Headquarters U.S. Air Force

Integrity - Service - Excellence

Human Systems Integration (HSI) in Acquisition – Integrating Human Concerns into Life Cycle Systems Engineering

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Overview

- Air Force HSI Office (AFHSIO)
- Project Objective
- Description
- Approach
- Results
- Possible Future Uses

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AFHSIO Background

- Established in 2007 as a result of a 2004 AF Scientific Advisory Board Report
- In the past two years since the AF HSI Office (AFHSIO) established:
  - Identified top issues and instituted policy changes
  - Formalized and initiated Air Staff-level IPT
  - Moved forward with an education and training path
  - Launched and completed a series of projects to achieve mission

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AFHSIO Mission Statement

- *Ensure all AF warfighting systems are designed, built, operated, and sustained in a manner that optimizes total system performance at every warfighter level*, directly supports the Air Force mission *to fly, fight and win in air, space, and cyberspace*
- AF HSI Objectives
  - *Integrate* HSI considerations and processes into the Acquisition, Technology and Logistics Life Cycle Management Framework to equip and sustain Airmen
  - *Institutionalize* HSI as the way of doing business to increase total system performance and reduce life cycle costs
  - *Sustain* HSI planning and implementation through collaboration with partners in OSD, AF, sister services, industry, and academia
  - *Improve* HSI processes through metrics, feedback, and lessons learned

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AFHSIO Roles

- Facilitate and advocate integration of HSI into the Integrated Life Cycle Management (ILCM) framework and AF policies and guidance to comprehensively implement, assess, and improve HSI.
- Develop and deliver comprehensive HSI education and training, tools, technology and methods to support Program Executive Officers (PEO), Program Managers (PM), Systems Engineers, and others involved in requirements development, acquisition and sustainment.
- Provide expert advice, real-time assistance, and implementation strategies of HSI.
- Support the development, communication and implementation of HSI initiatives.

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Project Objective

Objective: Integrate HSI considerations and processes into the Acquisition, Technology and Logistics Life Cycle Management Framework to equip and sustain Airmen

- Develop a product:
  - To facilitate systems engineers' understanding of what HSI domain experts bring to the table.
  - To help HSI domain experts understand their role in the acquisition process.
  - To assist domain and systems engineering integration on HSI issues.

