



711th Human Performance Wing



Fly – Fight – Win

Institutionalizing HSI in AF Advanced Technology Demonstration Programs



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Outline

- Introduction
- Current HSI Policy
- Cultural change
- Benefits
- Recommendations





Human Systems Integration Defined

HSI is the integrated, comprehensive analysis, design, and assessment of requirements, concepts and resources for systems

with respect to

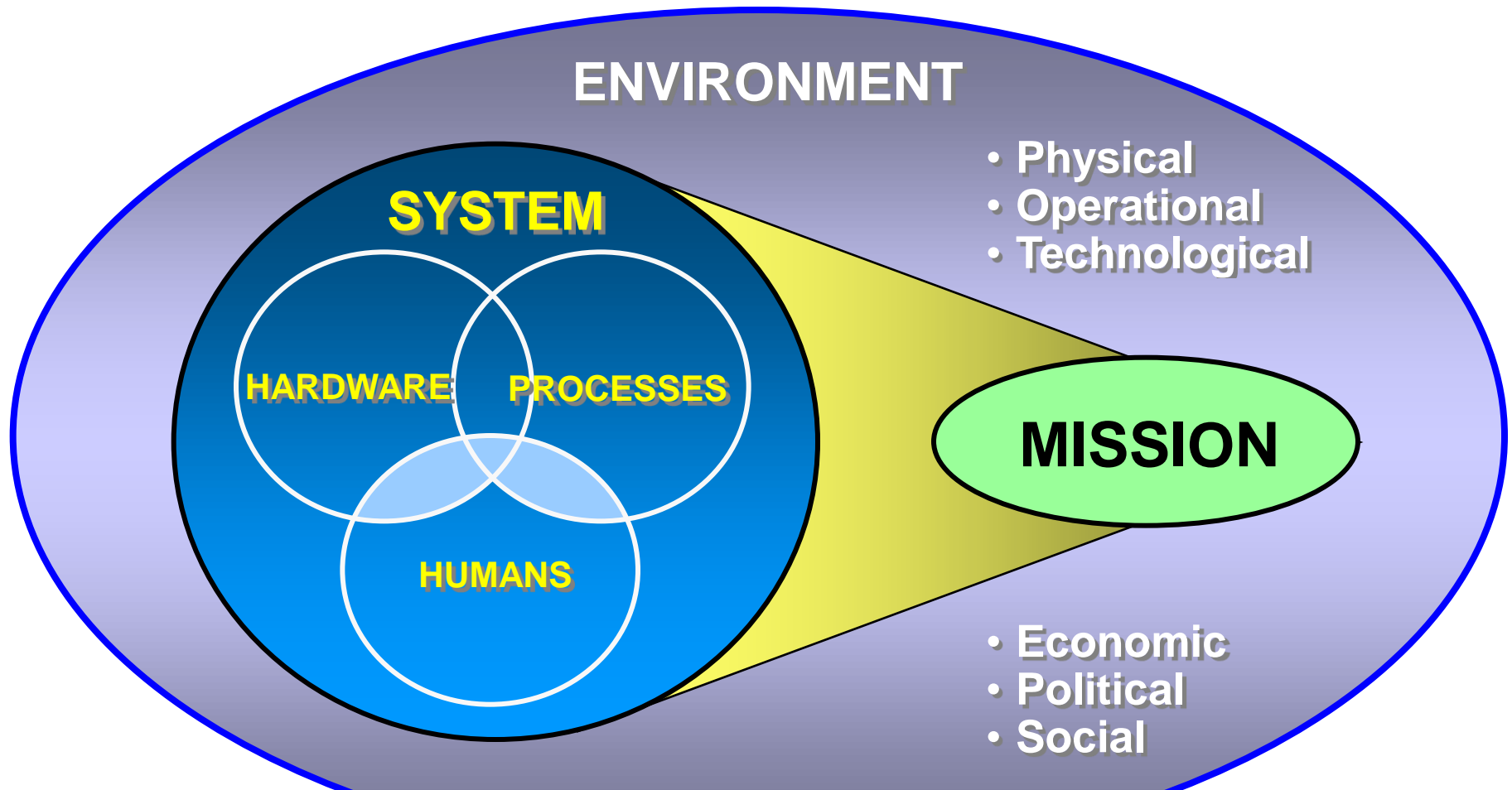
Manpower, Personnel, Training, Environment, Safety, Occupational Health, Habitability, Survivability, and Human Factors Engineering.

--Ref: AFI 10-601, Apr 07





Human-System Integration Conceptual Model



HSI must be an integral part of Systems Engineering



Why Human Systems Integration in ATDs?

- Too often there is little communication between researchers and SPO
- Technologies are transitioned without the needs and the limitations of the user in mind
- Lack of integration results in a lack of usability and longer development time in the acquisition stream - **exactly what ATDs are meant to avoid!**
- Technology may be mature but it may not ready to be used





Current HSI Status: Policy

DoD Policy mandates HSI

■ **DoDD 5000.01**

- “The Principle Investigator shall apply human systems integration to optimize total system performance (hardware, software, and human), operational effectiveness, and suitability, survivability, safety, and affordability.”

