Driving Human System Integration into Common Industry Practice

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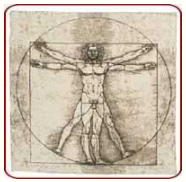
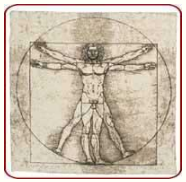
Why Human Systems Integration?



- HFE model is not sufficient to address complex systems design and government/defense increased emphasis on lowering life cycle costs
  - The human represents 70% of the variability of system effectiveness and 50-80% of the cost of a system
  - These percentages have changed little, especially for complex systems with large human component.
  - Addressing this variability and cost requires broader, systematic integration of HFE with a number of related disciplines (called domains)
- HSI is being mandated by the government
  - MANPRINT /HSI

HSI better addresses the human contribution to cost throughout the system life cycle

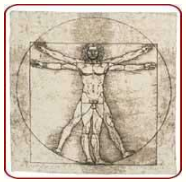
Acceptance of HSI in Acquisition Programs



- After 24 years of (Army) HSI, HSI still suffers a credibility and funding problem
- This paper discusses some of the reasons:
  - Government and industry maintain different interpretations and some misconceptions about Human Factors Engineering (HFE) versus HSI
  - HSI is not always properly accounted for in contract documentation to ensure inclusion in program efforts
    - SOW, Specs, CONOPS, etc
  - Established organizational structures separate HSI domains and prevent effective execution of HSI
  - Service branches have different levels of HSI maturity
  - HFE Standards are outdated, ambiguous, and insufficient

