Human Systems Integration
What is It? Why Should We Do It?

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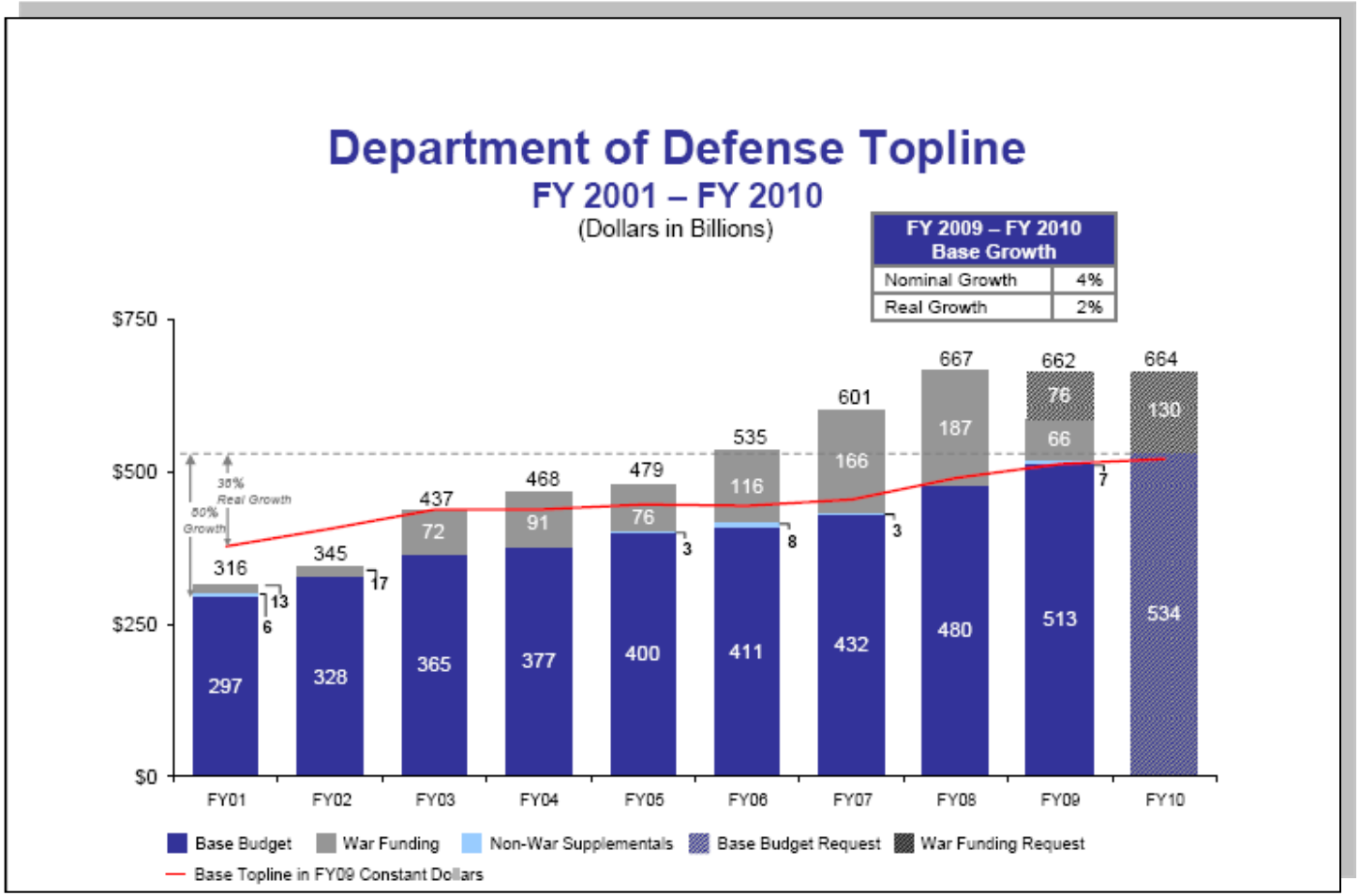
Outline

- Examine Human Component of the Defense Budget
- Summarize “What Is” Human Systems Integration (HSI)
- Summarize DoD HSI Policy
- Address the Role of the Human and the “System”
- Address How Much HSI is Enough
- Discuss Several HSI Success Stories
- Discuss DoD Efforts to Better Organize and Align HSI Efforts

DoD Defense Budget



Focusing on FY09 and FY10…… Base Budget > $500B **(see next slide)**

Ref: http://www.defenselink.mil/news/FY10%20Budget%20Request.pdf

Human Aspect of the Defense Budget…It's Really Big!

Summary By Appropriation Title

(Dollars in Billions)

Appropriation Title	FY 2009	FY 2010	Δ FY 2009 – FY 2010
Military Personnel	124.9	136.0	+8.9%
Operation & Maintenance	179.1	185.7	+3.7%
Procurement	101.7	107.4	+5.6%
RDT&E	79.5	78.6	-1.1%
Military Construction	21.9	21.0	-4.1%
Family Housing	3.2	2.0	-38.0%
Other	3.2	3.1	-1.1%
Total	513.3	533.8	+4.0%

We need to be smart when we think about the human dimension and the DoD Enterprise.

Ref: http://www.defenselink.mil/news/FY10%20Budget%20Request.pdf

HSI Domains

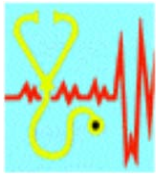
MANPOWER - number of military and civilian personnel required and potentially available to operate, maintain, sustain and provide training for systems

SURVIVABILITY - characteristics of system that can reduce fratricide, detectability, and probability of attack, as well as minimizing system damage, personal injury, and cognitive and physical fatigue

PERSONNEL - cognitive and physical capabilities require to train, operate, maintain and sustain material and information systems

SAFETY - design and operating characteristics of a system that minimize the human or machine errors or failures that cause accidents

TRAINING - instruction, education, and OJT required to provide personnel and units with their essential job skills, knowledge, values and attitudes.