Target Audience – Systems Engineers

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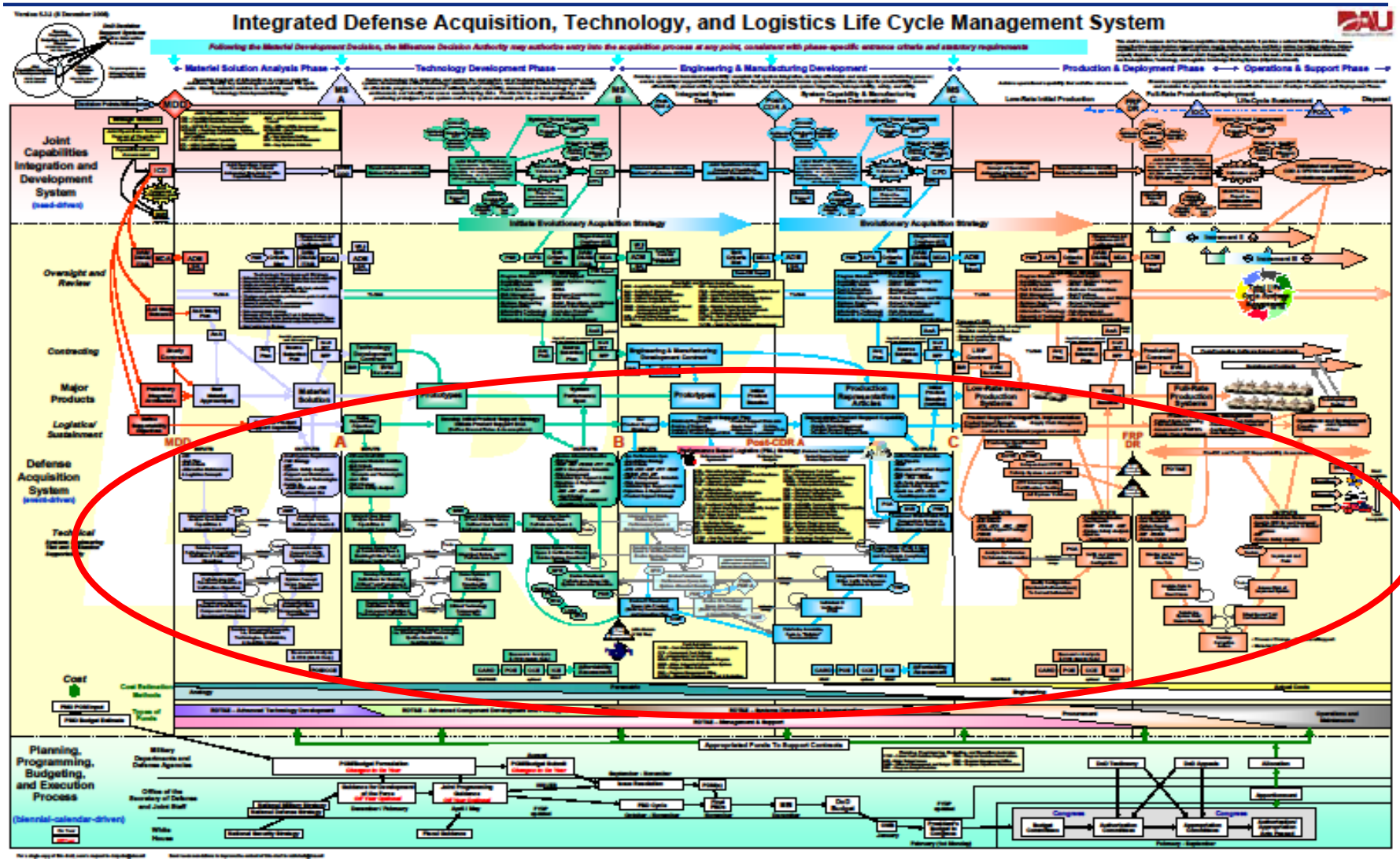
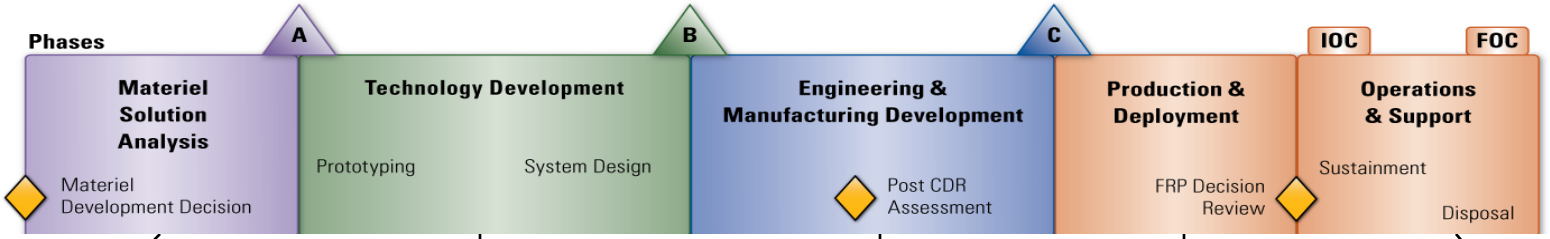
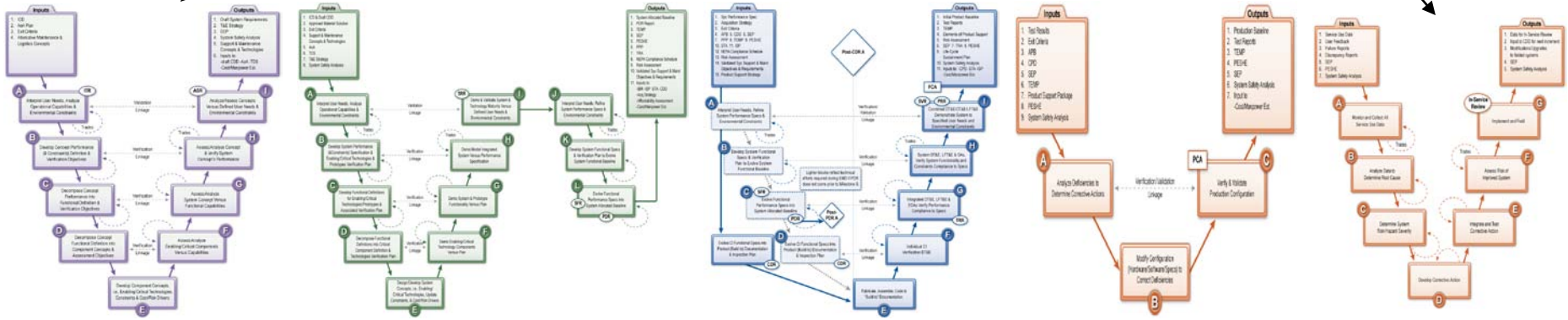
Starting Point – DoD Acquisition Life Cycle



