Overview

- Background
- Statement of Need
- Tri-Service Process
- DAU Launch
- Statistics and feedback
Background

Education and Training Venues for Systems Engineers
- DAU
- Service-specific institutions
- Commercial education offerings

Inquiry with Systems Planning, Research Development, and Engineering (SPRDE) Career Field

Backing / endorsement of Joint HSI Working Group; Air Force lead
- Education sub-committee formed from 3 Services' representatives
Statement of Need

- Requirement to educate SPRDE workforce on Human Systems Integration
  - DoDD 5000.01, The Defense Acquisition System, Enclosure 1, E1.29 (Nov 2007)
  - DoDI 5000.02, Operation of the Defense Acquisition System, Enclosure 8 (Dec 2008)
  - Defense Acquisition Guide (Chapters 4 and 6)
  - CJCSI 3170.01G (Mar 2009)
May 2008 briefed the Functional IPT for the SPRDE Career Field

Outcome was approval for a Tri-Service developed Continuous Learning Module written for systems engineers

Recognition/Acknowledgments

- George Prosnik, DAU and SPRDE – funded the programming
- AnnMarie Choephel, OSD and SPRDE – coordinated course
- Army – Dr. John Warner, MANPRINT Office, G-1
- Navy – Ms. Erika Colon – Navy HSI, N125
- Air Force – Colonel Larry Kimm, AFHSIO – Proponent
- Contractor Support – Jim Campbell, Alion Science

Human Systems Integration: interdisciplinary technical and management processes for integrating human considerations within and across all system elements; an essential enabler to systems engineering practice (INCOSE, 2007)

Systems Engineer must oversee to ensure that the human-centered disciplines are considered and addressed in the system development and design within Integrated Defense Acquisition, Technology and Logistics Life Cycle Management Framework
"...While many systems engineers intuitively understand that the human operator and maintainer are part of the system under development, they often lack the expertise or information needed to incorporate human capabilities with the capabilities of the hardware and software. ..." Appendix M, Version 3.1, 2007

"...A knowledgeable, interdisciplinary HSI team is generally required to address the full spectrum of human considerations, and the systems engineer is key to ensuring that HSI is included throughout the system’s life cycle..." Para 9.12.1 HSI is Integral to the SE Process, Version 3.2, 2010
Definitions were agreed upon by all 3 Services

CLE Definition of Human Systems Integration is NOT the same definition as INCOSE

Domains are as "described" in DoDI 5000.02, Enclosure 8

DoDI 5000.02 DOES NOT contain definitions for HSI or the Domains

For example: 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 ...
The CLM Process

Tri-Service Vetted Terminal Learning Objectives

- Describe the basic concepts and definitions of HSI (TLO 1)
- Identify the domains of HSI (TLO 2)
- Recognize HSI as a process within Systems Engineering in the Systems Acquisition life cycle (TLO 3)
- Discuss the implementation of HSI on the Systems Acquisition life cycle (TLO 4)
- Identify HSI information sources (TLO 5)

Final CLM Content for CLE 062, Human Systems Integration

Sample pages from DAU Continuous Learning Course CLE 062

HUMAN SYSTEMS INTEGRATION
Overview of Course

Module Overview

Module Structure

Approximate Module Length
This module will take approximately 2 hours to complete.

Topics
- Module Overview
- HSI Definitions and Domains
- HSI within the Systems Acquisition life cycle
- Information Resources and References
- Module Summary

Knowledge Reviews and End-of-Module Exam
This module contains periodic review questions and interactions, collectively referred to as knowledge reviews, that are intended to refresh your memory. These reviews should not be confused with the end-of-module exam, which must be successfully completed to obtain credit for the module.

Select Next to continue.
What Is Human Systems Integration?

Human Systems Integration is the unified and comprehensive analysis, design, and assessment of requirements, concepts, and resources for Human Factors Engineering, personnel, habitability, system manpower, training, environment, safety, occupational health, and personnel survivability with the aim to optimize total mission performance while reducing total ownership cost.
Definitions were Tri-Service vetted

Examples were REAL success stories or lessons learned provided by all the Services

- Manpower – Navy
- Personnel – Army
- Training – Army
- Habitability – Navy
- Occ Health – Air Force
- Safety – Navy/Air Force
- Environment – Navy/Marine Corps/Air Force
- Survivability - Army
Human Factors Engineering is the technical consideration and application of the integration of design criteria, psychological principles, human behavior, and capabilities and limitations as they relate to the design, development, test, and evaluation of systems.
Human Systems Integration Awareness

The Domains of HSI

Human Factors Engineering, cont.

