

# Updates on Human Systems Integration Governance and Responsibilities for Department of Defense

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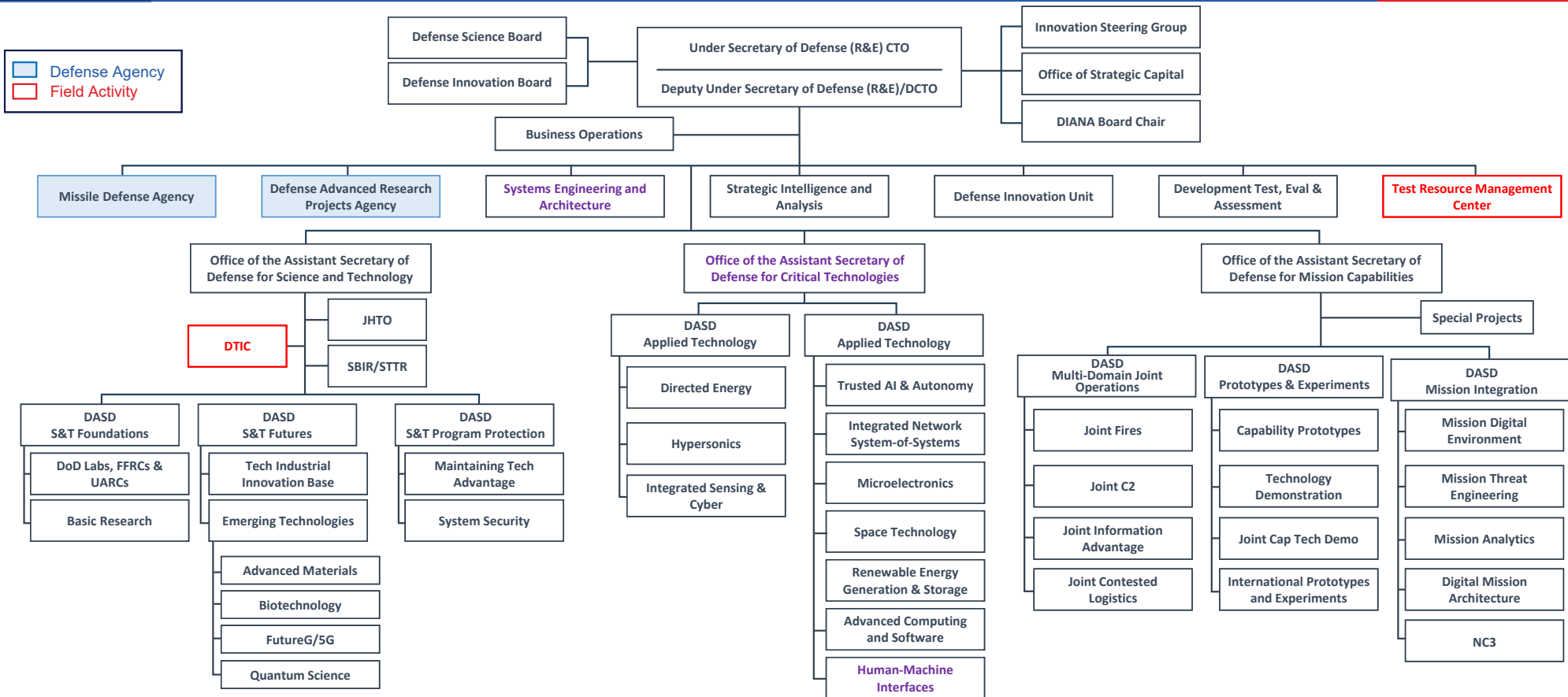


# Agenda

- Research and Engineering (R&E) and Systems Engineering and Architecture (SE&A) Overview
- HSI Policy Requirements and Guidance
- Capabilities-Based Assessment (CBA) Overview
- Path Ahead



