Human Factors Integration (HFI): The Means of Considering the Human Component of Capability within Acquisition

Mark Anthony and Mike Boardman

DE&S Engineering Group (EG) HFI Team
Presentation Aim

• To provide an overview of the UK MOD Approach to HFI and its Key Components
HFI – A Short History (1)

• 1971 – Human Factors for Designers of Naval Equipment

• 1983 – Def Stan 00-25: Human Factors for Designers of Equipment (Tri-Service, 12 Parts)

• Mid 1980s – US Army – MANPRINT (MANpower PeRsonnel INTegration)

• Late 1980s – UK Army adopt MANPRINT

• Late 1980s – Tri-Service MOD MANPRINT initiative established (re-titled ‘HFI’)

• 1989 – MoD-Industry HFI Working Group formed

• 1992 - Def Stan 00-25: Human Factors for Designers of Equipment (Issue 2)

• 2000 – Def Stan 00-25: Part 14 – Military Land Vehicle Design Issue 1
HFI – A Short History (2)

- 2001 – HFI Practical Guidance for IPTs
- 2004 – Def Stan 00-25 Human Factors for Designers of Systems - *Restructured and reissued*
- 2006 – MAP-01-010 and MAP-01-011 Issued (updates to STGPs)
- 2008 – Def Stan 00-250: Human Factors for Designers of Systems
- 2009 – The People in Systems TLCM Handbook (HFI DTC)
- 2010 – JSP 912: HFI for Defence Systems
- 2013 – JSP 912: HFI for Defence Systems v2.0
- 2015 – Def Stan 00-251: HFI for Defence Systems
- 2015 – JSP 912 update
- 2015 – Human Factors Integration Management System (HuFIMS) created
Human Factors Integration

Human Factors Integration is the UK MOD’s process by which the People Component of Capability is considered during Capability Delivery and Support.

It is a systematic **process** for identifying, tracking and resolving human related issues to ensure a balanced development of both technologies and human aspects of Capability.

*Can these personnel with this equipment and training perform their tasks to a specific standard under agreed conditions?*
Context and Drivers for HFI

• Organisational Drivers:
  – Project Cost
  – Project Risk
  – Requirements Driven Acquisition
  – Commercial Aspects of Acquisition

• HFI is now MOD Policy JSP912 v3

• Civilian First – Move away from bespoke Military Stds when possible

• Development of wider acquisition processes: Guide to Engineering Activities and Review – GEAR and SOSA

• Focus of Acquisition on Equipment and Logistics DLODs - HFI operates in both Acquisition and Integrated Logistics Support, but has wider implications
HFI and the Defence Lines Of Development

- Lines of Development
  - Concepts and Doctrine
  - Organisation
  - Personnel
  - Training
  - Equipment
  - Logistics
  - Information
  - Infrastructure
Current Problems with HFI

- Generally only applied in the procurement space.
- HFI was founded upon trades being undertaken between HFI Domains (and DLODs) - but majority of trades are against Equipment DLOD.
- Is often confused with Human Factors (HF) and Human Factors Engineering (HFE).
- Poor human factors requirements.
- Appears resource intensive and is not well understood.
- Transversal activity – organisational problems.
- Is often viewed as a sub part of ILS and/or a secondary or tertiary duty.
The HFI process is both goal-based and risk-based.

Provided these goals are achieved, the means by which they are achieved can be tailored to the circumstances of individual projects.

As a consequence, the extent and depth of HFI activities should be tailored to the degree of project risk presented.
HFI Domains

• HFI involves the identification and management of the human related issues that could impact upon defence acquisition of capability

• In order to ensure that all human-related issues are considered, they have been categorised into 7 main areas or domains

• These domains essentially form a viewpoint/aide memoir/checklist for consideration and risk assessment

• None of the domains should be considered in isolation. Any decision in one domain can easily impact on another.
HFI & HSI Domains

**HFI**
- MANPOWER
- PERSONNEL
- TRAINING
- HUMAN FACTORS ENGINEERING
- SYSTEM SAFETY
- HEALTH HAZARDS
- SOCIAL & ORGANISATIONAL