Human Systems Integration (HSI) is the interdisciplinary technical and management processes for integrating human considerations within and across all system elements; an essential enabler to systems engineering practice. The HSI processes facilitate trade-offs among the human-centric domains without replacing individual domain activities, responsibilities, or reporting channels. This product maps HSI activities to the systems engineering processes and technical reviews for the acquisition life cycle.

Acquisition Life Cycle and Systems Engineering Technical Review Timing





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HSI Domains

Human Factors Engineering	Manpower	Personnel	Training
*Design compatability with performance capability and expectations *Crew workload *Situational awareness *Human performance and reliability *Human performance requirements *Lighting *Usability *Maintenance interface *Costs implications of human error, inefficiency	*System manning requirements *Deployment considerations *Force structure *Manpower policy *System Manpower Estimate Reports (MERs) *A76 Considerations *BRAC Considerations *Life cycle cost implications of manpower decisions	*Personnel selection and classification *Human aptitudes *Demographics *Knowledge, skills, abilities *Accession/Attrition *Career progression & retention *Promotion flow *Personnel and training pipeline flow *Recruiting *Cognitive, physical, educational profiles	*Training concepts and strategies *Training tasks and development methods *Media, equipment, facilities *Modeling and simulation *Virtual applications *Trainer currency *Training vs. Job Aids *Timeliness of delivery *Inputs to policy implications for training flow and costs

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HSI Domains

		ESOH		
Habitability	**Survivability**	**Environment**	**Safety**	**Occupational Health**
*Physical environment (*e.g.,* berth, toilet, bath) *Support services (*e.g.,* food, medical, clergy, recreation) *Impact on sustained mission effectiveness *Impact on recruiting and retention	*Threats *Fratricide Identification Friend/Foe (IFF) *Crew compartment damage *Camouflage and concealment *Protective equipment *Medical injury *Fatigue & Stress *Degraded mission	*Induced health hazards *Mechanical *Acoustics *Biological & chemical *Radiation *Oxygen deficiency and pressurization *Temperature & weather *Shock & vibration *Laser protection	*Normal & Emergency Procedures *Human error *System reliability & fault reduction *System risk reduction *Comprehensive Safety (*e.g.,* Flight, Weapon, Ground, NBC)	*Occupational health hazard reduction *Repetitive motion injuries *Heat, cold, hydration *Stress and fatigue *Exercise & Fitness *Personal protection *Disease prevention (vaccines/hygiene)

