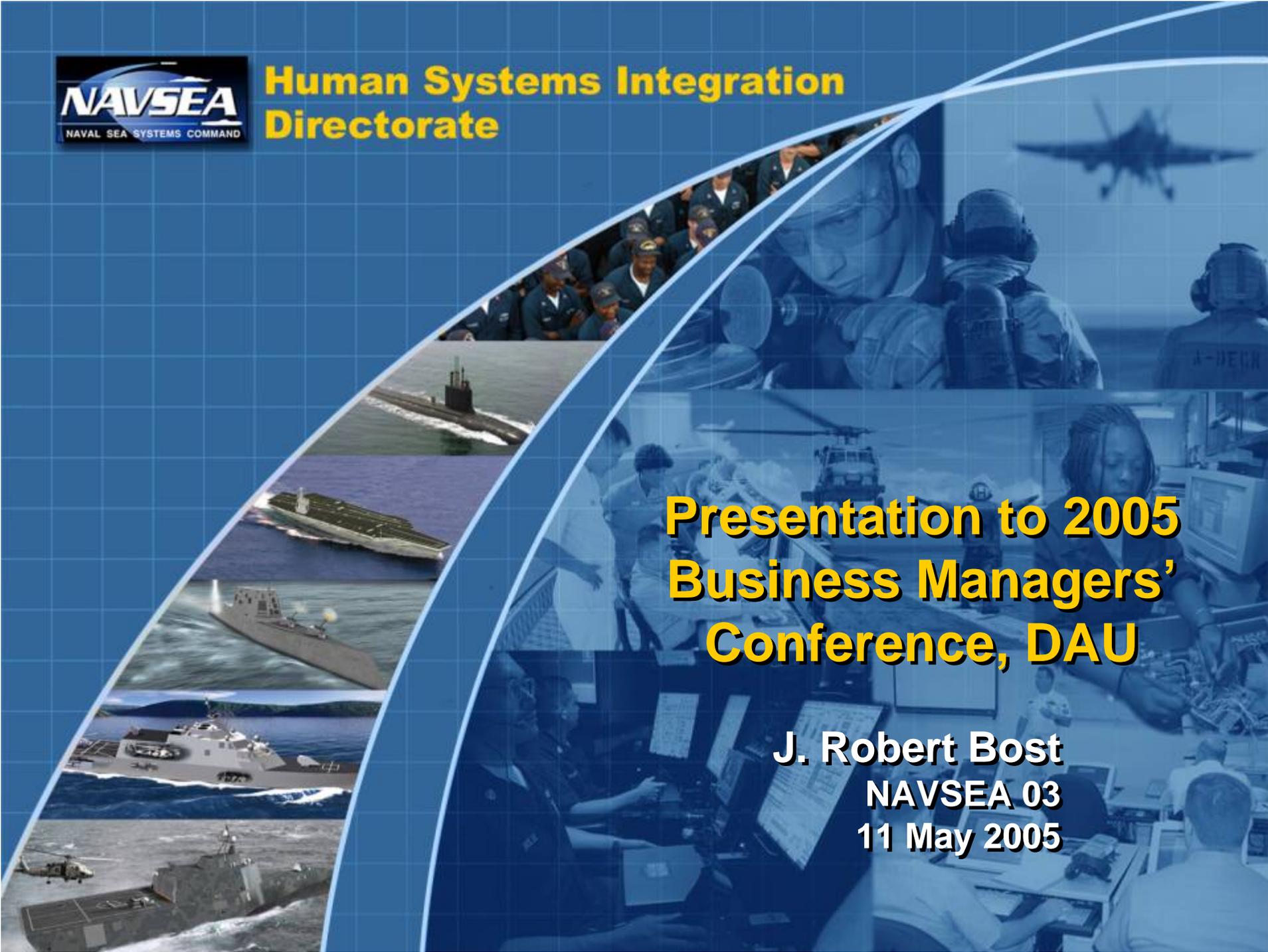




Human Systems Integration Directorate

The background of the slide is a blue-tinted collage of images. On the left, a vertical strip shows a submarine, a large cargo ship, a smaller vessel, a modern warship, and a helicopter on a ship's deck. On the right, a larger area shows a person in a control room looking at a screen, a person in a flight suit, and a person in a uniform. The overall theme is human systems integration in a naval context.

Presentation to 2005 Business Managers' Conference, DAU

J. Robert Bost
NAVSEA 03
11 May 2005

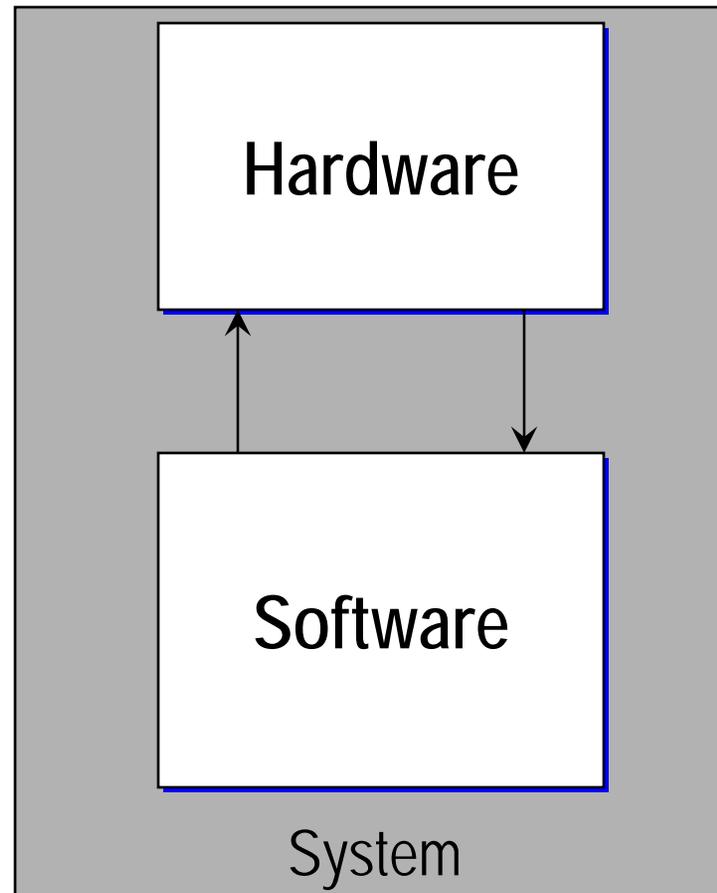


Outline

- ◆ Where we are today
- ◆ Acquisition Process
- ◆ New Acquisition Programs
- ◆ NAVSEA 03 and Human Performance Metrics
- ◆ Business Case Analysis
- ◆ Summary

