Embedding Human Systems Integration within Systems Engineering Processes – a Peek into the Draft HSI MIL-HDBK

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Integrity ★ Service ★ Excellence

The Goal of HSI

> **HSI fully considers…**
the human in the design and engineering of a system, in such a way as to maximize total system performance (human + hardware + software) and minimize total ownership cost

Human Systems Integration Directorate
711 HPW/HP

> **MISSION:**
Optimize warfighter capability through a human-centric approach to system development, acquisition, and sustainment

HP Role in the USAF

HSI Practitioner

Integration

We represent the human

- Identify human limitations and capabilities
- Identify risks along with a risk mitigation plan (risk reduction)

Goal-optimize a systems performance by

- Integrating human to system(s) processes
- Highlight inefficiencies/efficiencies caused by human-in-the-loop
- Reduce risks to system/human life
- Reduce cost

MISSION SUCCESS

Background: HSI MIL-HDBK

DoD needs a consistent approach for applying HSI across a system's acquisition and sustainment life cycle

- An HSI Standard is needed to document standardized practices and processes that can be tailored and directly cited on contracts
- Discussions within the Joint HSI Working Group and Department Standardization Offices (DepSO) led to chartering the HSI Standards Working Group (WG)
- The DoD HSI Standards WG includes representatives from all Services, Coast Guard, the Office of the Secretary of Defense, and leading industry partners

Background: HSI MIL-HDBK

- SAE G45 HSI Industry Standard (SAE6906)
  - Purpose: Serve as HSI best practice for implementing and conducting prime contractor HSI program efforts. Intent is to be tailored and used on acquisition program contracts
  - Document release: Feb. 2019
- HSI MIL-HDBK as companion document to Standard
  - Purpose: Guidance and Practices for Government Program Managers, Systems Engineers, and HSI Practitioners on how to use the HSI Standard Practice (SAE6906). Tailoring tasks/analysis/products and Government HSI responsibilities
  - Document release: March 2019
- Navy is Preparing Activity, Chelsey Lawson is chair

Background: HSI MIL-HDBK

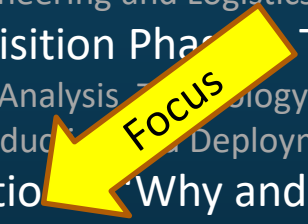
A team representing the Services, OSD, and the Coast Guard is writing / providing input into the handbook

Status: HSI MIL-HDBK

V4 in internal review, Oct 2018
Senior panel review, Jan 2019
Comment adjudication, Feb 2019
Document release, March 2019