■ **DoDI 5000.02**

- “The Principle Investigator shall have a comprehensive plan for HSI in place early in the acquisition process”



AF Policy mandates HSI

- **AFI 63-101 - 2005**

- **OPERATIONS OF CAPABILITIES BASED ACQUISITION SYSTEM**

- “Human Systems Integration. The PI should integrate manpower, personnel, training, human factors, safety and occupational health, personnel survivability, and habitability considerations into the acquisition process.”
- “The acquisition strategy should identify HSI responsibilities, describe the technical and management approach for meeting HSI requirements, briefly summarize the planning for each of the above elements of HSI.”



SAB Policy Recommendations

Scientific Advisory Board - 2004

“The Air Force should implement a **comprehensive, consistent policy that reflects the intent of DoDI 5000.2 [HSI]**, tailored to Air Force missions, organization and acquisition practices.”

Recommendations for Science and Technology

- *Strengthen HSI collaboration between AFRL & product centers (SMC, ASC, ESC, Warner-Robbins logistics center)*
- ***Establish focused S&T initiatives to address HSI process gaps***
- *Maintain strong S&T base in physical ergonomics*
- *Focus new initiatives in cognitive sciences, modeling, & engineering*
- *Develop tools to support knowledge-intensive operations*



Cultural Change in AFRL

- Change at the...
 - Policy level
 - Organization level
 - Grass-roots (field) level



Policy Change

Advocacy Pull

Cultural change at the leadership level

- ❖ Motivate AFRL leadership to create a culture of change to *institutionalize HSI in S&T rapid acquisition programs*
- ❖ Include HSI-enabling language in policy and instruction documents regulating technology development and transition: *AFPD 61-1, AFI 61-101, and AFMCI 61-102*
- ❖ Modify the Technology Transition Plan to include *Human Readiness Assessment* as part of the Technology Readiness Level Assessment to evaluate system maturity
- ❖ Include an HSI representative on the ATD *Integrated Product Team*
- ❖ *Authorize budget HSI costs* into the acquisition baseline



Organizational Change

Push HSI from Organizational Level

- ❖ HSI expertise to support the PI – feet on the ground
- ❖ Develop HSI plan that considers all of the human domain-related activity in the development of the technology
- ❖ Human Readiness Assessment - assess the maturity of the system to accommodate user capabilities, limitations, and to identify risks
- ❖ Cost estimation process for HSI activities consistent with Work Breakdown Structure
- ❖ Employ subject matter domain experts



Organizational Change

HSI Consultant supports PI in executing HSI

- ❖ Participates on the *IPT*
- ❖ Oversees HSI *analyses* and *test and evaluation* events
- ❖ Reviews the logistics concept to ensure that it is synchronized with the Target Audience Description (TAD) and training concepts
- ❖ Ensures HSI is addressed in *contractor activities*
- ❖ Performs *human readiness assessments (HRAs)*
- ❖ Assists in managing performance risk in the ATD by *integrating human-related requirements with other life cycle issues* embodied in the nine HSI domains
- ❖ Coordinates *subject matter expert activities* to ensure all human-centric domains have been considered in the HRAs



Field Level Change

HSI activities in the field

- Provide support at Technology Exercisess - Tech Warrior, Patriot, Black Dart, Terminal Fury, JEFX
- Inform Principle Investigators (PIs) of the advantages of incorporating human-centered design into current ATD projects
- Educate researchers on how their results can be transitioned to the user – design guidelines, specifications, etc.
- Educate the J9 planning staff on HSI



Managing Risk in ATDs

- Risk involves uncertainty in a program that can *negatively* impact its *successful development, deployment, and sustainment*.
- Risk can occur in all phases of a program but it is particularly *critical during the development phase*
- Risk may not be completely eliminated but must be *managed to minimize adverse effects*
- *All ATDs have inherent technical and performance risk* otherwise they would not be R&D programs



Mitigating Technical Risk

HSI helps PI mitigate risk in ATDs

- **Human Readiness Assessment** (in development)
 - Provides a set of milestone-sensitive **management and analytical activities** that guides PIs and Systems Engineers in the process of HSI implementation planning and execution
 - **Informs requirements and acquisition process documents** to enable HSI tradeoff decisions as program evolves
 - Tailored after **Technical Readiness Assessments**
 - **Assesses maturity of human system integration** from concept formation to full integration in 9 levels
 - Embedded in **systems engineering**
 - Based on the **MODAF “Human View”** of the multi-functional role of the human in socio-technical systems



Human Readiness Assessment

Assessing maturity of human-centered design

Technology Readiness Levels

TRL #1 Basic principles observed and reported

...

TRL #5 Component and/or breadboard validation in relevant environment

...

TRL #9 Actual system proven through successful mission operations.

Human Readiness Levels

HRL #1 Activation of Human Systems Integration Process: Baselineing & Commitment

...

HRL #5 Limited System Human Performance Parameters and Demonstration

...

