HFI CMM Study
Use of Quick Assessment

HFI CMM Study - Work Package 2

March 2001

1 Summary

This note discusses the form and function of quick implementations of HFI Process Risk Assessment (HFIPRA). Although a strong economic case can be made for full assessments on a fairly widespread basis, it has been recognised in the HFI CMM project that some valid forms of quick assessment are required. A set of generic quick assessments are presented, with supporting justification for the assessment scales and the scope of the Human-System Lifecycle (HSL) model used for each of the assessments.

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2 Need for quick assessments and assessment support

2.1.1 Even though it is likely that full Human Factors Integration (HFI PRA) assessments would yield cost-effective returns, it is recognised that the continuing engineering focus of much DPA acquisition means that they are unlikely to be undertaken on any major scale. Accordingly, a set of quick assessments has been developed as cheap means of de-risking acquisition. At the moment these assessments use paper resources or basic web forms. In the event of these resources being adopted widely, a database-supported set of assessments would probably prove appropriate to further reduce assessment costs and to encourage the gathering and distribution of metrics.

2.1.2 This note provides an audit trail to justify the form and content of a set of proposed quick assessments. Some supporting material on the cost-effectiveness of such assessments is also included.

2.2 Structure of this note

2.2.1 This note comprises the following:

- A description of the types of assessment (formative and summative) and the types of assessment scale that might be used. (Section 3)
- An analysis of the basis of assessment, identifying the processes necessary for compliance with AMS Instructions and for competitive advantage. (Section 4)
- Descriptions of how assessments might be used, and a summary of the quick assessments proposed as resources.
- Annex on Return On Investment (ROI) on assessment activities
- Annex summarising the Human System Lifecycle (HSL) model.

3 Types of quick assessment

3.1 Types of assessment

3.1.1 There are two types of evaluation carried out with quick assessments - summative and formative.

3.1.2 Summative evaluations are against the HFI instructions (supplemented by specifics from a project). A summative evaluation is one designed to present conclusions about the merit or worth of the object of evaluation and recommendations about whether it should be retained, altered or eliminated.

3.1.3 Formative Process Improvement evaluations are designed and used to improve the object of evaluation, especially when it is still being developed. They concentrate on strengths and weaknesses and unless they are conducted as part of a contractual Process Improvement programme, they do not have any specific requirements as to scope. They are likely to be driven by business need.

3.2 Forms of question and assessment scale

3.2.1 The form of question to be used as the basis of an assessment can be taken directly from a process title, from a base practice title, or can be developed for the occasion

using the model as a resource. The development of customised questions has a place to play in quick assessments, where it is appropriate to develop questions from specific risks. However, in general, the approach to quick assessments has been to develop generic questions that relate closely to the processes and their base practices. A project is free to tailor the questions to meet its needs. A full assessment would devote considerable resources to developing the questions to be asked. It has been assumed here that this effort is not available in a quick assessment.

3.2.2 It has been the intent that the format of questions and scales is compatible with other assessments that might be undertaken in the same time frame, so that the HFI PRA quick assessment can be integrated into a wider assessment.

3.2.3 For summative evaluations there is a choice of scales as to the extent to which something (such as a practice) is being done. The options are

- N, P, L, F from ISO 15504 (Not achieved, Partially achieved, Largely achieved, Fully achieved).
- Capability levels from ISO 15504
  - 5 Optimizing process
  - 4 Predictable Process
  - 3 Established Process
  - 2 Managed Process
  - 1 Performed Process
  - 0 Incomplete Process
- The Continuous Improvement maturity levels from the new ISO 9004:2000 (no formal approach/reactive approach/stable formal system approach/continual improvement emphasised/best-in-class performance).
- A scale from the Business Excellence Model (BEM) based on the European Foundation for Quality Management (EFQM) framework proposed in AMS documentation.
  - No Evidence or anecdotal
  - Some evidence
  - Evidence
  - Clear Evidence
  - Comprehensive Evidence
- A second EFQM scale (from the OGC Piloting version of EFQM)
  - 0. Don't know
  - 1. No - this doesn't happen.
  - 2. This happens occasionally but there is no consistency.
  - 3. Yes this usually happens but it could be improved.
  - 4. Yes, this is recognised as the way we do business, and we achieve real benefits.
  - 5. This is an integral part of our culture and operation and can be regarded as best practice.

3.2.4 For HFI quick assessments, we are interested in the 0/1 distinction as regards ISO 15504 capability levels, with aspirations to finding level 2 i.e. is a process or practice being done at all. The N, P, L, F scale is thus of more interest than the capability dimension. The second EFQM scale is very similar to N, P, L, F. A minor modification

to the EFQM scale would remove the hype and align it to our aspirations as regards N, P, L, F.

3.2.5 For formative evaluation, the intention is to use strengths/weaknesses/opportunities as headings.

4 Basis of assessment

4.1 Use of HFI Instructions from AMS

4.1.1 The AMS includes a number of Instructions relating to Human Factors Integration (HFI). Whilst these are Authoritative Guidance rather than Mandatory, any deviations from them need written justification and audit trail.

4.1.2 This section sets out the way in which compliance with HFI Instructions or a documented alternative will be assessed. The assessment framework is the HSL model see annex). The benefits of taking this approach to assessment (rather than a case by case examination of project documents) are:

- The assessment concentrates on activities and outcomes rather than intermediate outputs such as deliverable (which may be 'shelfware' with no design influence). It also concentrates on whether the aims of user-centred design are met, rather than whether or not there is a specialist HFI input.
- It is compatible with the current set of standards in software and system engineering, reducing learning cost, enabling collection of cross-project metrics, and enabling the assessment of HFI as part of a wider assessment. Assessment using the HSL model is compatible with the existing MOD/DERA approach to Software and System Capability Evaluation. Having a framework based on International Standards [current status is under consideration as an ISO Committee Draft] eliminates a number of potential barriers to multi-national procurement and operation.

4.1.3 There are 3 top level Instructions. In terms of life cycle, it is deemed that these apply to all stages of the life cycle (rather than relating to single events). The structure of the HSL model supports this by addressing life cycle-independent issues separately from addressing the needs of each stage of the life cycle.

4.1.4 The Instructions relate to 2 key documents, the Through Life Management Plan (TLMP) and the Procurement Strategy (PS). The assessment implications of these documents have been extracted and matched to the HSL model.

4.1.5 There are 2 sets of supporting Instructions. One of these relates specifically to the TLMP, while the other is general. There is also an Instruction relating to interface agreements that include manpower. Elements of the HFI assessment would almost certainly embrace assessment against this Instruction, but the focus has been on the HFI Instructions.

4.1.6 The TLMP and PS have been reviewed; elements from them have been incorporated with the Instructions and given equal precedence. The review took the approach that these documents (only) are cited directly in the top level Instructions, and so further sources of guidance (including the HFI Guides) have not been included.