**HSI**
- MANPOWER
- PERSONNEL
- TRAINING
- HUMAN FACTORS ENGINEERING
- SYSTEM SAFETY
- HEALTH HAZARDS
- SURVIVABILITY
- HABITABILITY
- ENVIRONMENT (USAF)
Application of the HFI Domains

- Domains not used explicitly in requirements.
- Used as viewpoints to look at risk and design.
- None of the Domains should be considered in isolation.
- Significant overlap with the DLODs.
- Focus tends to migrate towards HFE on most projects.
User engagement across the CADMID lifecycle

**CADMID lifecycle**

<table>
<thead>
<tr>
<th>Pre-Concept</th>
<th>Concept</th>
<th>Assessment</th>
<th>Demonstration</th>
<th>Manufacture</th>
<th>In-Service</th>
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<tbody>
<tr>
<td>Initial Gate</td>
<td>Main Gate</td>
<td>(HF Trials)</td>
<td>Acceptance</td>
<td>Spec Driven manufacture</td>
<td>No performance benchmarks</td>
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**Value of upfront analysis is not understood**

**Industry keep cost estimates low in order to win business**

**Not enough 'people' to provide accurate feedback**

**Feedback provided on technical failure not usability**

**Involved too late in the CADMID cycle**

**Goodwill and funding decreases across the duration of a programme**

**‘Emerging’ requirements are a known feature of HCI development, hence the iterative nature of UCD and software development methodologies such as Agile**

**Fear of user comments causing delays and expense, industry less willing to engage with users as programme continues**

**Understanding of requirements is at its peak when there is no scope of change**

**Tipping point**

Usability issues now become a trading commodity

**Offical**
HFI Policy and Standard Development
Rationalisation of HFI Policy, Process & Guidance

• Issues which triggered review:
  – New JSP structure and purpose
  – Inconsistency, conflict between documents
  – Range of documents
  – No documented common HFI process
  – Size: Def Stan runs to 1000+ pages
  – Ability to update Def Stan
  – Structure for accessibility by variety of end users
The Objectives

• Revise MOD HFI Policy & Process and Guidance Material to:
  – Ensure they are fit for purpose
  – Facilitate Contracting
  – Designed for the intended audience(s)
  – Organise to facilitate uptake

• Key Legacy Documents:
  – JSP 912
  – Def Stan 00-250
  – Supporting Guidance material (e.g. Single Service/Tri-Service)
Revised HFI Process

Mapping to CADMID Cycle, System Life Cycle Phases and Principal Acquisition Contract Activity

CADMID Stage
- Pre-Concept
- Concept
- Assessment
- Demonstration
- Manufacture
- In-Service

System Life Cycle Phase
- Specification
  - URD Development
  - Concept Definition
- Design
  - Preliminary Design
  - Detailed Design
- Development, Integration
  - Testing & Acceptance
- In-Service

HFI Process Stage
- HFI-1.0: User Need Definition
- HFI-2.0: System Requirements Definition
- HFI-3.0: Assess Tenders
- HFI-4.0: Detailed System Design
- HFI-5.0: Test & Acceptance
- HFI-6.0: In-Service Feedback

Principal Acquisition Contract Activity
- Planning & Enquiry Preparation
- Assess Tenders
- Solution Development
- Post Project Evaluation

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HFI Roles and Responsibilities

Three principal groups of involved in the management of HFI:

- **Capability Sponsor** - responsible for developing and specifying the User Requirements for the required Capability.
- **Capability Acquirer** - responsible for developing and specifying the System Requirements for the required Capability.
- **Supplier (or 'Solution Provider')** - responsible for developing the Solution.
# Audience and Documents

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<tbody>
<tr>
<td>JSP 912 Parts 1 &amp; 2</td>
<td>Summaries in JSP Parts 1 + 2</td>
<td>DEF STAN 00-251</td>
<td>- Technical Guides</td>
<td>- Technical Guides</td>
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<td>Detail in HFI Process Leaflets</td>
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<td>- Extant Def Stan 00-250</td>
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**FLC/CAP**

**ACQUIRER**

**SOLUTION PROVIDER**
Goal: To ensure that appropriate human considerations are included in the definition of user requirements and that sufficient information is provided to the acquisition authority to support the development of people related system requirements.
HFI-2.0 System Requirements Definition

Goal: To ensure that appropriate Human Factors Requirements for the system are identified and contained in ITT documentation, and that potential suppliers are provided with the necessary information to enable them to respond effectively.