HRL #9 Sustainment: Initiation of Capability Gap Feedback Cycle



Benefits to ATDs

Reduces Technical and Performance Risk

- Identifies human integration risks to the product center/system group
- **Systematically assesses maturity of human (warfighter) readiness**
- The higher the readiness level the lower the overall risk
- More likely to pass test and evaluation
- Identifies potential HSI risks that will need to be addressed at some future point
- **Systems that better equip, enhance, and sustain the warfighter**
- Reduces cost, especially operation and sustainment costs



Recommendations and Conclusions

- Write HSI language into Technology Development/Transition Regulations
- Provide content (HRLs) for the PIs to integrate the human component into development process
- Advocate and educate at the field level
- Speak the PI's language - Identify HSI shortfalls/risks during ATD process
- Begin parallel development for next block if urgency of acquisition cannot await full HSI maturity



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Back Up Slides



Consequences of Unmanaged Risk

Predator Lessons Learned

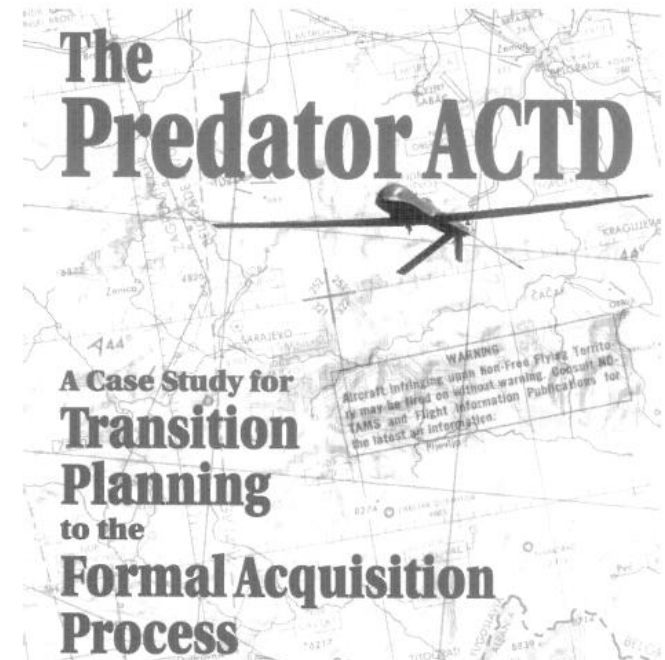


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Predator HSI Lessons Learned

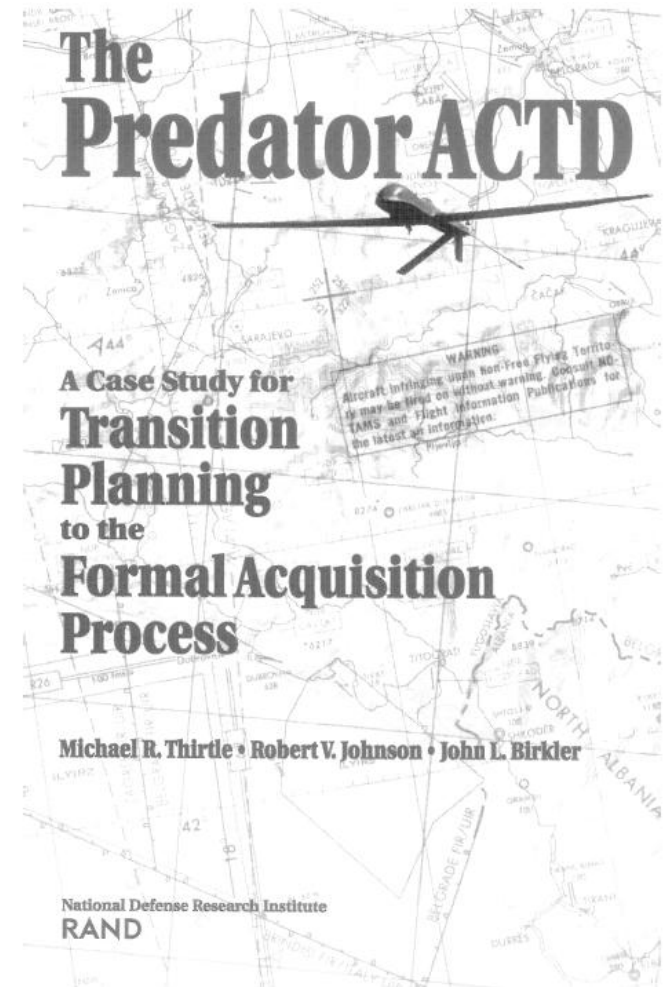
- **LL #1: Integration:** Failure to include human-centered requirements negatively impacted operational effectiveness
- **LL #2: Personnel and Training:** Failure to consider knowledge, skills, abilities, experience levels, and training required to operate, maintain, and support the system.





Predator HSI Lessons Learned

- LL #3: Manpower and Occupational Health: Long work hours and a limited manpower pool led to degraded human performance, fatigue, retention problems.
- LL #4: Habitability: Poor working conditions within the operating environment significantly affected mission performance.





Human-Centered Systems Engineering Design

