Headquarters U.S. Air Force

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CLE 062 -- DAU's New Continuous Learning Module on Human Systems Integration

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Overview

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

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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

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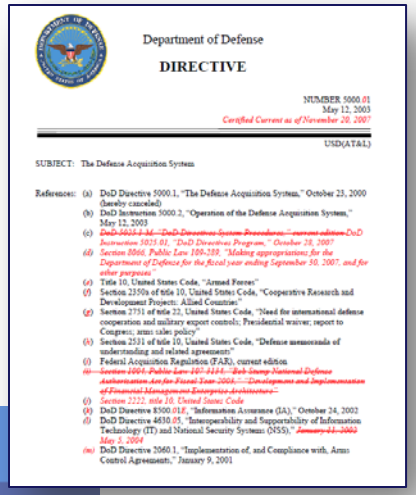
Statement of Need

- **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)**


Department of Defense

DIRECTIVE

NUMBER 5000.01
May 12, 2003
Certified Current as of November 20, 2007

USD(AT&L)

SUBJECT: The Defense Acquisition System

References: (a) DoD Directive 5000.1, "The Defense Acquisition System," October 23, 2000 (hereby canceled)
(b) DoD Instruction 5000.2, "Operation of the Defense Acquisition System," May 12, 2003
(c) DoD 5025.1-M, "DoD Directives System Procedures," current edition; DoD Instruction 5025.01, "DoD Directives Program," October 28, 2007
(d) Section 806, Public Law 106-398, "Making appropriations for the Department of Defense for the fiscal year ending September 30, 2007, and for other purposes"
(e) Title 10, United States Code, "Armed Forces"
(f) Section 2350a of title 10, United States Code, "Cooperative Research and Development Projects: Allied Countries"
(g) Section 2751 of title 22, United States Code, "Need for international defense cooperation and military export controls; Presidential waiver; report to Congress; arms sales policy"
(h) Section 2531 of title 10, United States Code, "Defense memoranda of understanding and related agreements"
(i) Federal Acquisition Regulation (FAR), current edition
(j) Section 1043, Public Law 107-314, "Bob Stump National Defense Authorization Act for Fiscal Year 2003," Development and Implementation of Financial Management Enterprise Architecture
(k) Section 2222, title 10, United States Code
(l) DoD Directive 8500.01E, "Information Assurance (IA)," October 24, 2002
(m) DoD Directive 4630.05, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," January 11, 2005 May 5, 2004
(n) DoD Directive 2060.1, "Implementation of, and Compliance with, Arms Control Agreements," January 9, 2001

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SPRDE Functional IPT and Tri-Service Efforts

- 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

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INCOSE Definition of HSI

- **HSI Working Group of INCOSE update to Version 3.1 of Systems Engineering Handbook (2007), Appendix M: Human Systems Integration**
- **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***

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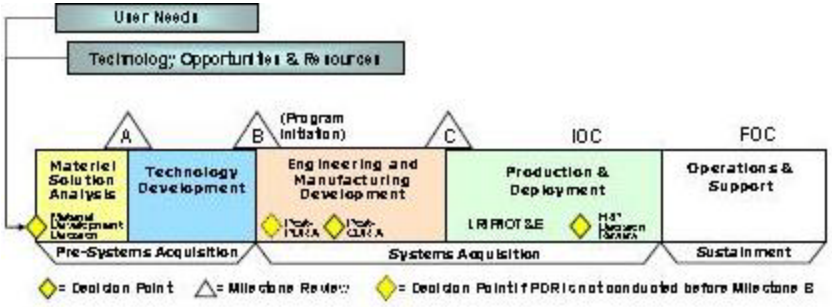
More from INCOSE Systems Engineering Handbooks

- "…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*



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Notes on Continuous Learning Module Development

- 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 …

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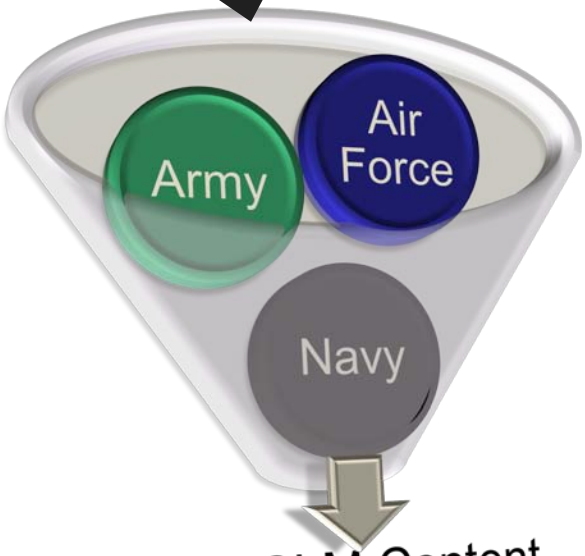
The CLM Process

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 implement-ation 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***

Vetted Learning Objectives (Jan 2009) → Definitions and Content (Nov 2009) → Programming to Final Product (Jun 2010)

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Sample pages from DAU Continuous Learning Course CLE 062