4.1.7 The approach to assessment is to use the Instructions, TLMP and PS mappings as a set of DPA requirements to identify those HSL processes that would need to be carried out to fulfil the requirements. Where appropriate, requirements have been placed under more than one process. The processes within HSL1 have not been addressed at this issue, pending a mapping of AMS requirements through the life cycle to the process model.

4.1.8 Assessment then focuses on those processes that embrace requirements. The assessment takes the process as a whole, with an emphasis on outcomes.

4.2 Mapping of HSL model to Instructions

4.2.1 HS.1 Lifecycle involvement

4.2.2 Whole Life planning (TLMP_bsj)

4.2.2.1 HS.1.1Human-system issues in conception

4.2.2.2 HS.1.2Human-system issues in development

4.2.2.3 HS.1.3Human-system issues in production and utilisation

4.2.2.4 HS.1.4Human-system issues in utilisation and support

4.2.2.5 HS.1.5Human-system issues in retirement

4.2.3 HS.2 Integrate Human Factors

4.2.3.1 HS.2.1Human-system issues in business strategy

4.2.3.2 HS.2.2Human-system issues and quality management

4.2.3.3 HS.2.3Human-system issues in authorisation and control

4.2.4 (BP1, 4) The IPT Leader shall include Human Factors Integration in the procurement strategy (ref:10510002)

4.2.5 (BP1, 4) Provision for Human Factors Integration (HFI) should be made in the Equipment Plan (ref:10510010) [Applies to CWG].

4.2.6 (BP1) The IPT Leader shall inform the Principal Personnel Officers of any likely impact on future recruitment criteria or trade group structures which will be required to support the introduction of the product (ref:10510005)

4.2.7 The Equipment Programme controls the equipment assumptions but other MoD areas control manpower & infrastructure. Assumptions made in the equipment programme need to be consistent with those in the other programmes. (ref:00007205)

4.2.8 (BP4) The responsibility for collecting and maintaining task analysis and Training Needs Analysis data should be identified (ref:10510030)

4.2.9 (BP2) Strategies leading to plans for Cost Of Ownership (COO) (TLMP_bsj)

4.2.10 (BP2) Whole Life costing (TLMP_bsj)

4.2.10.1 HS.2.4Management of human-system processes

4.2.11 (BP1, 3) The IPT Leader shall develop a Human Factors Integration plan consistent with the Through Life Management Plan. (ref:10510001)

4.2.12 (BP1) The IPT Leader shall include Human Factors Integration in the procurement strategy (ref:10510002)

4.2.13 (BP1) The Human Factors Integration (HFI) plan should provide an audit trail recording all decisions and actions made from the Early Human Factors Analysis through to the System Requirements Document and the development of the tender assessment criteria (ref:10510009)

4.2.14 (BP1) The responsibility for collecting and maintaining task analysis and Training Needs Analysis data should be identified (ref:10510030)

4.2.15 (BP1) The requirements for task analysis data and training needs analysis (TNA) data to support Human Factors Integration (HFI) and Logistic Support Analysis activities should be addressed (ref:10510029)

4.2.16 (BP1) Strategies leading to plans for Standardisation (TLMP_bsj)

4.2.17 (BP1) Strategies leading to plans for Requirements/acceptance (TLMP_bsj)

4.2.18 (BP2) The IPT Leader should establish an Human Factors Integration (HFI) focus as part of the IPT (ref:10510007)

4.2.19 (BP3) Whole Life processes (TLMP_bsj)

4.2.20 The Equipment Programme controls the equipment assumptions but other MoD areas control manpower & infrastructure. Assumptions made in the equipment programme need to be consistent with those in the other programmes. (ref:00007205)

4.2.20.1 HS.2.5Human data in trade-off and risk mitigation

4.2.21 (BP3) Define performance targets and trade-offs (TLMP_bsj)

4.2.22 (Whole process) The TLMP also discusses risk management, and the AMS risk instruction (07.15) mandates a risk management plan as part of the TLMP. [Note: the current DPA risk management guidance ignores operability/user aspects].

4.2.22.1 HS.2.6User involvement

4.2.23 (BP2) The IPT Leader shall inform the Principal Personnel Officers of any likely impact on future recruitment criteria or trade group structures which will be required to support the introduction of the product (ref:10510005)

4.2.24 The Equipment Programme controls the equipment assumptions but other MoD areas control manpower & infrastructure. Assumptions made in the equipment programme need to be consistent with those in the other programmes. (ref:00007205)

4.2.25 (BP4) The need to make appropriate arrangements for operational resources for Human Factors Integration (HFI) trials and demonstrations should be addressed (ref:10510028)

4.2.25.1 HS.2.7Usability engineering integration

4.2.26 (BP2) The IPT Leader should establish an Human Factors Integration (HFI) focus as part of the IPT (ref:10510007)

4.2.27 (BP3) Define performance targets and trade-offs (TLMP_bsj)

4.2.28 (BP5) The Human Factors Integration (HFI) plan should provide an audit trail recording all decisions and actions made from the Early Human Factors Analysis through to the System Requirements Document and the development of the tender assessment criteria (ref:10510009)

4.2.29 (BP5) Define assumptions, constraints, drivers (TLMP_bsj)

4.2.29.1 HS.2.8Provision of human data

4.2.30 (BP1) The responsibility for collecting and maintaining task analysis and Training Needs Analysis data should be identified (ref:10510030)

4.2.31 (BP5) The IPT Leader should seek advice from HF centres of excellence both in MOD and industry (ref:10510008)

4.2.32 HS.3 Usability engineering

4.2.32.1 HS.3.1Context of use

4.2.33 (BP1, 4)Define (?system) boundaries (TLMP_bsj).

4.2.34 (BP4, 5, 6) Define Military context (TLMP_bsj).

4.2.35 Define assumptions, constraints, drivers (TLMP_bsj).

4.2.36 The IPT Leader should produce a defined operational scenario which is sufficiently detailed to support Human Factors Integration (HFI) design decisions and evaluation testing (ref:10510014).

4.2.37 The IPT Leader should produce a target audience description (TAD) in consultation with the appropriate members of the IPT. This should contain information on the characteristics of intended users (ref:10510013).

