A MESSAGE FROM THE DIRECTOR

Welcome to the Army HSI Newsletter, Fall Edition 2017. It’s rapidly becoming winter in the Northeast, but before we’re officially there, I’d like to share some updates and activities.

In the last edition of our newsletter, I noted that there’s a lot of great Army HSI work being done. In this edition, you’ll find a full feature section on the Human Systems Integration C4ISR Field Element – a mighty team of seven individuals who perform HSI for Intelligence & Electronic Warfare Systems, DoD Biometrics, and Mission Command, Control, & Communication – Tactical. From the highly visible DCGS-A (Distributed Common Ground System), Aerial & Ground Sensors, the CP CE (Command Post Computing Environment), and the Tactical Network, to the hundreds of small systems within each of these System of Systems powerhouses.

(Continued on page 1)
Army HSI continues to be a leader in making HSI a collaborative, Joint Services endeavor, complete with shared policy elements, best practice standards, tools, and training and staffing policy development. Our efforts center on what is called the “HSI Capabilities Based Analysis” or “CBA” study which received support from all the services. A CBA is a well-known analysis method, typically associated with system requirements and development processes to determine where existing capabilities fall short.

For the HSI Enterprise, we identified five gap areas: 1) limited HSI “BoK” (Body of Knowledge) to provide a common operating HSI picture driven by agreed roles, resources, and what is needed to keep HSI up and running; 2) lack of a collective HSI process policy and comprehensive set of HSI best practices; 3) need to define benchmarks for HSI certification; career ladder, and suitable and accepted centers of education and training to achieve the benchmarks; 4) lack of a definitive repository, management staff, and research arm to maintain and keep current the essential HSI tools, models, and measures; and 5) lack an HSI outreach and marketing strategy to ensure the HSI “Brand” is universally recognized, understood, and refreshed so that HSI is always used in capability requirements and system acquisition.

Wow! Sounds ambitious, doesn’t it? Not just because it’s challenging, but also because there is a vast universe of HSI effort that has already addressed parts of the five gap streams. Yet we are already working to fill these gaps. A significant step was taken in FY 17, by the Joint HSI Working Group, for all services to adopt the seven HSI analytic domains specified in the DoDI (Department of Defense Instruction) 5000.02, Operation of the Defense Acquisition System, dated January 07, 2015.

This will be done in a phased process, and somewhat differently by each service, and the changes are in the works.

More to follow on the HSI CBA gap stream champions and their teams. If you would like a copy of the CBA document, contact me or someone in our office and we will send it out. Be advised, you may be drafted to participate in a gap stream team and we will encourage that.

Finally, our Newsletter has a short sidebar on our recent “HSI Display Days” here in the Pentagon. This was an overwhelming success. There is a photo gallery from the Displays and fact sheets are available on it.

We project that our Spring HSI Newsletter will be at your electronic doorstep before you know it. Until then, HSI Forward!

Bev Knapp
The Math of HSI in C4ISR Systems by the Numbers

If Human Systems Integration (HSI) = Useable Systems, and Usable Systems = User Centered Design (UCD); then HSI = UCD. Therefore, at least two questions come to mind and based on the math, one answer should satisfy - What is HSI and what is UCD? Let's begin by addressing the first question – What is HSI? A refresher for some, and for those unaware, HSI in a nutshell is about fitting the system to the Soldier, not the other way around. It involves systematically and scientifically

ASSESSING THE TRADESPACE AMONG SEVEN (7) ANALYTICAL DIMENSIONS (see left)

with an end state that our systems, business processes, and other Soldier capabilities are usable, suitable, and acceptable, as Dr. Knapp is often heard saying.

There are many tools and techniques in our toolkit for achieving this HSI end state; however, for purposes of this article we focus on one – User Centered Design, or UCD. Now let's pause and invoke the law of substitution: if user = Soldier, then UCD = Soldier Centered Design (or SCD) and is defined as understanding and fulfilling Soldier needs through system design!

In the series of short articles that follow we introduce you to a team of subject matter experts (SMEs) performing UCD or SCD for software systems at the United States Army’s Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Center of Excellence located at Aberdeen Proving Ground, MD.

We hope you gain an understanding of what HSI means through the lens of system design to the C4ISR HSI SME, while examining their unique skills and recent accomplishments.

As you learn about their work ask yourself “are the systems I work on also fitted to the Soldier?” whether the system is a science and technology project, in early development, an off-the-shelf commercial application, or in operational test and evaluation.