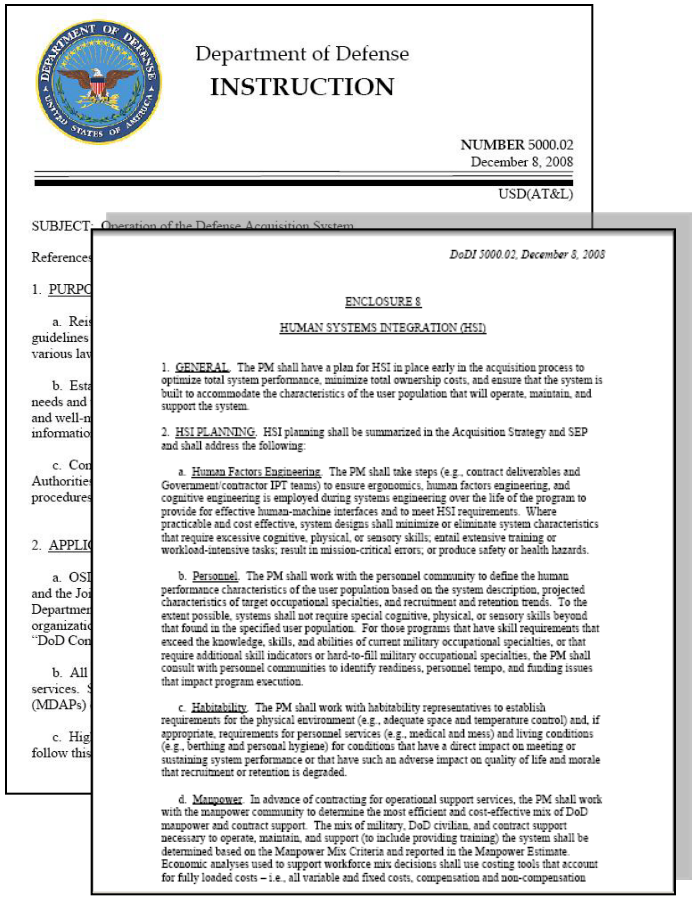
OCCUPATIONAL HEALTH - design and operating characteristics of a system that create significant risks of bodily injury or death; sources of health hazards include: loud noise, chemical and biological substances, extreme temperatures, and radiation energy.

HUMAN FACTORS ENGINEERING - integration of characteristics into system definition, design, development and evaluation to optimize human-machine performance

HABITABILITY – establish requirements for physical environment (e.g. , adequate space and temperature control) and, if appropriate, requirements for personnel services (e.g., medical and mess) living conditions that have a direct impact on meeting or sustaining system performance.

HSI Policy and Guidance

Policy: DoD Acquisition Management System



Department of Defense
INSTRUCTION

NUMBER 5000.02
December 8, 2008

USD(AT&L)

SUBJECT: Operation of the Defense Acquisition System

DoDI 5000.02, December 8, 2008

ENCLOSURE 8

HUMAN SYSTEMS INTEGRATION (HSI)

1. GENERAL. The PM shall have a plan for HSI in place early in the acquisition process to optimize total system performance, minimize total ownership costs, and ensure that the system is built to accommodate the characteristics of the user population that will operate, maintain, and support the system.

2. HSI PLANNING. HSI planning shall be summarized in the Acquisition Strategy and SEP and shall address the following:

a. Human Factors Engineering. The PM shall take steps (e.g., contract deliverables and Government/contractor IPT teams) to ensure ergonomics, human factors engineering, and cognitive engineering is employed during systems engineering over the life of the program to provide for effective human-machine interfaces and to meet HSI requirements. Where practicable and cost effective, system designs shall minimize or eliminate system characteristics that require excessive cognitive, physical, or sensory skills; entail extensive training or workload-intensive tasks; result in mission-critical errors; or produce safety or health hazards.

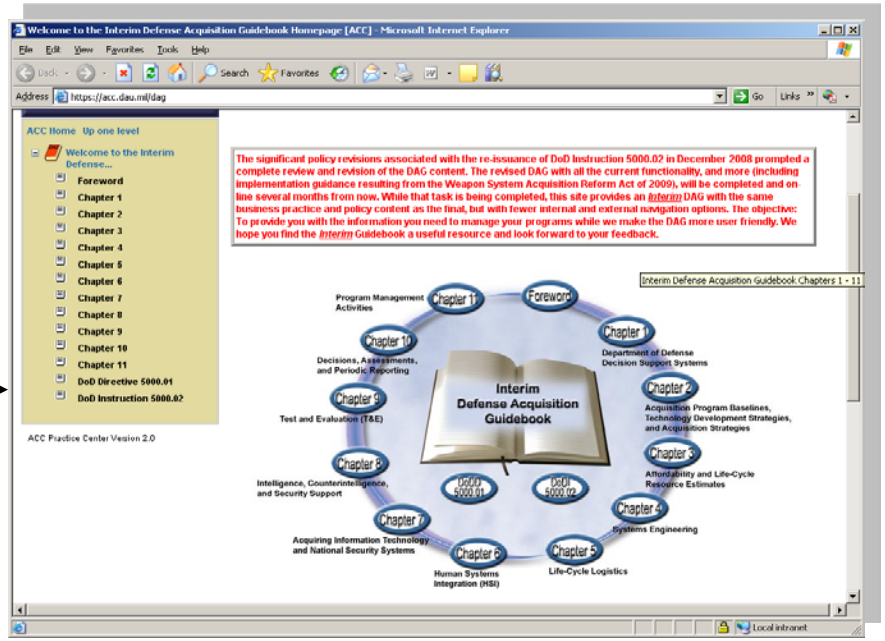
b. Personnel. The PM shall work with the personnel community to define the human performance characteristics of the user population based on the system description, projected characteristics of target occupational specialties, and recruitment and retention trends. To the extent possible, systems shall not require special cognitive, physical, or sensory skills beyond that found in the specified user population. For those programs that have skill requirements that exceed the knowledge, skills, and abilities of current military occupational specialties, or that require additional skill indicators or hard-to-fill military occupational specialties, the PM shall consult with personnel communities to identify readiness, personnel tempo, and funding issues that impact program execution.

c. Habitability. The PM shall work with habitability representatives to establish requirements for the physical environment (e.g., adequate space and temperature control) and, if appropriate, requirements for personnel services (e.g., medical and mess) and living conditions (e.g., berthing and personal hygiene) for conditions that have a direct impact on meeting or sustaining system performance or that have such an adverse impact on quality of life and morale that recruitment or retention is degraded.

d. Manpower. In advance of contracting for operational support services, the PM shall work with the manpower community to determine the most efficient and cost-effective mix of DoD manpower and contract support. The mix of military, DoD civilian, and contract support necessary to operate, maintain, and support (to include providing training) the system shall be determined based on the Manpower Mix Criteria and reported in the Manpower Estimate. Economic analyses used to support workforce mix decisions shall use costing tools that account for fully loaded costs – i.e., all variable and fixed costs, compensation and non-compensation