# OUSD(R&E) ORGANIZATIONAL STRUCTURE





# National Security Authorities: Research and Engineering (R&E)



## Leaders



**Heidi Shyu**

Under Secretary of Defense for Research and Engineering



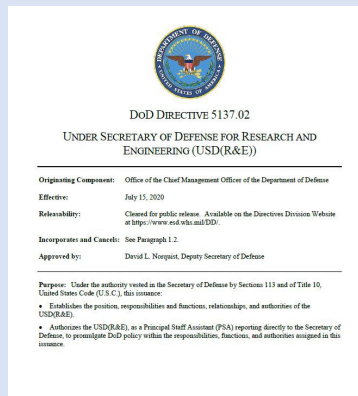
**Dr. David A. Honey**

Deputy Under Secretary of Defense for Research and Engineering



## Authority From

### DoDD 5137.02



<https://www.esd.whs.mil/DD/>

**Purpose:** Under the authority vested in the Secretary of Defense by Sections 113 and of Title 10, United States Code (U.S.C.), this issuance:

- Establishes the position....of the USD(R&E).
- **Develops “governing policy and advances practices and workforce competency for... human systems integration...”**

## Priorities

*National Defense Science and Technology Strategy 2023*, Section I  
Focus on the Joint Mission, pg 3

“In 2022 the Department designated these Critical Technology Areas to address the key national security challenges the nation faces, including... **human-machine interfaces...**”



# SE&A Roles and Responsibilities

**SE&A: Develops and promotes innovative engineering principles and techniques to advance DoD engineering practice.** SE&A develops policy, guidance, standards, and best practice resources; manages DoD Standards; facilitates engineering-related communities of practice; and develops the defense engineering workforce by refining competency models and curricula. SE&A applies engineering and risk management expertise to inform decisions and improve system-of-systems architectures to reduce integration risk in mission-enabling systems.

**Policy and Workforce:** Leads policy, guidance, and workforce development initiatives for the DoD engineering and technical workforce.

**Systems Engineering (SE):** Focuses on modernizing SE practice, including using modular open systems approaches to build systems that can be upgraded to incorporate new technology and respond to emerging threats.

**Digital Engineering Modeling & Simulation (DEM&S):** Focuses on digital engineering transformation and implementation, promoting the use of models and simulations across the DoD life cycle.

**Software Engineering (SWE):** Promotes Agile/DevSecOps software practices and cross-organizational collaboration to modernize DoD software capability and expertise.

**Specialty Engineering (SpE):** Focuses on improving delivery of advanced capability to warfighters by modernizing reliability and maintainability, manufacturing and quality, system safety, human systems integration, and value engineering practices.

**Defense Standardization Program Office (DSPO):** Identifies, develops, and provides access to standardization processes and products for the defense community to promote interoperability, reduce cost, and sustain readiness.

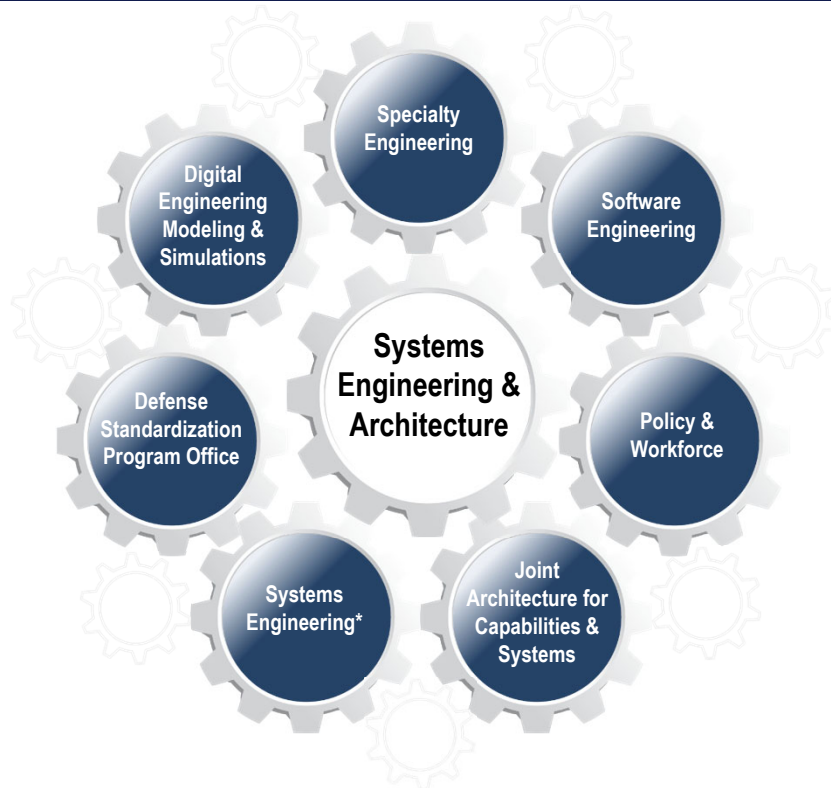
**Joint Architecture for Capabilities and Systems (JACS):** Promotes system of systems fielded with speed, fidelity, and adaptability to enable continual evolution of U.S. warfighting dominance.