Remember, the answer is the difference between a system that is usable, suitable, and acceptable; or one that requires increases to manpower, degrades Soldier survivability, safety and probability of mission accomplishment, or an increase to total system life-cycle costs.
Meet the Army’s HSI C4ISR Team
Located at APG, MD

At the Army’s Human Systems Integration C4ISR Field Element, of the Army Research Laboratory Human Research and Engineering Directorate located at Aberdeen Proving Ground (APG), MD, there are seven (7) Army HSI subject matter experts (SMEs) working with various program managers, capability developers, product supportability managers, and systems engineers across three (3) Program Executive Offices (PEOs), the Department of Defense Biometrics Project Management Office, and at least six (6) other APG Installation tenants. Using the lens of systems design, this team answers the fundamental HSI question of –

Can this Soldier/civilian... as part of this formation/agency... with this training/skill set... perform and lead these tasks... using this equipment.. in this environment and be fully successful based on personal, unit, and family support?

Let’s begin by the numbers:

- Seven (7) is the number of HSI SMEs with a combined 65 plus years of experience in systems design.
- They collaborate with development teams in at least three (3) specific areas of user interface design for websites, apps, and systems that are used in vehicles, command posts, and mobile environments.
- Actively engaged in the development and prototyping of two (2) Army Science and Technology (S&T) projects and concepts led by the research, development and engineering center (RDEC) on APG, MD.
- Provide overall HSI SME as well as serve as the human factors engineer to systems engineers and product supportability managers on at least four (4) major acquisition category (ACAT) I programs of record – Mid-Tier Networking Vehicular Radio (MNVR); two increments of the Distributed Common Ground System-Army (DCGS-A); three increments of the Warfighter Information Network-Tactical (WIN-T); and the Common Operating Environment Cross Cutting Capabilities Information (COE CCC).
- Provide HSI SME and serve as the human factors engineer on at least three (3) acquisition category (ACAT) II programs of record – Advanced Field Artillery Tactical Data System (AFATDS), Enhanced Medium Altitude Reconnaissance and Surveillance System (EMARSS), and the Aerial Reconnaissance Low-Enhanced (ARL-E) System, and one ACAT III program—Precision Fires-Dismounted and Precision Fires-Mounted.
- Partner with U.S. Army Test and Evaluation Command (ATEC), Army Evaluation Center (AEC) to assist in the planning, field data collection, and evaluation on more than (8) army capabilities undergoing acquisition sensitive operational testing and/or logistics demonstrations.

Although small in size, but large in capability, the Army’s HSI C4ISR Field Element of the Army Research Laboratory (ARL) Human Research and Engineering Directorate (HRED) continues to accomplish pioneering HSI work, whether through modeling and simulation (M&S) or boots-on-the-ground user juries and/or contextual observational studies, to derive measurable user requirements, using the lens of UCD. Continue reading and follow the links for additional details from some of their work.
A commercial off the shelf (COTS) system has a number of benefits that make it a preferred choice in many of today’s situations. Benefits include cost savings, rapid deployment, and user friendly functions, among others. However, one major issue is COTS based systems are not built for response to particular system circumstances that the Soldier/User may face, and in some instances, have not always considered military standards. This introduces new use cases in which user design must be considered that haven’t previously been addressed as they would in a typical custom design solution. The following 10 activities outlined below, provided by the ARL HRED C4SIR team, are focused around the user, have been, are being, and should continue to be considered when acquiring COTS systems for military gaps, to ensure that the system meets user/Soldier and mission requirements.

• **Comparative Evaluation of User Interface Congruency.** Evaluates the extent to which a system’s user interface aligns with an existing/legacy system’s user interface. This heuristic analysis conducted by Human Factors Engineers/Human Systems Integration (HFE/HSI) experts is especially important for complex systems and systems-of-systems. Critical system attributes (e.g., navigation, data entry, automation, system status, and menus) and “look and feel” features (e.g., color, layout, and button design) as well as the overall system conceptual model are compared and contrasted. This results in recommendations to reduce misalignments.

• **Comparative Task/Workflow Analysis.** Evaluates the extent to which a system’s design aligns with an individual or unit’s tasks/workflow. This analysis identifies where doctrinal misalignments as well as Tactic, Techniques, and Procedures (TTPs) or functionality from other systems that may be required to fill capability gaps.