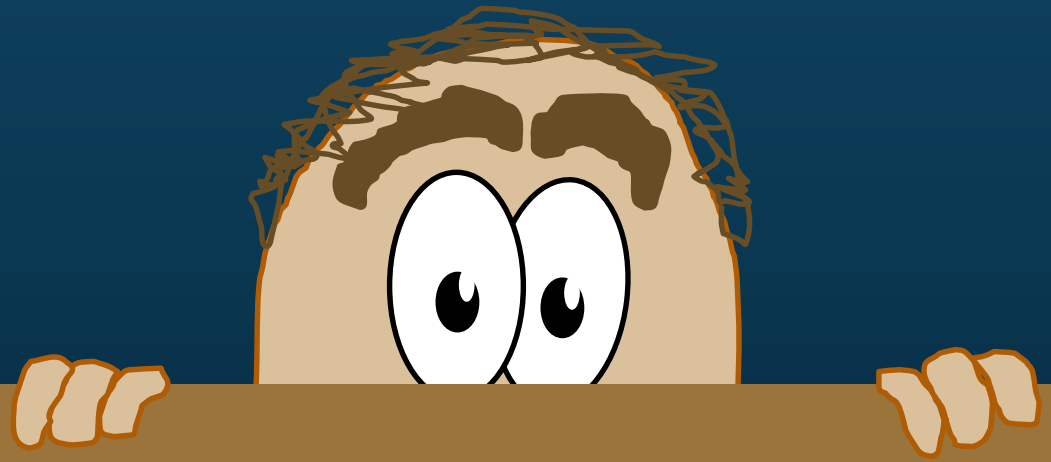
HSI MIL-HDBK OUTLINE

1. Scope
2. Applicable Documents
3. Definitions
4. Introduction
   Purpose, Overview, Directives, HSI Domains, Integration Role across HSI Domains, Integration Role with Systems Engineering and Logistics, Relationship with AS6906, Roles
5. HSI in the Acquisition Phase Timeline - "What and When"
   Materiel Solution Analysis, Technology Development, Engineering and Manufacturing Development, Production and Deployment, Operations and Support
6. Program Execution - "Why and How"
   HSI in the Systems Engineering Process, HSI in Logistics, HSI Planning, IPTs/WGs, HSI in Contracting, Tailoring Guidance for Contractual Application, HSI Tools, HSI Trades, HSI Risk Management, Quality Assurance and Quality Management, HSI Certifications
7. HSI Documentation
8. Notes
9. Appendices



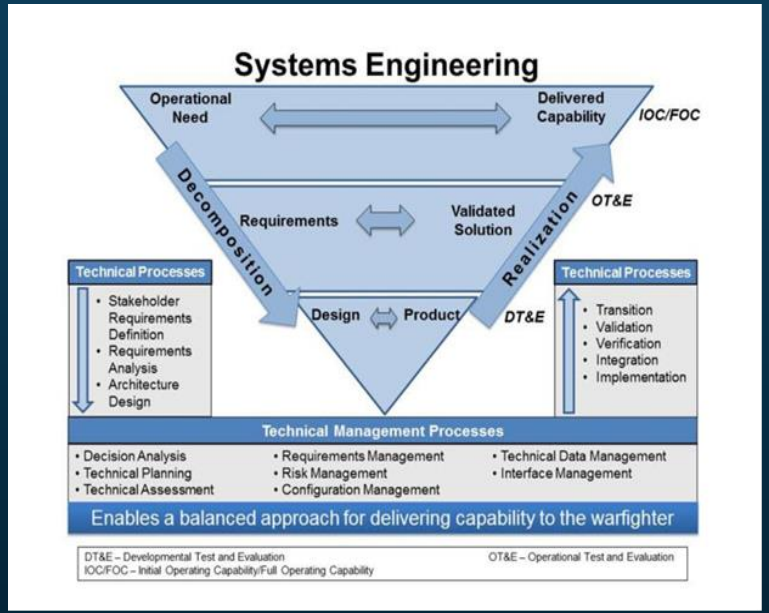
Draft HSI MIL-HDBK

A peek…
into the Program Execution - Systems Engineering section



Systems Engineering Section

"Because systems engineering is the essential framework to provide capabilities to the warfighter, it is critical that HSI processes, requirements, and practitioner leadership are embedded within the systems engineering processes."



SE Section: New! Table 6.1-1

New! Table 6.1-1:

Guidance for each of the 16 SE technical and technical management processes - typical HSI activities