DoDI 5000.02 Enclosure (8)

Defense Acquisition Guidebook (DAG)



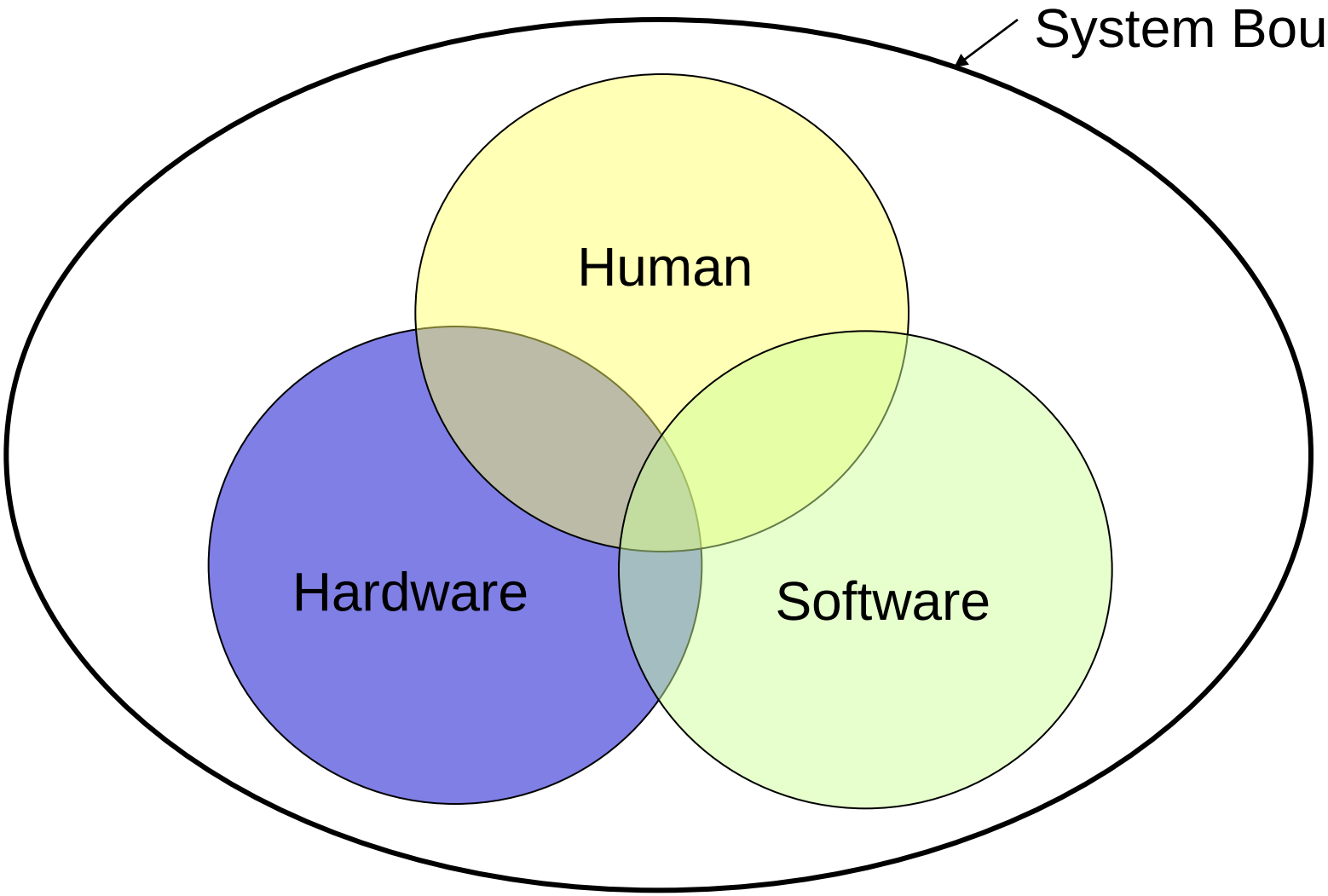
DAG Ch 6 Human Systems Integration (HSI)
https://acc.dau.mil/dagch6/

DoD Acquisition Policy

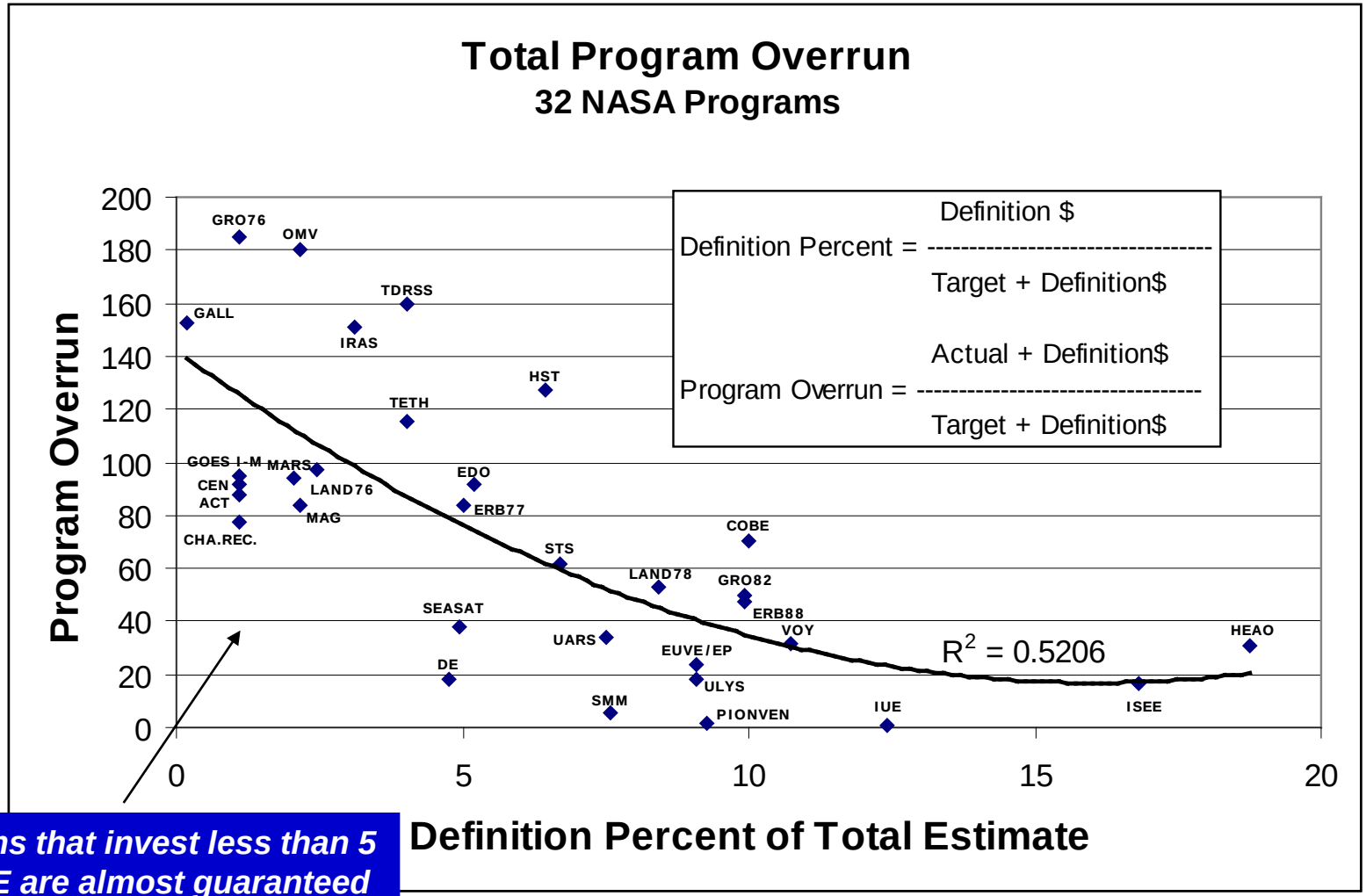
"The PM shall have a plan for HSI in place early in the acquisition process to **optimize total system performance**, **minimize total ownership costs**, and ensure that the system is built to accommodate the characteristics of the user population that will operate, maintain, and support the system."