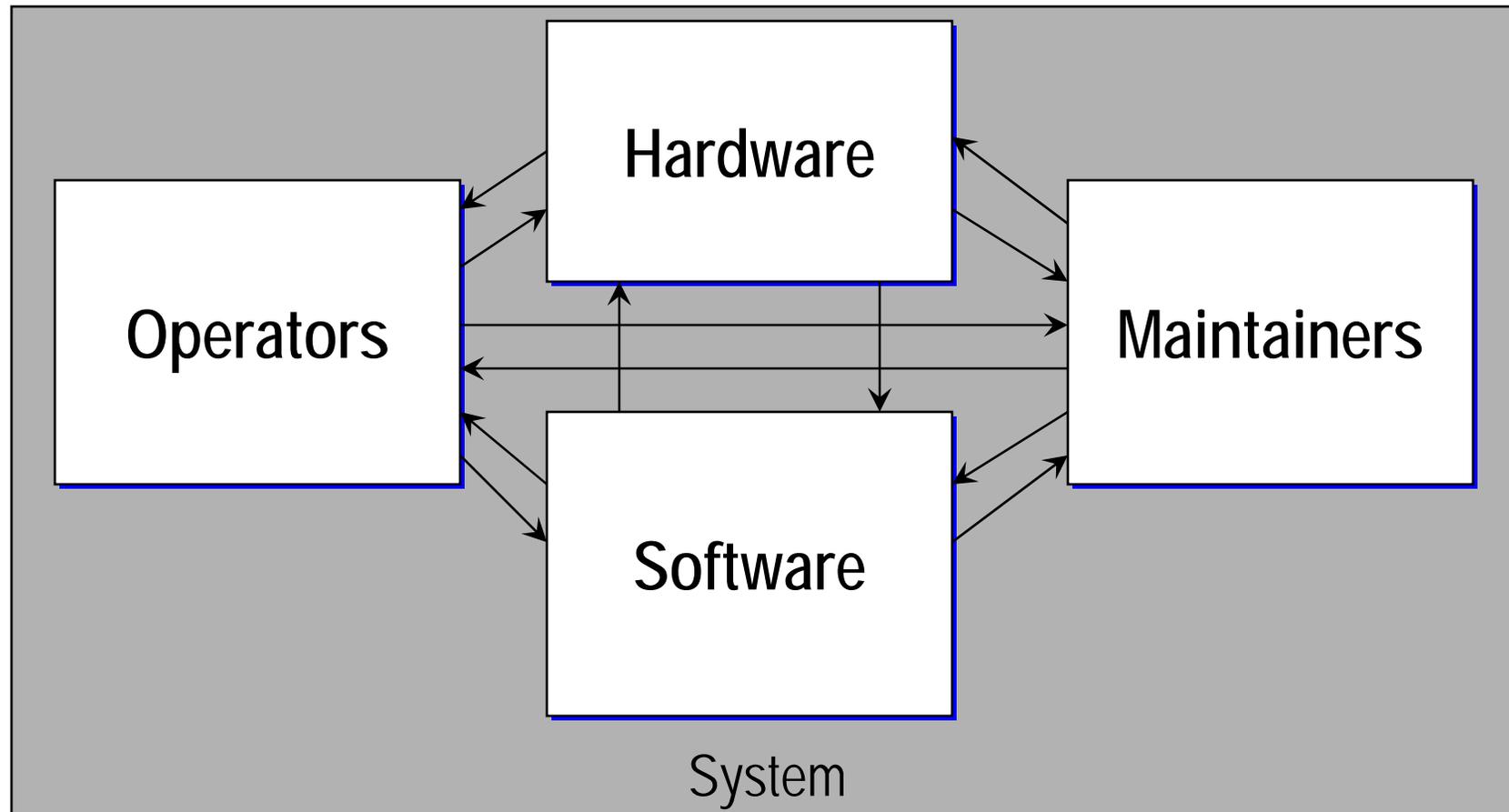
Thinking Traditionally

Traditional Perspective of System



Thinking Differently

New Perspective of System



Warfighting Performance Challenges

◆ *Complex Battle Environment*

◆ *Compressed Decision Making and Threat Response Times*

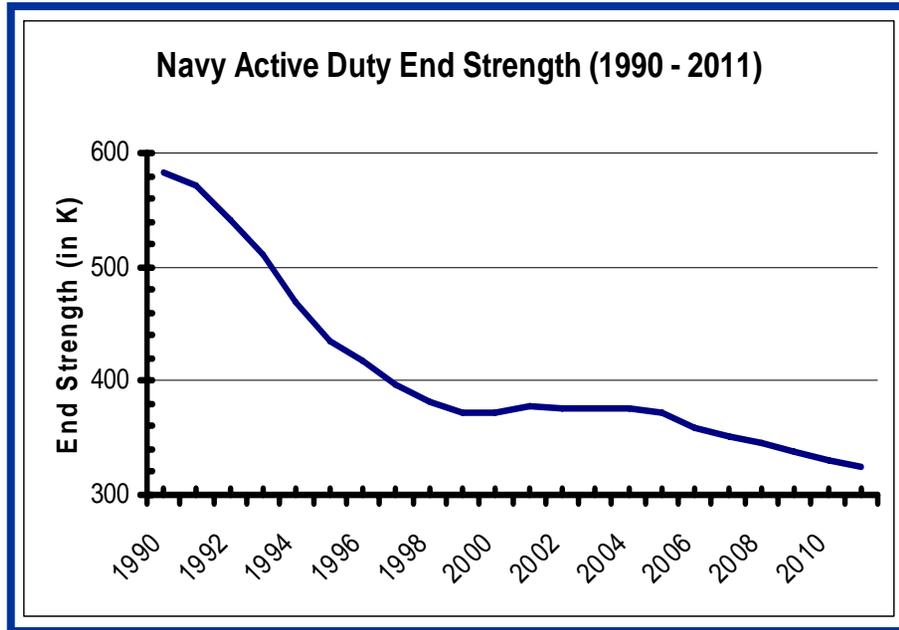
◆ *Fewer People*





Human Capital Challenge

Navy Example

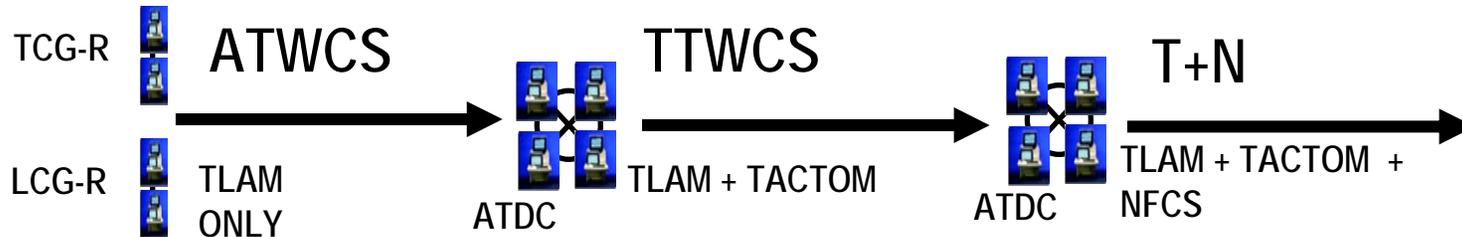
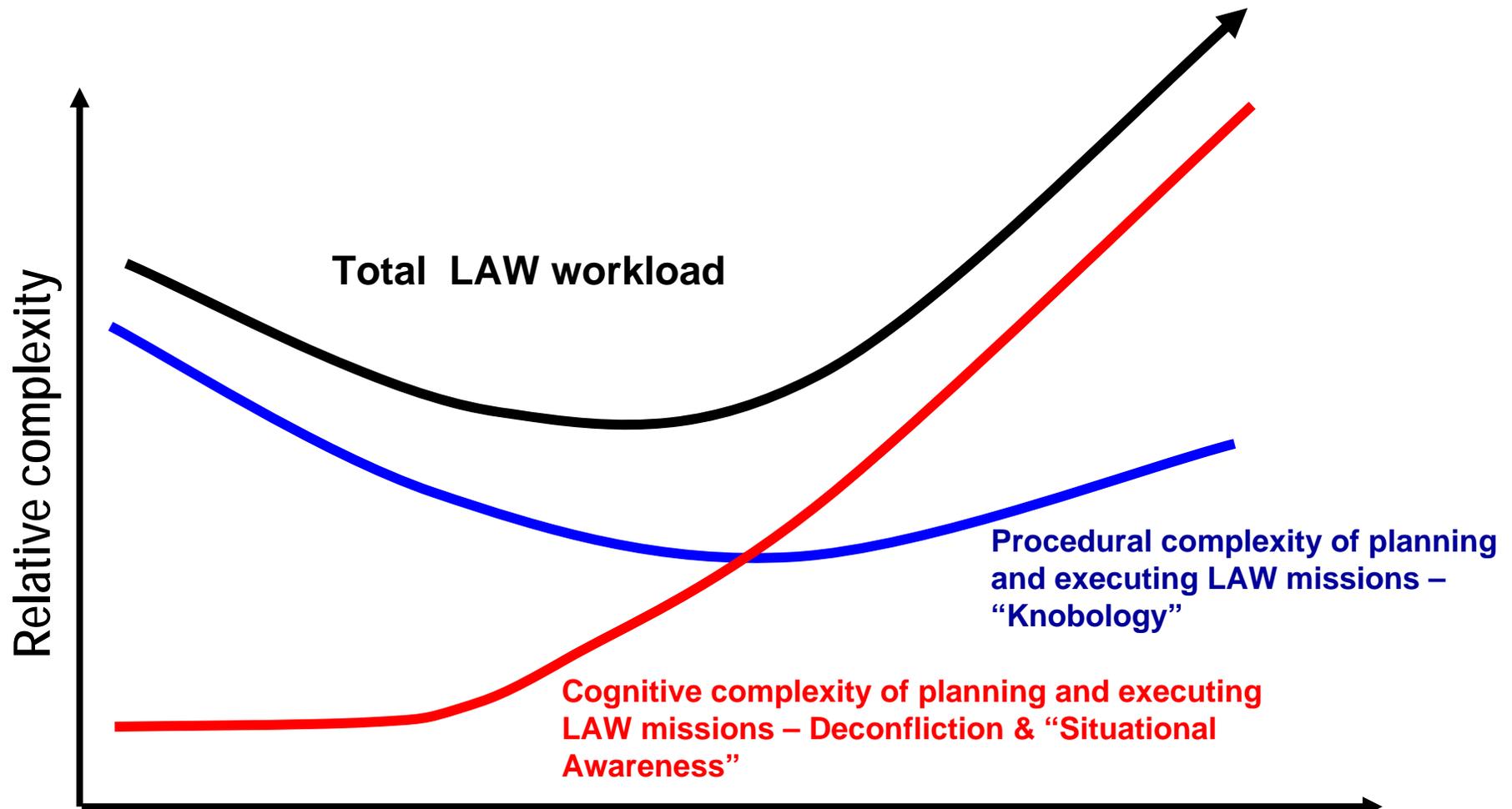


**2006 - 2011 cuts
to come from
infrastructure**

- ◆ Navy plans substantial end strength reductions to free resources for investment
- ◆ Modernized and future platforms & systems will have smaller crews requiring new skills and broader cognitive abilities
 - Impacts recruiting, retention, performance, and training
- ◆ Infrastructure will change – work offloaded from ships must be considered as part of total design and budget
- ◆ Acquisition process and HR system need to be in alignment
 - HSI is key to that process



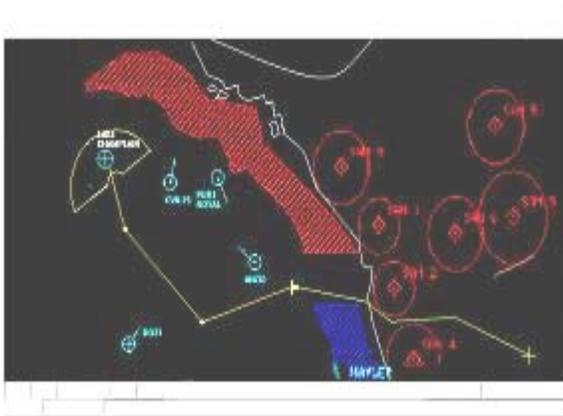
Situational Awareness, Performance, and Training Challenge



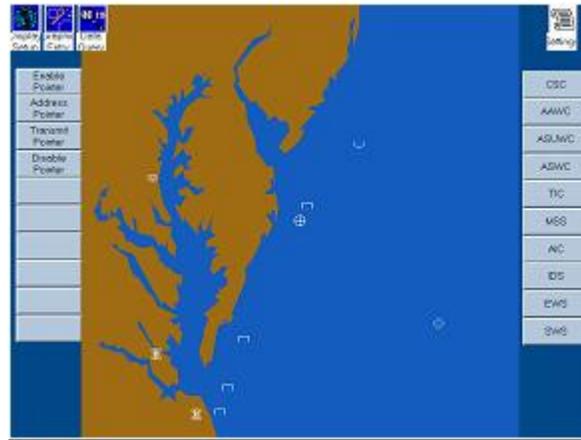


Aegis and Land Attack Related Displays

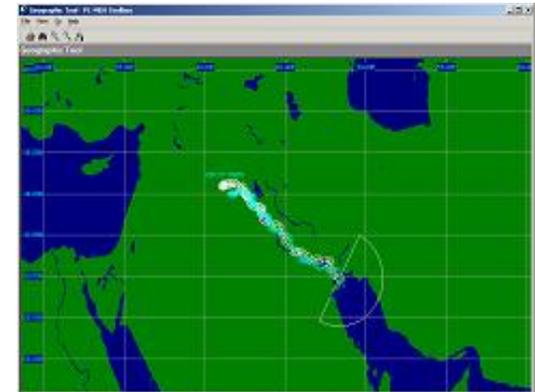
TTWCS



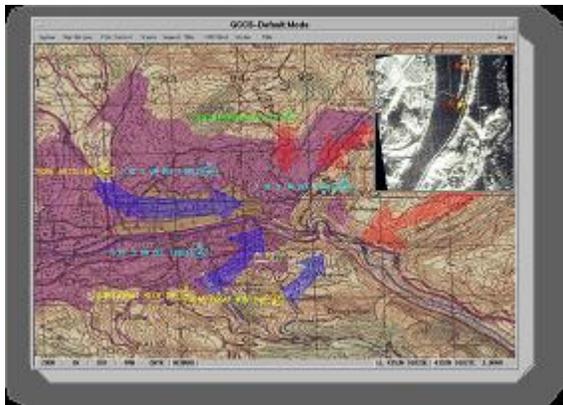
ADS



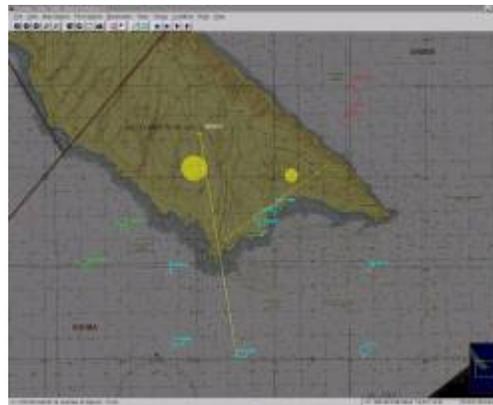
PC MDS



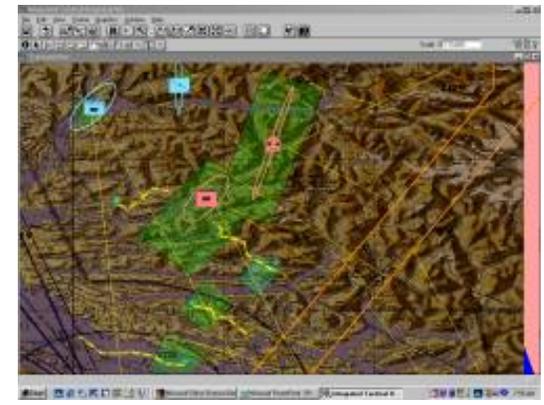
GCCS-M



NFCS



DCGS





Old Think – Hardware / Software Engineering

- ◆ Primary focus on acquisition cost and hardware and software performance
- ◆ Results:
 - Sub-optimized human performance and reliability
 - Poor maintainability and supportability
 - Complicated systems
 - High training & manning costs
 - Increased system response time due to support time
 - Decreased capability and complex, costly logistic tails
 - Warfighters and Logistics elements treated as afterthoughts





New Think – Total Systems Engineering

- ◆ Design in Warfighter performance to meet operational and Warfighting requirements
- ◆ Results:
 - Optimized human performance and reliability
 - Optimal usability
 - Clear situational awareness
 - Simple, intuitive user interfaces
 - Streamlined logistic tails
 - Skills-based manning and tailored training
 - Improved system response time
 - Increased capability and performance





HSI Critical to Total Platform System Engineering

HSI and Total Platform Design Considerations



Optimizing Total System Performance and Total Ownership Cost



Outline

- ◆ Where we are today
- ◆ **Acquisition Process**
- ◆ New Acquisition Programs
- ◆ NAVSEA 03 and Human Performance Metrics
- ◆ Business Case Analysis
- ◆ Summary



Why Do HSI? DoD 5000.1 (5/12/03)

E1.29 Total Systems Approach. The PM shall apply **human systems integration** to optimize total system performance (hardware, software, and **human**), operational effectiveness, and suitability, **survivability, safety, and affordability**. PMs shall consider **supportability, life cycle costs, performance,** and schedule comparable in making program decisions. Planning for Operation and Support and the estimation of total ownership costs shall **begin as early as possible**.