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Overview of Course

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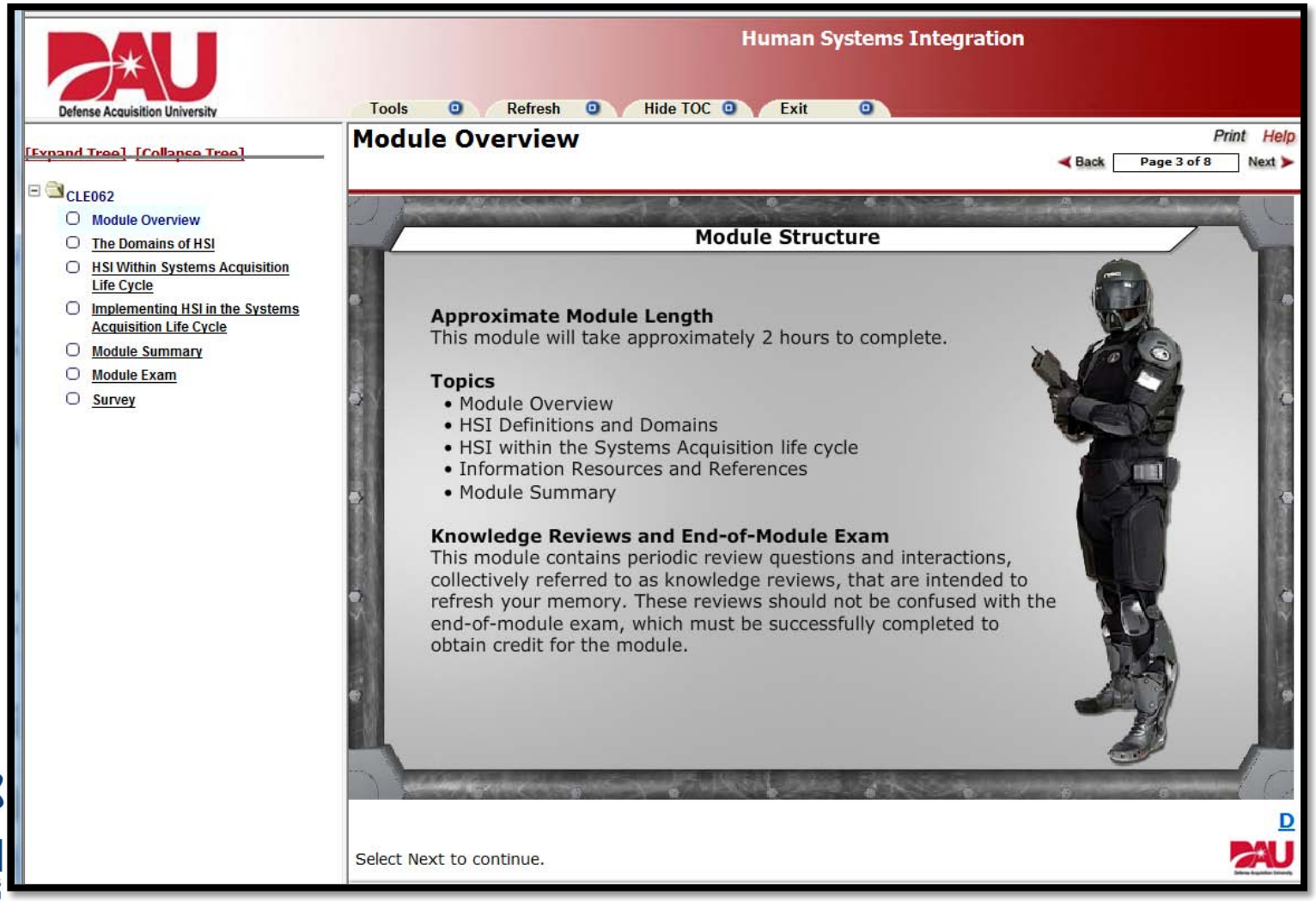

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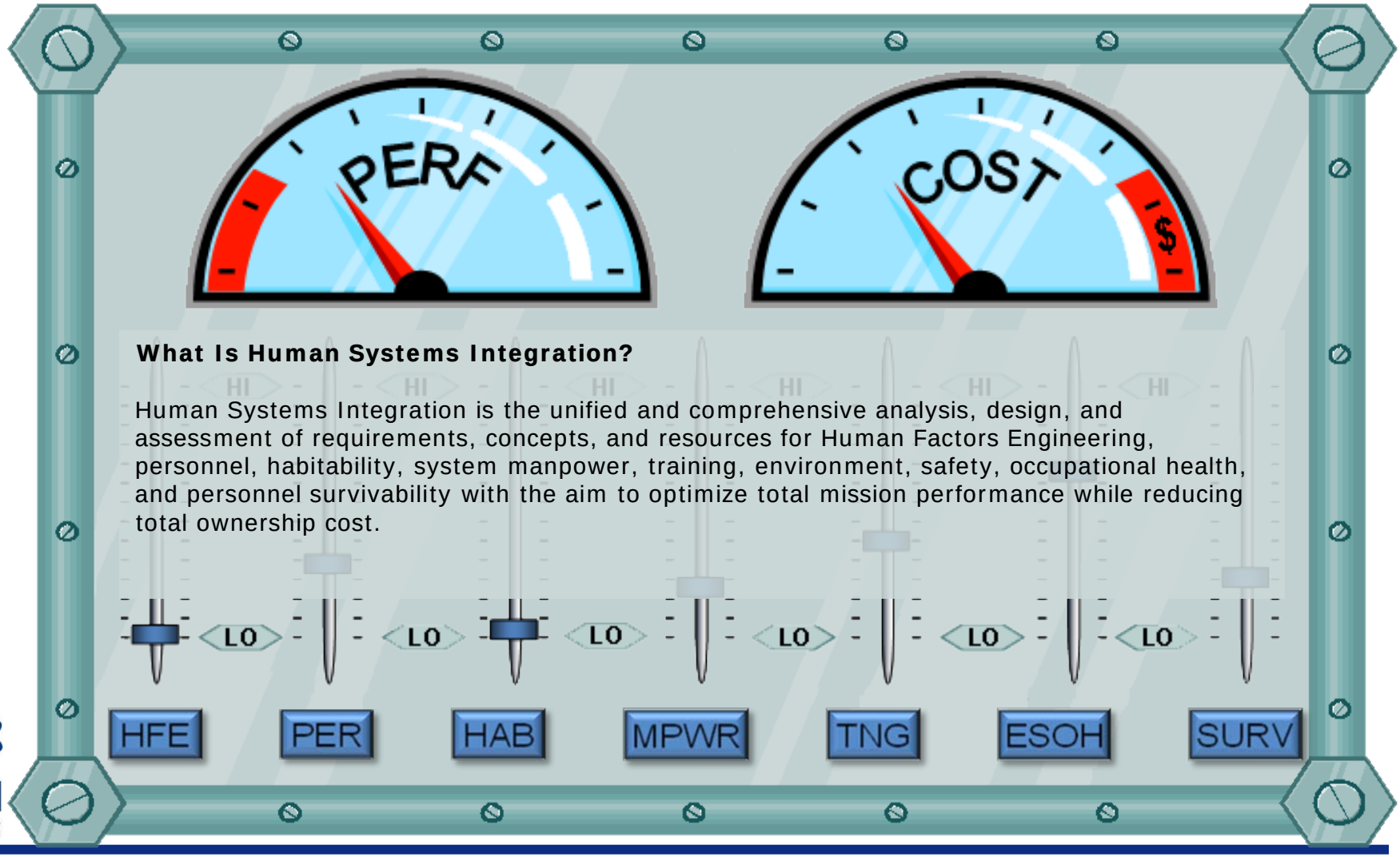
Human Systems Integration Awareness

The Domains of HSI



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.