DoDI 5000.02: Operation of the Defense Acquisition System, Enclosure (8)

The Human is Part of the System



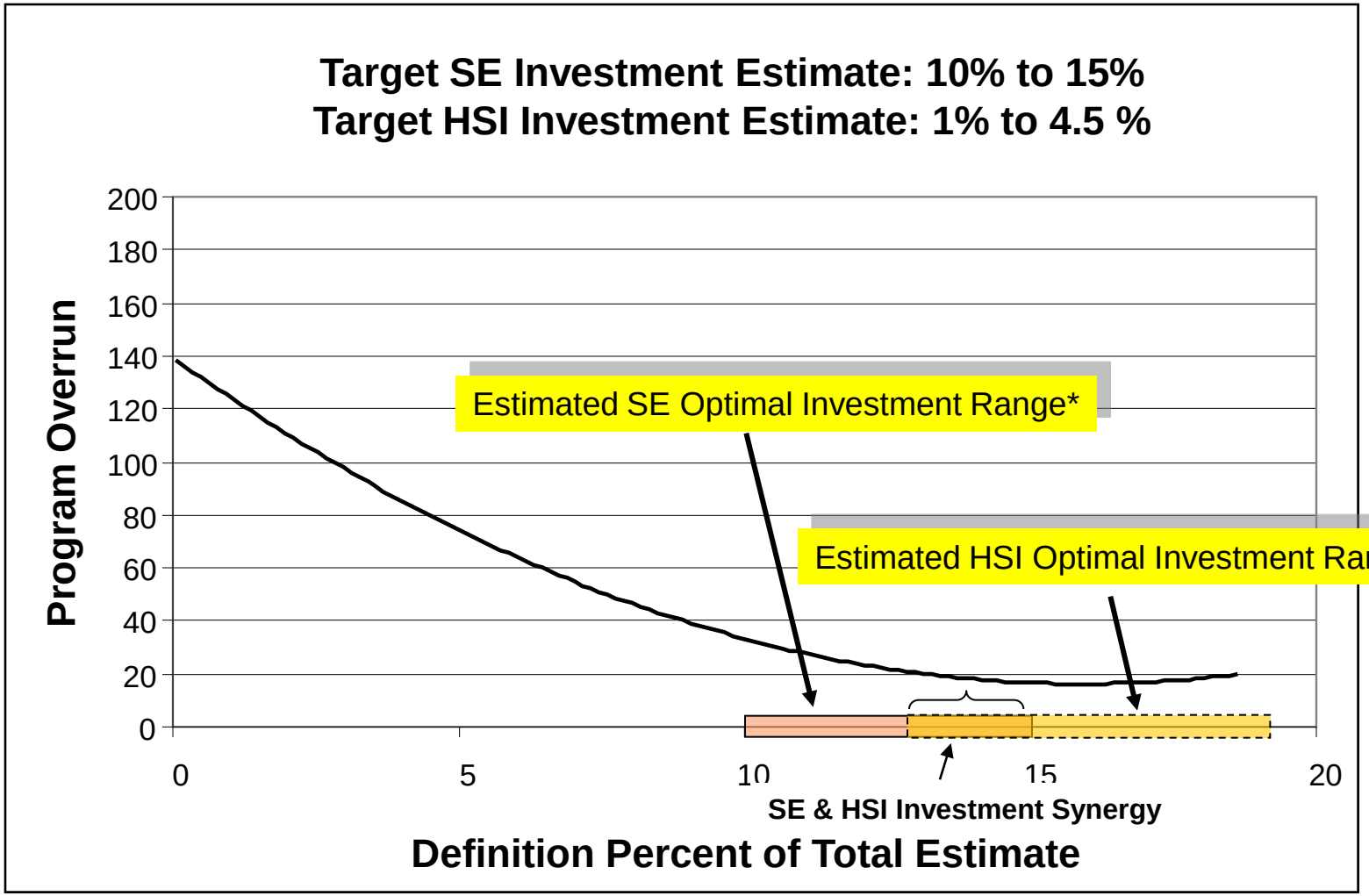
NASA SE Investment Analysis



Programs that invest less than 5 % on SE are almost guaranteed an 80% or greater overrun.