**Collaborators: OUSD(R&E) offices, the Services, DOT&E, CIO, CDAO, and OUSD(A&S)**



# SE&A Lines of Effort

SE&A develops and promotes advanced engineering principles, techniques, and practices to improve Joint Warfighting Capabilities



## Lines of Effort

1. Advance the Engineering Practice
2. Connect and Strengthen the Technical Community
3. Develop the Workforce
4. Advance and Manage Standards
5. Provide Technical Expertise for Independent Engineering Assessments
6. Provide System of Systems (SoS) Architectures Guidance

\*Includes Modular Open Systems Approach (MOSA)



# HSI Statute and Policy

- **HASC recommendations FY2017 HASC Report (HR) 4909:**

- *Continuing top-level HSI leadership* through existing committees, such as the Joint HSI Steering Committee (JHSISC) and Working Groups
- *Provide a DoD HSI Standard practice* and update existing HSI-related MIL Standards
- Incorporate additional *HSI learning content into DAU's systems engineering courseware*
- Provide support to USD(A&S) to *strengthen HSI language in the revamped DoDI 5000.02 (as a result of the Adaptive Acquisition Framework transformation of DoD policy)*

- **Public Law No: 116-92, SEC. 902, January 3, 2019:**

"The Secretary of Defense, acting through the Under Secretary of Defense for Acquisition and Sustainment, shall coordinate and **manage human systems integration activities throughout the acquisition programs** of the Department of Defense."

- **DoDD 5000.01, Defense Acquisition System (DAS):**

"1.2.p. Human systems integration planning will begin in the early stages of the program life cycle. The goal will be to **optimize total system performance and total ownership costs**, while **ensuring that the system is designed, operated, and maintained consistent with mission requirements.**"



# Why HSI?



Marines prepare to take off in a MV-22B Osprey at Norwegian Air Force Base Bodø during Exercise Cold Response 22, Norway, March 16, 2022. (Lance Cpl. Elias E. Pimentel III/Marine Corps)

**Pilot error the cause of Norway Osprey crash that killed 4 Marines (Aug 2022)**



**KC-46A's long-troubled vision system cannot reliably show the end of the refueling boom (May 2021)**



**The Army's futuristic new goggles are a literal pain in the neck (Oct 2022)**



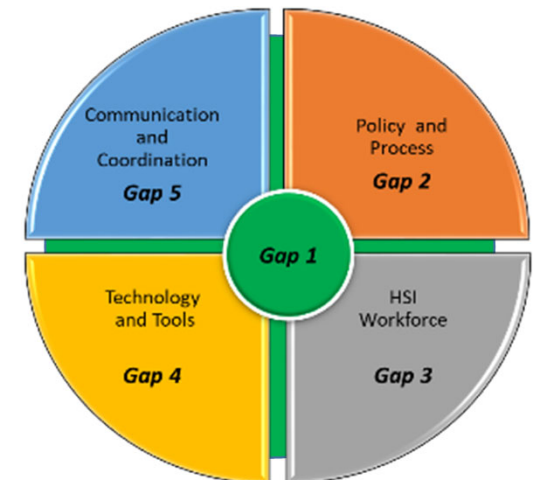
**USS Fitzgerald and container ship MV ACX Crystal; USS John S. McCain and Alnic MC collisions (2017-2018)**  
"The ship's [user interface](#) was found to have contributed to the sailors' confusion."