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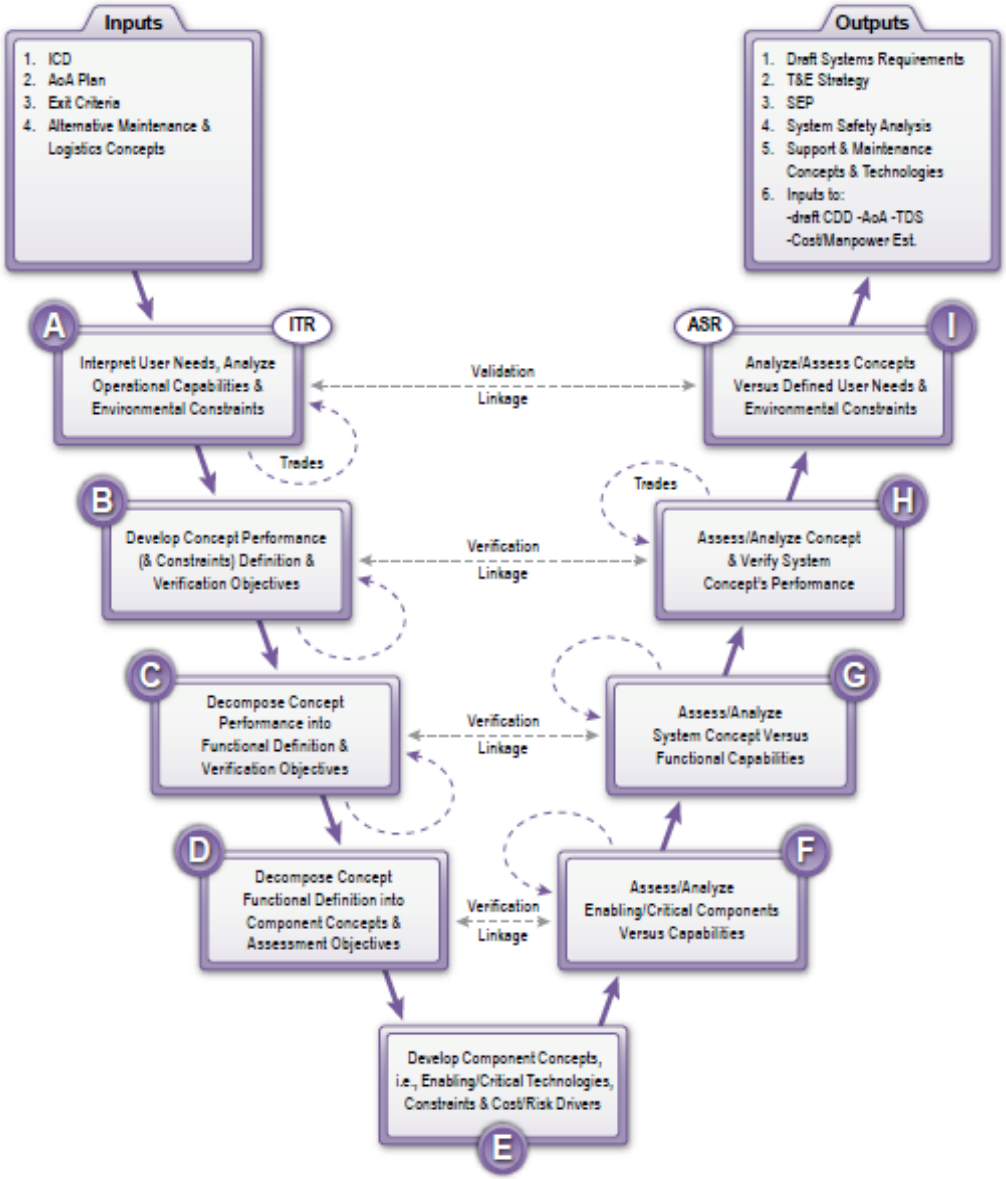
Description

- Graphically depict HSI domain activities for each acquisition phase
- Identify applicable references and potential tools for performing the domain activities
- Analyze domain activities to produce a list of integrated HSI activities for each acquisition phase