HFI-2.1 Appoint HFIF(PT)
DE&S

HFI-2.2 Plan Approach to HFI
DE&S

HFI-2.3 Establish MOD HFI Steering Group
DE&S

HFI-2.4 Conduct HFI Analyses
DE&S

HFI-2.5 Create & Maintain HFI RAIDO
DE&S

HFI-2.6 Engage MOD HFI Steering Group
DE&S

HFI-2.7 Identify Human Factors Requirements
DE&S

HFI-2.8 Compile HFI Contract Documentation
DE&S

HFI-2.9 Determine Tender Assessment Criteria for HFI
DE&S
HFI-3.0 Assess Tenders

Goal: To ensure that the Solution Provider’s tender suitably addresses Human Factors requirements.

HFI3.1 Assess Tenderer Response

HFI3.2 Liaise with CIWG / RWG

HFI3.3 Support Solution Provider Selection

DE&S Inputs

- HFSRs in SRD
- HFPRs in SOW
- HFI RAIDO
- Tenderer Assessment Criteria for HFI

DE&S Outputs

HFI Input to tenderer selection

SP Project Inputs

- Tender Response(s)
  - (incl. Compliance Statements)

FLC HFI Inputs

- TAD

DE&S Project Inputs

- HFSRs in SRD
- HFPRs in SOW

SRL/HFI Maturity Level
Goal: To ensure that all Human Factors requirements are addressed and people related risks and issues are managed and mitigated through the system design process.

HFI-4.0 Detailed System Design

**mod - supplier HFI working group**

- HFI4.3 Establish MOD-Supplier HFI Working Group
  - DE&S

- HFI4.4 Plan SP HFI Activities
  - Solution Provider

- HFI4.5 Review SP HFI Plan
  - Solution Provider

**Solution Provider Activities**

- HFI4.2 Solution Provider HFI Management

- HFI4.6 Approve SP HFIP
  - DE&S

- HFI4.7 Conduct HFI Activities
  - Solution Provider

- HFI4.8 Review Outcomes from HFI Activities
  - Solution Provider

- HFI4.9 Assess Outcomes from HFI Activities
  - DE&S

- HFI4.10 Manage Solution HFI Issues & Risks
  - Solution Provider

- HFI4.11 Review Solution HFI Issues & Risks
  - Solution Provider

- HFI4.12 Manage HFI RAIDO
  - DE&S

- HFI4.13 Manage Design Changes
  - Solution Provider

- HFI4.14 Manage HFI Requirements
  - Solution Provider

- HFI4.15 Liaise with CIWG / RWG
  - DE&S

- HFI4.16 Provide HFI Inputs to Project Documents
  - Solution Provider

- HFI4.17 Manage HFI inputs to Project Documents
  - DE&S

**FLC Project Outputs**

- CONUSE

**DE&S HFI Outputs**

- HFI RAIDO

**SP Project Outputs**

- System Design Subsystem Specs
- ITEAP
- Safety Case
- Support Solution Training Solution

**SP HFI Outputs**

- SP HFIP
- HFI Case

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**HFI Maturity Level**

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**Notes**

- FLC Project Inputs
- URD CONEMP TAD
- DE&S Project Inputs
- HFSRs in SRD HFPRs in SOW
- DE&S HFI Inputs
- MOD HFIP HFI RAIDO
- SP Project Inputs
- Tender Response(s) (incl. Compliance Statements)
HFI-5.0 Test & Acceptance

Goal: To ensure that all Human Factors requirements are tested and accepted in accordance with the Integrated Test and Acceptance Plan (ITEAP)

- HFI5.1 Conduct Testing in accordance with ITEAP
- HFI5.2 Review HFI Component of Test & Evaluation Activities
- HFI5.3 Assess HFI Component of Test & Evaluation Activities
- HFI5.4 Manage Emerging HFI Issues / Risks
- HFI5.5 Review Solution HFI Issues & Risks
- HFI5.6 Manage HFI RAIDO
- HFI5.7 Liaise with CIWG / RWG
- HFI5.8 Manage HFI Requirements
- HFI5.9 Manage Design Changes
- HFI5.10 Populate HF Inputs to VVRM