E1.27 Systems Engineering. Acquisition programs shall be managed through the application of a systems engineering approach that **optimizes total system performance and minimizes total ownership costs**.



Why Do HSI? DoD 5000.2 (5/12/03)

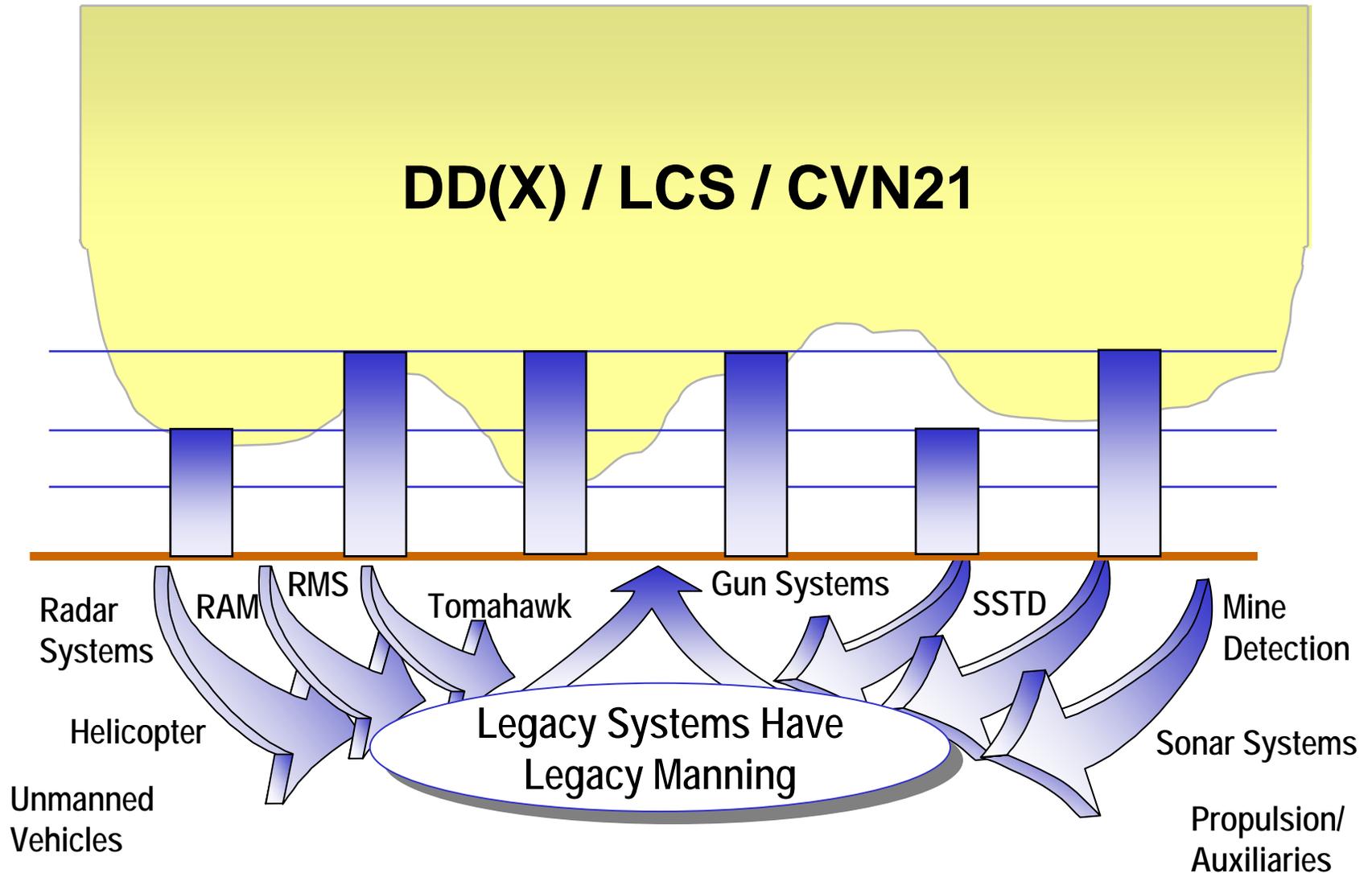
3.4.1. "The capability needs and acquisition management systems shall use...an analysis of ...(DOTMLPF)...to define desired capabilities to guide the development of affordable systems."

3.9.2.2. "...As part of this process, the PM shall employ human factors engineering to design systems that require minimal manpower; provide effective training; can be operated and maintained by users; and are suitable (habitable and safe with minimal environmental and occupational health hazards) and survivable (for both the crew and equipment)."

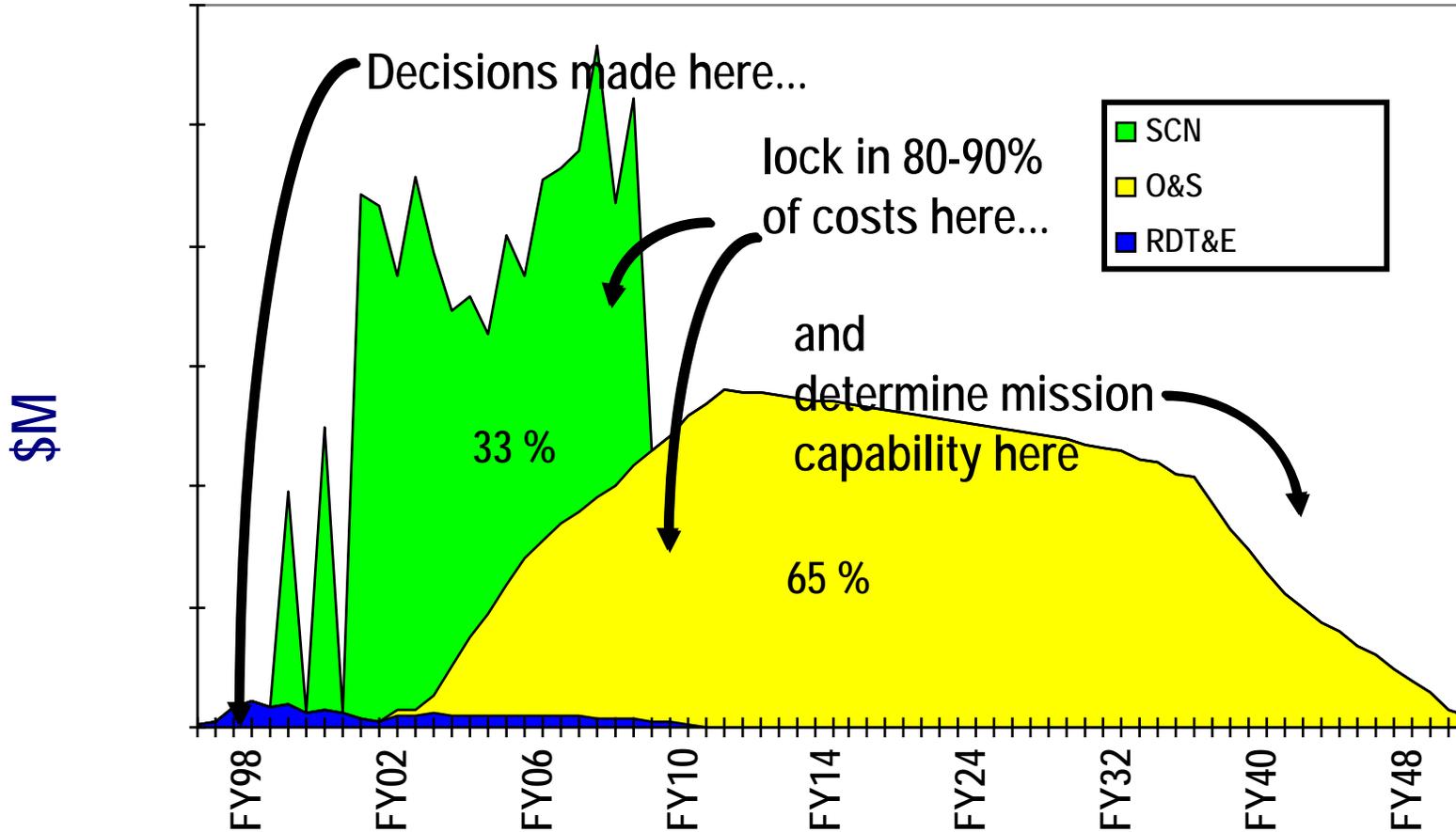
3.7.1.1. "The purpose of the SDD phase is to ...implement human systems integration...."