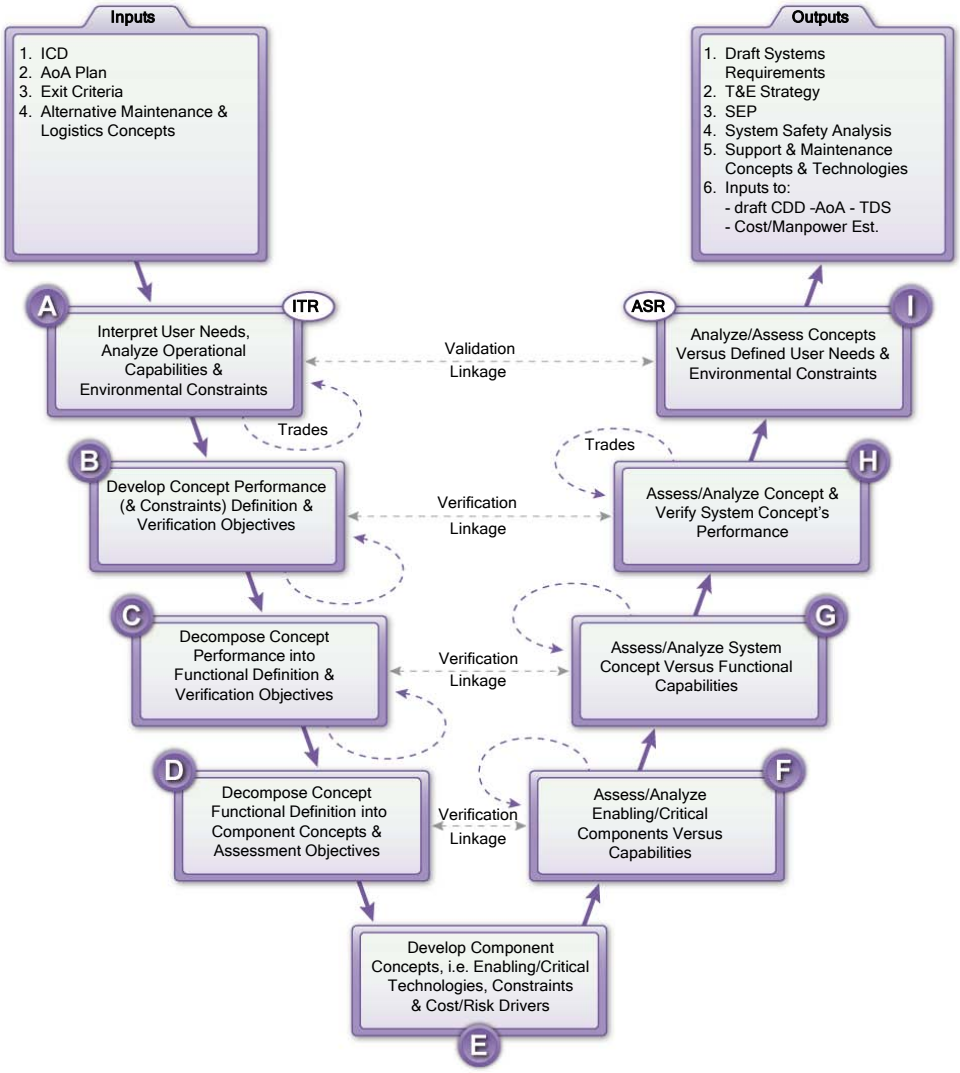
Materiel Solution Analysis Phase



Materiel Solution Analysis Phase:
Personnel

Activities for Each Input :

1.0 Review all available data (CONOPS, ICD, requirements documents, etc.)
1.1 Identify a baseline comparison system (BCS) for comparative analysis
1.2 Initiate Personnel requirements assessment
2.0 Begin developing a target audience description
2.1 Provide key skill set necessities to support system for AoA inclusion
3.0 Provide exit criteria including BCS and Integration Strategy for Personnel into the SEP
4.0 Assess personnel drivers
4.1 Look for problem areas and consider tradeoffs
4.2 Provide a list of issues/risks



The numbers in the Activities boxes correspond to the numbers in the Inputs and Outputs boxes.

