

Human Systems Integration (HSI) Billets in the Department of Defense

WHITEPAPER

Introduction

The DoD has established Human Systems Integration (HSI) as a systemic approach “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).

This concept of HSI considers the total human involvement with the system throughout its life cycle through the *integration* of seven core engineering disciplines (domains): Manpower, Personnel, Training, Human Factors Engineering, Personnel Survivability, Habitability, and Environmental Safety, and Occupational Health. While each of these individually provides substantial and meaningful contribution to meeting the goals of DoDI 5000.02 cited above, it is in the *integration* of these disciplines that significant improvements in human performance, safety, and total ownership costs are truly realized. [For further information regarding systems engineering and HSI policy and guidance, refer to DoDI 5000.02, Enclosures 12 and 8, and the Defense Acquisition Guidebook (DAG), Chapter 4 and 6 respectively.]

Challenge:

“HSI is today where Computer Science was 40 years ago.” - Ruben Pitts, SES

The sheer complexity of the human being makes it a challenge to integrate personnel into the rest of the system design. For example, what makes one training regimen result in better performance some individuals but not others? What makes one display design produce better performance and fewer errors? These questions are answered with a combination of technical design processes and focused research to inform design decisions. As a result, there has been specialization in the individual HSI domains.

Although the individual engineering disciplines of HSI have been around for a long time, the integration of these activities is a fairly young discipline, gaining most of its momentum in the establishment of the MANPRINT program in 1986. However, even after the establishment of MANPRINT, there were few HSI practitioners and even fewer with significant training in the requisite study areas to effectively integrate the various domains. HSI is first and foremost a systems engineering activity that brings the human element into the engineering and design tradespace, and the skill set to do that is highly specialized. Hiring, growing, and retaining these highly skilled individuals (both military and civilian) is a major challenge for the discipline.

Current HSI Billet Responsibilities:

The primary role of HSI is often considered as a Systems Engineering activity, emphasizing the roles and activities of the human operators, maintainers, and decision makers in the accomplishment of the system’s mission. As systems engineers, they participate in the system trades to ensure that the resultant system fully meets mission requirements while minimizing total ownership costs. Within the acquisition cycle, HSI practitioners engage in:

- requirements elicitation and refinement,
- functional decomposition and allocation,
- design,
- test, evaluation, and verification, and
- production, life-cycle support, and other mission assurance functions.

In addition to these acquisition roles, HSI engineers also participate in stewardship of their discipline by engaging in research (basic and applied), establishment of policy, and warfighter support.

HSI Gaps and Training Needs:

Formal training in HSI has been lagging behind the joint service's demand. The first formal masters degree program in HSI was only established in 2004 at the Naval Postgraduate School. Since then, efforts have been made to establish HSI programs at several major universities (UCSD, GA Tech, VA Tech) but that has had limited success, resulting in programs that focus upon human factors engineering (HFE) or systems engineering (SE) with an "HSI flavor". Some of the individual services and Systems Commands have created "awareness training" but that too is limited. By and large, the vast majority of HSI training today occurs as on-the-job training and mentorship.

A more structured, formal instruction in the *integration* of the HSI domains would enable the acquisition workforce to more effectively incorporate those elements into the systems engineering and acquisition process. This effective integration requires a combination of identifying relevant research needs and applying disciplined acquisition engineering activities. Depending upon where HSI resides within the various DoD acquisition activities, senior leadership does not necessarily have the experience and background to effectively champion HSI research and acquisition engineering activities. They too would benefit from HSI instruction.

The current military billet and career structure is not supportive of an HSI career path. For example, in the Navy, HSI has been wedged into the 4600 designation (human resources), but that is not a good fit beyond use of the word "human". As a systems engineering activity, it should be an engineering-type billet. As it stands, it is now perceived to be a dead-end and career-killer (as evidenced by a recent SWO-NET discussion thread that stated such). Aerospace Experimental Psychologists (AEPs) have traditionally performed the majority of the heavy lifting in the theory and research of HSI, but they are limited in their impact in influencing the actual acquisition of military systems. What is needed is more specialized training in HSI for our military acquisition professionals for all services and within all interested specialties. These include the resource sponsors, the program offices, the systems commands, and the T&E community.

On the civilian side there are issues as well. Firstly, current job classification for many HSI domain engineers falls under non-engineering classifications (e.g., 180 series) because they may have a psychology degree, despite having a rigorous engineering background and coursework. Others may be classified with human resources. Secondly, the critical nature of HSI as a key part of systems engineering is not yet fully appreciated within the various PMOs and systems commands. Thirdly, the same educational challenges exist with respect to availability of HSI undergraduate and masters-level programs.

Future of HSI Responsibilities:

The primary future role of HSI remains a Systems Engineering activity. However, rather than learning the integration functions of HSI as on-the-job training, the majority of HSI engineers and their command chain will benefit from a specialized instruction in the discipline of integrating the various human systems domains. Because no one can be an expert in all the domains of HSI, it is understood that the HSI engineer will start with knowledge in one or more of the domains, and then follow that up with more formal HSI training and qualifications.

Recommendations:

- Provide more appropriate military billet designations to align HSI engineering activities to acquisition processes and to provide career growth potential for uniformed HSI professionals.
- Ensure that military and civilian acquisition leadership has at least a modest instruction in HSI and how it is a part of sound systems engineering acquisition practice.
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HSI Billet Whitepaper outline

Outline:

- Define / describe HSI (indicate that senior leadership does not necessarily have the experience and background to effectively champion HSI research and acquisition engineering activities)
 - o Include the HSI role as a Systems Engineering activity (see 12/4/09 memo from Dennis)
- Describe HSI Billets (duties performed by an HSI billet)
 - o Acquisition (Rqmts, Design, T&E, Production, Life-cycle Support)
 - o Research
 - o Policy (OPNAV N15)
 - o Warfighter / Fleet Support
- Describe Future state / Vision
- Describe current state and gaps
- Provide recommendation for the “way-ahead”

Takeaways:

- Military:
 - o Navy AEPs are primarily research and development-focused
 - o Need for warfighter SMEs with HSI knowledge and experience in acquisition programs (Rqmts, resource sponsors, PMOs, T&E, etc...)
 - o Current military structure is not supportive of HSI career path. For example, in the Navy, HSI is wedged into the 4600 designation, but that is not a good fit... ultimately it is a dead-end (as evidenced by a recent SWO-NET discussion thread that stated as much)
 - o Billets that do exist are not where needed
 - o In summary, there is a gap in meeting the demand signal in the acquisition side to support the “full spectrum of HSI roles”
- Civilian:
 - o Job classification issues (HSI requires multi-disciplinary roles, but not all requisite skillsets are classified as “engineers” (this impacts the hiring of non-SMEs)
 - o Education opportunities for HSI-related disciplines are limited
 - o Universities have not developed HSI degree programs.
 - o Quote: “HSI is today where Computer Science was 40 years ago”

–Ruben Pitts