Enclosure 7

Legacy Impact on New Ship Manning



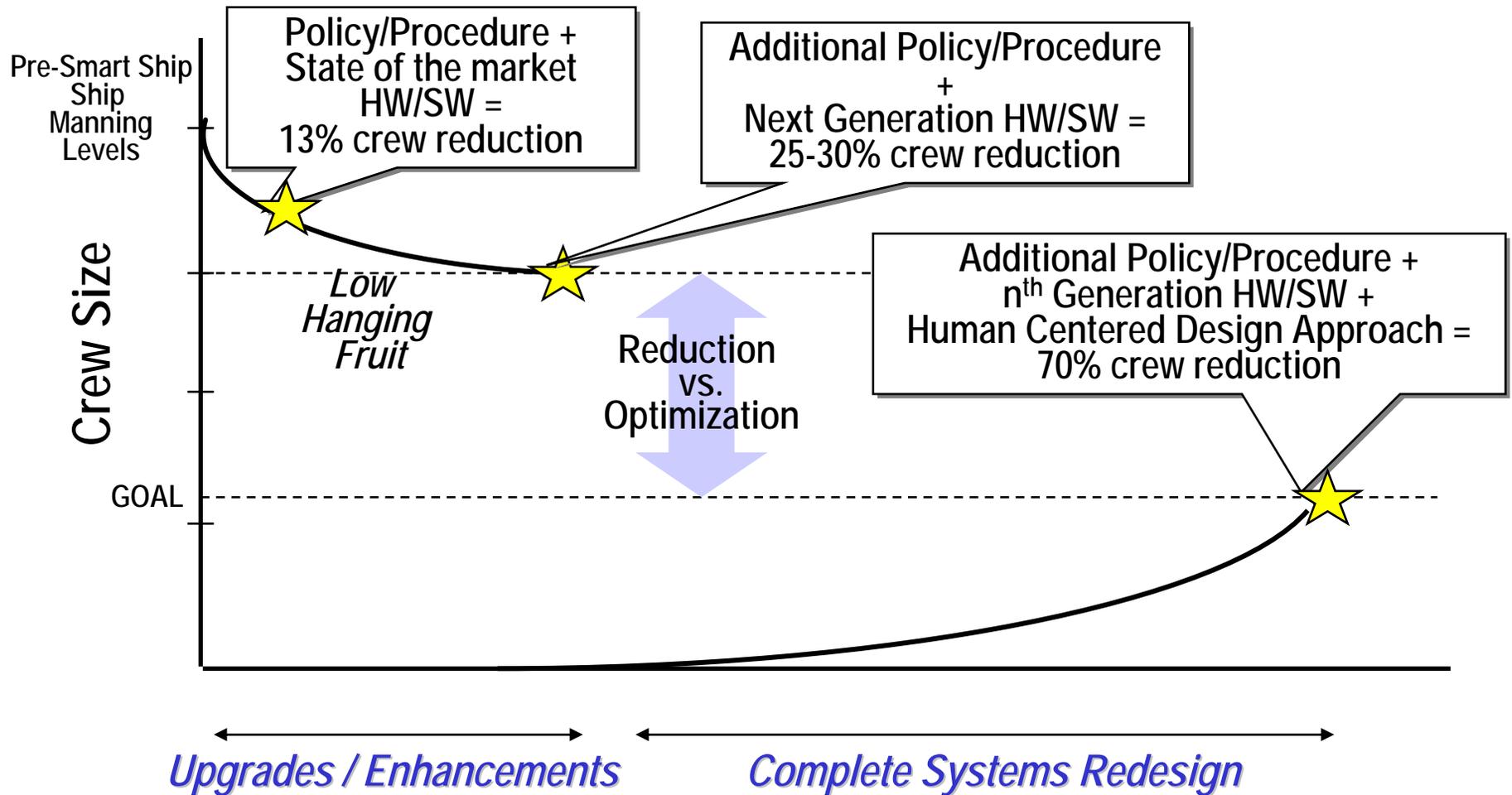
No Change = Legacy \$ Profile



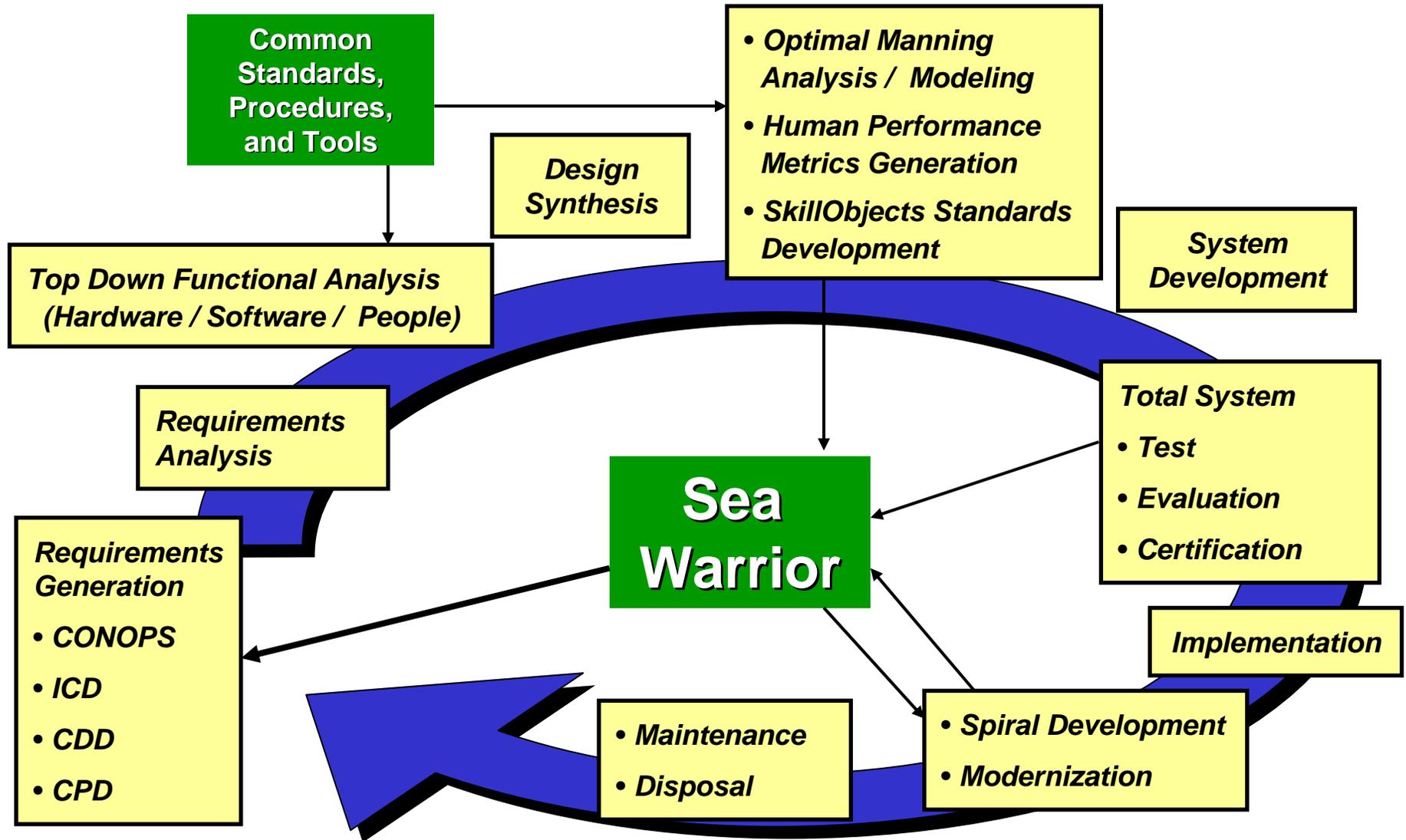
Early decisions drive TOC



Engineering & Operational Revolutions



Total Systems Engineering



Sea Warrior: Center Stage in System Engineering

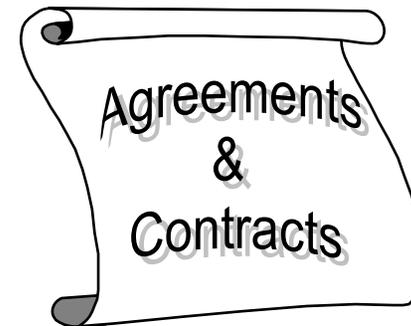
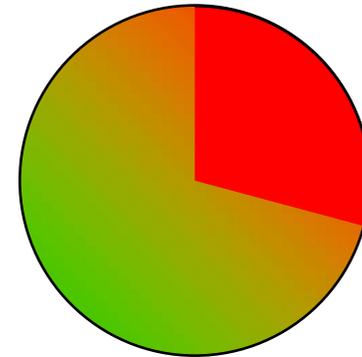
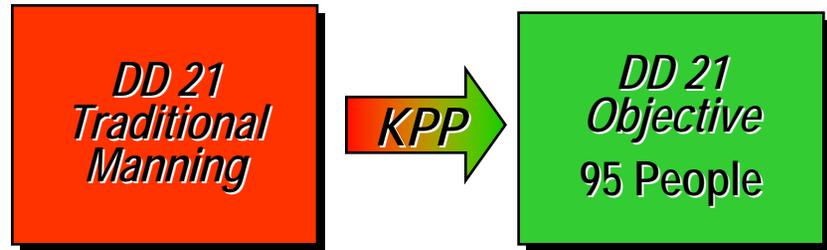


Outline

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Acquisition Revolution

- ◆ Manning as a KPP
- ◆ Total Ownership Cost includes the human cost
 - Reduces Operation & Support cost by 70% of DDG 51
- ◆ New funding profiles to support acquisition and life cycle support reformations





Littoral Combat Ship (LCS) HSI Issues

Hey, Chief! I just woke up in Rota!
How did I get detailed to this module?
How did I get trained??
How do I maintain my proficiency?
Where's the rest of the crew?
Do I have a future?

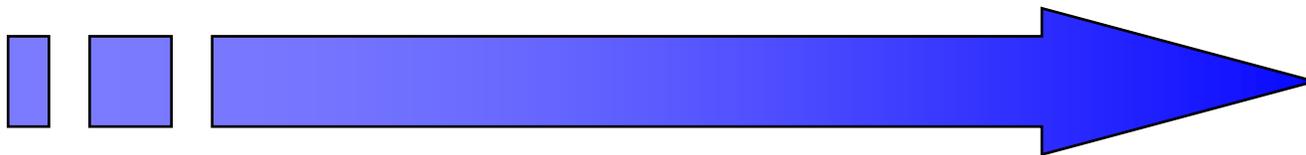
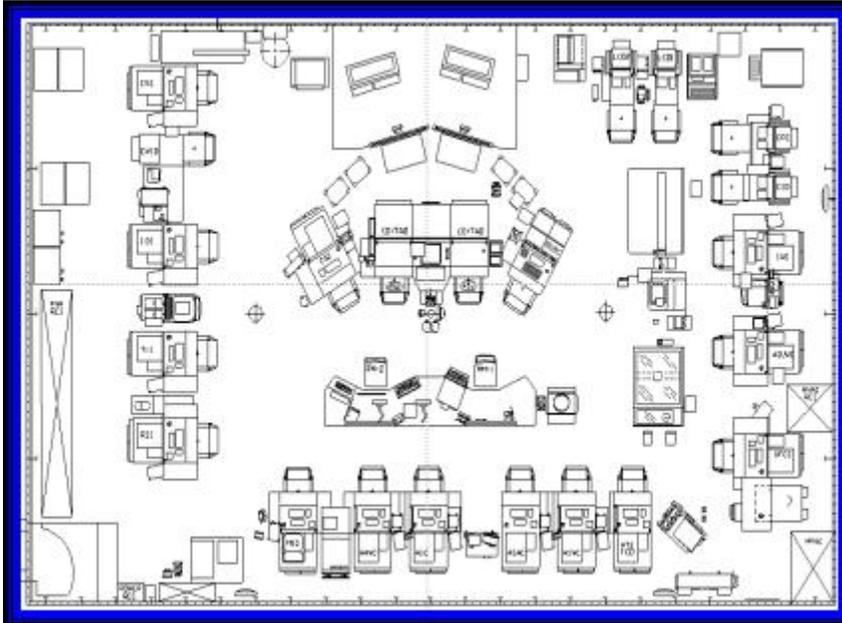


Knowledge Superiority



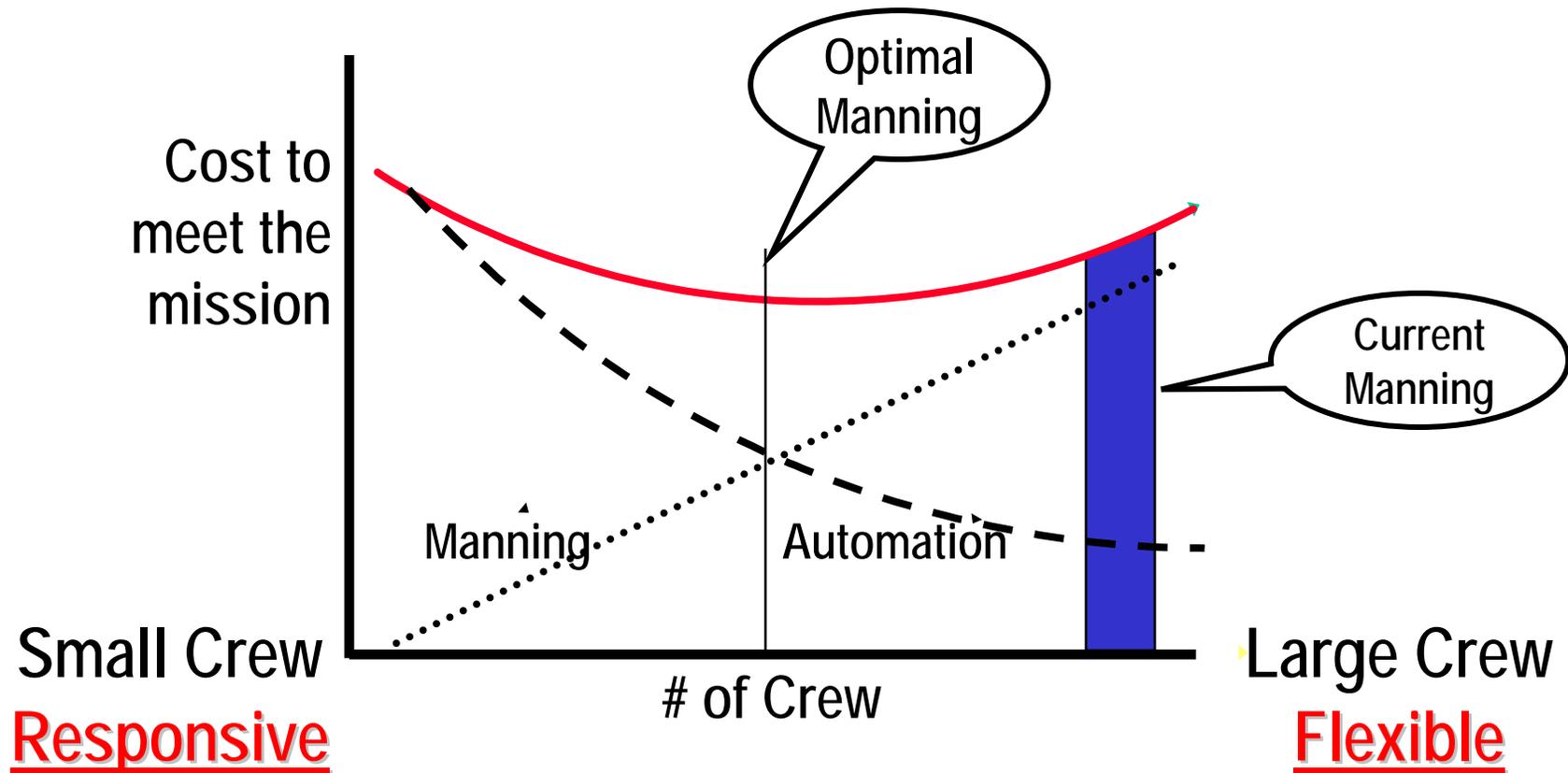
- ◆ Fused information
- ◆ Situational awareness