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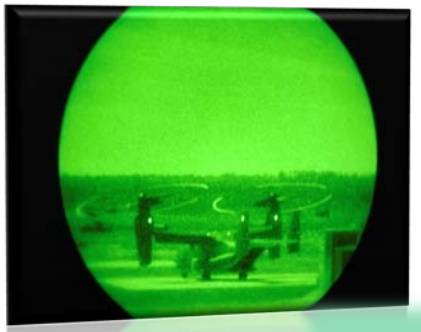
Domains of HSI

- 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



Concept design for future ships

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Human Systems Integration Awareness

The Domains of HSI

Human Factors Engineering

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.

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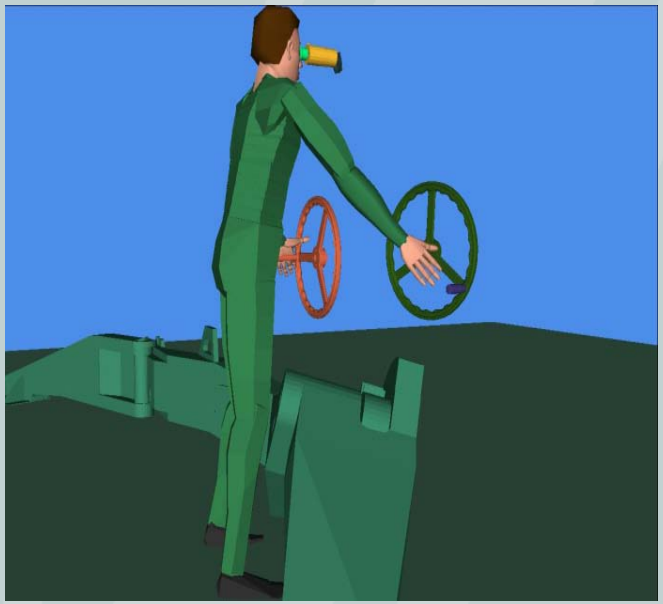
Human Factors Engineering, cont.

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 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.



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Human Systems Integration Awareness

The Domains of HSI

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.

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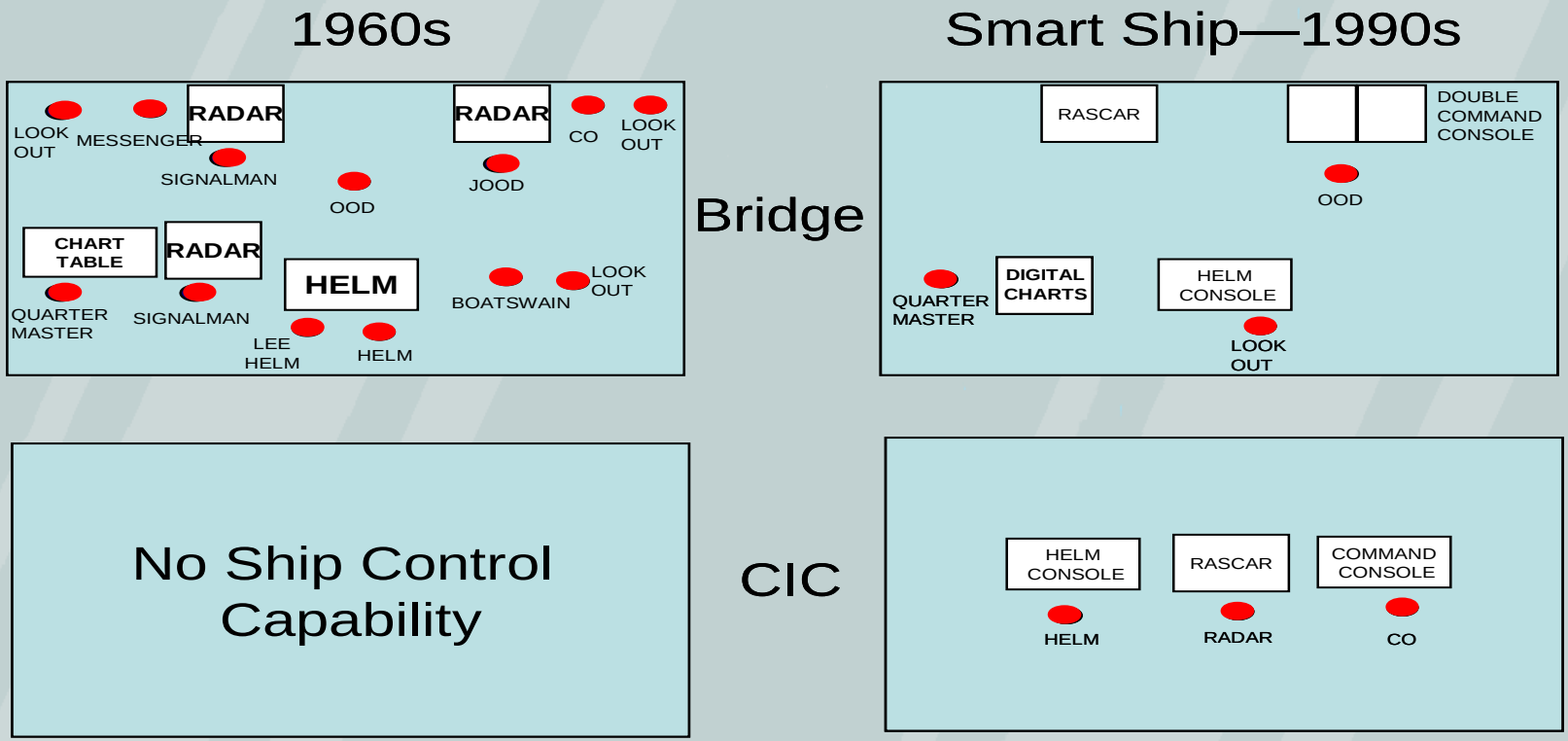
The Domains of HSI

Manpower domain example



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Stress Domain Interdependencies