Table 6.1-1 HSI Activities and the 16 DoD SE Processes

SE Process	Typical Documents, Products	Typical Gov't. HSI practitioner activities [High level why/how]
Stakeholder Requirements Definition	CBA-related documents, AoA Study Guidance, Capability Documents (e.g. ICD, CDD), CONOPs, Threat documents, HSIP	Conduct early HSI analysis based on 'Top Down Mission Task Analysis'. Ensure HSI-related requirements and implications are captured during the translation of stakeholder capabilities into stakeholder requirements. Provide HSI-related input throughout the process from JCIDS capabilities to acquisition of materiel solution by participating on AoA team, CBA team, and JCIDS-level HPT. Provide input during the development of HSI-related MOPs, MOEs, and MOSs. Participate in Development Planning activities [hyperlink to Development planning sub-section]. Assess HSI aspects of affordability and risk. [hyperlinks to sections in Handbook including HSI in Early SE]
Requirements Analysis	CONOPs, HSIP, HSIPP, SEP, SEMP, Software Development Plan (SDP), Capability Documents (e.g. ICD, CDD), System level requirements (SRD, ORD, system specifications), sub-systems specifications, design specifications	Provide human performance requirements analysis. Participate on SE team that translates, decomposes, and integrates capability requirements into system level requirements and verification methodology to ensure HSI-related requirements are met. Provide integrated and comprehensive HSI analysis, design, and assessment of requirements. Participate in TIMs and on SE team review of contractor deliverables: requirements decomposition, functional allocation, verification methodology; reference 'Top Down Mission Task Analysis requirements' review process. [hyperlinks to sections in Handbook]

Table 6.1-1: a Closer Look…

SE Process	Typical Documents, Products	Typical Gov't. HSI Practitioner Activities [High Level why/how]
Stakeholder Requirements Definition	CBA-related documents, AoA Study Guidance, Capability Documents (e.g. ICD, CDD), CONOPs, Threat documents, HSIP	Conduct early HSI analysis based on 'Top Down Mission Task Analysis'. Ensure HSI-related requirements and implications are captured during the translation of stakeholder capabilities into stakeholder requirements. Provide HSI-related input throughout the process from JCIDS capabilities to acquisition of materiel solution by participating on AoA team, CBA team, and JCIDS-level HPT. Provide input during the development of HSI-related MOPs, MOEs, and MOSs. Participate in Development Planning activities. Assess HSI aspects of affordability and risk.

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Requirements Analysis	CONOPs, HSIP, HSIPP, SEP, SEMP, Software Development Plan (SDP), Capability Documents (e.g. ICD, CDD), System level requirements (SRD, ORD, system specifications), sub-systems specifications, design specifications	Provide human performance requirements analysis. Participate on SE team that translates, decomposes, and integrates capability requirements into system level requirements and verification methodology to ensure HSI-related requirements are met. Provide integrated and comprehensive HSI analysis, design, and assessment of requirements. Participate in TIMs and on SE team review of contractor deliverables: requirements decomposition, functional allocation, verification methodology; reference 'Top Down Mission Task Analysis' process

SE Section: New! Table 6.1-2

Table 6.1-2 created:

Guidance for HSI-related input into the SEP

Table 6.1-2 HSI Content and the SEP (based on 2015 V 2.0 SEP Outline)

SEP Outline V2.0 Section	SEP Outline 2.0 Sub-section	HSI-related content	Rationale/Discussion
2.1 Architectures and Interface Control	n/a	Include human aspects of architectures and interface control as appropriate.	Interfaces are important to the human – add touch points and linkage with architectures where possible.
3. Engineering Resources and Management Sections 3.1-3.3		Insert HSI resources and activities as appropriate	While this section may be high level, depending on the program it may be appropriate to add HSI input. Ensure HSI resources are accounted for within SE team resource planning.
3.3 Technical Risk and Opportunity Management	3.3.3 Risk Management	If HSI-related risks or opportunities exist they should be included among program risks and opportunities and documented in tables within SEP section 3.3.3. The Risk ID, Risk Statement, Likelihood/Consequence and Handling Method/Mitigation Plan and Planned Closure Date are provided. Likewise if opportunities exist, the program will document these in a table in section 3.3.3; HSI-related activities should be included as applicable.	A robust HSI program will include studies, evaluations and other planned activities to identify and address HSI-related risk. Examples of key HSI-related activities to address risk include: evaluation of modeling and sim results, evaluation of design-related documents, prototype developmental test and evaluation, HSI WG decision points, test plans, etc. A summary of key activities are documented in the SEP table and closure dates are provided.
3.4. Technical Organization	3.4.1 Government Program Office Organization	Include HSI practitioner in Figure 3.4.1-1 organizational chart (See Figure XX in this Handbook).	Documents who is responsible for HSI: practitioner name, organizational alignment, and reporting chain.
3.4. Technical Organization	3.4.4. Engineering Team	Include HSI WG among SE IPT/WG Team Hierarchy (See Figure 3.4.4-1).	Documents hierarchy and relationship of HSI WG and involvement of HSI practitioner. Includes HSI as a design