• **Comparative Usability Testing.** Similar to Usability Testing (described below), this test typically uses the same group of participants to test the functionality of two or more systems. A within-subjects (rather than a between-groups) design should be considered because it requires fewer test participants. Results are useful for understanding design attributes that are “best in class”, identifying user interface and system requirements. *(Continued on page 6)*
• Continuous User Needs Analysis Framework & HSI Oversight. Development of a tailored framework for conducting continuous user needs analyses to obtain design data that informs decisions impacting a COTS program’s incremental design update(s), change management, training, and deployment is critical support provided by HFE/HSI for COTS systems. This is typically a Lead for a HSI Working Group or IPT and is an integral member of other relevant IPTs, making certain that HSI is appropriately considered throughout system design and development. This ensures that the appropriate HSI activities are conducted in accordance with Army regulations throughout the acquisition process while considering programmatic constraints. After any system deficiencies are identified, the Lead works with the program office and IPT(s) to prioritize and mitigate deficiencies.

• Ergonomic Assessment. Evaluates accommodation of the human when operating and maintaining systems (e.g., small arms/light weapons and optical systems) or working within COTS systems (e.g., shelters and tactical vehicles). Identifies design issues and constraints imposed by characteristics of new equipment relative to the Army population. When actual equipment is not available for assessment early in the acquisition process, human figure modeling (e.g., CAD and JACK) is used to predict human accommodation by identifying issues, constraints, and their associated risk. This results in recommendations to improve human accommodation.

• Functional Assessment. A functional system is exercised in a near-real operational environment using tactically relevant mission scenarios/threads. COTS systems are not necessarily designed/developed in accordance with military environmental standards which ensure safe and effective use in harsh, stress-inducing environments. This assessment identifies issues and concerns that may require the development of caution and warning labels that can be affixed to a system to avoid personnel injury and system damage. Results can also inform the development of job aides, training, and documentation. Recommendations to improve ruggedness and improve ease of use are useful input to vendors who are considering future product upgrades.

• Human-System Functional Allocation. Through the conduct of user-centered design activities and analysis, results of analyses will identify appropriate human-system (hardware and software) functional allocation which includes the coupling of automation with appropriate system transparency. This facilitates the ability of the human operator to intervene and regain effective control of system processes when needed (especially in time-sensitive, life-threatening, emergency situations).

• Literature and Product Reviews. Identifies and documents a product’s strengths, weaknesses, and workarounds as identified by users of a COTS product. This information is publicly available and is useful to inform source selection as well as for use as source material when developing job aids and instructional design.

• Requirements Elicitation, Refinement, Validation, Review, and Tracking. Using a variety of user-centered design techniques (e.g., subject matter expert interviews, usability testing, task/workflow analyses) elicit user requirements for user interface/system design, refine and validate requirements during subsequent user-centered design activities, and ensure traceability of all requirements from capabilities needs through design and test in programmatic documentation and during program technical reviews. Maintain an HSI Program Plan and a historical database tracking HFE/HSI requirements (explicit and derived), the extent to which they are being met, HSI domain issues as they are identified, potential issue mitigations, mitigations implemented, and the extent to which implemented mitigations have resolved issues.

• Usability Testing. Identifies system functionality that is useful and usable and that which is not by having intended users assess the ease of use with which they perform tasks, the cognitive workload associated with conducting representative tasks, and the usefulness of the functionality provided by the system. By understanding the root cause(s) of usability issues, job aides and instructional design can fill identified usability gaps with workarounds. This results in valuable source selection data as well as issue mitigation recommendations and identification of unnecessary functions.
The HSI Viewpoint From Within a PEO

To understand a broader viewpoint of HSI applied across several programs within a program executive office (PEO), look no further than the buildings next door to the Army HSI ARL HRED Field Element Office at APG, MD. Under PEO, Intelligence, Electronic Warfare and Sensors (IEW&S), ensuring equipment is usable by Soldiers means applying the process of HSI; or as we learned also means UCD in the wheelhouse of our Army HSI C4ISR team.

So how exactly do you improve critical military systems? In the words of Mark Kitz, Division Chief of the Systems of Systems Engineering (SoSE) team, you must begin looking for opportunities to “…broaden the HSI program across [the] portfolio...since HSI is now a requirement in the DoD 5000 process, so will it be a staple in our engineering policies going forward.”

Link: http://www.army.mil/article/187349
The ARL research psychologists identified thirty-three (33) user requirements for Block II of the Precision Fires – Dismounted (PF-D) capability developed by the Program Manager, Mission Command (PM MC). The user requirements will improve the user experience for Forward Observers using the PF-D. This human factors was also performed as part of ARL’s Assessment and Analysis Campaign plan in support of the Training and Doctrine Command Big 6+1 Capabilities - Cross Domain Fires and Expeditionary Mission Command / Cyber Electromagnetic described by Lt. Col. Corey Chasse’, the Training and Doctrine Command Headquarters, Army Capabilities and Integration Center, force management officer and TRADOC Big 6+1 Capabilities chief at Fort Eustis, Va. We look forward to ARL HRED’s Dr. Pamela Savage-Knepshield and Mr. Charlie Hernandez, LTC (ret).