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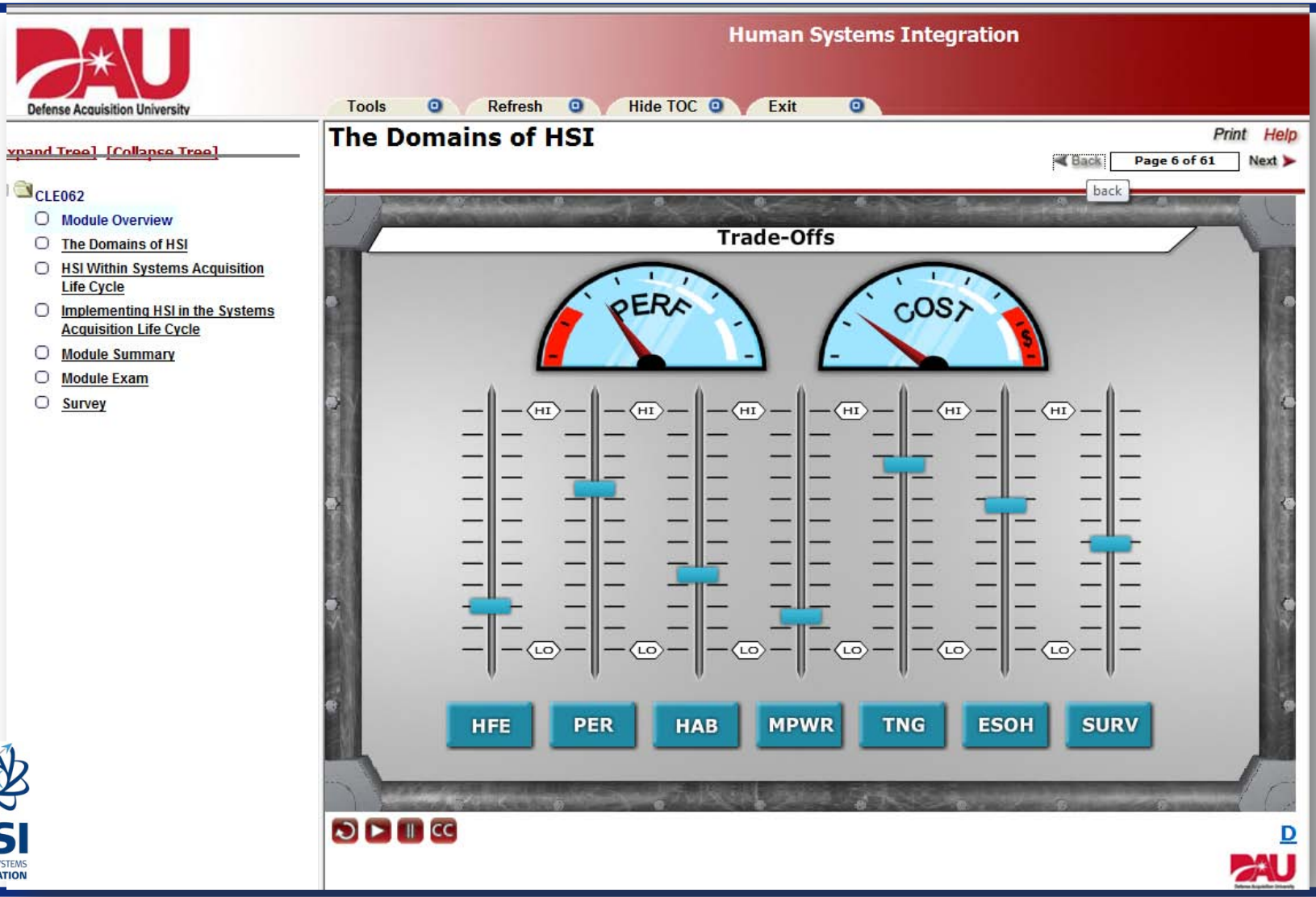

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HSI in Systems Acquisition Life Cycle

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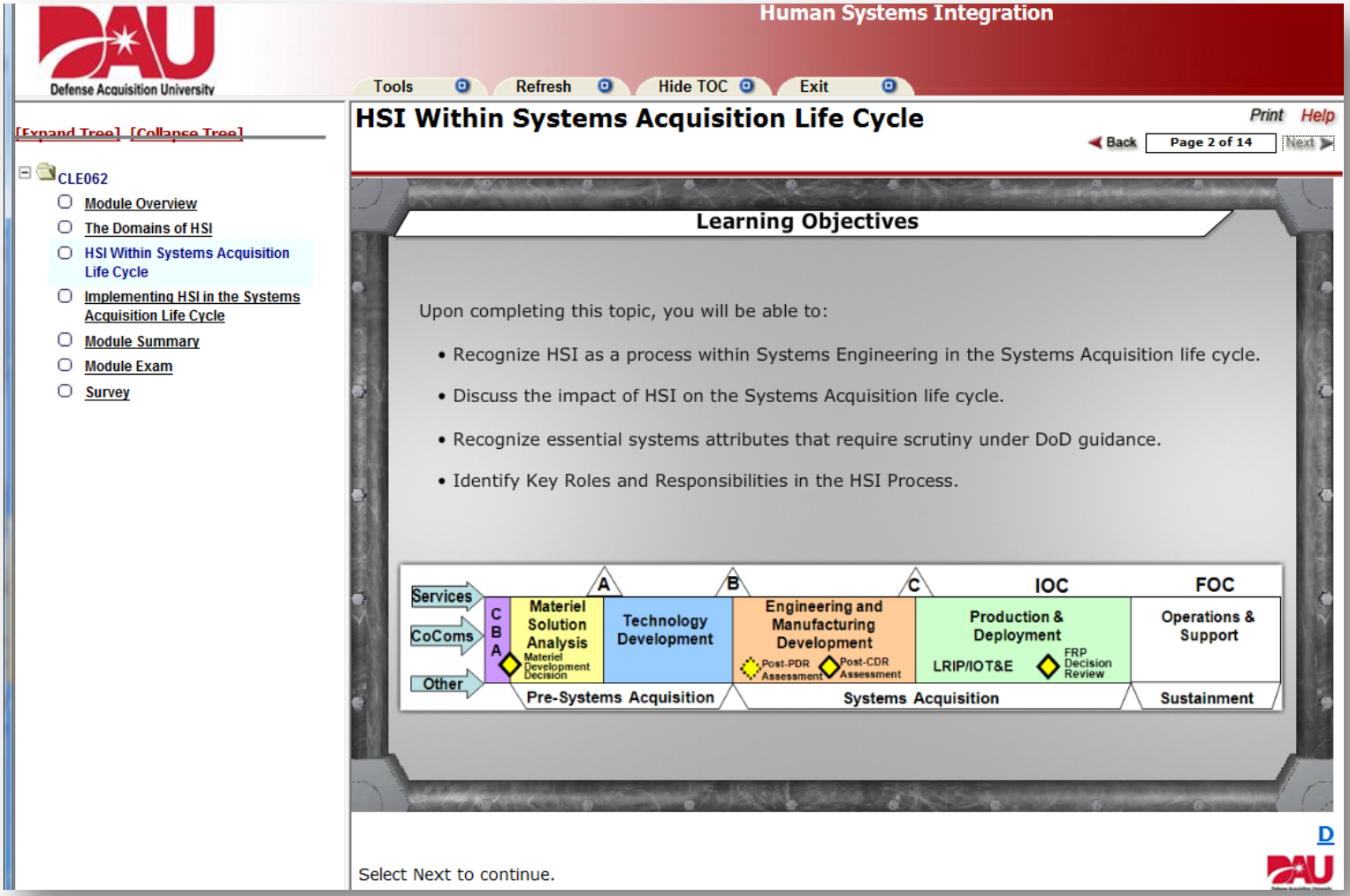