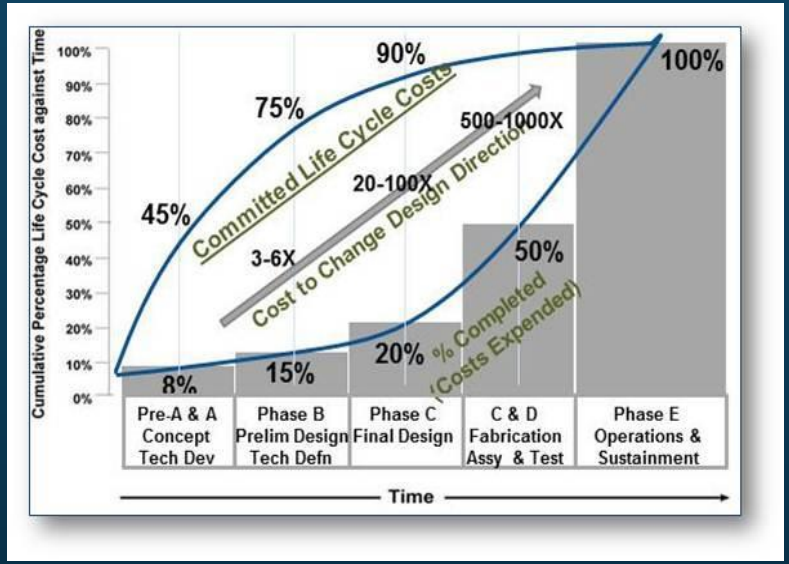
Table 6.1-2: a Closer Look…

SEP Outline V2.0 Section	HSI-Related Content	Rationale/Discussion
4.4 Technical Reviews	In each table for planned technical reviews (see Table 4.4-1), provide HSI Entrance Criteria, Exit/Success Criteria, and Products/Artifacts	Technical Review tables within the SEP provide criteria/artifacts that the contractor must accomplish/furnish. It's important to include HSI criteria in the tables because results are documented and action items are driven to closure in technical reviews. HSI criteria are based on the specific technical review and analysis/verification/reports that inform the review, mitigate risk, and inform the technical baseline. As a minimum, the status of key HSI-related design considerations should be provided at each technical review…

HSI Analysts

Optimize total system performance
- the relative and combined performance
- human + software + hardware
- trade offs