POC: Dr. Pam Savage-Knepshield, pamela.a.savage-knepshield.civ@mail.mil
The HPM M&S efforts, if continued, are poised to contribute to overall program schedule and performance by reducing operational suitability risks (i.e. reliability and usability) that impact system operations (configuration, network management, troubleshoot, and monitoring), mission command and decision making, and training readiness.

For additional information or evidence of HSI processes positively impacting PM WIN-T check out the following articles:


Education and Events

**Army HSI Practitioner’s Course**

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| Mondays & Tuesdays as requested | Huntsville, AL (Can be delivered virtually) | **Instructor:** Taylor Jones  
**Training Coordinator:** Kelly Hopkins  
**Email:** khopkins@alionscience.com |

**Defense Acquisition University**

**DAU Course CLE 062, Human Systems Integration**

**SPRDE-SE level II:** [https://dap.dau.mil/career/sys/Pages/Certification2.aspx](https://dap.dau.mil/career/sys/Pages/Certification2.aspx)  
**SPRDE-PSE level I:** [https://dap.dau.mil/career/pgm/Pages/Certification.aspx](https://dap.dau.mil/career/pgm/Pages/Certification.aspx)

Over 500 military, government, and industry professionals have completed the course in less than one year.  
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**NDIA Human Systems Conference**

13-14 March, 2018  
Springfield, VA  

**Ergonomics & Human Factors 2018**

April 23–25, 2018  
Birmingham, UK  
[http://events.ergonomics.org.uk/event/ehf2018/](http://events.ergonomics.org.uk/event/ehf2018/)

**DOD HFE TAG**

Tentatively scheduled May 2018  
more details to follow  

**Human Factors & Ergonomics Society International Annual Meeting**

1-5 October 2018  
Philadelphia, PA  
[https://www.hfes.org/](https://www.hfes.org/)

The Army HSI Newsletter is an official bulletin of the Deputy Chief of Staff, G-1, Department of the Army. The Army Human Systems Integration (HSI) Program (AR 602-2) is a comprehensive management and technical initiative to enhance human performance and reliability during weapons system and equipment design, development, and production. Army HSI encompasses seven key domains: manpower, personnel, training, human factors engineering, system safety, health hazards, and soldier survivability. The focus of Army HSI is to integrate technology, people, and force structure to meet mission objectives under all environmental conditions at the lowest possible life-cycle cost. Information contained in this bulletin covers policies, procedures, and other items of interest concerning the HSI Program. Statements and opinions expressed are not necessarily those of the Department of the Army. This bulletin is prepared twice yearly under contract for the HSI Directorate, G-1, under the provisions of AR 25-30 as a functional bulletin.
Recent Events

Joint HSI Pentagon Display 12-13 September

The HQDA G-1 HSI Directorate chaired the annual Joint Human Systems Integration (HSI) Display Days at the Pentagon on 12-13 September 2017. The Joint HSI Display Day, a function of the DoD Joint HSI Working Group chaired by Dr. Knapp, Director (A) of the HQDA G-1 HSI Directorate, provides a forum for the services to share recent HSI success stories, advances in methodology and tools, and core capabilities as a critical defense systems acquisition system enabler as per DoD 5000.02. Pictured above, Mr. Gold, Director Engineering Enterprise, OUSD ATL was briefed by Jonathan Crutcher from ARL-HRED regarding HFE evaluation tools used by HSI Practitioners to increase soldier survivability and user acceptance in design and production. Other VIPs to visit the Display included the HQDA SECARMY Speechwriter who plans to author an article on HSI and its impact to systems acquisition and the Chief, Training Requirements Division, HQDA DCS G-1. In-depth discussions were garnered at the Display regarding strategies for integrating HSI expertise and knowledge points into the Joint Capabilities Integration Development System (JCIDS) requirements writing processes and processes for enhancing collaborations between the HSI and systems engineering (SE) disciplines.

The 2017 Joint HSI team of presenters

Jonathan Crutcher briefs Mr. Gold on the Black Hawk Gunner Seat

Rachael Lund and Ana Borja discuss crew endurance with Dr. Christian

Dr. Knapp explaining where to implement HSI in the acquisition life cycle