HSI has not achieved sufficient acceptance and influence in system design

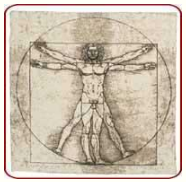
Distinction between HFE and HSI

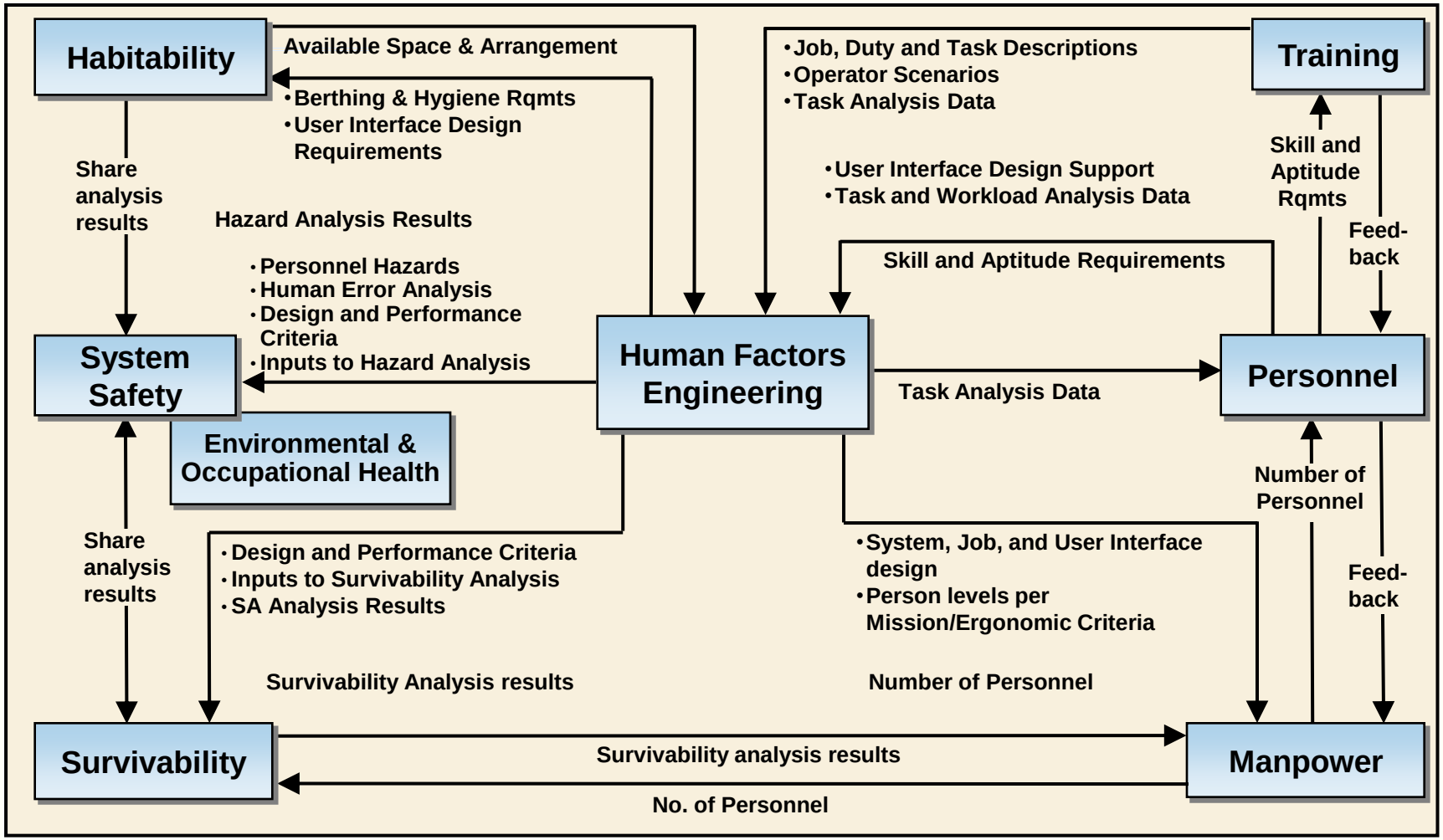


- Human Factors Engineering (HFE) is the application of human capabilities and limitations to the design, development and deployment of systems
  - HFE plays a central role in providing the scientific basis for design decisions…but it is not the whole story
- HSI is a Systems Engineering-based technical management activity integrating multiple domains, including HFE
  - These domains together capture most aspects of the human interface
  - Many of these domains have not traditionally worked closely together
    - Training
    - Manpower
    - Personnel (skill level),
    - Safety/Occupational Health
    - Habitability (Navy)
    - Personnel Survivability
    - Human Factors Engineering
- HSI coordinates these domains during Requirements Definition, Design and Development, Testing, Initial deployment, Fielding, and System Decommission

HSI is not another name for Human Factors!

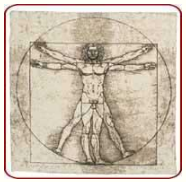
Distinction between HFE and HSI (cont'd): Relationships among HSI domains





Human Factors Engineering remains a central element in the effective integration of the human with all other domains

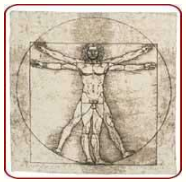
Distinction between HFE and HSI (cont'd)



- Industry HFE and HSI specialists must continue to educate program management regarding distinctions
  - Recognize HSI in program effort from proposal through fielding
- Government must continue to educate management and practitioners
  - Naval Postgraduate School
  - Army Directorate

Industry and Government must work together to educate management and practitioners

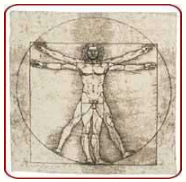
Contractual Considerations



- HSI is often mentioned only briefly in contracts documents
- Sometimes an HSI program is specified, but deliverables are the Human Engineering DIDs!
- Human Factors is completely eliminated from the contract
- Without proper terminology, industry HSI specialists cannot influence the scope of HSI on the program
  - Without inclusion in appropriate documents, cannot create requirements necessary for budget and resources
  - HSI then lacks deliverables to document/ensure a robust effort

The Contract must include HSI to ensure adequate focus – no program is devoid of a human interface!

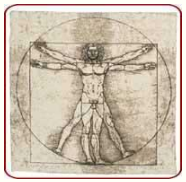
Contractual Considerations (cont'd)



- Specify HSI requirements, work tasks, or deliverables
  - However, maintain the traditional HFE effort as well
- Write HSI into RFP, SOW, WBS, Operational Requirements Document, Initial Capabilities Documents, CONOPS/TAD, HSIPP DID, and PDR/CDR Risk Assessment Checklists
- Define HSI milestones at a high enough level for IMP/IMS
  - HSI can be tracked, with associated risks and risk reduction efforts
  - This ensures that *sufficient time, resources, and visibility* will be allocated to HSI effort

"What gets measured gets done!"