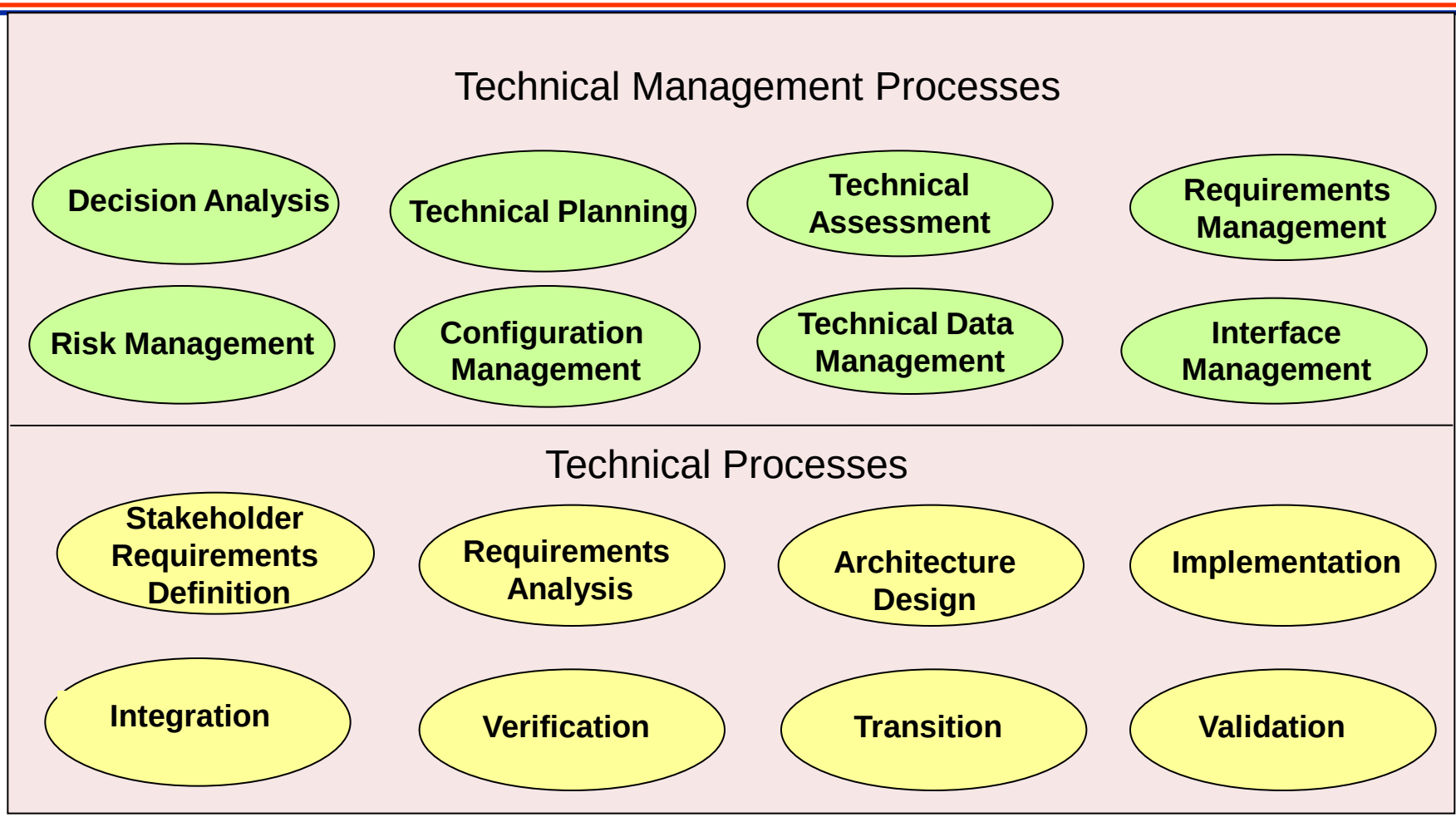
Source Werner Gruhl, 1992
NASA Comptroller's Office

Consolidated SE and Design Consideration (e.g. HSI) Investment Outlook



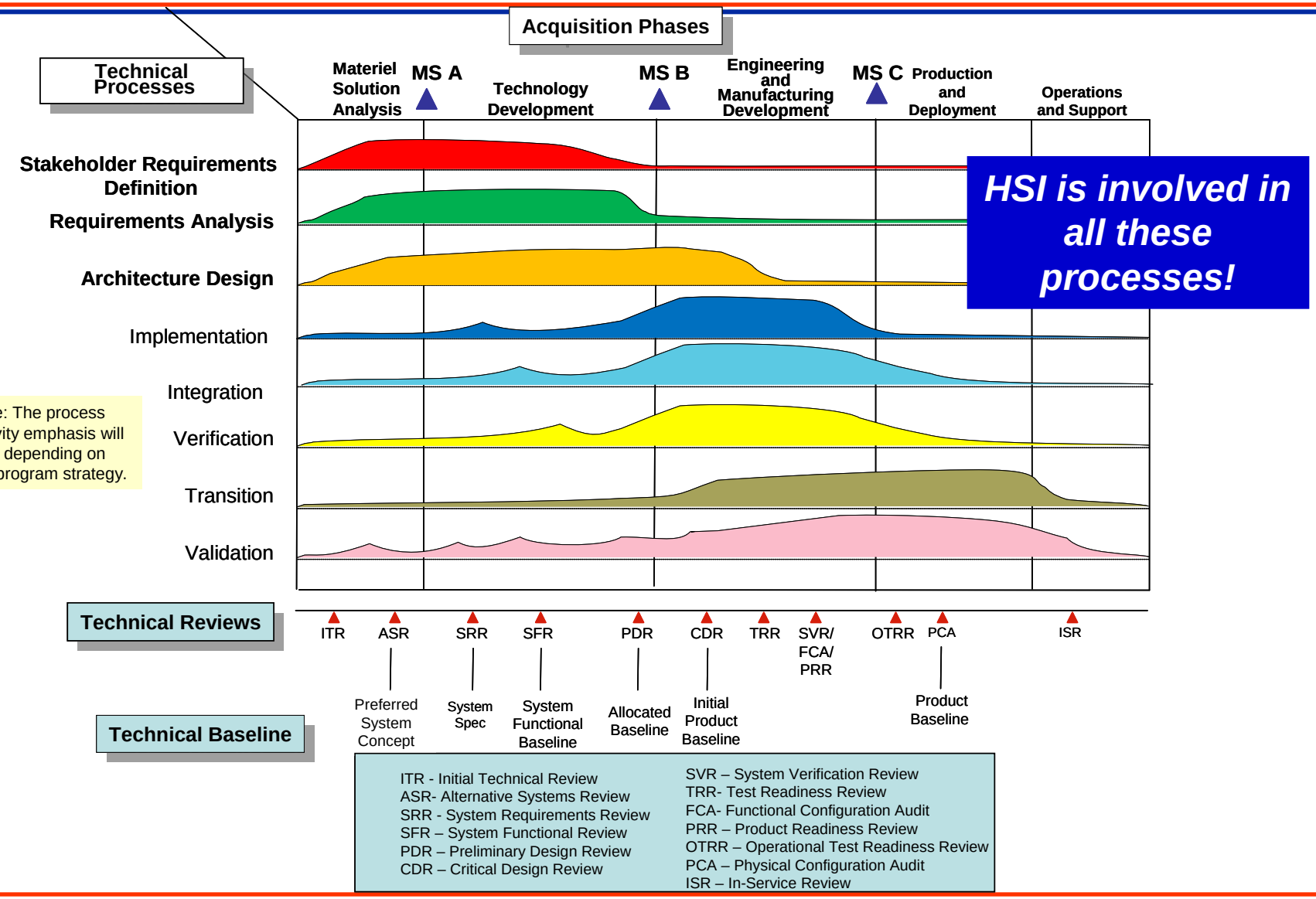
*Ref: Impact of SE at NASA (SECOE 02-02) http://www.incose.org/secoe/