4.2.38 (BP8) The IPT Leader shall inform the Principal Personnel Officers of any likely impact on future recruitment criteria or trade group structures which will be required to support the introduction of the product (ref:10510005)

4.2.39 The Equipment Programme controls the equipment assumptions but other MoD areas control manpower & infrastructure. Assumptions made in the equipment programme need to be consistent with those in the other programmes. (ref:00007205)

4.2.39.1 HS.3.2User requirements

4.2.40 The System Requirements Document should include the performance to be achieved when the product is operated, supported and maintained by the full range of end users as specified in the Target Audience Description. (ref:10510015)

4.2.41 The Systems Requirements Document should include the performance to be achieved when the product is operated under realistic operational conditions and mission profiles (ref:10510016)

4.2.42 Define performance targets and trade-offs (TLMP_bsj).

4.2.42.1 HS.3.3Produce design solutions

4.2.43 Strategies leading to plans for Standardisation (TLMP_bsj)

4.2.44 The need for an HF style guide to ensure consistency of operation across all interfaces should be addressed. MOD HF style guides exist for certain types of system (ref:10510031)

4.2.44.1 HS.3.4Human Factors evaluation

4.2.45 The need to confirm product performance characteristics through Human Factors Integration (HFI) trials and demonstrations should be addressed (ref:10510027)

4.2.45.1 HSL4.1 Human Resources strategy

4.2.46 The Equipment Programme controls the equipment assumptions but other MoD areas control manpower & infrastructure. Assumptions made in the equipment programme need to be consistent with those in the other programmes. (ref:00007205)

4.2.46.1 HSL4.2 Define standard competencies and identify gaps

4.2.47 The IPT Leader shall inform the Principal Personnel Officers of any likely impact on future recruitment criteria or trade group structures which will be required to support the introduction of the product (ref:10510005)

4.2.47.1 HSL4.3 Design staffing solution and delivery plan

4.2.47.2 HSL4.4 Evaluate product system solutions and obtain feedback

4.3 Summary of compliance requirements

4.3.1 The table below summarises the requirements for compliance with the Instructions in the AMS.

4.3.2 Three sets of processes have been defined. The 'Initial' set is a small set designed to be indicative of likely compliance. It is NOT a complete set of processes. It has been designed to as a rapid de-risking assessment. The 'Mandatory' set is that set of HSL processes deemed necessary to meet the intent and wording of the Instructions. The 'Required' set is that set of processes necessary to actually conduct HFI in accordance with the Instructions. The 'Required' set includes processes not directly called up in the Instructions, but which are necessary inputs to those processes that are called up. Because of the acquisition focus of HFI as part of the AMS, HS.4 has not been considered.

4.3.3 IT MUST BE NOTED THAT THERE ARE OTHER, EXTERNAL CRITERIA THAT MIGHT DETERMINE THE SCOPE OF HFI TO BE APPLIED TO A DPA PROJECT. THESE CRITERIA HAVE NOT BEEN CONSIDERED HERE. For example, a project may need to comply with the Safety of Machinery Regulations, in which case the

process requirements of BS EN 614-1 would apply over and above any requirements here.

No.	Title	Initial	Mandatory	Required
HSL.1	Lifecycle involvement	Deliverables here in accordance with deliverables required for TLMP, Procurement Strategy, HFIP. Coverage of whole life is mandatory in so far as TLMP covers whole life. HFIP must address address whole life. For the purposes of brevity in compliance assessment, it is proposed that HS.1 processes are not included in Initial, that processes deemed high risk on a project-specific basis are included in Mandatory, and that all processes are included in a Required set of processes.		
HSL.1.1	Human-system issues in conception			
HSL.1.2	Human-system issues in development			
HSL.1.3	Human-system issues in production and utilization			
HSL.1.4	Human-system issues in utilization and support			
HSL.1.5	Human-system issues in disposal			
HSL.2	Integrate Human Factors			
HSL.2.1	Human-system issues in business strategy			
HSL.2.2	Human-system issues in quality management			
HSL.2.3	Human-system issues in authorisation and control	Yes	Yes	Yes
HSL.2.4	Management of Human-system issues	Yes	Yes	Yes
HSL.2.5	HF data in trade-off and risk mitigation	Yes	Yes	Yes
HSL.2.6	User involvement	Yes	Yes	Yes
HSL.2.7	Usability engineering integration		Yes	Yes
HSL2.8	Develop and re-use HF data			Yes
HSL.3	Usability engineering			
HSL.3.1	Context of use	Yes	Yes	Yes
HSL.3.2	User requirements		Yes	Yes
HSL.3.3	Produce design solutions			Yes
HSL.3.4	Human Factors evaluation			Yes
HSL4	Human Resources			
HSL4.1	Human Resources strategy		?	Yes
HSL4.2	Define standard competencies and identify gaps		?	Yes
HSL4.3	Design staffing solution and delivery plan			
HSL4.4	Evaluate product system solutions and obtain feedback			

4.4 Processes considered necessary for competitive advantage and effective teamworking

4.4.1 The processes that are deemed by the HFI CMM study team to yield most return to both supplier and customer in terms of cost-benefit are, interestingly, distinct from those required for compliance with Instructions. They are: HS.2.1, HS.2.2 at a policy level, and HS.2.7 at a working level. HS.2.1 deals with management commitment to HFI and HS.2.2 provides the means to support such commitment. HS.2.7 deals with the *Integration* aspects of HF**I** that is so vital to its effective application.

4.4.2 Nonetheless, HS.2.3, HS.2.4 are also seen as key to providing a risk-driven approach that bites.

5 Types of quick assessment required

5.1 Some example uses

5.1.1 This section identifies some typical ways in which quick assessments might be used.

5.1.2 An HFI focus, after a short course, runs a planning session starting with a self-assessment. This is a workshop that involves the stakeholders (PCO as well as MOD and PPO). It does the following:

- Clarifies responsibilities
- Initiates team building
- Sorts out the work programme for the next stage of the project
- Identifies PI targets.

5.1.3 Inputs to the workshop are process model summary wallcharts and scoring scheme, and any HFI risks that have already been identified. The focus would be on HSL2. This exercise is potentially quite long, and tools to help the HFI focus (or PCO equivalent) do some pre-work would be valuable. A delphi-type web-based input to the meeting might be very useful. The scale should be Strengths, Weaknesses, Opportunities as the session is aimed at improvement rather than compliance assessment.

5.1.4 The HFI focus does some long term planning with ILS and Equipment Capability Customer to contribute to the TLMP. The input would be HSL1 and risks. The output would be work packages, dependencies etc.

5.1.5 HFI specialists or champions in design organisations working with hardware, software engineers and other stakeholders to ascertain how to meet HCD principles. The focus would be HSL3. This would be post contract award. . The scale should be Strengths, Weaknesses, Opportunities as it is a formative assessment.

5.1.6 An HFI specialist or champion in the bid stage wishes to show the level of user-centred design in her organisation, probably in relation to DPA requirements, possibly prompted by a PQQ or some other output from DPA, or some capability evaluation words in the ITT. This use is vital if HFI is to succeed. The emphasis has to be on compliance with instructions (HS2) and phase outputs (HS1) with DPA tailoring. The scale would be for a summative assessment with PI opportunities/needs identified, and - if called for in the ITT - a commitment to a PI programme made.

5.1.7 An HFI focus wishes to build up partnering relations with stakeholders and potential suppliers. The interest here is in the policies and strategies of the organisation, with the intent of encouraging user-centred design being seen as a source of competitive advantage. An assessment using EFQM may well be part of the project approach to partnering. An assessment of HS.2.1, HS.2.2 would be appropriate at a management level, perhaps supported by a more technical assessment at a working level, where the process of most interest would be HS.2.7.