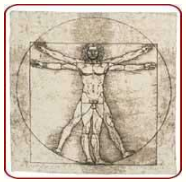
Organizational Structure



- It is Impossible to reach across various disciplines without the proper management and process structure
- There is often a large organizational / process “distance” between
  - Training and HFE
  - Manpower, Personnel and Safety, HFE
  - Survivability and most other domains
- This requires a large leap across management chains to coordinate trade-offs
- The “Shared” decision maker is likely to be at a middle management or ranking officer level
- Few technical issues will be presented at that level
- Industry and Government HSI structure often quite different

Without a recognized organizational placement, HSI will not achieve the necessary coordination and cooperation

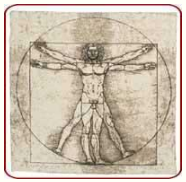
Organizational Structure (cont'd)



- HSI depends on a process-driven management structure
  - Represented across all IPTs with appropriate RAA
    - Enables HSI consideration of all user interface design decisions
    - Domains "do their job" but HSI integrates and levels requirements
  - Established early in acquisition, no later than SDD
  - HSI Management plan and process documented in SEMP
  - Contribute to early trade off and function allocation decisions
  - Sit on Engineering Review Board
  - Establish an HSI Audit Trail
  - HSI logs, coordinates, tracks, and documents HSI requirements, issues, and resolutions
- HSI effort would benefit from closer Industry and Government organizational alignment

Effective HSI design demands disciplined, integrated structure

Differing Levels of HSI Maturity among the Services



MANPRINT

- Established Policy
- Institutionalized Across Army
- Standardized Processes
- Centralized Functionality

NAVPRINT

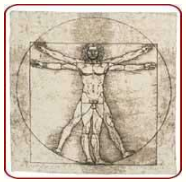
- Relatively New
- Established Policies
- Based on MANPRINT
- Standard Processes being developed

AIRPRINT

- Under Development
- HSI Lead Identified

Each service is at a different phase of HSI development

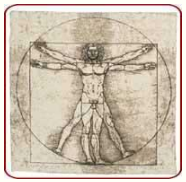
Differing Levels of HSI Maturity among the Services (cont'd)



- Government/Armed services should work together to institutionalize HSI and represent a unified voice for warfighter/user
- Government and Industry should develop common terminology
- Industry must work with government to understand what is expected from an HSI program/effort

An integrated government voice could be a force of nature in establishing HSI

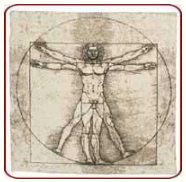
HFE as a Central Discipline to HSI



- HFE, as an integral part of HSI, remains an inexact science
- While there is a continual refinement of HFE tools, techniques and methodologies, most HFE effort remains in development and validation testing
  - Management is often unwilling to make the investment for early prototyping and testing
    - Analysis is often qualitative, crude, and early in program
    - Systems are often not mature enough for valid testing
    - Field testing is very expensive and too late to effect change
    - Late “fix-its”, end-user dissatisfaction/errors incur greater cost

Funding and system availability render HFE less effective

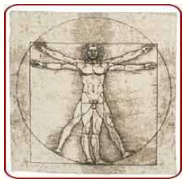
HFE as a Central Discipline to HSI (cont'd)



- Much of 1472 is guidance material, not a requirements document
- Invoking 1472 wholesale is an archaic method of imposing "requirements"
  - Not enough RFP/Proposal time or proposed design detail to tailor 1472 effectively
  - Even for actual requirements, most "over-define" the interface
  - Incomplete, at best, for User Interface considerations

MIL-STD-1472 provides great guidance, but it is insufficient to ensure effective human-centered design

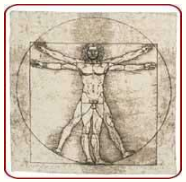
HFE as a Central Discipline to HSI (cont'd)



- Apply MIL-STD-1472 selectively
  - Industry must work to the contract!
  - Over-application of 1472 creates paperwork nightmare
  - Under-application of requirements leaves industry HSI personnel no opportunity for adequate resources and focus
- Move toward performance requirements
  - Functional requirements can limit design; Cannot cover all possibilities
  - Performance and constraint requirements must be clearly defined

Government and Industry work together to better define HFE requirements and constraints

Summary



- Continue to educate practitioners within Industry and Government about HSI
  - Provide clear examples of HSI contributions to cost and safety
- Ensure that contracts include HSI in RFPs, SOW, Specs etc
  - But don't forget to include the HFE effort!
- Create process and structure to incorporate HSI in programs
- Branches come together to provide single and consistent HSI voice
- Continue to develop HFE requirements, constraints, performance measures, ensure adequate testing

Industry and government must work together to ensure an effective implementation of HSI