# Joint HSI Steering Committee

- OSD has **tri-chair** responsibilities in the JHSISC for providing leadership direction for the HSI enterprise across DOD
  - OUSD(R&E) Principal Deputy Executive Director, Systems Engineering and Architecture
  - OUSD(R&E)/DCTO(ST&T), Director, Defense Research Operations
  - OUSD(P&R)/DASD(SOH) Director, Force Safety and Occupational Health
- The JHSISC guides accelerating the delivery of human systems capabilities, scaling the Department-wide impact of HSI, and synchronizing DoD HSI activities
- The Joint HSI Steering Committee commissioned an HSI Gap Capabilities-Based Assessment (CBA) Report in 2018, which identified five lines of effort to enhance HSI maturity and effectiveness





# HSI Definition and Goals for Defense System Acquisition

- **HSI: The SE process and program management effort that provides integrated and comprehensive analysis, design, and assessment of requirements, concepts, and resources for human factors engineering (HFE), manpower, personnel, training, safety and occupational health (SOH), force protection and survivability (FP&S), and habitability.**
- These domains are intimately and intricately interrelated and interdependent and must be among the primary drivers of effective, efficient, affordable, and safe system designs.
- HSI integrates and facilitates trade-offs among these domains, but does not replace individual domain activities, responsibilities, or reporting channels.
- **The goal is to:**
  - **(1) Optimize total system performance**
  - **(2) Reduce total ownership costs**
  - **(3) Ensure that the system is designed to be operated, maintained, and supported while providing users with the ability to effectively complete their mission(s)**
- **HSI Impacts:**
  - **Total System Performance: The end state functionality achieved by a system when including the human with hardware and software components under its intended operational condition(s) to achieve required operational, effectiveness, and suitability, survivability, safety, and affordability.**
  - **User: Humans who will operate, maintain, train, and support the equipment, system, or facility. Includes “End user” as defined in DoDI 5000.87 who will operate, maintain, train, and support the equipment, system, or facility. Includes “End user” as defined in DoD.**



## Sections of DODI 5000.95

- Sec. 1: General Issuance Information
- Sec. 2: Responsibilities
- Sec. 3: HSI Procedures, including:
  - General (3.1)
  - HSI Planning (3.2)
  - Overall tasking in programs for each of the HSI domains (3.3-3.9)
- Glossary, including standardized acronyms and definitions
- References

**16 pages total, compared with 2 pages total for previous “Enclosure 7 - HSI”**



# “Component capability developer or program manager will...” statements comparison from Enclosure 7 to DoDI 5000.95

Policy Section	DoDI 5000.02 Enclosure 7 (Change 4, 31 Aug 2018)	DoDI 5000.95 (1 Apr 2022)
General (Sec 3.1)	hsj hsj	hsj hsj hsj
HSI Planning (Sec 3.2)	hsj	hsj hsj hsj hsj
HFE domain (Sec 3.3)	hsj	hsj
Personnel domain (Sec 3.4)	hsj hsj	hsj hsj hsj
Habitability domain (Sec 3.5)	hsj	hsj hsj
Manpower domain (Sec 3.6)	hsj hsj	hsj hsj hsj hsj
Training domain (Sec 3.7)	hsj hsj hsj hsj	hsj hsj hsj hsj hsj hsj hsj hsj
SOH domain (Sec 3.8)	hsj	hsj hsj
FP&S domain (Sec 3.9)	hsj	hsj hsj hsj

 = One distinct responsibility statement



# JCIDS and HSI Guidebook

- **JCIDS – CDD Format:**

**“Human Systems Integration (HSI) considerations that have a major impact on system effectiveness, suitability, and survivability.** The HSI Force Protection and Survivability domain contributes to the Force Protection KPP by defining requirements for personnel force protection and personnel survivability. The HSI Safety and Occupational Health domain contributes to the Force Protection KPP by defining requirements for personnel and system safety. DOTmLPF-P analyses should identify and address HSI.”

*JCIDS Manual, October 31, 2021*

- **HSI Guidebook**

- Establishes guidance for incorporating HSI and domain-level activity by practitioners and stakeholders during system acquisition
- Replaces DAG Chapter 5 Manpower Planning and Human Systems Integration
- Published May 2022 <https://www.cto.mil/wp-content/uploads/2023/06/HSI-Guidebook-2022.pdf>
- See also SE&A Policy and Guidance page <https://www.cto.mil/sea/pg>