5.2 Possible sequences of use

5.2.1 This section summarises possible ways that HFI PRA might be included in traditional and smart procurement.

5.2.2 Caricature of old-style procurement

5.2.3 Here there is a focus on equipment rather than capability (e.g. equipment to be replaced) rather than on military capability of a system that includes people and equipment. The ITT production could include:

- Cut, paste, edit (write) STR, SMIR,
- Add OTS questionnaires for software estimating, ILS (MART).
- Call up SSCP's Def Stan 00-25.
- No resources to write customer HFIP.
- Possibly paste in threat of Software Capability Evaluation (SCE).

5.2.4 Draw up bidders list and marking scheme (for compliance). Send out ITTs. Hold bidders conference. [At this point, a full SCE may be applied, but there is probably no money to fund it].

5.2.5 Receive bids, clarify, award to lowest cost compliant bid.

5.2.6 Smart Procurement

5.2.7 Here, military capability has some weight to counter an equipment focus, with a URD related to user tasks rather than equipment functions. The steps might comprise the following.

5.2.8 The IPT leader forms a CWG/IPT stakeholder group. HSL processes can be included as part of team building exercises in breakout. HS.2.6 would be of shared interest. What might be possible in a successful breakthrough would be a discussion of stakeholder roles in HS.1 and HS.4.

5.2.9 Develop/advance URD. Identify risks to project outcome and to current processes. The project risks could be the stimulus for a tailored self-assessment on areas of concern.

5.2.10 Form industrial group [add HSL to EFQM benchmarking, with emphasis on HS.2.2, HS.2.3 linked to the policies and strategies element of EFQM, and HS.2.7 as an organisational process] [use HSL self-assessments in a group as part of risk identification, clarification of responsibilities across stakeholders].

5.2.11 PQQ [Include request for self-assessment, evidence of PI in longer term]. If the PQQ is concerned principally with partnering, then HS.2.2, HS.2.3 would be to the fore. If concerned with compliance with Instructions then HS.2.3, HS.2.4, HS.2.5, HS.2.6, HS.3.1,HS.3.2 would be prominent (see Section 4).

5.2.12 For PFI it would be appropriate to include an HSL assessment as part of the Service Level Agreement (SLA).

5.2.13 For ITT/ITN; include questions based on processes related to compliance with Instructions (see Section 4).

5.2.14 Under contract; include usability metrics as part of reporting metrics, along with customer satisfaction metrics. Include assessments in subcontractor procedures and PI results as milestones.

5.3 Sets of quick assessments proposed

5.3.1 This section summarises some typical occasions for quick assessments. It is NOT proposed that assessments be made at each and every occasion. The specific opportunities to take depend on the project, but the sooner assessments are started, the easier subsequent assessments become. Project risk assessments may indicate that it would be cost-effective to assess other, additional processes.

Occasion	Purpose of assessment	Participants	Type of assessment	Processes used
CWG formation	Stakeholder input to URD, Team building, Planning, Interface definition, TOR.	CWG, PPO	Formative	HS.1, HS.4 HS.2.6 HS.3.1, Possibly HS.3.2
IPT formation	Team building	IPT, CWG	Formative	HS2.1, relevant stage of HS.1
Breakthrough	Target setting	All stakeholders	Formative	HS.2.1, HS.2.3, HS.2.5, HS.2.6
IPT planning	HFIP production, input to TLMP, Procurement Strategy	HFI focus, ILS focus, IPT planner	Summative	HS.1, HS.2.2, HS.2.3, HS.2.4, (HS.2.5), HS.2.6
Industrial partnering	Team building, Benchmarking	All stakeholders, including supply chain	Formative	HS.2.1, HS.2.3, HS.2.6
PQQ	Producing short list of tenderers, Expectations management	Candidate suppliers	Summative	HS.2.1, HS.2.3, HS.2.4, HS.2.6, HS.2.7
ITT track record tender assessment	Demonstration of experience in HFI	Candidates from short list of suppliers	Summative	HS.2.7, HS.2.3, HS.2.4, HS.3
ITT SMIR response tender assessment	Assessment of proposed HFI management	Candidates from short list of suppliers	Summative	HS.1, HS.2.3, HS.2.4, HS.2.4, HS.2.5, HS.2.6
ITT STIR response tender assessment	Assessment of proposed technical activity (not just in HFIP, but considering engineering documentation as well)	Candidates from short list of suppliers	Summative	HS.2.7, HS.3
Post contract award team building	Planning, interface definition, TOR.	IPT, Industry	Formative	HS.2.1, HS.2.4, HS.2.6
Process Improvement	Risk reduction	IPT, Industry	Formative	HS.2.3, HS.2.7

HFI WG meeting	Risk reduction, cost reduction, Clarify TOR and interfaces	IPT, Industry	Formative	HS.2.7,HS.2.8, HS.3
HFI session in major project Design Review	Compliance assessment, Risk assessment	IPT, Industry	Summative	HS.2.3, HS.2.4, HS.2.5
HFI session in major system Design Review	Compliance assessment, Risk assessment	IPT, Industry	Summative	HS.2.7, HS.3
LFE, enquiry	Lessons Learned, identification of causes of project failure	LFE, NAO, PPO, CWG	Summative	HS.1, HS2.3-2.7

6 Frequently Asked Questions (FAQs)

6.1.1 This section answers questions typically asked when first encountering HFI CMM.

6.1.2 **Is conducting an HFI assessment expensive, and how might the cost of the exercise be justified?** A quick assessment takes a few days of resource and is likely to be a very cost-effective form of risk reduction on any project with HFI risks, issues or opportunities. A full assessment would consume typically 45 days of MOD effort as the assessor, and 5 days of the organisation being assessed (this might be a contractor or may include MOD). This cost would be justified on the basis of the risk reduced. The question is slightly misleading. The question to be asked by the HFI focus is "Is an assessment using HFI CMM the best use of resources in a risk assessment or risk mitigation exercise?" and (because the resources are already to hand) the answer is likely to be "yes". See also the Annex on Return On Investment (ROI).

6.1.3 **Conducting even a simple assessment looks difficult – do I need specialist resources?** For any use of HFI PRA, it is important that someone involved has been on a (brief) training course or workshop. For simple assessments, this is all that is necessary. For a full assessment, it would be cost-effective to involve a specialist. The competence requirements are discussed in a separate note.

6.1.4 **Why is the model an International Standard, rather than something specifically tailored for MoD requirements?** The advantages of an International Standard (IS) are as follows. An IS can be used without controversy in international procurement. An IS can be used in conjunction with multi-national operations. An IS is given the highest precedence in the MoD standards hierarchy. An IS is in accord with the MoD wish to use commercial standards and best practice where possible. The IS has been developed to provide a supportable definition of best practice that could be used in support of safety cases, security accreditation or mitigation of business risks. It also represents a stable body that can be used as the basis for the development of expertise, methods and tools. The tailoring to the (evolving) MoD procurement practice is contained in separate documents such as this, that are more easily kept up to date.