The goal is to maximize the ability of users to perform at required levels through the elimination of design-induced errors, and to ensure that system operation, maintenance, and support are compatible with the total capabilities and limitations of users operating or maintaining those systems.
Human Systems Integration Awareness

The Domains of HSI

Human Factors Engineering Example

• Human Factors Engineering applied to the light weight 155mm howitzer, the M777.

• During the design phase, program engineers used CAD drawings to investigate form and fit considerations.
Habitability domain example

- Streamlined operations = Less waiting, better food quality, and less food-borne illness.

- Less waiting + better food quality < food-borne illness = improved morale.

- Centralized services = reduced personnel requirements, reduced fire hazards, and the elimination of overhead fire suppression system.
Human Systems Integration Awareness
The Domains of HSI

Manpower domain example

1960s

Bridge

Smart Ship—1990s

CIC

General Quarters Watchstations

No Ship Control Capability

1960s: CHART, TABLE, HELM, RADAR, QUARTER MASTER, SIGNALMAN, LOOK OUT, MESSENGER.

Smart Ship—1990s: RASCAR, DOUBLE COMMAND CONSOLE, DIGITAL CHARTS, HELM CONSOLE, CO, OOD.
Stress Domain Interdependencies
HSI in Systems Acquisition Life Cycle

HSI Activities Across the Life Cycle Phases

Learning Objectives

Upon completing this topic, you will be able to:

- Recognize HSI as a process within Systems Engineering in the Systems Acquisition life cycle.
- Discuss the impact of HSI on the Systems Acquisition life cycle.
- Recognize essential systems attributes that require scrutiny under DoD guidance.
- Identify Key Roles and Responsibilities in the HSI Process.
Materiel Solution Analysis

During this phase of the life cycle, possible materiel solutions are being analyzed, so alternatives for potential systems will keep MANPOWER, PERSONNEL and TRAINING at the forefront.

Additionally, initial considerations for HUMAN FACTORS ENGINEERING and SURVIVABILITY will begin ...
Technology Development

During TD, potential solutions progress until an increment of capability is militarily useful and technologically mature. MANPOWER, PERSONNEL and TRAINING remain a focus.

Additionally, HUMAN FACTORS ENGINEERING considerations are being applied to each potential solution system.

As designs get more mature, SAFETY AND OCCUPATIONAL HEALTH (and ENVIRONMENT), SURVIVABILITY, and HABITABILITY become part of the design consideration and analysis.
Roles and Responsibilities

Roles and Responsibilities – Program Manager, Systems Engineer, Subject Matter Expert, Logician, T&E, User

There are several key players in the HSI process: the Program Manager, the Systems Engineer, the HSI Subject Matter Expert, the Logician, the Tester & Evaluator and finally, the User.

Please select each role indicated on the graphic to learn more about the HSI responsibilities of each key player.
Roles Defined

Roles and Responsibilities – Program Manager, Systems Engineer, Subject Matter Expert, Logician, T&E, User

There are several key players in the HSI process: the Program Manager, the Systems Engineer, the HSI Subject Matter Expert, the Logician, the Tester & Evaluator and finally, the User.

Please select each role indicated on the graphic to learn more about the HSI responsibilities of each key player.

Systems Engineer

The Systems Engineer is responsible for design and development of the total system including hardware, software, AND people. The Systems Engineer is responsible for incorporating HSI considerations into the overall System Engineering Plan and ensuring that domain considerations are applied to the system design and development process. The Systems Engineer is key to initiating HSI early in the development process, executing integrated technical processes, and conducting proactive trade-offs.
Standards, Guidance and Policy to Execute HSI

Implementing HSI in the Systems Acquisition Life Cycle

Learning Objectives

Upon completing this topic, you will be able to:

- Choose appropriate statutory and regulatory requirements for system development.
- Apply pertinent military and industry standards that guide HSI.
- Identify additional support and information resources.

