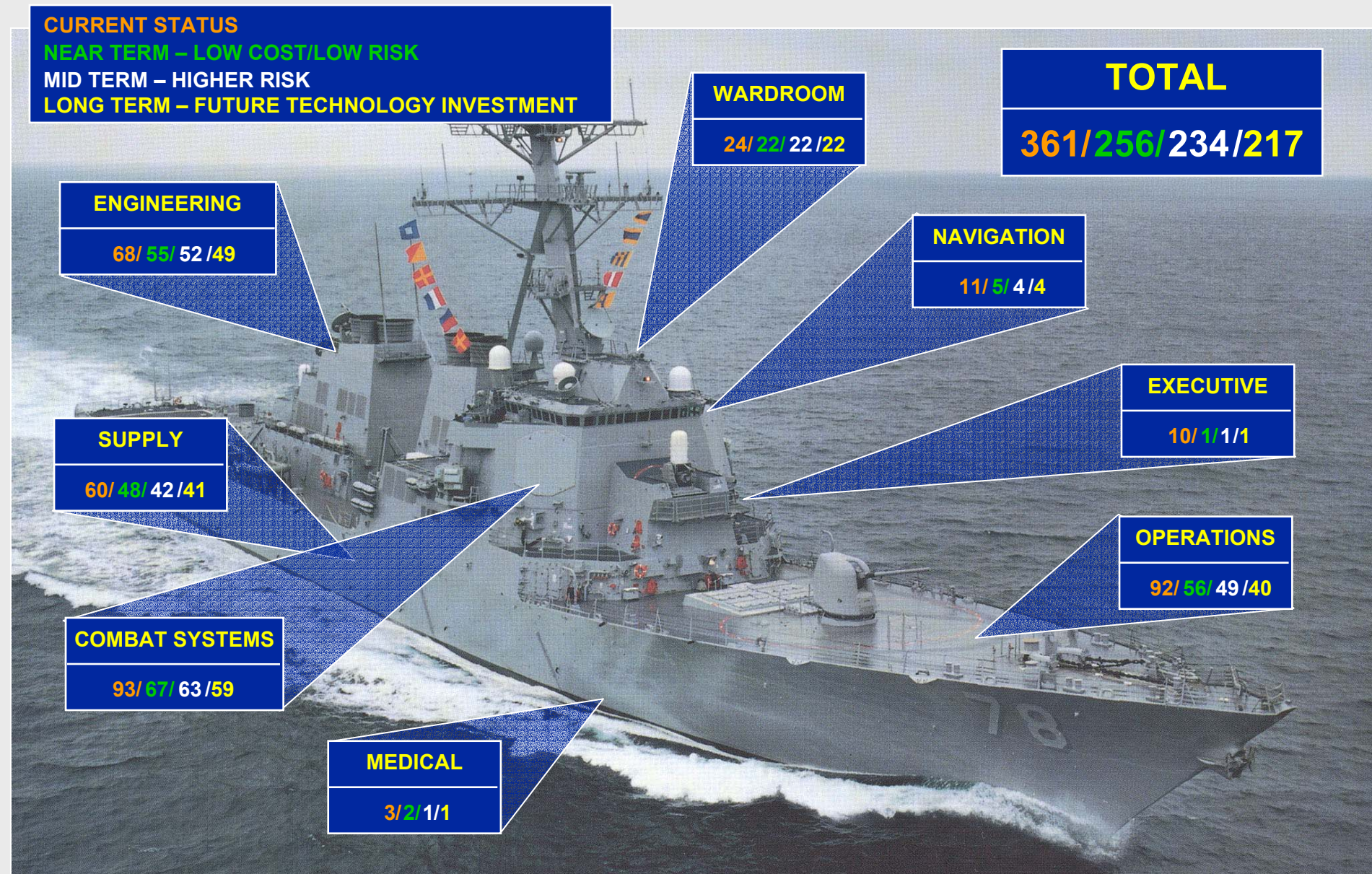
60/48/42/41

COMBAT SYSTEMS

93/67/63/59

MEDICAL

3/2/1/1



CONCLUSIONS

- The concept is dependent on achieving economies of scale in the shore support area that come from applying these reductions across the entire Class. The crew reduction of 34 (69 bodies removed from each ship - 35 reinvested in the shore infrastructure) people across 40 ships at an advertised rate of \$44K per sailor per year equates to about \$60M in MPN savings per year. Assuming Navy end-strength were reduced accordingly, one would expect savings in recruiting and training as well. Some of the savings will need to be reinvested in the redesigned shore infrastructure, required bandwidth, and future technologies. As a matter of fact, there may be investments required prior to any savings being achieved.
- By demonstrating a willingness to accept an increased level of risk, 22 additional billets could be eliminated, e.g., eliminating all lookouts, consolidating more watchstations, reducing hospital corpsmen and reducing hotel services (barber shop, laundry, etc.). This equates to an additional savings of \$38M in MPN for a total of about \$98M in MPN savings per year
- Finally, there are technologies, such as multi-modal work stations, that could be introduced into a future DDG 51 prototype that offer even more opportunity for future manpower reductions, but not without considerable investment. A conservative estimate of 17 additional billets being removed from each ship equates to and additional savings of \$30M in MPN for a total of about \$128M in MPN savings per year.

Future Signposts for the U.S. DoD

“In the case of the Navy surface combatants, we evolved the Aegis fleet which today is a proven, extremely capable force. We have a Nimitz carrier fleet that is a proven, capable, lineage of ships that can do what we need. We have a submarine force with wide proven characteristics. By luck, design, or whatever, we have created a moment in time when leveraging those proven capabilities the Navy can, I believe, take some risks we might not otherwise be willing to take. We can move forward, jump ahead a little further in technology than we might be willing to do if we didn’t have those solid foundations. And in ships like DD(X), CVN-21, Virginia-class submarines, LCS, it is our goal to move that technology as far ahead as we think we can.”

**Vice Admiral Phil Balisle
Commander, Naval Sea Systems Command**

- Signpost: U.S. Navy Virtual SYSCOM MOA
- Signpost: Navy SYSCOM HSI MOA efforts
- Signpost: C4ISR integration between and among U.S. military services
- Signpost: Technology insertion and manning trends throughout the U.S. DoD

Conclusions, Recommendations and Challenges for Future Research and Analysis

“The stakes are high...We must never lose sight of the challenge of a future enemy...an enemy who uses asymmetric means. But the Navy has two asymmetric advantages – incredible technology and incredible people...industry must help the Navy improve HSI to win the battle for finance and be competitive economically in acquisition.”

**Admiral Vern Clark
Chief of Naval Operations**

Conclusions, Recommendations and Challenges for Future Research and Analysis

- For the U.S. DoD: Expand ONR and DARPA HSI-related technology insertion efforts
- For all potential coalition partners: Increase R&D and crosstalk regarding HSI efforts
- For U.S. DoD (ASD NII? EBR?): Conduct analysis of the “true” cost of manpower
- For ICCRTS forum: Elevate HSI initiatives to a more prominent place in future events

Questions?