Technical and Technical Management Processes for Engineering a System



The respective overarching technical processes (that include HSI) are iterative, concurrent, & integrated …and the processes are applied with different emphasis over the program development life cycle.

Technical Processes
Notional Emphasis of Activity



HSI Success Stories

Lightweight 155mm Howitzer

HRED Contributions:

- Human Factors Evaluation
- Task Network Modeling & Validation
- Human Figure Modeling
- Concept Design, Fabrication Evaluation
- Operational Assessment

REQUIREMENTS RISK REDUCTION

FUNCTION	SHOOT-OFF	JORD	IMPRINT
EMPLACEMENT (firm soil)	284 sec	180 sec	184 - 202 sec
EMPLACEMENT (loose soil)		180 sec	138 - 152 sec
DISPLACEMENT	176 sec	120 sec	120 - 134 sec
RATE-OF-FIRE (for 2 min)	4.2rd/min 5.0 rds/min	4.1 - 4.5 rds/min[1]	
BOLD SHIFT	423# sec	180 sec	172 - 204 sec [3]
1ST RD RESPONSE LOW ANGLE	41 sec	30 sec	27- 30 sec [3]
1ST RD RESPONSE HIGH ANGLE	56 sec	45 sec	45 - 49 sec [3]

(1) assumes bang-to-bang and first round free
(2) fixed; may need 7 crewmen in sand & mud
(3) worst case QE (800 LO, 1200 HI); lower QE will have lower times

JPM XM777 estimates $6.2M cost avoidance due to MANPRINT efforts

F-22 Maintenance Study

U.S. AIR FORCE

Domains affected: manpower, personnel, training

- 1995-1996 IMPACT analysis for Rivet Workforce
  - How many maintenance specialties can be "rivetted" together?
- Predecessor F-16 system had 15
- Study looked at 10, 7, and 5
- Max compression of 5 specialties reduced manpower cost but raised training cost for life of F-22
- "Sweet spot" was 10 specialties

- $2M overall investment
  - Manpower, personnel, and training decision support system (MPT-DSS)
- $777M overall savings
  - $335M saved on Maintenance AFSC structure and training
  - $442M saved on ACC maintenance organization restructure
- Return on investment 388:1 in life cycle cost avoidance
- MPT-DSS recommended and used in JSF decision making

Integrity - Service - Excellence

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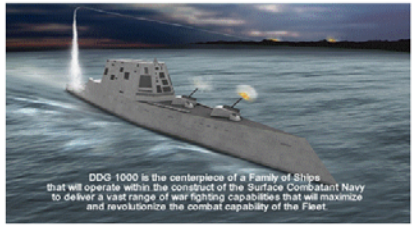
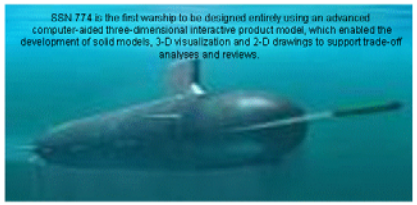
HSI Success: DDG1000 & VA Class Submarine



DDG 1000 is the centerpiece of a Family of Ships that will operate within the construct of the Surface Combatant Navy to deliver a vast range of war fighting capabilities that will maximize and revolutionize the combat capability of the Fleet.



SSN 774 is the first warship to be designed entirely using an advanced computer-aided three-dimensional interactive product model, which enabled the development of solid models, 3-D visualization and 2-D drawings to support trade-off analyses and reviews.

- **High HSI impact for both programs:**
  - Reduced manning costs
  - Manpower / Workload reductions
  - Survivability, Safety, Health Hazard Risk avoidance
  - Performance enhancement
  - Cross domain use of task and role analysis
- **Fleet brought in early to identify design hazards, proposing modifications to optimize design for human performance**
- **DDG 1000 leveraged human performance modeling very early in system design to explore impact of manning concepts, automation technologies, and other system design concepts on crew ability perform the mission.**
- **VA Class Submarine identified life cycle cost avoidance, safety, human performance enhancement**

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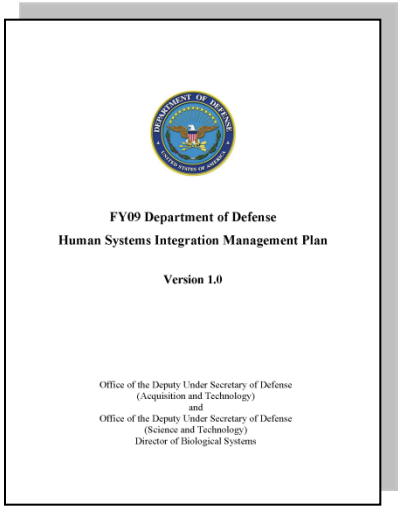
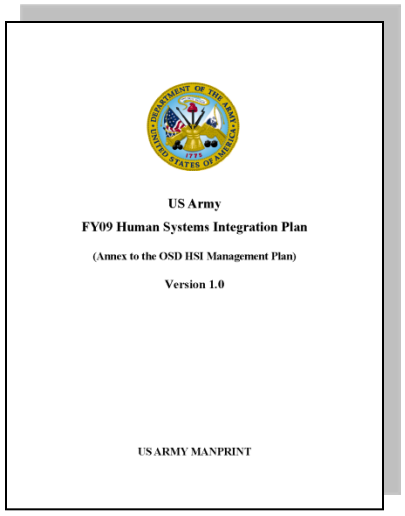
DoD HSI Plan