Activities for Each Output :

1.1 Provide Personnel objectives, constraints, performance criteria
1.2 Identify potential new AFSCs or SEIs required to operate and support the new system
2.0 Review the initial task list based on test operations tasks
3.0 Identify responsibilities for Personnel integration into SE
4.0 Review the system safety analysis for potential personnel impacts
5.0 Assess the support and maintenance concepts and technologies
6.0 Provide Personnel inputs, as needed

References :

- AFPD 36-14, AFPD 36-21, & AFPD 36-22
- AFI 36-3802, AFI 36-2623, AFI 36-2305, AFI 36-2101, & AFI 36-2110

Tools :

- MIL/CIV PDS, CHRIS
- MPT DSS
- JASS, MVTA, TDFA
- Task Architect
- ACTA

Materiel Solution Analysis: Personnel

A

- Review aptitude constraint affects on the system functionality
- Identify potential needs for a new specialty code and/or skill set
- Recognize applicable Personnel criteria and asset requirements
- Review historical information (e.g., successes, mishaps, lessons-learned, poor human performance, etc.)

B

- Identify a baseline comparison system (BCS) and/or components for comparative analysis
- Determine personnel objectives, constraints, performance criteria, trade-offs, risks, and cost-drivers as inputs to major program documentation

C

- Begin developing a target audience description (TAD) based on the functional definition and the operations and support concept
- Compare known parameters of the BCS with functional requirements of the new system(s)

D

- Compare known parameters of the BCS with functional requirements of the new system(s)

E

- Estimate personnel necessities required for the new system (operation, maintenance, support)
- Ensure personnel requirements are adequately addressed in analyses, modeling & simulation, demonstrations, etc.

F

- Assess personnel requirements against critical component capabilities
- Document risks where Air Force personnel (military and civilian) may be unable to support system components without process and/or product modification
- Begin building task lists for the various alternatives for tasks associated with operating, maintaining, and supporting the system

G

- Associate tasks to AFSCs and assess initial training personnel requirements
- Assess personnel requirements against functional capabilities
- Document risks where Air Force personnel may be unable to support system functions without process and/or product modification
- Assess each system concept against identified Personnel criteria and requirements

H

- Evaluate the overall system's concept ability to meet performance capability requirements within identified personnel constraints
- Document risks of Air Force personnel ability to support the system without process and/or product change

I

- Evaluate the overall system's concept ability to meet performance capability requirements within identified personnel constraints
- Document risks of Air Force personnel ability to support the system without process and/or product change
- Refine the initial task lists for tasks associated with operating, maintaining, and supporting the system, including identification of all AFSCs and civilian series

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ITR

- Review initial technical configuration and identify any personnel issues
- Ensure technical baseline is detailed enough to support a valid cost estimate

ASR

- Evaluate personnel costs for each alternative system and provide strategy options for reducing personnel costs if/as appropriate
- Ensure set of requirements agrees with user needs and expectations with respect to operations and maintenance concept

Trades

- Participate in trade studies to evaluate options against manpower costs throughout this phase

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The letters on this page correspond with the letters on the previous page, and are associated with the respective SE step boxes.

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Approach - Content

- Define HSI and domains for project
- Design a graphic template to easily display information
  - Leverage a sample format from another DOD ESOH product
  - Include information on references and tools leveraged from other projects
- Research past and existing information on HSI domain activities
- Develop straw man activity charts
- Identify subject matter experts (SMEs) and ask for chart reviews
- Consolidate over 500 SME comments
- Display and edit the information
- Revise content for new releases of the Acquisition Life Cycle chart (Dec 08), DODI 5000.02 (Feb 09) and AFI 63-101 (Apr 09)

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Approach – Usability Efforts

- Leverage familiarity with the DoD chart
  - Similar look and feel
  - Color coding sections to match
- Graphical Flow Considerations
  - Letters/bubbles, Lines dividing sections, etc.
  - Splitting larger acquisition phases into multiple charts
- Font type and size for readability
- Fingertip access to large amounts of data via hyperlinks
  - Internal book marks between terms, glossary, tools, acronyms
  - External links to reference documents and tools
- Screen tips on all acronyms