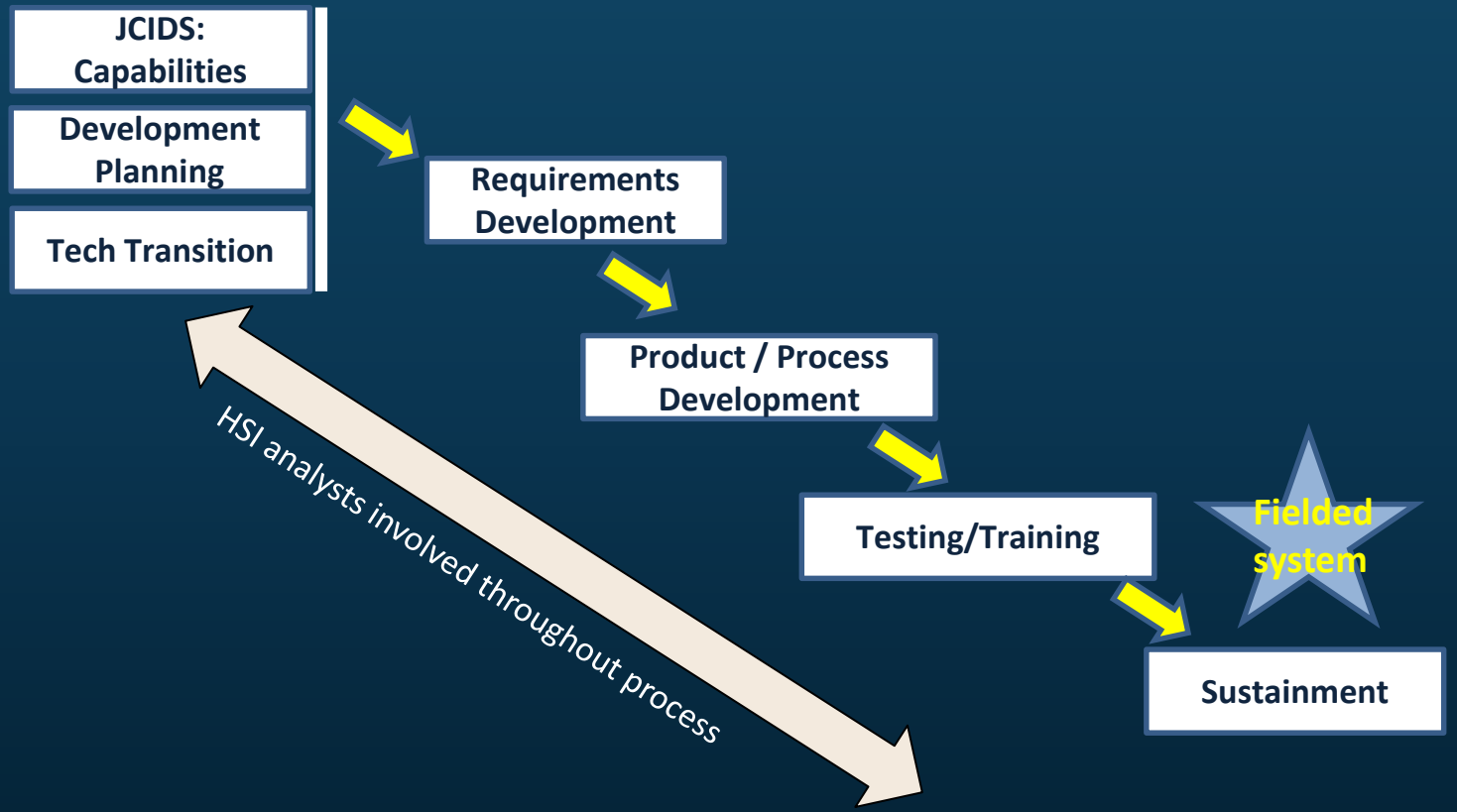
Optimize total life cycle costs
- projecting sustainment costs
  … over 30-70 years (adds up)!