Objectives:
- Foster communication
- Address common need areas
- Describe how HSI is implemented
- Report on progress against plan
- Foster consistency where it makes sense

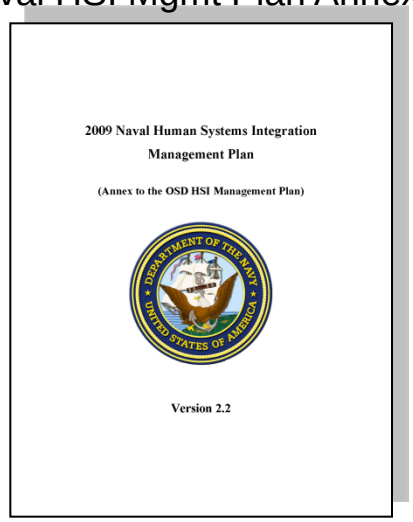

FY09 Department of Defense
Human Systems Integration Management Plan
Version 1.0
Office of the Deputy Under Secretary of Defense
(Acquisition and Technology)
and
Office of the Deputy Under Secretary of Defense
(Science and Technology)
Director of Biological Systems

Summary Outline
- HSI Organization
- Roles and Responsibilities
- Lifecycle Process
- HSI Acquisition Integration
- HSI Human Capital Development
- FY09 Key Tasks
- FY09 Schedule
- Resource Requirements
- Maturity and Effectiveness Metrics
- Assessment Process

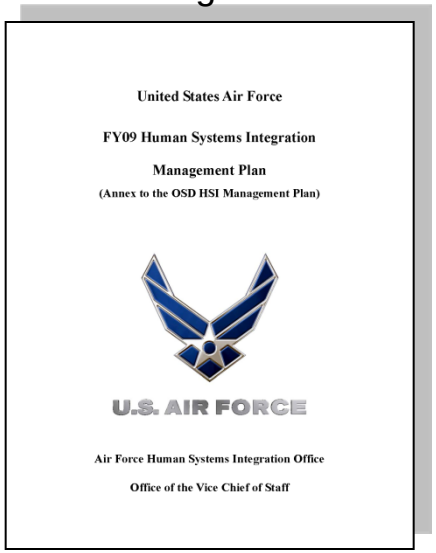
Army HSI Mgmt Plan Annex


US Army
FY09 Human Systems Integration Plan
(Annex to the OSD HSI Management Plan)
Version 1.0
US ARMY MANPRINT

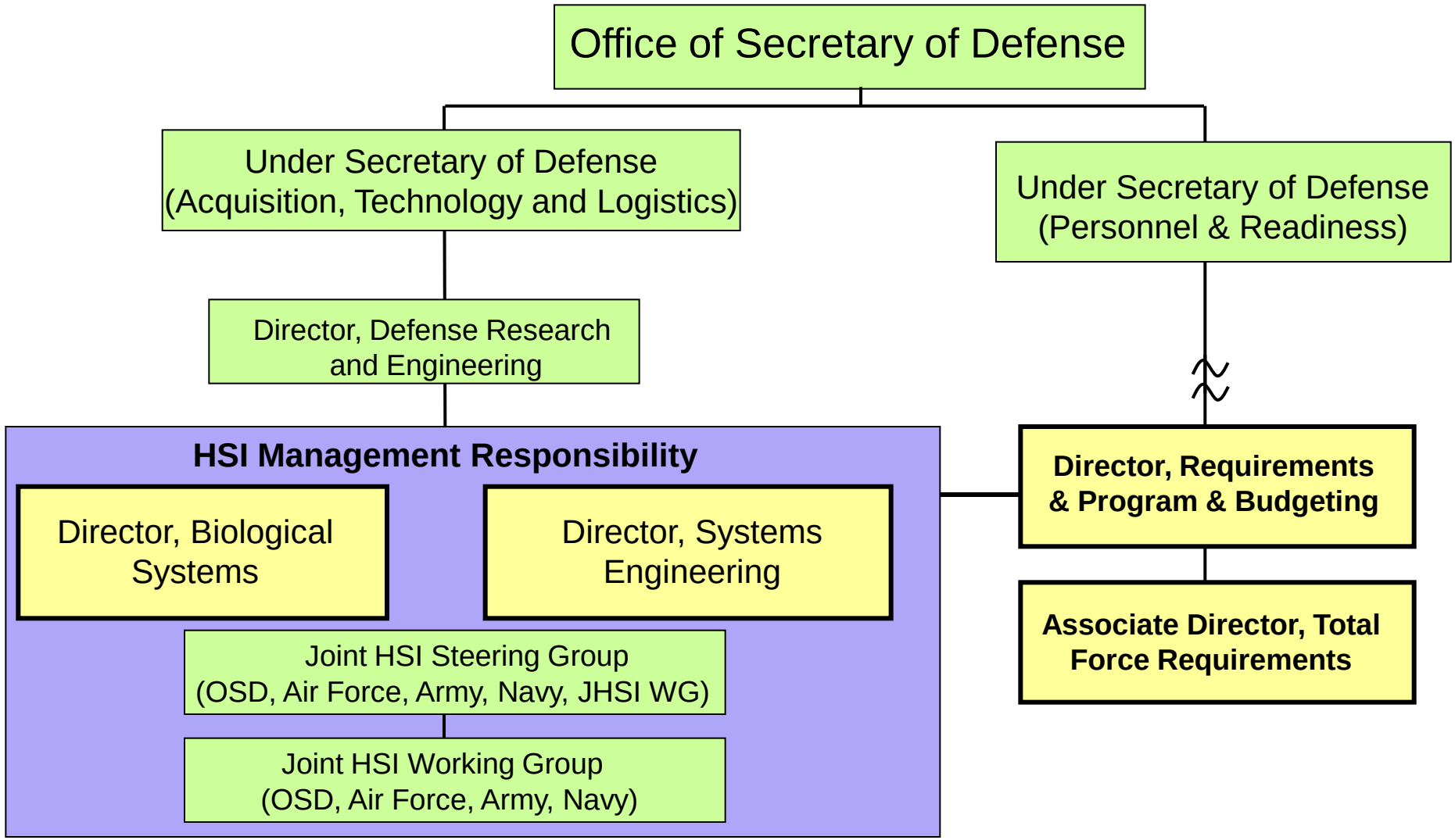
Naval HSI Mgmt Plan Annex


2009 Naval Human Systems Integration
Management Plan
(Annex to the OSD HSI Management Plan)
Version 2.2

Air Force HSI Mgmt Plan Annex

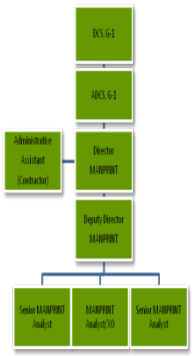

United States Air Force
FY09 Human Systems Integration
Management Plan
(Annex to the OSD HSI Management Plan)
U.S. AIR FORCE
Air Force Human Systems Integration Office
Office of the Vice Chief of Staff