6.1.5 **Does HFI PRA mean that I don't need an HFIP?** No. A PRA assessment will look for evidence of planning and management processes. A HFIP is required for all but very small projects when it can be embraced in some wider project plan. An internal brainstorming session using the processes in the HSL model may well be a valuable aid to developing a HFIP,in conjunction with the list of project HFI risks, issues and opportunities. When evaluating a supplier HFIP, HFI PRA may assist in two ways: as a framework to discuss the HFIP against project need with the supplier, and as an aide memoire of best practice.

6.1.6 **Surely you can't expect reference model perfection on a limited budget?** No. It is extremely unlikely that any project would require that all practices under all processes would need to be fully carried out to the highest standards of maturity, or anything approaching this. It is intended that a project can set a profile of what processes are required to what level in order to mitigate project risk. This profile can then be examined for each of the project stakeholders and an evaluation made of the Process Improvement required. The intent of HFI PRA is that scarce resources are used to best effect, not that unnecessary paperwork is generated.

6.1.7 **HFI is not my only source of risk – why should I conduct a specialist**

assessment? The way that HFI PRA has been organised is that an assessment can be made in conjunction with software risks and (prospectively) system engineering risks. However, because HFI is still a specialist area, it may be desirable to involve a specialist in the assessment to some degree.

6.1.8 **The contracts have already been placed – does this mean that HFI PRA is no longer relevant?** No, HFI PRA can be used once a contract is in place, but the scale of benefit is likely to be reduced. However, if a contract has been placed with a supplier that is proving incapable of delivering HFI, then HFI PRA is one of the few instruments that can improve the situation. Depending on the climate, and the particulars of the contract, there are a number of options for using HFI PRA post-contract award. Firstly, the customer team can conduct an assessment of their own processes with the participation of the suppliers, and then broaden this out to look at the supplier processes with the intent of informal Process Improvement. Secondly, the customer can decide to use HFI PRA as a means of monitoring the project, as a supplement to normal progress reporting. Whilst the metrics produced would not have contractual status, they would flag up problems and opportunities in a very clear fashion, which may lead to an improvement in the situation.

6.1.9 **Our project is only just starting, is using HFI PRA overkill?** No, HFI PRA has a range of assessment methods that can be adopted to suit the situation. For a project that is still at a very low spend rate, with participants from a small number of stakeholder organisations, then a very brief self-assessment can prove a cost-effective aid to thought. There are times when projects - even at start up - are at a high spend rate with multiple stakeholders. Under these circumstances, a larger scale of assessment may be appropriate, even at an early stage. Where a project is safety-critical, then a fairly formal process assessment at start up is an extremely cost-effective way of ensuring that the necessary processes are in place. Being able to demonstrate this represents a significant milestone on such projects.

6.1.10 **The project is using the HFI Guides – does this mean that HFI PRA is unnecessary?** Maybe. A project that is using the guides correctly is likely to be undertaking appropriate HFI activities. There are two circumstances when HFI PRA would be valuable. Firstly, when there are concerns that HF activities are not being fully integrated into the project, and secondly when there are concerns that the HF activities are not correctly focused on the needs of the project. Under such circumstances, it is possible to identify the specific processes of interest and conduct a tailored assessment.

6.1.11 **What is the difference between an HFI CMM assessment and an ISO 9000 audit?** There are a number of differences.

- Firstly, in style and approach: an ISO 9000 audit is generally conducted in a hostile and uncompromising atmosphere. CMM assessments are specifically designed to avoid these problems.
- Secondly an ISO 9000 audit addresses whether the tasks and procedures called up in the quality plan have been carried out. A CMM assessment looks underneath the paperwork to see if the real activities have been carried out to meet the correct intent.
- Thirdly, ISO9000 has no reference model of HFI best practice against which to base an assessment. However, ISO 9000/2000 incorporates Process Improvement as an integral requirement, and the initial assessment uses the ISO

9000/2000 scale, so by doing a initial assessment, a project is contributing to the requirements of ISO 9000/2000.

6.1.12 **A software assessment using SEI CMM gives a formal maturity level that can be used for tendering and accreditation. Does HFI PRA give such a level?** US DOD Software PCAE is aimed at providing a rating of the CMM maturity level of each contractor's process. However in the UK the default is that no such rating is produced. In SCE as tailored for MoD usage, the primary focus is on assessing the impact of contractors' processes on project risks. A similar approach has been adopted for HFI PRA.

6.1.13 **The model contains quite general activities such as risk management, project management and planning. Is this another case of HF specialists re-inventing the wheel?** No, the approach taken to the development of HFI PRA has been to enable assessments of HSL process risks on their own, concentrating on HFI processes and their management, or to include HFI processes in a wider software or system assessment. When taking part in a wider assessment it is possible to replace generic processes in the HSL model with those from the software or System Engineering model with the proviso that the aspects of concern to HFI are fully addressed (probably by assessor expertise).

7 Risk-based uses of quick assessments

7.1.1 This section discusses the various sources of risk, and how process assessments and process improvements can be used to mitigate such risks.

7.2 General Project Factors

7.2.1 If a project has general risks related to user aspects, then you may be considering trying HFI PRA.

7.2.2 In general, if one or more of the factors in the table below is significant on a Category A or B project, then a full assessment is likely to be cost-effective, but if only one factor is significant on a Category C or D project, then a initial assessment may be appropriate. However, this is a very rough guideline at the present time.

Project Factor	Description of when an HFI PRA assessment may be appropriate
HFI risks, issues and opportunities prominent in project risk register	If HFI risks, issues, opportunities are prominent in the risk register (e.g. from EHFA).
Human aspects of project whole life cost	Where manpower costs represent a significant proportion of Whole Life Costs, or where the difference between upper and lower manpower cost projections is significant.
Human aspects of system effectiveness	Where individual or Collective Performance measures make a significant contribution to system effectiveness.
Changing organisational environment in the context of use	Where the organisational environment in the system context of use is changing as the armed services evolve at an increased rate (e.g. changed use of reserves, evolving branch structures, increased contractorisation).
Changing operational environment in the context of	Where operational requirements have placed an

use	inherent need for flexibility (an attribute traditionally supplied by the human element).
Changing technical environment in the context of use	Where the range of equipments that users interact with is undergoing technical change, increasing the difficulty of managing equipment common features and integration from the user point of view.
Use of COTS (hardware or software) originally developed for a different context of use.	Where there may be a gap between the context of use that formed the COTS design case and the context of use envisaged in the procurement. A maturity assessment may well be expected to focus on the processes involved in defining context of use and in analysing the gap.
System being acquired has complex interactions with other systems	Where there is 'close coupling' between the system being acquired and other systems, especially as regards interactions between human and machine elements, and where overall performance is driven by the wholistic interaction of systems rather than a simple sum.
Compressed project timescales	Where the timescale has been compressed and makes demands on Concurrent Engineering, so that requirements may not be fully decomposed before (sub)-contracts are placed, or where evaluation at one level may be concurrent with system design at another level.
Complex supply chain	Where the length or complexity of the supply chain poses difficulty in decomposing user requirements and constraints or transmitting HFI risks, issues or opportunities in a timely manner.
Lack of supplier HFI experience	Where suppliers who hold significant HFI risks, issues or opportunities lack established HFI processes or expertise.
Partnering initiatives	Where the IPT wishes to strengthen partnering arrangements and to improve cross-stakeholder processes. HFI represents many of the key processes that cut across stakeholders.
Non-prescriptive requirements	Where, in order to maximise design flexibility, to make best use of new technology and to transfer risk to industry, MoD has moved away from prescriptive requirements which specify design content towards functional requirements aimed at specifying the military capability required.