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Results

- Products contains on one easy-to-use CD
- Three hyperlinked guides
  - Management Version (32 slides)
    - Focus on integrated HSI activities
    - Target Audience: Program Managers
  - Acquisition Phase Version (184 slides)
    - Focus on acquisition phases
    - Target Audience: Systems Engineers
  - Domain Phase Version (194 slides)
    - Focus on domain activities
    - Target Audience: Domain SMEs

Main

Management Overview

Acquistion Phase

Domain Phase

Air Force Human Systems Integration Office

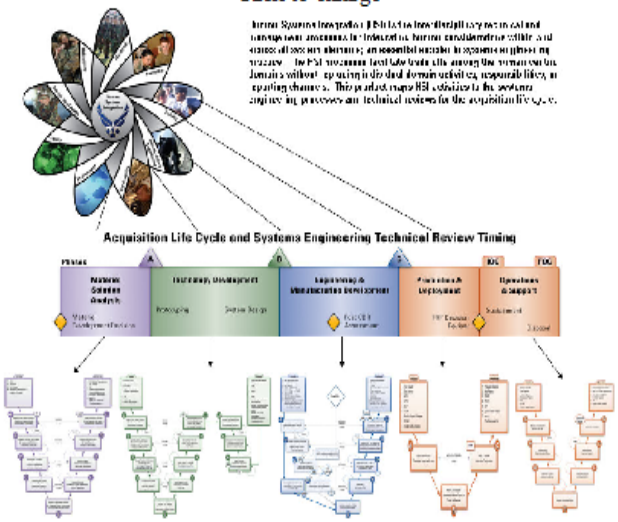
This CD contains three guides which map core Human Systems Integration (HSI) activities to the systems engineering activities depicted on the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System, Version 5.3.2 (3 December 2008). Relevant tasks, tools, and references for HSI and each of the HSI domains are identified and aligned with existing Systems Engineering processes and reviews for each acquisition phase.

The first guide is a management overview focusing on HSI activities. The second guide is a more detailed collection of HSI domain activities organized by acquisition phases. The final guide contains the same level of detail as the second, but is organized by domain to make it easier to narrow in on specific functional HSI activities required to support systems engineering processes.

These guides were designed to put a lot of information into a simple to understand graphic format with supporting reference material within fingertip reach. Each of the guides contains an acronym list, glossary, and descriptions of the tools identified. Hyperlinks for the references and tools are embedded throughout and screen tips spelling out every acronym appear when moving a mouse over the acronym.

This product was produced for the Air Force Human Systems Integration Office (AFHSIO) by Booz Allen Hamilton under the auspices of the Survivability/Vulnerability Information Analysis Center (SURVIAC).

Click to enlarge



Requests for copies and any other questions should be sent to;

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At this point in the presentation switch to open CD files and briefly illustrate the look and feel of the final product along with the maneuverability features (screen tips, hyperlinks, and bookmarks)

Results

- Captured domain and integrated HSI activities in a graphic format that can be used for:
  - Ready reference
  - Training
  - Increasing HSI awareness
- Organized information for ease of use for different audiences and purposes
  - Versions organized by acquisition phase and domain
  - Overview version focusing on HSI integrated activities and performance measures
- Hyperlinked electronic files
  - Internal bookmarks to acronyms, glossary, and tools
  - External hyperlinks to references and tool web sites

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Possible Future Uses

- Training – tool/illustration for acquisition and domain courses
- Reference Tool – handy reference for systems engineers and HSI practitioners
- Review Checklist – basis of future checklists to ensure HSI-related activities are performed during the acquisition life cycle
- Policy – ensure domain instructions incorporate and mandate these activities
- Strategic Communication – increase awareness of HSI concepts and activities
- Progress Measurement – basis for collecting performance data and monitoring HSI program effectiveness