# HSI Guidebook – May 2022

Guidebook TOC Section	Section Description
Introduction (Sec 1)	This guidebook addresses Human Systems Integration (HSI) in Department of Defense (DoD) acquisition.
HSI Overview (Sec 2)	HSI in DoD; HSI ROI; Optimizing Total Systems Performance; HSI in the acquisition lifecycle; HSI in risk management.
Integration Role Across HSI Domains (Sec 3)	<b>HSI practitioners are responsible for integrating and facilitating trade-offs among HSI domains, assimilating considerations, and providing recommendations. HSI domains are interrelated and interdependent, such that the HSI practitioner should consider trade-offs among the primary drivers of effective, efficient, affordable, and safe system designs.</b>
HSI Domains (Sec 4)	<b>Describes each HSI Domain and best practices; HSI domains are interrelated; changes in system design or capabilities could improve one HSI domain and adversely affect another.</b>
HSI Tools and Methods (Sec 5)	Introduction, taxonomy description, classification and characteristics of HSI tools and methods
HSI Workforce Advancement (Sec 6)	Implementing HSI within the acquisition process can be successful when members of the workforce are trained and educated in the tools, techniques, approaches, and methods of HSI and have a command of HSI Knowledge, Skills, Abilities and other attributes; Courseware review.
HSI Communities of Practice (Sec 7)	Introduce Joint HSI Steering Committee, Joint HSI Working Group, DAU online venue
Glossary; Acronyms; References	Self-explanatory



# Policy Updates – HSI language strengthened across functional areas

- **DoDI 5000.88, “ENGINEERING OF DEFENSE SYSTEMS**
  - **Use a Human-Centered Design Approach**
  - Frequent and Iterative End User Validation
  - Risks identified and managed throughout acquisition phases
  - **SEP must contain HSI elements**
- **DoDI 5000.89, “TEST AND EVALUATION”**
  - Cybersecurity testing with representative users
  - **TEMP to account for End Users and operators in end-to-end live operational scenarios and collect data**
  - The PM will develop a plan to determine automated data processing and collection for evaluation and analyses
- **DoDI 5000.91, “PRODUCT SUPPORT MANAGEMENT”**
  - An LCSP is required for covered systems ....
  - establishes the system’s product support planning and sustainment to detail:
    - Performance goals, to include (a) Sustainment key performance parameters (KPPs), (b) Key system attributes, and (c) Other appropriate metrics.
    - **Use HSI operational feedback data for sustainment analysis.**
    - Coordinate with Users and SMEs for Prototyping designs and User Assessment planning