7.3 Using Early HF Assessment and HFI PRA together

7.3.1 Early HF Assessment (EHFA) is an activity that helps to identify the technical risks associated with the operability of a system.

7.3.2 There may also be risks associated with the management, resources or programme of the project. HFI PRA can complement EHFA by assessing the risks associated with processes or programme aspects.

7.3.3 Additionally, specific activities may be considered necessary to mitigate technical risks identified in EHFA. Again HFI PRA can complement EHFA by assessing the project's capability to carry out the processes that embrace the required activities.

7.4 Complying with the HFI instructions in the AMS

7.4.1 The AMS has 3 high-level instructions relating to HFI. These are:

7.4.2 The IPT Leader shall develop a Human Factors Integration plan consistent with the Through Life Management Plan. (ref:10510001)

7.4.3 The IPT Leader shall include Human Factors Integration in the procurement strategy (ref:10510002)

7.4.4 The IPT Leader shall inform the Principal Personnel Officers of any likely impact on future recruitment criteria or trade group structures which will be required to support the introduction of the product (ref:10510005)

7.4.5 In the event that it is necessary to assess the extent to which a project or organisation complies with these instructions, then a Capability Evaluation of project processes necessary for HFI to meet these instructions will be undertaken.

7.5 Risks Related to Project Stage

7.5.1 This section discusses typical HFI issues or risks at the two earliest stages of a project, concept and assessment.

7.5.2 Stage: **Concept**: At this stage in the project, there will be relatively little evidence available of HSL processes having produced deliverables, and the emphasis is on checking that the processes are in place to address user aspects of design and of acquisition. The table below gives examples of risks and of how HFI PRA can be used in AMS to mitigate them.

Issue/Risk	Mitigating HSL processes	AMS Evidence, Deliverables	Possible interview questions
Equipment focus (say in URD)	Technical HCD activity (HS.3), integrated into the project (HS.2.7), backed by commitment to operability (HS.2.1), and user involvement (HS.2.6). Report on operability risks arising (HS.2.5) from equipment focus.	Evidence of following process for URD in Smart Requirements in IPT Guide. Statements in URD iaw requirement i.e. "the user shall be capable of..." referring to operational tasks rather than system interaction. Risk register	How were Human-system issues accounted for in acquisition (HS.2.3)? How was the allocation of function between the user and the equipment envisaged (HS.3.3)? How was the context of use seen to influence user goals (HS.3.1)?
Acquisition/MPT disconnect or mis-alignment	Present the context and Human Resources options and constraints as output (HS.1.1.BP6). Manage MPT stakeholders (HS.2.3.BP1) Involve users (HS.2.6) Technical activity is principally HS.4 by the PPO, aligning with project-based HS.3.1.	Assumptions and dependencies in URD or Master Data Assumptions List (TLMP). Identity of all stakeholders in TLMP. TNA plan in TLMP.	What manpower options were developed to accompany (or generate) equipment options (HS.4.3)? What manpower and training constraints were identified (HS.4.1)?
Human effectiveness and cost issues not in business case	Technical work is in HS.3.2. The output appears in HS.1.1.BP8. The inclusion of Human-system issues in financial management is HS.2.3.BP2.	Human costs and effectiveness (with uncertainties) put into business case, CEA and TLMP. Human effectiveness appears in CONOPS.	How were human costs and effectiveness issues included in the business case (HS.2.3.BP2)? Do Human-system issues appear in the business case (HS.1.1.BP8)? How were user performance criteria set and

			agreed (HS.3.2.BP4)?
Separate procurements lead to lost MPT opportunities	Identified in HS.3.1. Risks and opportunities managed by HS.2.5 Reported in HS.1.1.BP5	On small projects a cluster IPT may address this. Assumptions and dependencies in URD.	What are the characteristics of any other equipment to be used in the system and working environment (HS.3.1.BP5)?
User Requirements abstract, open to misinterpretation, not tested with user community, consequential changes in operations missed	HS.3.2 processes for exploring requirements. User evaluation of concept against requirements (HS.3.4). Early prototyping (HS.1.1.BP6). User involvement (HS.2.6)	Evidence of following the correct processes in URD production.	How are users involved in the project (HS.2.6)? How is the concept evaluated from a user point of view (HS.3.4, HS.1.1.BP6)?

Stage: Assessment

Issue/Risk	Mitigating HSL processes	AMS Evidence, Deliverables	Possible interview questions
Equipment focus in SRD with lack of operability drivers	Gain commitment to operability (HS.2.1). Setting user requirements with measurable criteria (HS.3.2). Evaluating system (HS.3.4). Reported by HS.1.BP5.	Traceability of SRD to URD and performance goals.	How are system requirements and performance criteria linked to user requirements and criteria (HS.3.2)?
User roles missed e.g. due to focus on 'operator'	Effect on stakeholders considered in HS.1.2.BP1 Staffing solution identified by HS.4.3 User roles identified by HS.3.1. Users involved by HS.2.6 Users identified by HS.3.1.BP3	Identification of all users in URD.	How are the users specified (HS.3.1.BP3)?
Operability loses to cost in work up to Main Gate, WLC loses to UPC in work up to Main Gate, resulting in operability and MPT problems	Use operability risks in trade-offs, raise new consequential risks, advise on severity (HS.2.5.BP3). Consider HS issues in financial management (HS.2.3.BP2) Apply procedures for HFI sign-off (HS.2.3.BP4). Include HFI in business case (HS.1.1.BP8)	Inputs to TLMP of consequential WLC increases. Inputs to CEA on capability shortfalls. Entries in risk register. PPO aware of risks.	How do you use HS data to identify and reconcile conflicts between Human-system issues and other aspects of system design and operation (HS.2.5)?
COTS equipment designed for a different context of use is adopted without tailoring to save money	System context of use defined and analysed (HS.3.1). Trial implementation tested (HS.1.2.BP5) using HS.3.4.	Testing identified in ITEA. Context identified in URD. Mismatch identified in risk register.	How do you test key aspects of the system with users (HS.1.2.BP5)?
Inadequate HFI budget leads to potential operability problems not being identified or corrected when cost-effective to do so.	Usability is seen as a competitive asset (HS.2.1.BP1). Plan and Manage use of HF data to mitigate HS risk (HS.2.5.BP1).	TLMP relates work programme to risks. Risk management plan assigns resources. HFIP shows risk-driven approach.	How do you manage the HFIP to address HFI issues and risks (HS.2.4.BP3)?