SP Project Outputs
- Accepted System Design
- Training Solution
- Accepted Support Solution
- VVRM

SP HFI Inputs
- HFI RAIDO
- HFI Case

SP HFI Outputs
- HFI RAIDO
- Approved HFI Case

DE&S HFI Inputs
- HFI RAIDO

SP Project Inputs
- ITEAP

SRL/HFI Maturity Level

User Need Definition
System Requirements Definition
Assess Tenders
Detailed System Design
Test & Acceptance
In-Service Feedback

DE&S
Solution Provider
HFI-6.0 In-Service Feedback

Goal: To ensure that the delivered system meets the customer capability needs through life and that the human aspects of design changes are suitably managed.

HFI6.1 Capture HFI Lessons From Procurement
- DE&S

HFI6.2 Capture information from In-Service Feedback
- DE&S

HFI6.3 Update & Maintain HFI RAIDO
- DE&S / Solution Provider

HFI6.4 Assess impact of changes to the system design across HFI Domains / DLOD
- DE&S
**Process Tailoring**

NB: Tailoring guidance will be included in each of the process leaflets which will detail the activities associated with each process step.

<table>
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A completely new item developed and designed when existing systems or products cannot meet the Operational Requirements (OR), this is usually referred to as a Development Item (DI). It is designed to meet certain performance specifications. The HFI process should be followed in full. Some tailoring of the individual activities may be required and the level of effort and attention afforded to sub-activities will depend on the size, complexity and cost of the system being acquired. Guidance on tailoring is included in individual process leaflets.

<table>
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These are a subset of NDI, where the product has been developed to commercial rather than military standards, with minimal MOD influence on the design. Design data on which to base HFI test and acceptance activities may not be available from commercial sources. If such information is required it may need to be calculated, predicted or measured on delivered products. This procurement strategy often applies to products that have undergone significant user requirements analysis and user acceptance testing during design. Although the HFI Process may not be able to influence the design, the process should be used to:

- Identify risks and concerns associated with the design.
- Identify any necessary risk mitigation activities associated with introduction of the item.
- Identify any required modifications to the design which may be necessary to ensure the item is fit for purpose in its military context.
Revised JSP 912

Part 1
1. Introduction (Policy, Scope, Applicability)
2. MOD HFI Process
3. MOD Staff Responsibilities
4. HFI Resource Competencies
5. References
6. Acronyms and Abbreviations

Part 2
1. Introduction to HFI
2. Overview of HFI Process
3. HFI Process: Stages and Steps
4. Tailoring the Process
5. Roles and Responsibilities
6. HFI Resource Competencies
7. References
DEF STAN 00-251

Presented as 4 Parts

Part 0
  Introduction to HFI, HFI Domains
  MoD Contracting Process Using
  new HF Process and System
  Requirements.

Part 1 - Early Lifecycle HFI Process
  Requirements

Part 2 - HFI Process Requirements
  for Solution Provider

Part 3 - HFI Technical
  Requirements
  – Candidate HFURs (5/6)
  – Candidate HFSRs (15)

Defence Standard 00-251 part 0
Draft issue
Human Factors Integration for
Defence Systems
Part 0: Human Factors
Integration
Critical Factors to HF success

• Right Requirements
  – HF requirements notoriously difficult to write.
  – SMART Requirements (Specific Measurable Achievable Relevant Time Bounded/Traceable).
  – evidence based MOPs.

• Right HF elements within the SOW / Contract with Industry (including contracted deliverables at the right time to provide incremental assurance and acceptance), to facilitate:
  – the adoption of good HFI management processes, integrated with wider project activities.
  – the timely conduct of HF technical activities aligned with the wider schedule.
  – close Project Team / Industry / military user working relationship and Human/User Centred Design processes.
HF Requirements Hierarchy

Joint Service Publication (JSP)

Statement of Work (SoW)

Solution Response

User Requirements Document (URD)

System Requirements Document (SRD)

HF Process Requirements

Satisfies

HF System Requirements

Satisfies

Tech Guide X, Y, Z Reqs

Satisfies

Design Specifications

Prime Contractor/Sub-contractor HFI Plans

DEFS 00-251

HF Tech Guides

Project Documents

Colour Key

Customer

Supplier

Ministry of Defence

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On behalf of MoD, the Customer Friend role (‘the Supplier’) shall ensure that appropriate human considerations are included in the definition of user requirements and that sufficient information is provided to the acquisition authority to support the development of people related system requirements.