Engineering Challenges Integrated Command Environment



- ◆ Streamlined organization
- ◆ Flexible teams

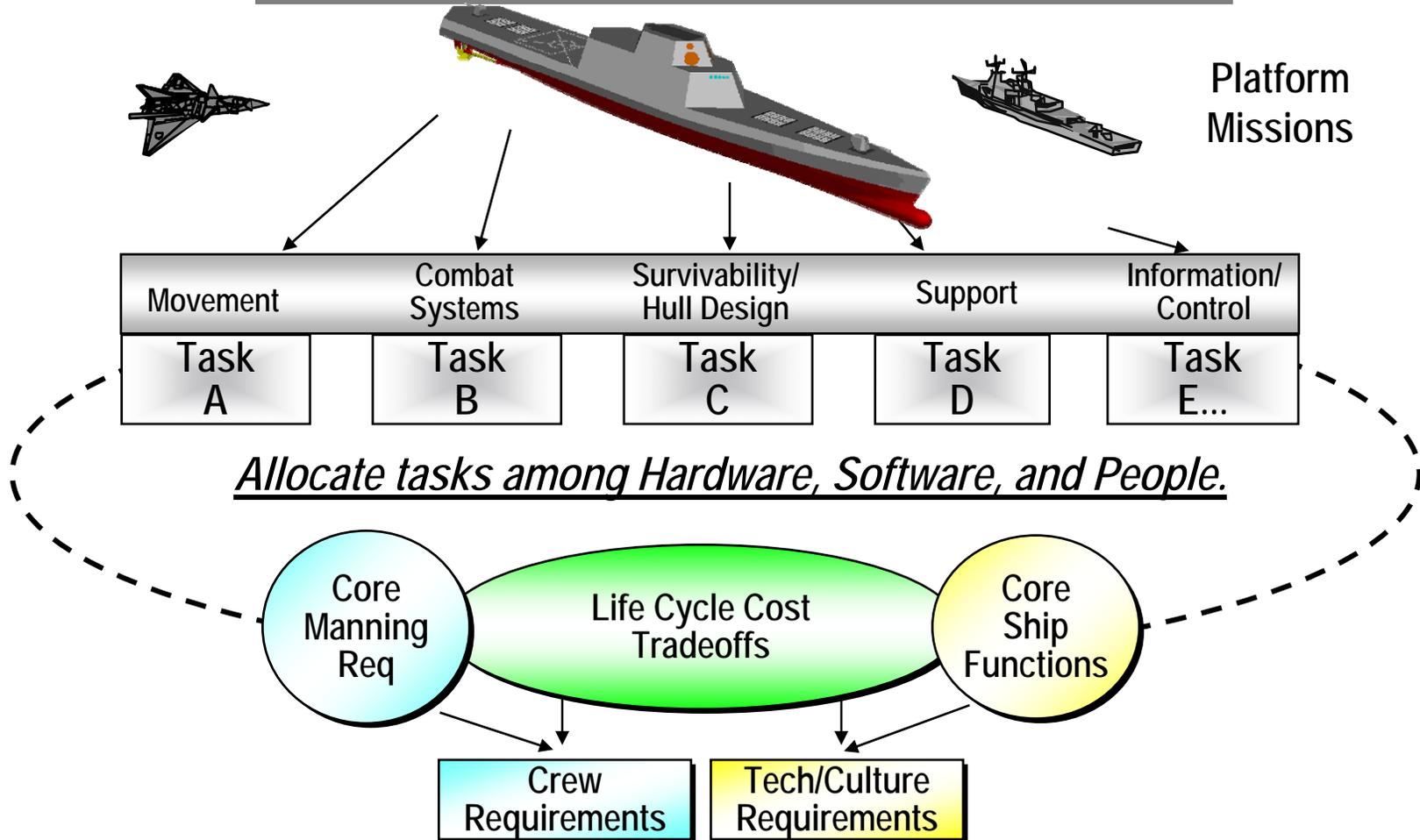
Optimal Manning



↑ Total System Performance and Total Ownership Cost ↓

Crew Composition - Industry Responsibility

Top Down Function Analysis

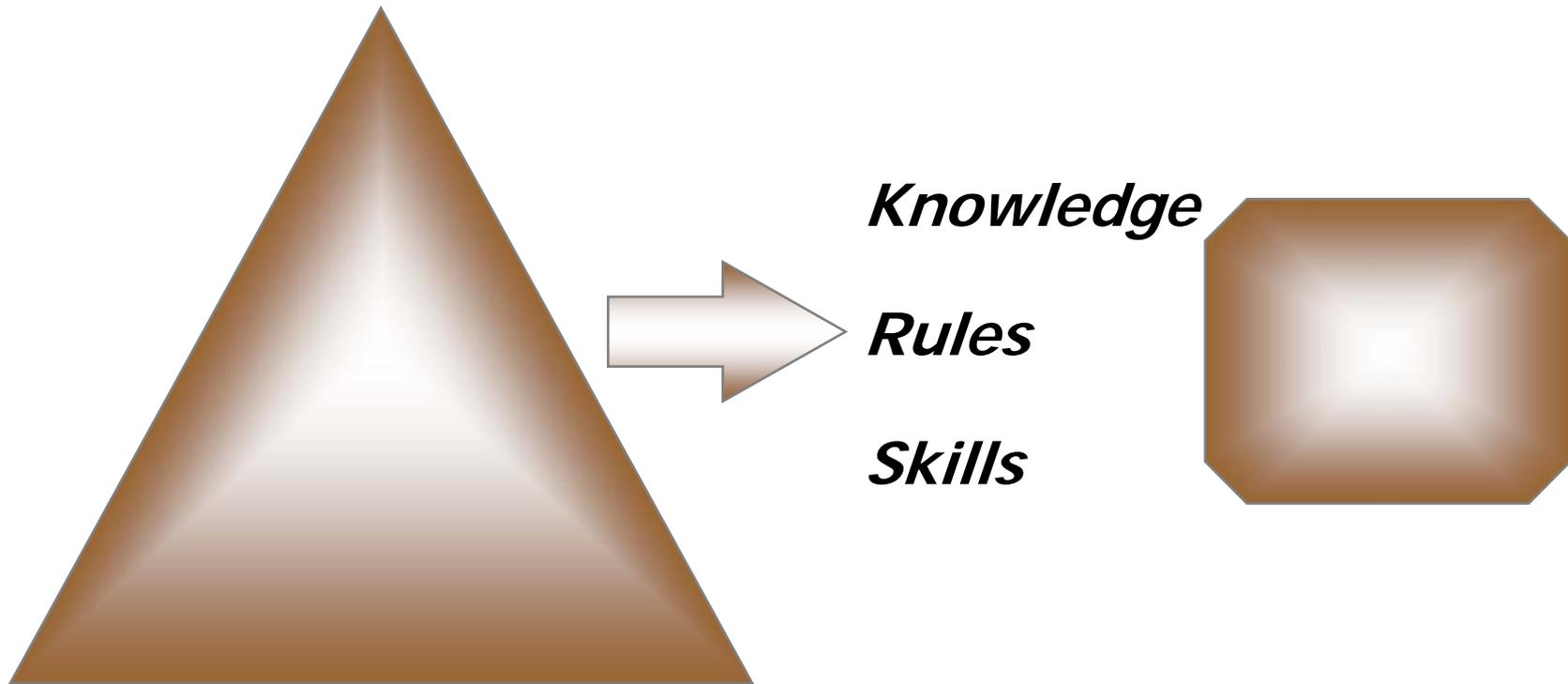


Key Areas and Influences on Performance and Cost





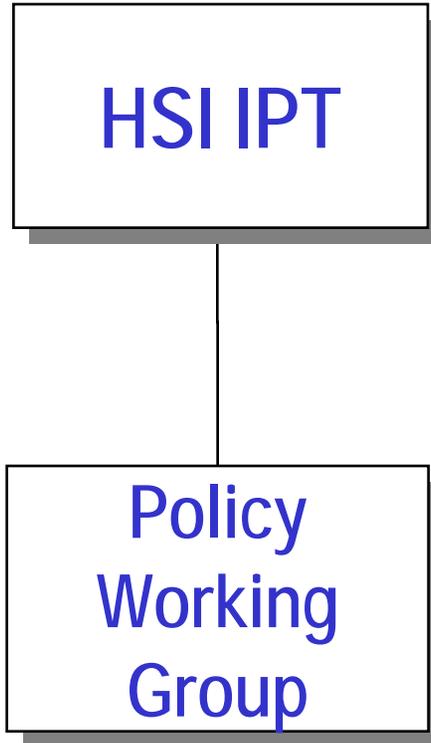
Manning Revolution



*Experienced personnel on future platforms
and no room for gaps*



Ship Clearinghouse for Issues and Policy (CLIP)



All ships and subs
CNO
N12 (+NAVMAC)
N13 N7
N76 N78

Membership:
NETC, N00T, NPDC
TYCOMS
N1 N8 ATG

Coast Guard
MSC
Navy Labs
Industry Team

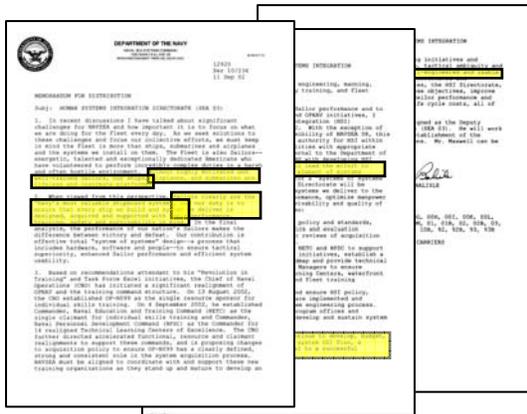


Outline

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NAVSEA HSI Directorate - NAVSEA 03



“Without highly motivated and well-trained Sailors, our ships, airplanes, and submarines are lifeless and inanimate platforms...”

“Sailors clearly are the ‘Navy’s most valuable shipboard system,’ and our duty is to ensure that every ship we build and system we deliver is designed, acquired and supported with their performance, training, safety and survivability in mind...”



- ◆ *“The HSI Directorate will lead the effort to **institutionalize HSI as a fundamental element of systems engineering...**”*
- ◆ *“PEOs and Program Managers will continue to **develop, budget, execute and sustain all elements of a system HSI Plan...**”*
- ◆ *“PEO’s must deliver well-engineered and usable systems for our Warriors...”*
- ◆ *“**Certification authority for HSI within NAVSEA**”*

HSI tools and methodologies must be embedded in engineering processes and staffed.