HSI Activities Across the Life Cycle Phases

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Sample HSI Activities Across the Acquisition Life Cycle

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 …

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Sample HSI Activities Across the Acquisition Life Cycle

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

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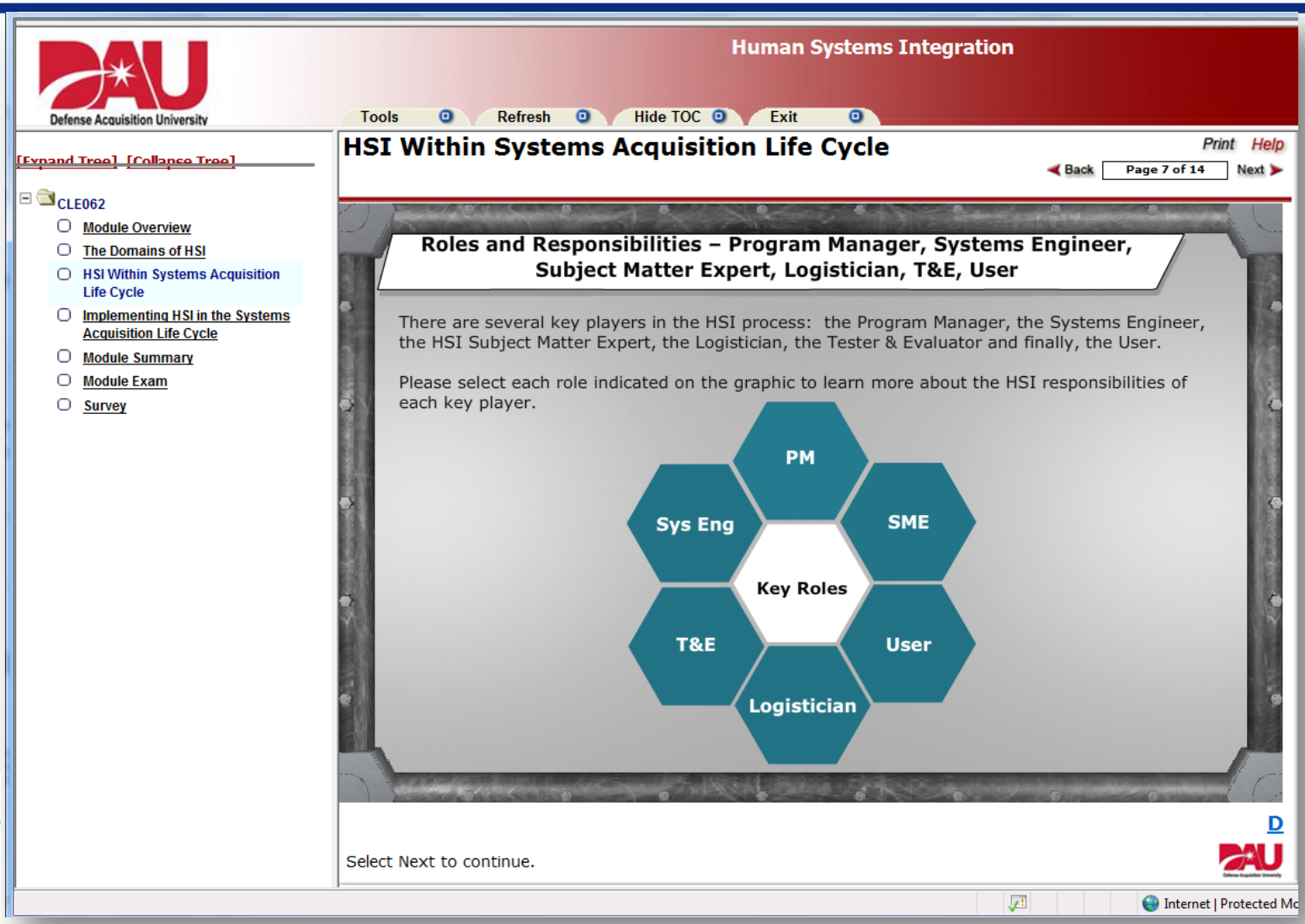