# Capabilities-Based Assessments

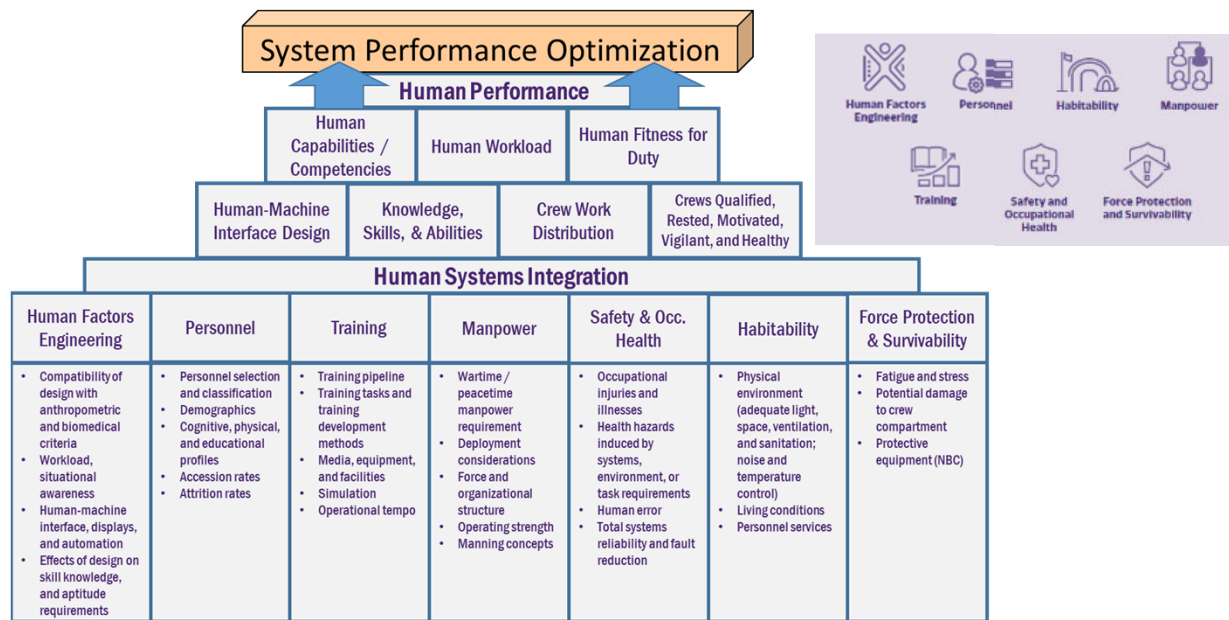






# DAU ENG 0620 “Introduction to Human Systems Integration”

- Supports JHSISC CBA 3: Develop Career Certification and Career Paths/Billets for HSI Workforce Supported by a Persistent Training Function
- Offers a fundamental understanding of HSI as part of the Department of Defense's Total Systems Engineering approach
  - Optimization of system performance
  - Minimization of total ownership costs
- Introduction to HSI domains
  - Human Factors Engineering
  - Personnel
  - Manpower
  - Training
  - Safety & Occupational Health
  - Habitability
  - Force Protection & Survivability





# “Good News” Exemplar– Applying User-Centered Design Early in Acquisition

## • Mission

- **Applying User-Centered Design Early** in the Precision Fires Dismounted (PF-D) Acquisition Process

## • Background

- A **software (SW) end-user application** began as a Science and Technology (S&T) initiative developed by the U.S. Army Aviation and Missile Research Development and Engineering Center (AMRDEC) that transitioned to Product Manager (PdM) Fire Support Command and Control (FSC2) who oversees the development, testing and fielding for the app under Program Executive Office (PEO) Command, Control and Communications-Tactical.

## • Approach

- Execution of a User-Centered Design (UCD) process (Understand-Visualize-Evaluate) that complements **agile development** for both the PF-D and PF-M SW applications.

## • Benefit/Return on Investment

- **Two (2) critical system safety issues were identified and resolved** to prevent potential fratricide issues that translated to cost avoidances (i.e., cost of correcting inadequate functionality and providing software updates for fielded systems).
- **Thirty-three (33) user needs/requirements were identified and accepted** as part of future requirements packages for SW release. This will increase system utility and user acceptance.
- **Increased system up-time and operational availability through improved troubleshooting procedures for faster and accurate problem identification, diagnosis, and repair.**
- **Reduced Cognitive overload** - A Quick Reference Guide SW application with improved instructional design presents information in such a way that it reduces extraneous cognitive load (non-relevant content) and increases germane cognitive load (content that assists with information processing) for those learning to use PF-D as well as for those seeking to sustain procedural knowledge

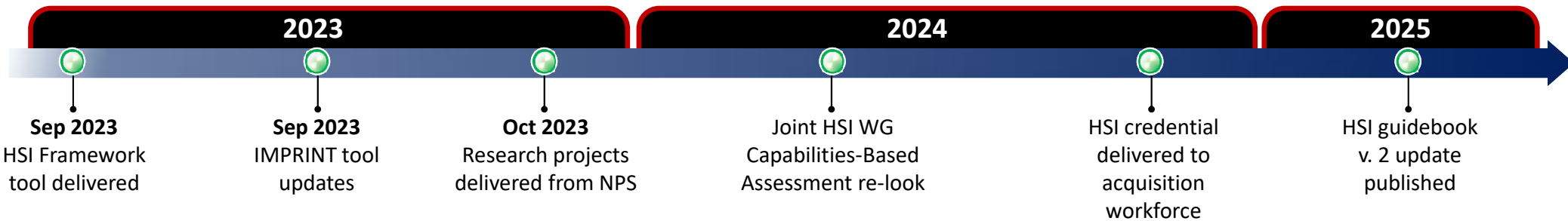
### *Case Study metrics:*

- ***Capability theme/Critical Tech Area***
- ***ROI in terms of cost, schedule, performance, risk***
  - ***Reduced maintenance cost***
  - ***Reduced injury cost***
  - ***Reduced Cognitive workload***
  - ***Improved human performance***
- ***HSI domain impact statements***
- ***Approaches, TTAMs***
- ***HSI Activity(ies) involved***
- ***...And more!***



# Path Ahead

## Future Roadmap for Human Systems Integration





## Contact

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<https://www.cto.mil/sea/>