Enable the users to effectively complete the mission

HSI analysts work to ultimately reduce overall program risk

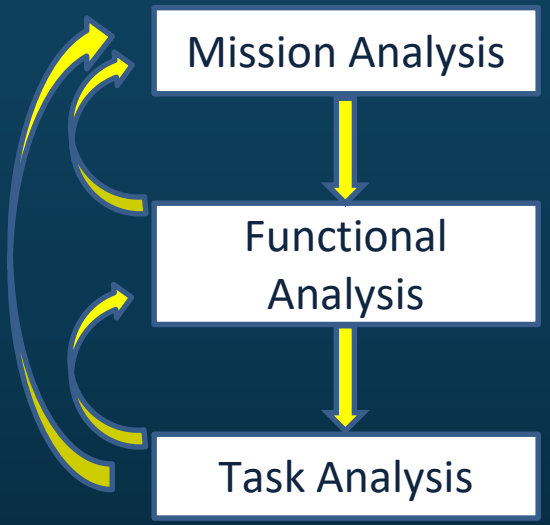
HSI – the Means



Top Down Analysis

Part of the overall systems engineering process – a team effort

Decompose mission capabilities into functions and tasks



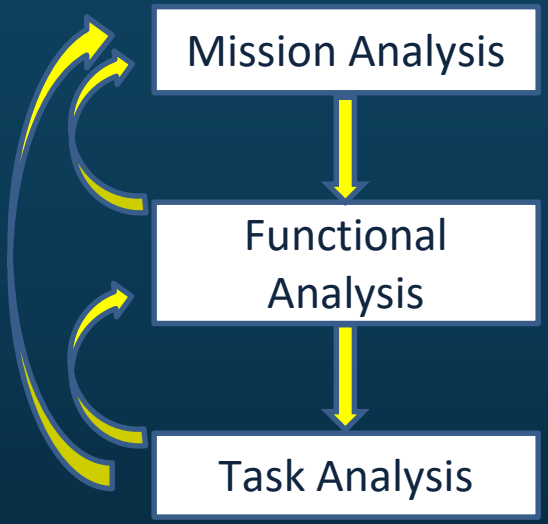
Consider the human as part of the overall system

Human capabilities and limitations factored into the design EARLY

Described in MIL-STD-46855A

Top Down Analysis

Commercial off the shelf or transitioning technologies



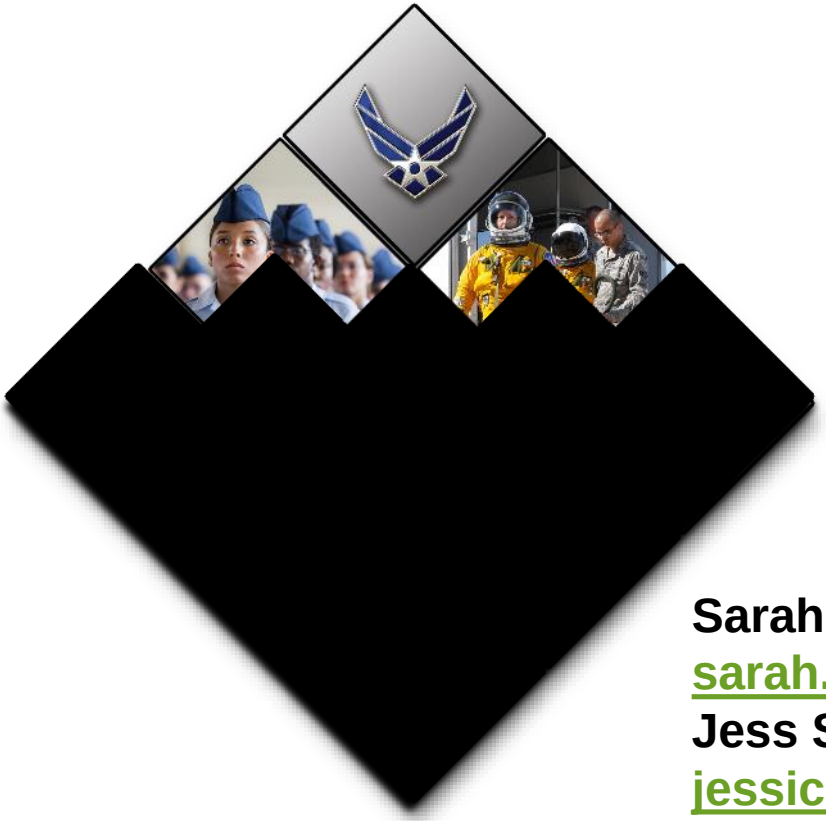
Allocate functions to hardware, software, and/or human

Factors into Systems Engineering top down requirements decomposition process

Empowering the human to excel in tasks that they do better than machines

Designing hardware and software to assist humans when machines can do tasks better

Questions?



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