Sea Power 21

SUPERIOR WARFIGHTING PERFORMANCE AT BEST COST

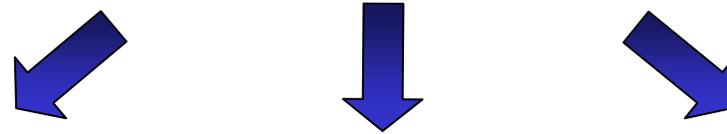
- Fewer People Operating in a More Complex Operational Environment



"The Warrior is a Premier Element of All Operational Systems"
- CNO, U.S. Naval Institute Proceedings, October 2002



TOTAL SYSTEM ENGINEERING



Hardware



Software



People



TOTAL SYSTEM PERFORMANCE

Measurable and Certifiable

P_k Probability of Kill
 A_o Operational Availability
 R_{op} Operator Reliability



Manpower Requirements



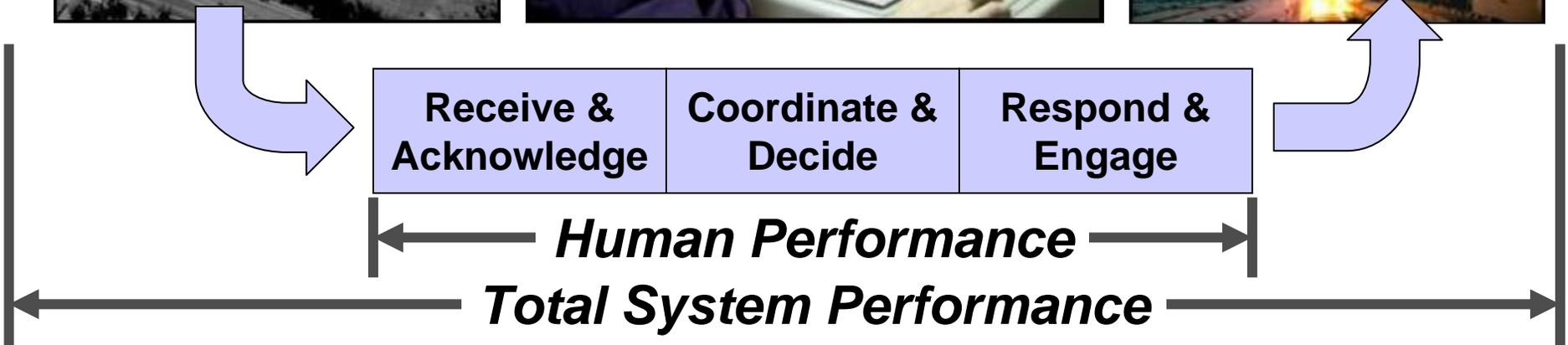
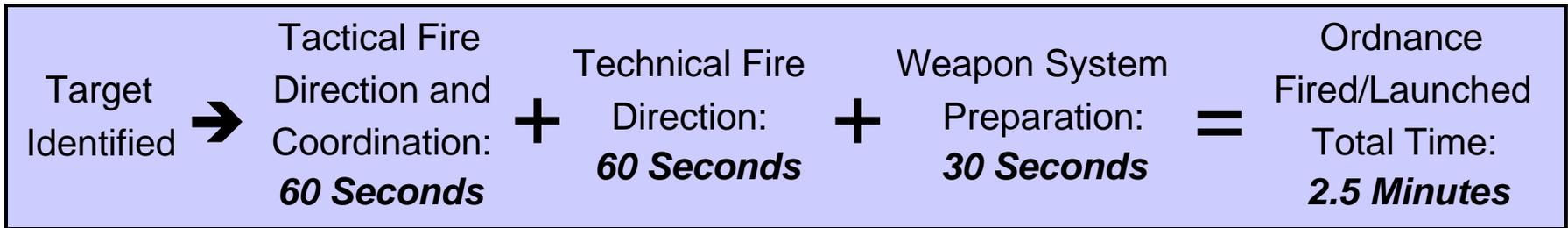
Knowledge, Skills, and Abilities (KSAs) to Execute Human Functions and Tasks



Tailored Training

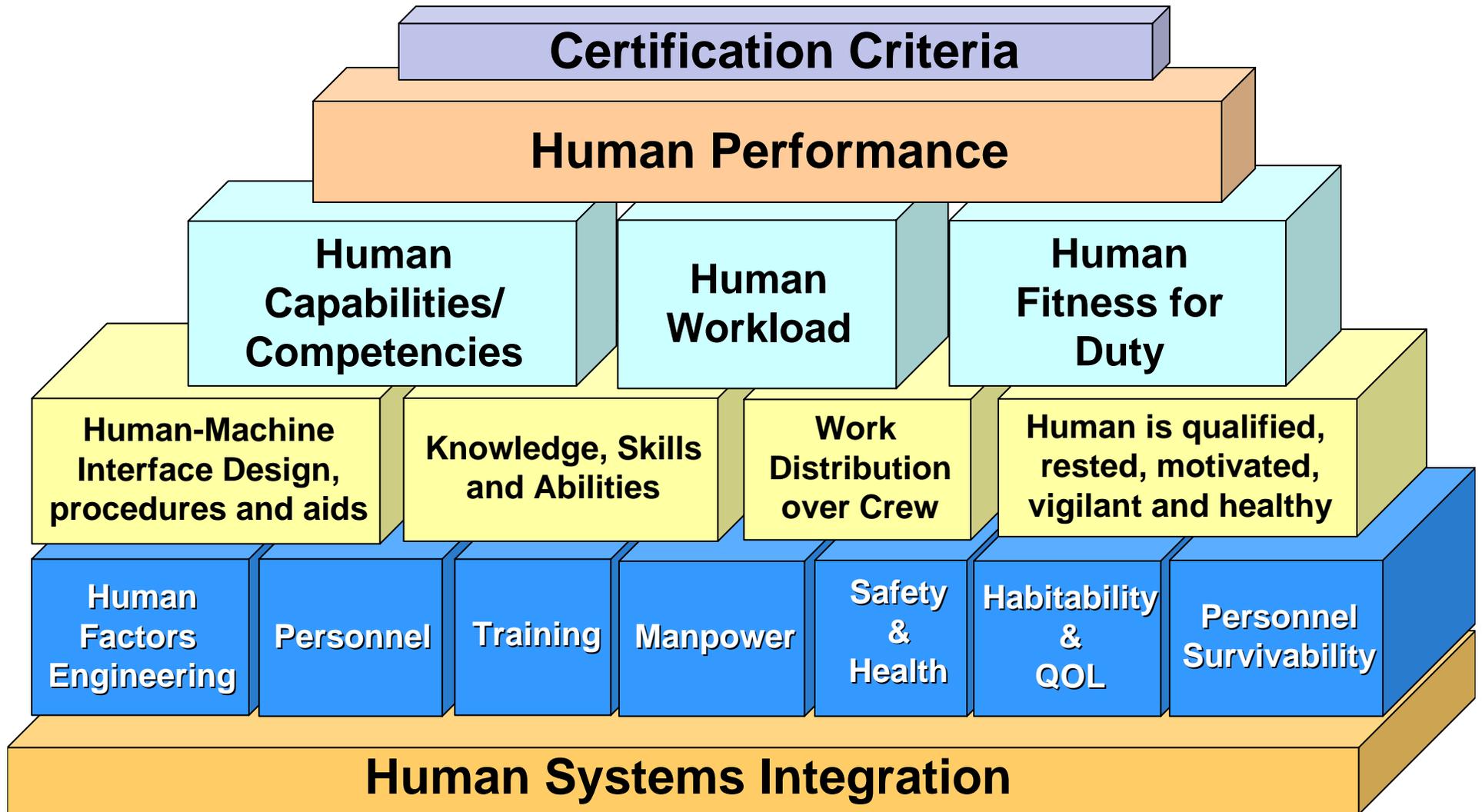


NSFS Execution Response Time





Building Blocks of Human Performance





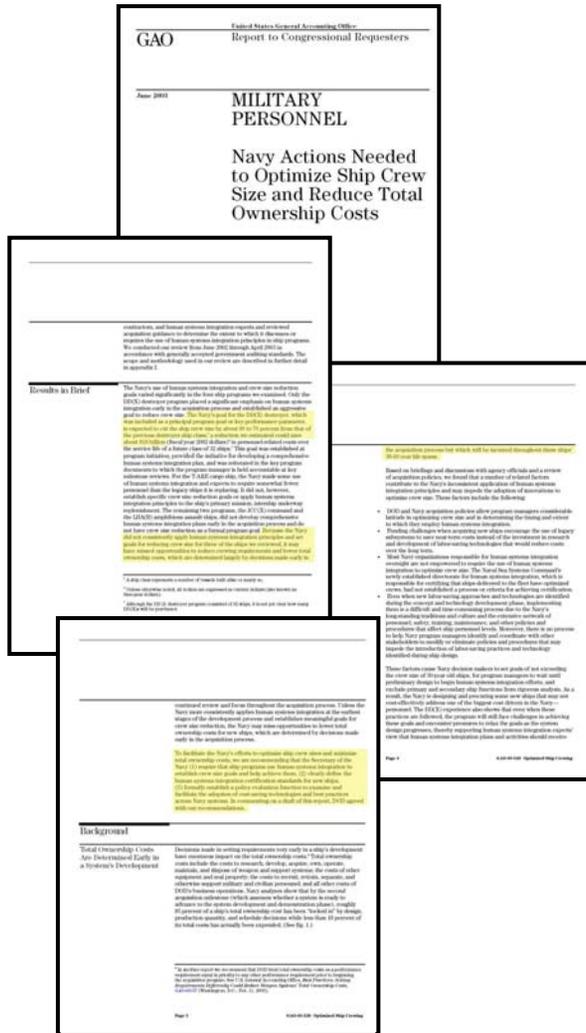
Outline

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Business Case: GAO Congressional Report - Navy

- June 2003 GAO Congressional report (GAO-03-520) on Military Personnel: Navy Actions Needed to Optimize Ship Crew Size and Reduce Total Ownership Costs reports:
 - Expected 60% - 70% Reduction in Crew Size
 - Translates into \$18 Billion Saved over service life of 32 ships.
 - Notes missed opportunities for further cost savings gained from HSI to further ship programs for
 - GAO also recommends SECNAV help through:
 - Require ship programs use HSI to establish and meet crew size goals
 - Define HSI certification standards for new ships





Manning Affordability Experiment



MODIFICATIONS:

- Improved Human Computer Interface
- Focused Design on User needs
- 50% Manning Reduction

RESULTS:

- Reduced Training Time
- Improved Situational Awareness
Example: Better deployment of air assets
- Improved Reaction Time

Example: Noticed Threat Track kinematics changes and initiated warnings

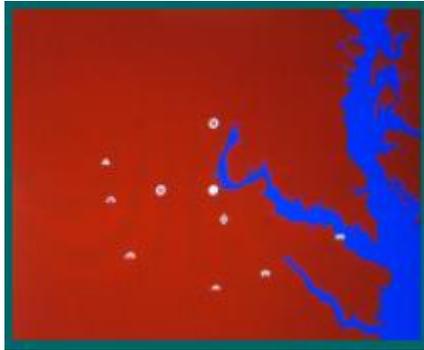


Human-Centered Design Approach
supported 50% manning reduction for CIC Air Defense
Warfare with **improved warfighting performance**

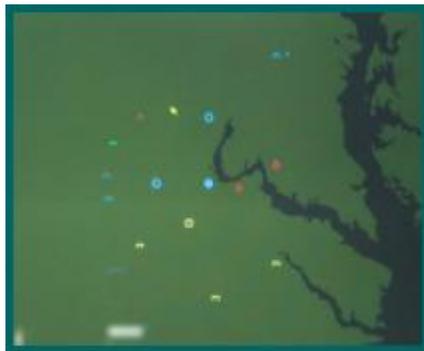


Display Comparison: For Engagement Reaction Time Improvement

From Current ADS...