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Roles Defined

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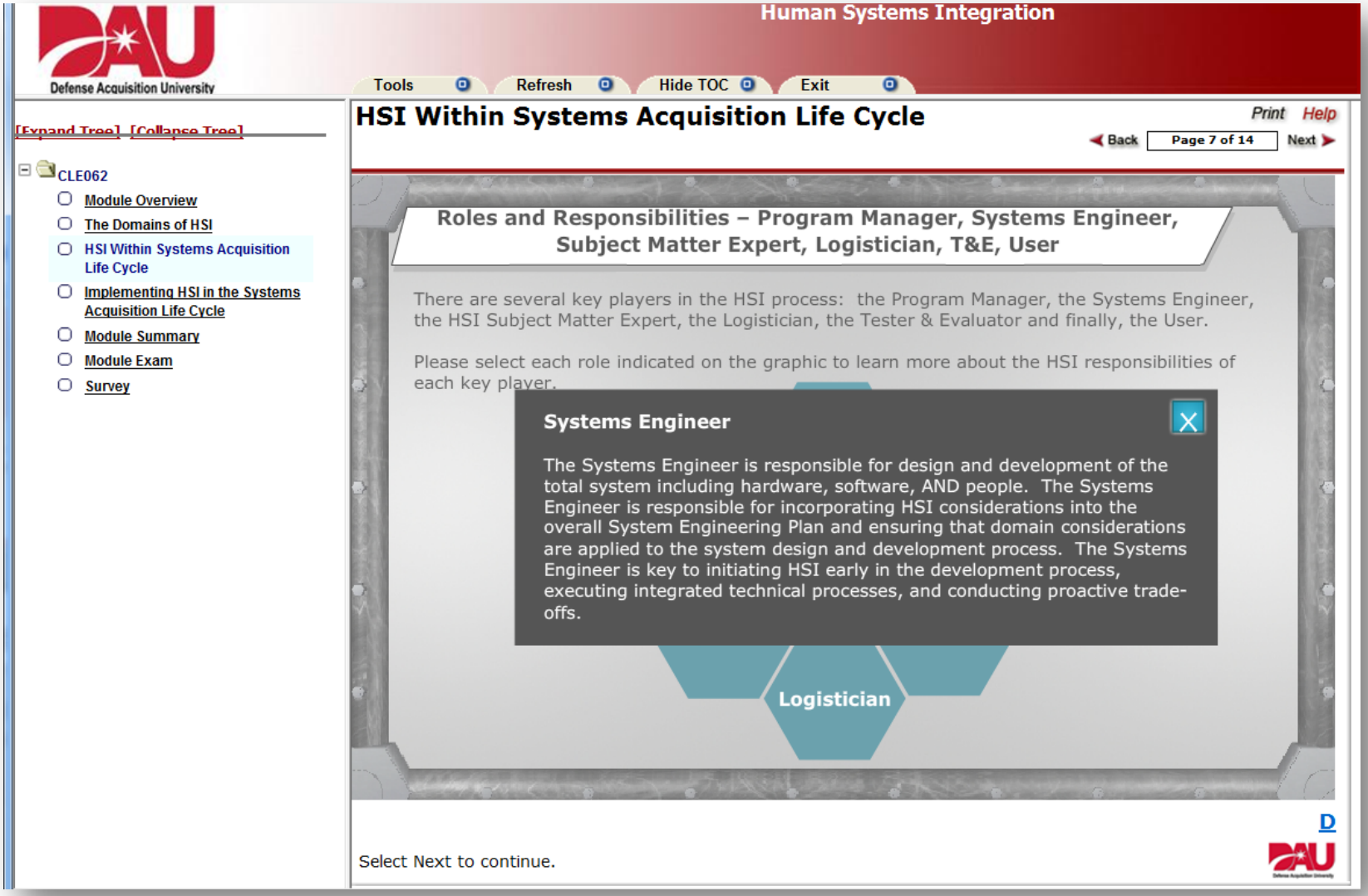

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Standards, Guidance and Policy to Execute HSI

Human Systems Integration

Defense Acquisition University

Tools | Refresh | Hide TOC | Exit

[Expand Tree] [Collapse Tree]

- CLE062
  - Module Overview
  - The Domains of HSI
  - HSI Within Systems Acquisition Life Cycle
  - Implementing HSI in the Systems Acquisition Life Cycle
  - Module Summary
  - Module Exam
  - Survey

Implementing HSI in the Systems Acquisition Life Cycle

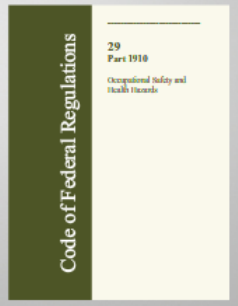
Print Help

Back Page 1 of 7 Next

Learning Objectives

Upon completing this topic, you will be able to:

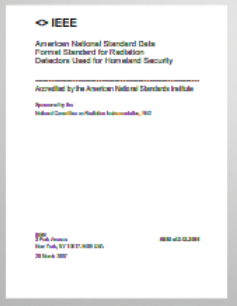
- Choose appropriate statutory and regulatory requirements for system development.
- Apply pertinent military and industry standards that guide HSI.
- Identify additional support and information resources.



CFR

DoDD 5000.01

MIL STD



IND STD

D

Select Next to continue.

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DoD and Service Guides

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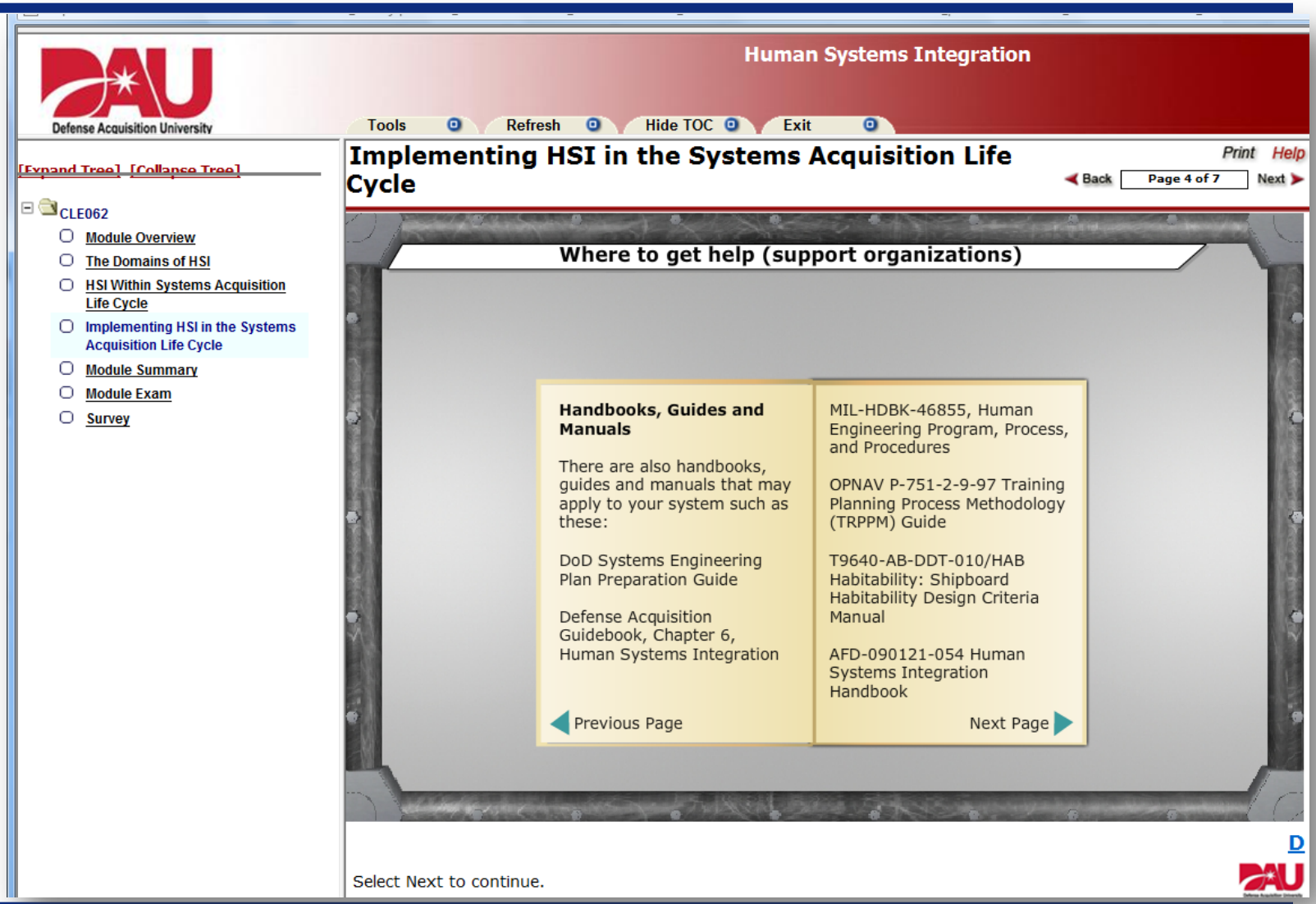