7.6 Typical Risks for types of project

7.6.1 This section identifies typical risks for some types of major project and is intended as an aid to thought when starting a full risk assessment and Process Improvement exercise.

Type of project: Platform (air, sea or land)

The risk is that...	The processes that would mitigate the risk are...
The drive to reduce manpower on the platform leads to excessive workload, inappropriate job design and reduced flexibility.	HS.4 should identify the concerns from a manpower point of view. HS.3.1 should identify issues related to this. HS.3.4 should show these problems. HS.2.5 should present these issues to management. HS.2.3 should prevent them going through to acquisition.
The organisational split between platform design and onboard C4I design leads to poor workplace and workstation layout.	HS.2.4 should put management measures in place to prevent this, supported by HS.2.7 at a working level. Design problems should be identified in HS.3.3, HS.3.4
Changing employment patterns and conditions of service are not accommodated in the emerging design leading to inappropriate job design assumptions.	HS.4.1 should identify this from a manpower point of view. Continuing HS.3.1 should identify this from a system point of view.
Separation of platform delivery and training delivery leads to difficulties in supporting rollout and initial capability.	HS.2.3 should allow input from HS.4 activities. HS.2.4 should provide suitable communication in a plan. HS.2.7 should support communication at a working level. These issues should be addressed by HS.1.3

Type of project: CIS

The risk is that...	The processes that would mitigate the risk are …
The complex and changing context of use, particularly the technical environment, leads to a system with poor interoperability from the user point of view (i.e. with the other user interfaces in the context of use).	Describing the equipment in the context of use (HS.3.1.BP5). HS.2.8.BP2 produces resources such as style guides to promote common features which are applied to the design.
The rapidly evolving nature of COTS-based technical solutions leads to a drift between the real requirement and the solution and the loss of key features in the design that was awarded the contract.	User requirements (HS.3.2) should anticipate drift. Evaluations (HS.3.4) should detect drift. Risk management should assess impact (HS.2.5). Drift in deliverable descriptions should be rejected by HS.2.3.BP4.
Complex system management functions are not hidden from non-specialist staff leading to a mis-match between user skill and system complexity e.g. system management role requires IT skills beyond candidate user.	HS.4 should identify skill requirements for candidate users. HS.3.1 should specify users. HS.3.2 should specify requirements that refer to user characteristics. Evaluation (HS.3.4) should reveal mismatch. In practice, likely to be detected by users (HS.2.6).
The increasing volumes of information to be managed leads to crowded displays and/or complex navigation.	Guidelines applied to the design (HS.3.3) should prevent clutter. User requirements (HS.3.2) should make such solutions non-compliant. A practical model of the design concept should identify this risk early on (HS.1.1, HS.1.2).

Type of project: C4I

The risk is that...	The processes that would mitigate the risk are...
An equipment focus leads to a neglect of understanding a) true information needs to support new types of decision b) true information flow requirements for modern battlefield organisation c) the centralisation/de-centralisation options that may be required.	Understanding user goals and the context of use (HS.3.1) should provide the material for decision centred design. User information and decision needs relating to the operational task are specified in user requirements (HS.3.2.BP1, BP4). Early prototypes (HS.1.1, HS.1.2) should show up problems. Relating human performance to the business case should help drive design (HS.1.1.BP8)
'Smart' operator support based on mathematically appealing models of uncertainty lead to inappropriate advice to the operator in the real operational environment and inadequate access to the data that is really needed.	
An equipment focus makes an assumption that complex RISTA tasks (e.g. associated with image analysis) can be done in Near Real Time in the field by front line non-specialist analysts which leads to a mismatch between operational demand and operator capability.	Human issues in concept (HS.1.1) should report on this mis-match, identified by understanding context of use (HS.3.1), generating user requirements (HS.3.2) and evaluating the design (HS.3.4). The manpower-driven view (HS.4) should identify the excessive demands on users.
Piecemeal procurement and federated systems are specified with overlapping functionality leading to the same information presented in different ways in the same context of use.	Standards, style guides (HS.2.8) applied to the design (HS.3.3) should prevent this. Understanding the context of use (HS.3.1) should identify the risk.
The rapid pace of operational change and the need for flexibility is not translated into requirements and cost justified initially, and then not tracked leading to an evolving design that does not match the evolving requirement or context of use.	Continued tracking of concept isssues (HS.1.1), coupled with iterative design and test (HS.3.4). Continuing Context of Use process should trap this (HS.3.1).

8 Annex ROI on assessment

8.1.1 This section contains an article on Return On Investment (ROI) for software capability evaluations, and a very brief note on HFI PRA ROI.

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This Month We Examine Bang For The Buck Or What Kind Of Return On Investment (ROI) Can I Expect.

Although misplaced, the first argument I usually hear from project managers concerning a software process improvement effort or more particularly a software process assessment is how much later it will make us, or how much over budget it will put us. A better argument might be, what is my return on investment?

First, Let's Examine The, "Won't That Make Us Later / More Over Budget Premise."

Assumptions:

1. An average assessment, inclusive of all training, briefings, interviews, etc. takes about 6 calendar weeks from start to finish, with intensive, full-time effort occurring in weeks 1, 5 and 6.
2. The assessment team will be made up of five members of the organization being assessed. Each of these people will be dedicated to the effort for 120 hours over the 6 weeks, in weeks 1, 5 and 6.
3. Approximately 50 people from the organization will be interviewed. These people will need to allocate about 4 hours to the assessment distributed during weeks 5 and 6.
4. The "average" organization has 100 people that develop or manage software.
5. An "average" software development project or release delivery is 6 months long.

Computations:

1. Six months of effort for 100 people is 104,000 hours of effort for the organization.
2. The effort required for the assessment is 5 people x 120 hours + 50 people x 4 hours = 800 hours.
3. 800 hours / 104,000 hours = 0.8% (That's right, less than 1 %)

Conclusion:

During the six months of a typical organization's project schedule, the organization will be impacted to the tune of less than 1% of its project-based effort. The cost of an assessment is in the noise level with respect to the estimation accuracy of both cost and schedule. Therefore it can be concluded that an assessment will not cause a project to be any later than, or cost any more than if no assessment were performed. Most project managers I know would not bet their paychecks that their cost or schedule estimates were accurate to within 1%.

How To Calculate The Total Cost Of An Assessment:

- Lead assessor fees vary from approximately $40,000 to $50,000.
- Three weeks of expenses (Airfare, Room, Board, Vehicle, Equipment Rental, Supplies, Shipping)

- Fully burdened costs for 800 hours of effort from the organization. This number might increase depending on how many people over the minimum attend the Introduction to Software Process Improvement and CMM class.

The Costs Of The Continuing Software Process Improvement Effort:

General rule of thumb data puts the costs of a continuing software process improvement effort at somewhere between 3 and 6 percent of the software budget. In terms of people, you would need a Software Engineering Process Group (SEPG) or equivalent that is 3 to 6 people per 100 developers and managers. The SEPG is composed of process people, software quality assurance people, configuration management specialists, etc. These are the types of people develop, improve and assure that the proper processes and procedures are being followed during the project's lifecycle phases.