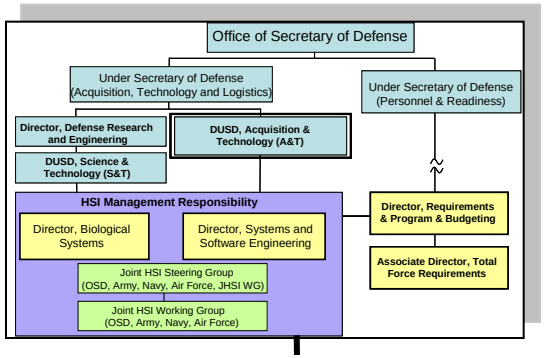
OSD HSI Organization



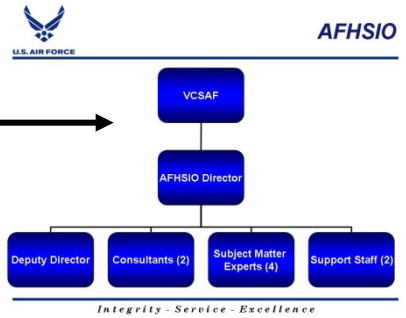
DoD HSI Acquisition Implementation

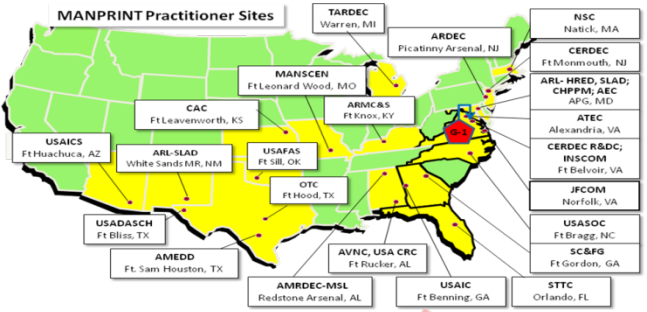
Army MANPRINT Program



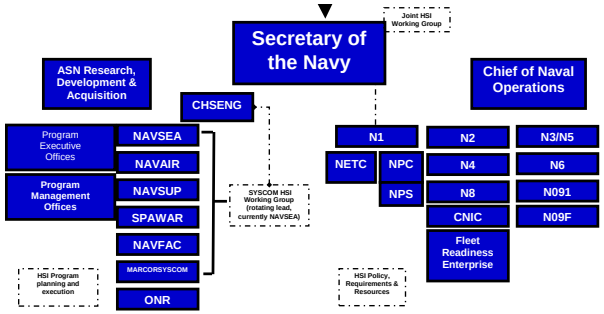


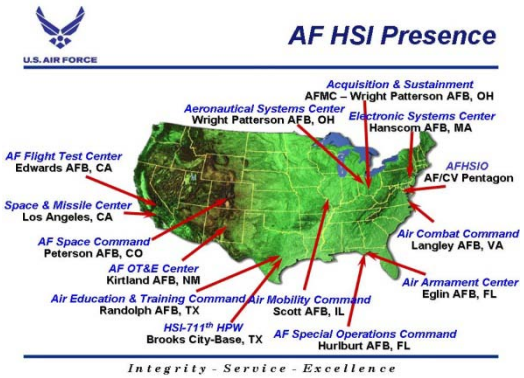
Air Force HSI Program

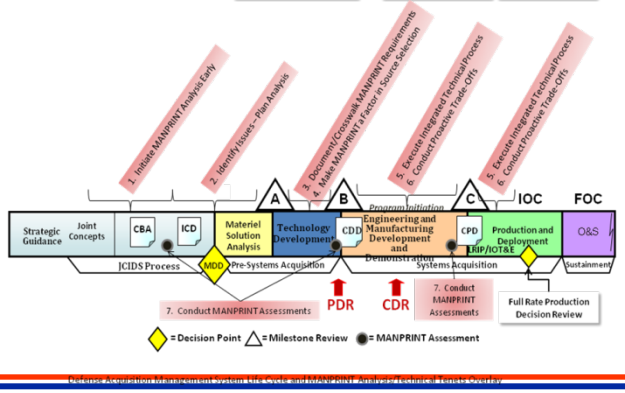


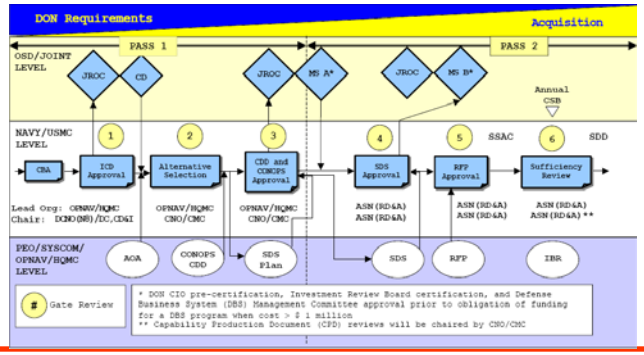


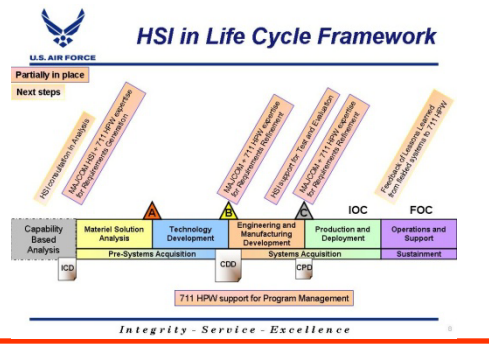
NAVPRINT Program











Defense Acquisition Management System Life Cycle and MANPRINT Analysis Technical Tenets Overlay

UNCLASSIFIED

Summary

- The Human Component is a significant portion of the overall defense budget.
- HSI is a strategy to optimize total system performance and minimize total ownership costs.
- HSI is part of Systems Engineering.
- The DoD HSI Management Plan is intended to better organize and align efforts within acquisition.

Thank You!

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