To Color Symbology



- *Five second reduction* time to hook suspect track
- Increase in Total System Performance w/ *\$200K per Baseline investment*
- Equivalent improvements in reaction time through RADAR changes would cost *several hundred million dollars*
- Good ROI - quick, inexpensive short-term improvement allows real RADAR needs to be fully assessed over time

Explore All System Improvements

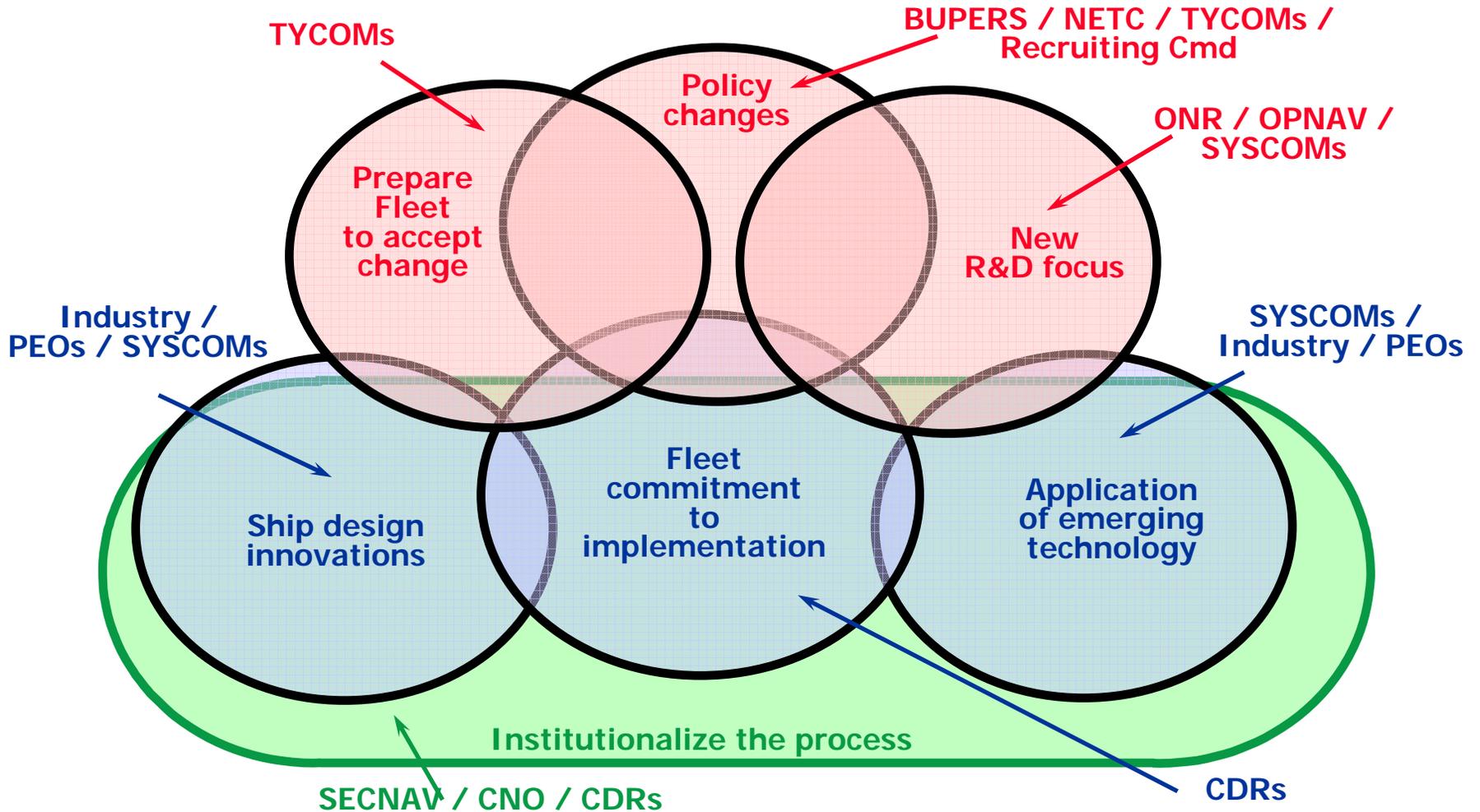


Outline

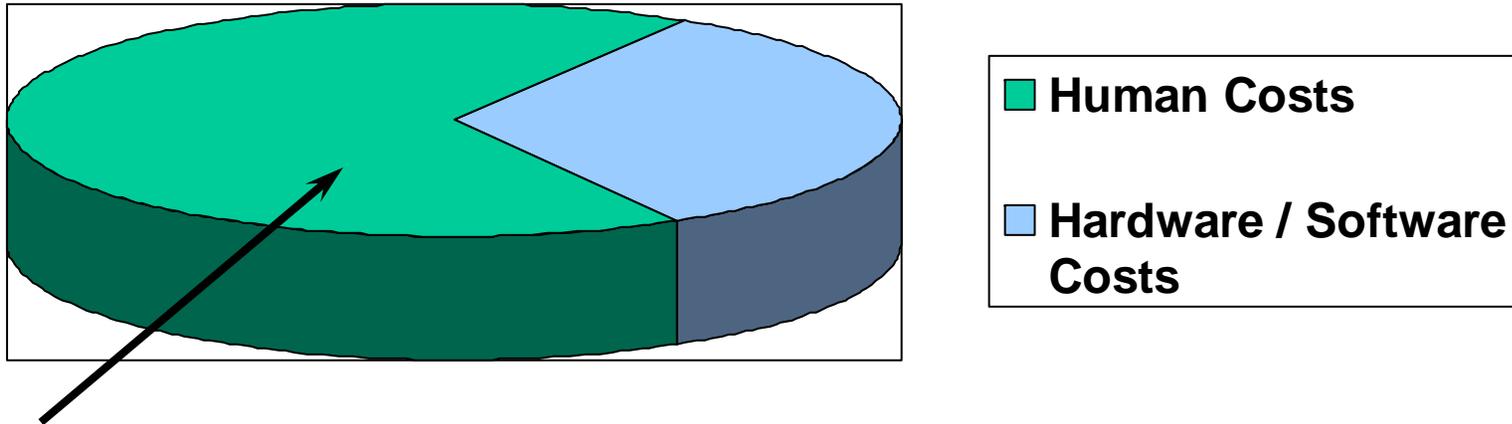
- ◆ Where we are today
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- ◆ **Summary**



Plan and Leaders Needed to Influence DoD – Navy example



Total Ownership Costs



Typically, human related costs represent 67% of total ownership costs.

Human costs include:
Warfighters deployed
Warfighters in training
Logistics Support Staff
etc.

Hardware / Software costs include:
OEM Equipment
Spares
Digital Media

What elements are typically thought of as
“Ownership Costs?”



HSI in Acquisition Principles

- ◆ Warfighters are the most valuable platform system
 - Design platforms and systems around them
 - Provide Optimal Manning, Training and Logistic Support

- ◆ Total System Performance is the focus
 - Hardware, software and Warfighters
 - Function/Task Based Requirements Analysis
 - Knowledge, Skills, Abilities

- ◆ Relevant technical training and integrated training architectures are essential
 - Learning Center / Fleet Training Activity technical support
 - Aboard the platform and throughout the Force
 - Compatible / interoperable with existing and future systems



Summary

- ◆ Solving the MPT challenges in DoD's future requires the coordinated efforts of many commands and activities
- ◆ The answers must be best value to the DoD, not just one service, command, or activity
- ◆ New challenges require new ways of thinking

*To get different results, we have to do things differently
To do things differently, we have to think differently
To think differently, we have to think about thinking*

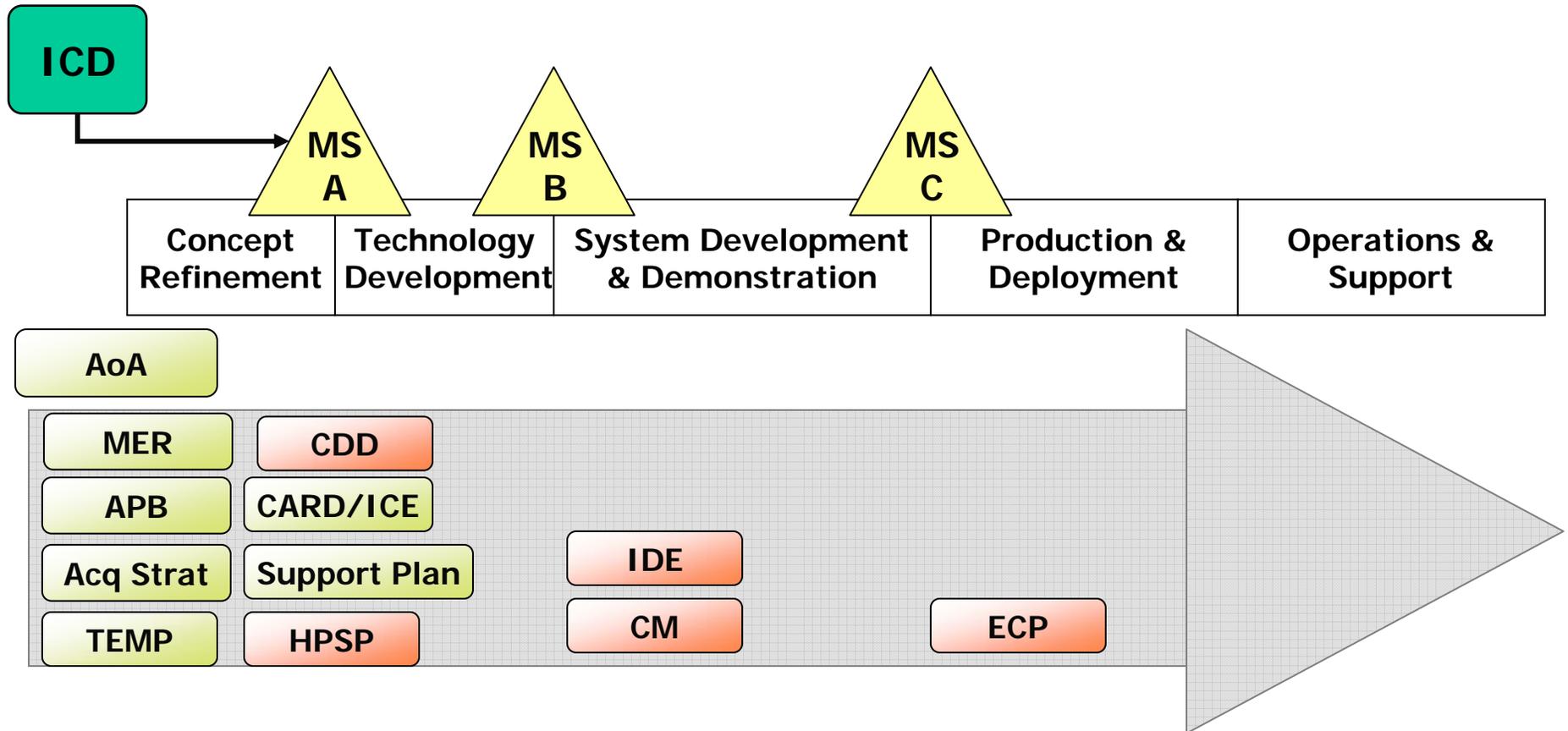
ΜΙΝΔΣΗΙΦΤ



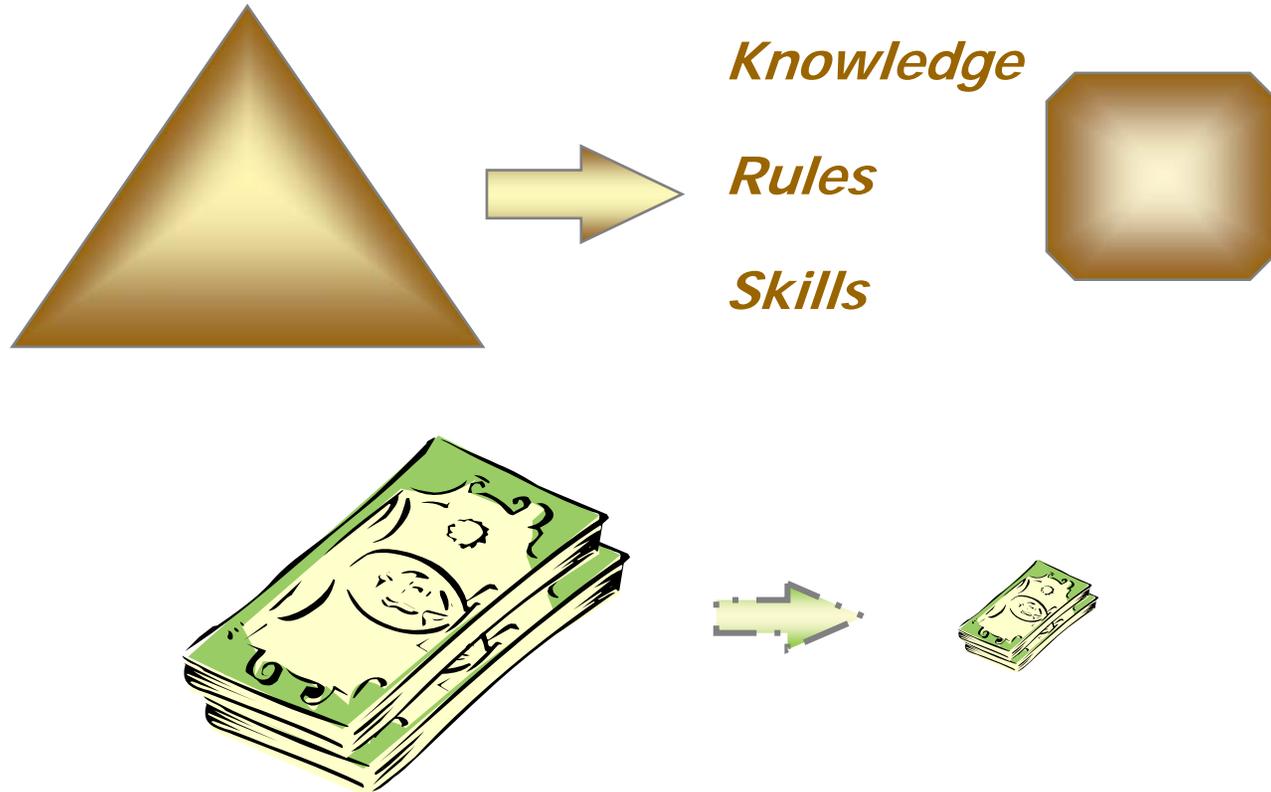
QUESTIONS?