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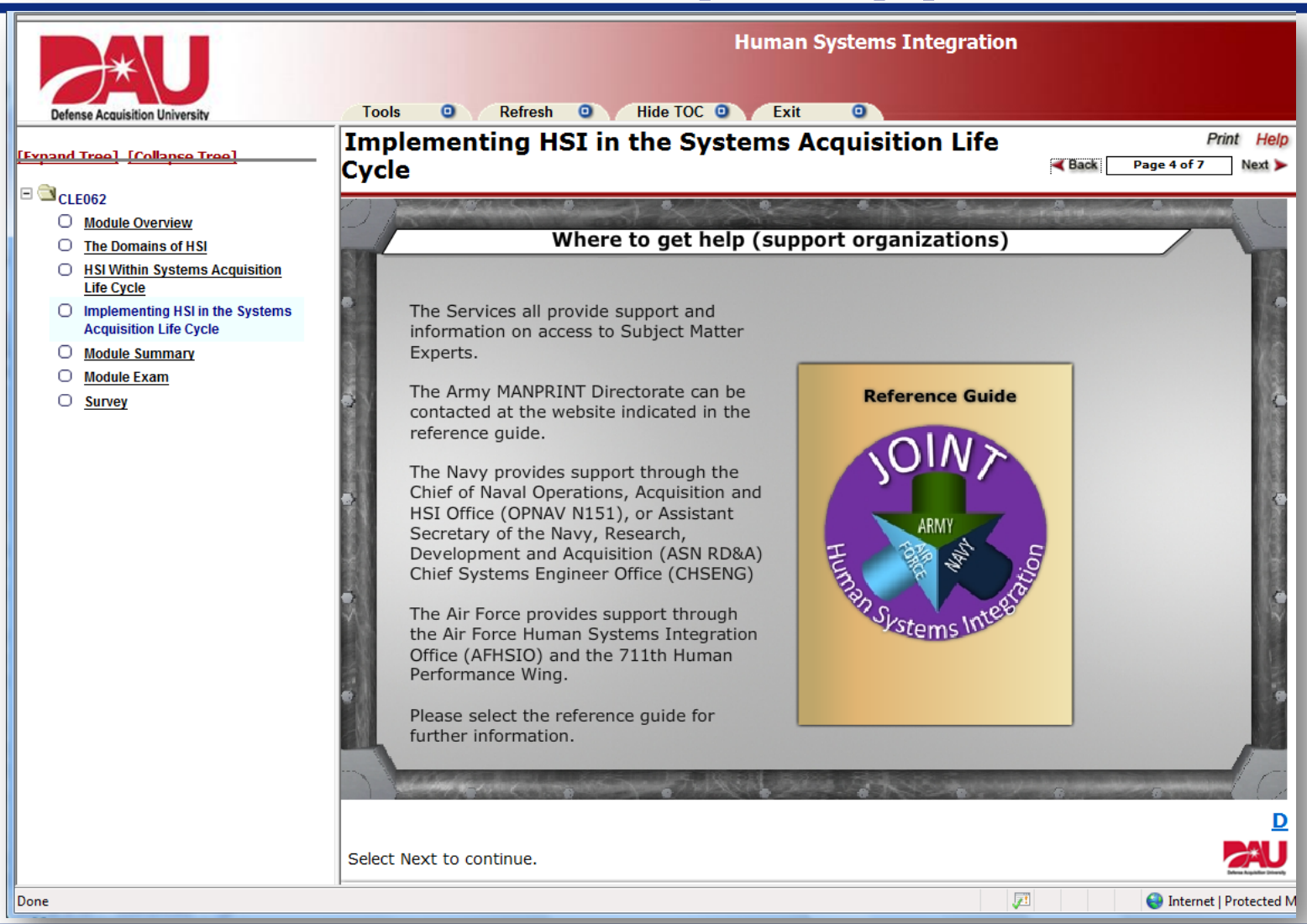
Service Organizations for Help/Support for HSI



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Example to Put it All Together

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Integration example that highlights cost and risk

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

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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.