**Goal Statement**

1. **HFI Process Stage**
   - **HFI-1.0 User Needs Definition**

2. **DEF STAN HF Process Requirement (HFPR)**
   - **HFPR-1.1** An HFI Focus shall be appointed to represent the Front Line Command Organisation (HFI 1.1)
   - **HFPR-1.2** The HFI Focus shall provide an HFI Strategy (HFI 1.2)
   - **HFPR-1.3** The Human Component of Capability need shall be identified (HFI 1.4)
   - **HFPR-1.4** The Human Component of Capability shall be adequately reflected in the User Requirement Document (URD) (HFI 1.6)
   - **HFPR-1.5** HFI Input to the Single Statement of User Need (SSON) shall be provided (HFI 1.5)
   - **HFPR-1.6** HFI input to the Concept of Employment (CONEMP) shall be provided (HFI 1.7)
   - **HFPR-1.7** The Target Audience shall be identified (HFI 1.8)
The Capability shall integrate people to achieve the required performance under all conditions of use in accordance with the TAD, ConEmp and ConUse.

**HF User Requirement (HFUR) For SSUN**

- **HFUR-1** The Capability shall accommodate the characteristics of human capabilities.
- **HFUR-2** The Capability shall provide for human habitability.
- **HFUR-3** The Capability shall protect the Human from adverse effects of system use.
- **HFUR-4** The Capability shall integrate humans in ways which maximise System Safety.

**Generic DEF STAN HF System Requirements**

- **HFSR-1.1** The System shall accommodate the anthropometric and physical characteristics of the specified user population (including the relevant clothing corrections).
- **HFSR-1.2** The System shall accommodate the sensory characteristics of the specified user population.
- **HFSR-1.3** The System shall accommodate the communication needs of the specified user population.
- **HFSR-1.4** The System shall accommodate the cognitive capabilities of the specified user population.
- **HFSR-1.5** The System shall provide appropriate means for the human to make control inputs to the system.
Human Factors within Requirements

- HF requirements that are contractually verifiable/testable can be challenging to write
- Examples of bad HF requirements:
  - The system shall be easy to use.
  - The system shall be usable.
  - The system shall not place excessive workload on the user.
- Examples of better requirements:
  - The system shall allow the user to complete [task] in [time] under [conditions].
  - The system shall accommodate the anthropometric and physical characteristics of the specified User population (including the relevant clothing corrections).
Human Factors Integration – Myths and Excuses

- It’s all common sense, I’m a human after all!
- I’ll design for the average/me rather than the whole population
- I can just rely on end users opinions.
- HFI is only about the person that uses the system.

- Technology/automation is the answer.
- I can use training to overcome design faults.
- It’s just a technology project.

- It can wait until after user trials
- HF is just costly gold-plating and therefore optional.
- I have tight deadlines, I don’t have time to do HFI.
- It’s COTS/MOTS, I don’t need to/can’t do HFI.
- I haven’t been trained.
Final Thoughts

• Who is the target audience?
• What are we trying to get them to do?
• Where are the boundaries?
• What language should we use?
• Is HSI/HFI the best/right term?
• How do we communicate the value?
Contacts

Mark Anthony - HFI Team Manager
EG - Elm 1A
Mil: 9679 Ext 37739
Civ: +44 (0) 3067 937739
DESTECH-EGEng-AsstHd-Sw-HFI@mod.uk

Mike Boardman – Principal Ergonomist
DSTL HSS – DSA Div
Mil: 967705275
Mob: 07900 709160
MJBOARDMAN@dstl.gov.uk
Or
DESTECH-EGHFI-SME2@mod.uk
DES TECH-EG HFI-SME2 (Boardman, Mike Mr)

HFI Team mailbox:
destech-eghfi-team@mod.uk