HP Insertion into Systems Acquisition



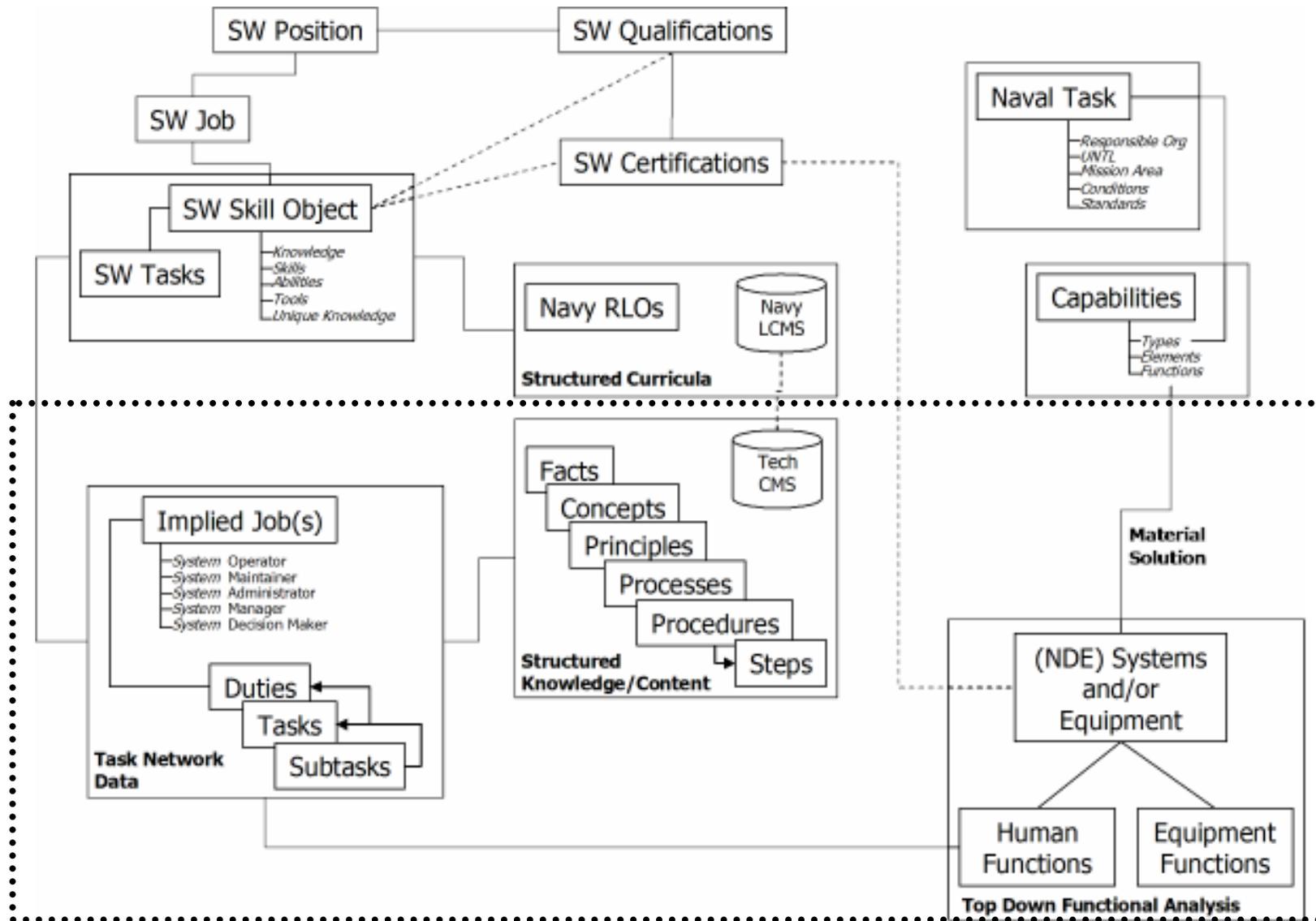
Manpower and Fiscal Constraints



Navy decided to reduce manpower

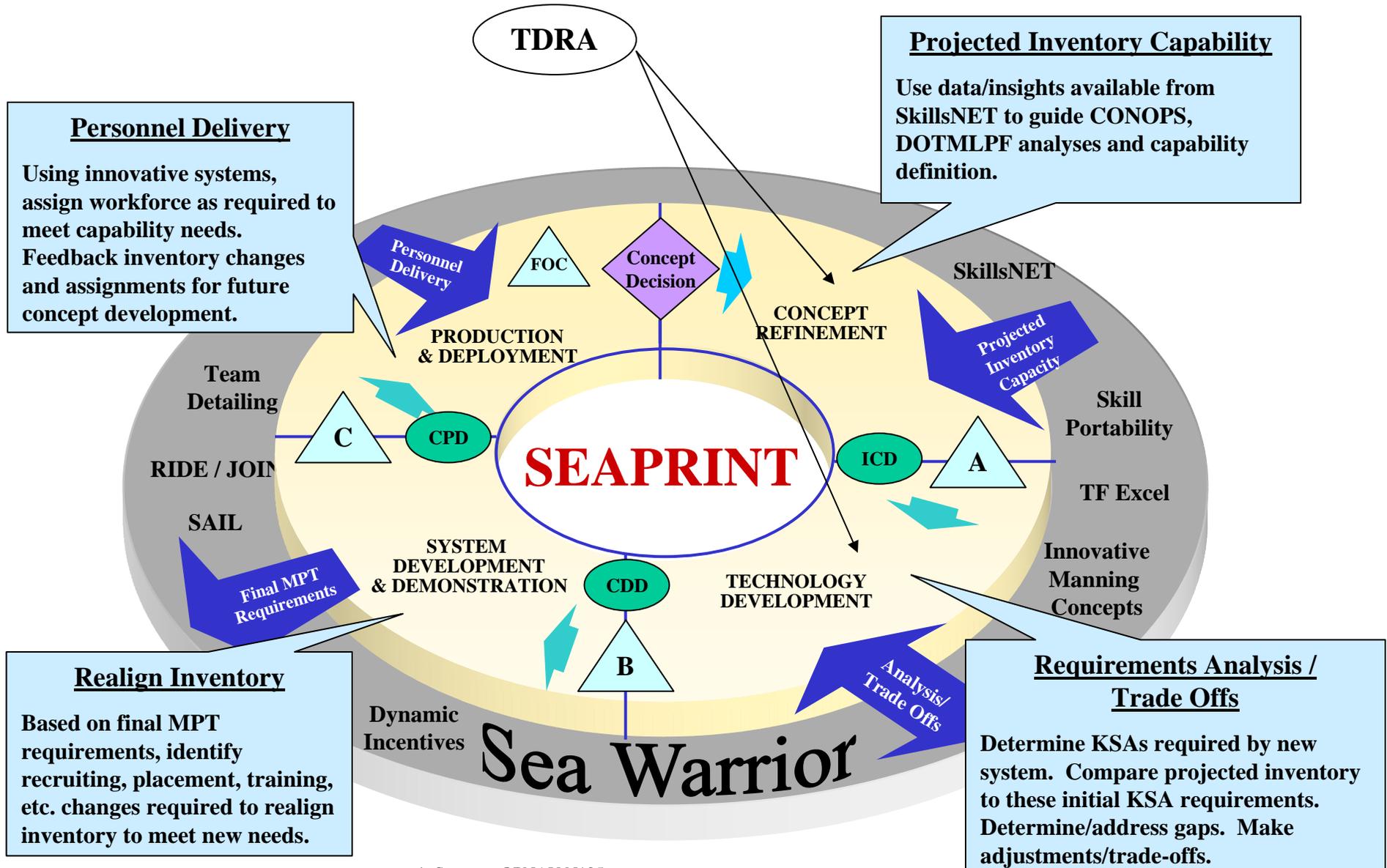
- **New Skills and Skill Mix**
- **Manpower KPP – Potential Showstopper**
- **Training cannot be an afterthought**
- **No \$'s in budget for error**

SYSCOM Deliverables





The SEAPRINT Interface

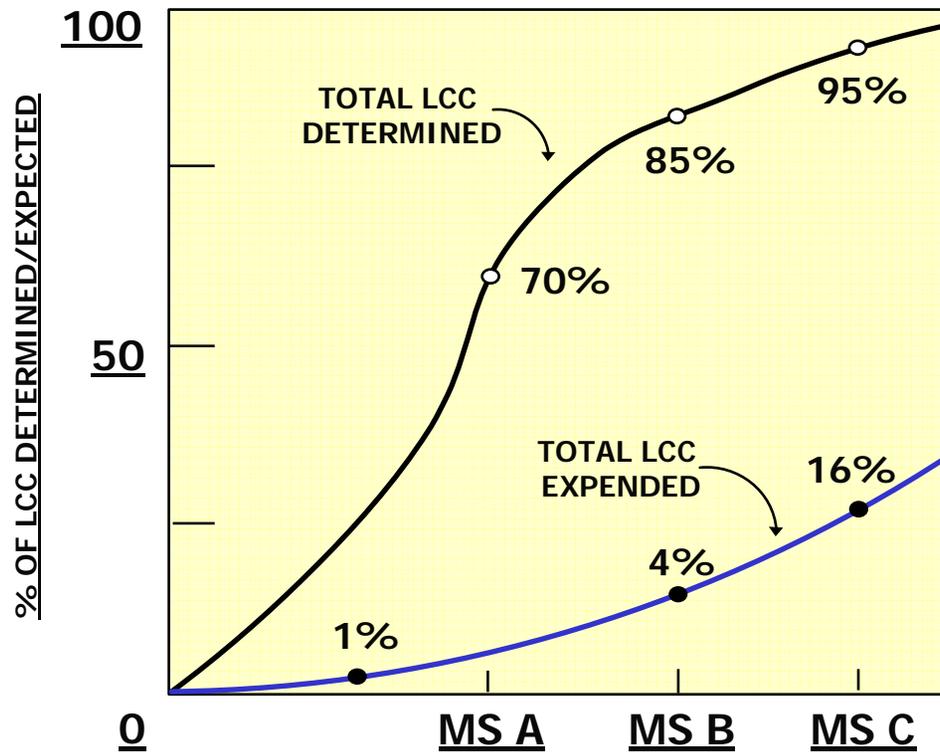


* Source.. OPNAV N125



System Life Cycle DAB Milestones

Impact of Decisions on Life Cycle Costing





Distance Support 2.0 Is...

...the Foundation for the Joint Distance Support and Response ACTD



JDSR Concept of Operation

1. Project Near Real Time National SME and Knowledge to Weapon Maintainer and Platform

Weapon System Program Mgr.

Weapon System Overhaul Depot

Weapon System Manufacturer

Audio / Video / Data Collaborative Telecommunications

- Remote Diagnostic Support Sys
- Interactive Electronic TMs
- Remote TMDE Access / Control
- Help Desk Operation
- Case-Based Maintenance

2. Provides JTF Commanders Situational Awareness of Weapon System(s) / Platform(s) Readiness



www.jdsr.net