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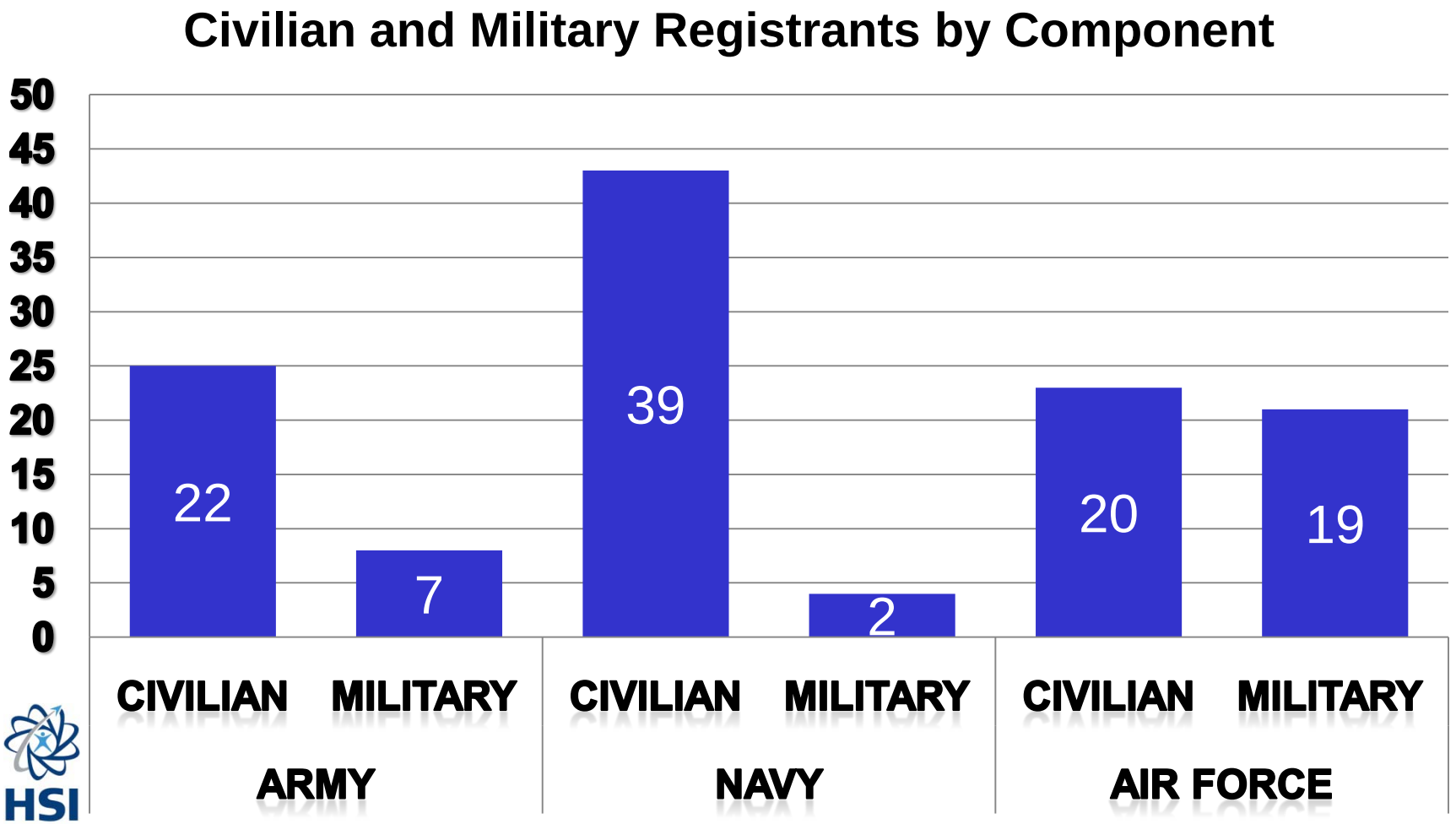
Student Type by Service



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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**

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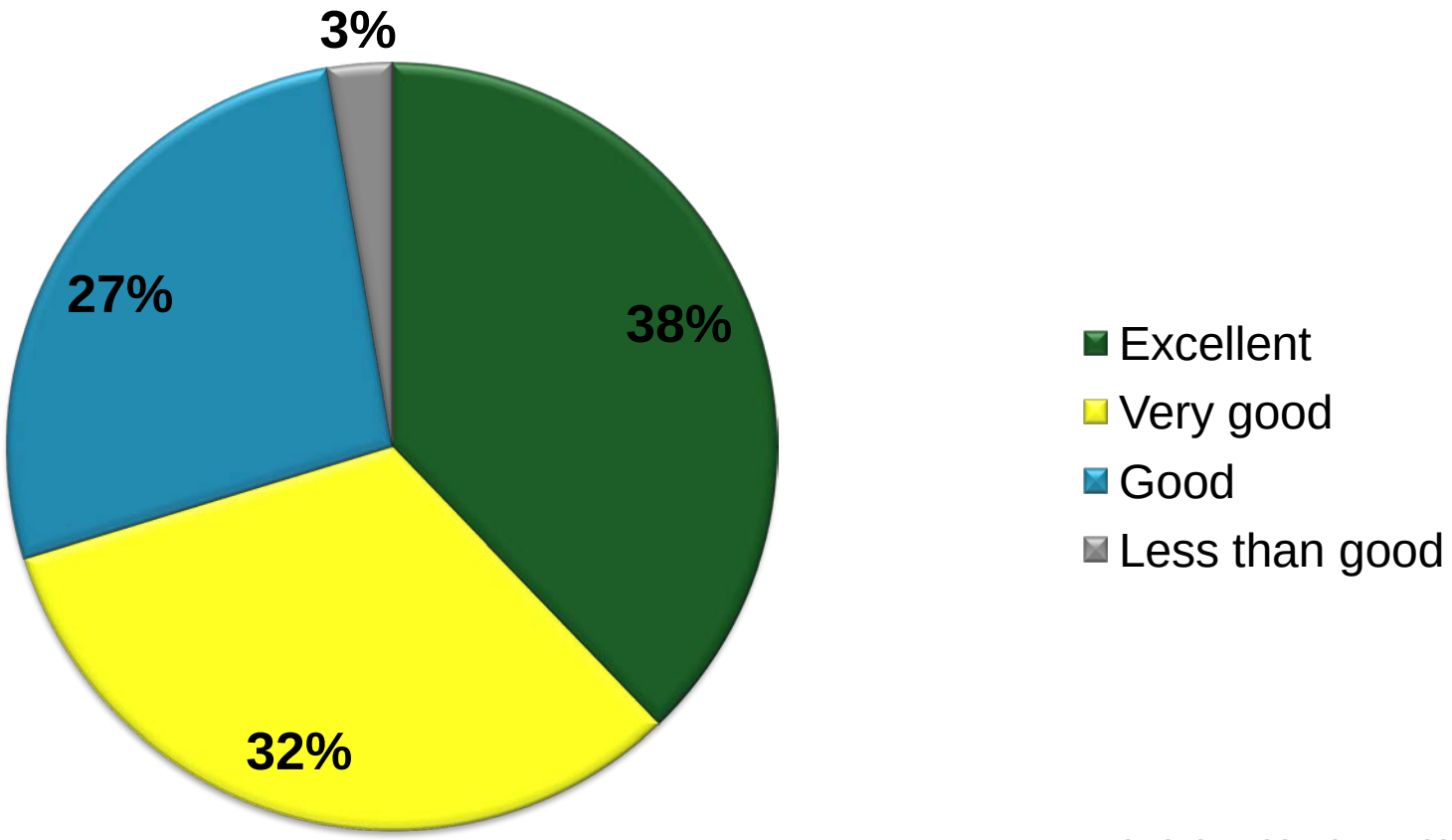
What was your overall opinion of the course?

Overall Comments on Course (out of 47)*



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*** Comments' analysis is subjective and based on author's opinion of classifications**

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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

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Where Can You Sign up?

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

What are you waiting for?

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Questions