Select Next to continue.
Implementing HSI in the Systems Acquisition Life Cycle

Where to get help (support organizations)

Handbooks, Guides and Manuals

- There are also handbooks, guides and manuals that may apply to your system such as these:
  - DoD Systems Engineering Plan Preparation Guide
  - Defense Acquisition Guidebook, Chapter 6, Human Systems Integration

MIL-HDBK-46855, Human Engineering Program, Process, and Procedures
OPNAV P-751-2-9-97 Training Planning Process Methodology (TRPPM) Guide
T9640-AB-DDT-010/HAB Habitability: Shipboard Habitability Design Criteria Manual
AFD-090121-054 Human Systems Integration Handbook

Select Next to continue.
Service Organizations for Help/Support for HSI

Implementing HSI in the Systems Acquisition Life Cycle

Where to get help (support organizations)

The Services all provide support and information on access to Subject Matter Experts.

The Army MANPRINT Directorate can be contacted at the website indicated in the reference guide.

The Navy provides support through the Chief of Naval Operations, Acquisition and HSI Office (OPNAV N151), or Assistant Secretary of the Navy, Research, Development and Acquisition (ASN RD&A) Chief Systems Engineer Office (CHSENG).

The Air Force provides support through the Air Force Human Systems Integration Office (AFHSIO) and the 711th Human Performance Wing.

Please select the reference guide for further information.
Let’s look at an example associated with the M777 that illustrates the convergence of the HSI domains in support of that system’s development and highlights a test system that is itself an HSI success story. During system development of the M777, program engineers used the Firing Impulse Simulator (FIS) to conduct component testing of mechanical and hydraulic components. The M777 benefited from the use of this testing tool and was able to significantly reduce time, cost, and risk in its development. Estimates are that about $10 million in costs were avoided using the Firing Impulse Simulator and the system was fielded less than ten years from the initial shoot-off.

The Firing Impulse Simulator is itself a study in HSI application. Before the installation of the FIS at Aberdeen Proving Ground, much of the type of testing that the FIS supports was done via live fire. That required 13 men, including a full gun crew and forward observer team, in order to ensure the safe impact of rounds in designated firing impact areas. Using the FIS, the manning requirement is reduced from 13 to four. Since no live rounds are fired, there is no requirement for observed fire and significantly lower safety threats both at the weapon and at point of impact.
Civilian and Military Registrants by Component

- Army:
  - Civilian: 22
  - Military: 7

- Navy:
  - Civilian: 39
  - Military: 2

- Air Force:
  - Civilian: 20
  - Military: 19
Sample Survey Feedback

What about this class was MOST useful to you?
- HSI Domain interactions
- HSI within acquisition life cycle
- Gave you a general understanding of HSI Awareness
- It is an excellent class
- Good review

Was anything missing from this course that you felt should have been included?
- Link to Service ergonomics programs
- More examples of each of the domains
- More explanation of supporting documents

No – 16 responses
What was your overall opinion of the course?

Overall Comments on Course (out of 47)*

- Excellent: 38%
- Very good: 32%
- Good: 27%
- Less than good: 3%

* Comments' analysis is subjective and based on author's opinion of classifications
Representative Organization Statistics for CLE 062

- 155 students total have earned CLE 062 certificate as of 15 Oct
- Army (29) – Army Europe, ALMC, AMC, Safety Center, ATEC, AMCOM, TACOM, FORSCOM, TRADOC
- Navy and Marines (41) – NAVAIR, NAVFAC, NAVSEA, NETC, SPAWAR, NRF, CNO and Marine Corps (1)
- Air Force (39) – AFMC, ACC, AMC, AFSOC, AFPC, PACAF, SAF
- DoD (11) – DCMA Aeronautical and Space and Missile Systems, DIA, DESC, NGA, DLA, DISA
- Industry (29) – Booz Allen Hamilton, L3, Lockheed Martin, LMI, Northrop Grumman, Raytheon, SAIC, Battelle, ITT, ASC, EG&G
- Federal Government (6) – DHS, VA
Where Can You Sign up?

- https://learn.dau.mil/html/clc/Register.jsp

What are you waiting for?