Return On Investment:

Although organizations just beginning their process improvement journey typically don't have enough data to generate meaningful statistics, there are some generally accepted figures for ROI. ROI can be categorized according to: gain in lines of code developed / decrease in development time, gain in defects detected earlier rather than later/overall reduction in defects, and an overall business value score. Based on the various categories the business value score ranges in estimate from 4:1 all the way up to 8.8:1 Return on Investment. That translates to nearly $9 dollars retained or made for each dollar spent on software improvement efforts, best case. Even if we took an average and claimed an ROI of only 6.4:1 that still beats any investment return you can get today.

If you have any further questions about software process improvement, assessments or training, we can be reached via our website or you can contact me by voice, email or FAX.

8.1.2 The evidence of the cost-effectiveness of HFI is limited and largely US, but the scale of benefit is generally greater than that quoted above, and the scale of cost is considerably less. For software-intensive systems, it has been shown that the bulk of the reason for delay and overspend is associated with user aspects. The author is unaware of comparable analysis for traditional engineering, but there is no particular reason to assume radically different findings. On a superficial analysis, HFI effort is well below the point of obtaining a decent ROI and full assessments are likely to yield a good return.

8.1.3 For assessments conducted in conjunction with tendering, it would be possible to compare the return on customer and supplier investment for an HFI PRA with other questionnaires such as software estimating or Mean Active Time to Repair. Given the far greater scale of risk for HFI, it is likely that even a full HFI PRA would prove to be a cost-effective use of tendering resources.

9 Annex Summary of Human-System Lifecycle (HSL) model

HS.1	HS.2	HS.3	HS.4
Life cycle involvement	**Integrate human factors**	**Usability engineering**	**Human resources**
HS.1.1 Human-system issues in conception **HS.1.2** Human-system issues in development **HS.1.3** Human-system issues in production and utilization **HS.1.4** Human-system issues in utilization and support **HS.1.5** Human-system issues in retirement	**HS.2.1** Human-system issues in business strategy **HS.2.2** Human-system issues in quality management **HS.2.3** Human-system issues in authorisation and control **HS.2.4** Management of human-system issues **HS.2.5** HF data in trade-off and risk mitigation **HS.2.6** User involvement **HS.2.7** Usability engineering integration **HS.2.8** Develop and re-use HF data	**HS.3.1** Context of use **HS.3.2** User requirements **HS.3.3** Produce design solutions **HS.3.4** Human Factors evaluation	**HS.4.1** Human resources strategy **HS.4.2** Define standard competencies and identify gaps **HS.4.3** Design staffing solution and delivery plan **HS.4.4** Evaluate product system solutions and obtain feedback

HS.1.1	HS.1.2	HS.1.3	HS.1.4	HS.1.5
Human-system issues in conception	**Human-system issues in development**	**Human-system issues in production and utilization**	**Human-system issues in utilization and support**	**Human-system issues in retirement**
HS.1.1.BP1 Identify expected context of use of product systems HS.1.1.BP2 Analyse the product system concept HS.1.1.BP3 Describe the objectives which the user or user organisation wants to achieve through use of the product system HS.1.1.BP4 Identify and analyse the roles of each group of stakeholders likely to be affected by a product system HS.1.1.BP5 Perform research into required product system usability HS.1.1.BP6 Present context and human resources options and constraints HS.1.1.BP8 Contribute to the business case for the product system	HS.1.2.BP1 Generate design options for each aspect of the product system related to its use and its effect on stakeholders HS.1.2.BP2 Produce human centred solutions for each design option HS.1.2.BP3 Design for customisation HS.1.2.BP4 Develop simulation or trial implementation of key aspects of the product system for the purposes of testing with users HS.1.2.BP5 Collect user input on the usability of the developing product system HS.1.2.BP6 Assess the health and well-being risks to the users of the product system HS.1.2.BP7 Assess the risks to the community and environment arising from human error in the use of the product system	HS.1.3.BP1 Evolve options and constraints into an implementation strategy covering technical, integration, and planning and manning issues HS.1.3.BP2 Identify, specify and produce the infrastructure for the product system HS.1.3.BP3 Maintain contact with users and the client organisation throughout the definition, development and introduction of a product system HS.1.3.BP4 Build required competencies into training and awareness programmes HS.1.3.BP5 Test that the product system meets the requirements of the users, the tasks and the environment, as defined in its specification HS.1.3.BP6 Analyse feedback on the product system during delivery and inform the organisation of emerging issues	HS.1.4.BP1 Produce personnel strategy HS.1.4.BP2 Deliver training and workshops to users and maintainers HS.1.4.BP3 Review the product system for adherence to applicable human science knowledge, style guides, standards, guidelines, regulations and legislation HS.1.4.BP4 Assess the effect of change on the usability of the product system HS.1.4.BP5 Review the health and well-being risks to the users of the product system HS.1.4.BP6 Review the risks to the community and environment arising from human error in the use of the product system HS.1.4.BP7 Take action on issues arising from in service assessment HS.1.4.BP8 Perform research to refine and consolidate operation and support strategy for the product system	HS.1.5.BP1 Collect and analyse in-service reports to generate updates or lessons learnt for the next version of the product system HS.1.5.BP2 Identify risks and health and safety issues associated with removal from service and destruction of the product system HS.1.5.BP3 Define how users will be re-allocated, dismissed, transferred to other duties. HS.1.5.BP4 Plan break-up of social structures HS.1.5.BP5 Debriefing and retrospective analysis for replacement version

HS.2.1	HS.2.2	HS.2.3	HS.2.4	HS.2.5	HS.2.6	HS.2.7	HS.2.8
Human-system issues in business strategy	**Human-system issues in quality management**	**Human-system issues in authorisation and control**	**Management of human-system issues**	**HF data in trade-off and risk mitigation**	**User involvement**	**Usability engineering integration**	**Develop and re-use HF data**
HS.2.1.BP1 Define usability as a competitive asset HS.2.1.BP2 Set usability objectives for product systems HS.2.1.BP3 Follow competitive situation in the market place HS.2.1.BP4 Develop user-centred infrastructure HS.2.1.BP5 Management relate HS to business benefits	HS.2.2.BP1 Establish and communicate a policy for human-centredness HS.2.2.BP2 Include HR and user centred elements in support and control procedures HS.2.2.BP3 Define and maintain HCD and HR infrastructure and resources HS.2.2.BP4 Increase and maintain awareness of usability HS.2.2.BP5 Develop or provide staff with suitable HS skills	HS.2.3.BP1 Take account of stakeholder and user issues in acquisition activities HS.2.3.BP2 Take account of HS issues in financial management HS.2.3.BP3 Assess and improve HS capability in processes which affect usability HS.2.3.BP4 Include HS review and sign-off in all reviews and decisions	HS.2.4.BP1 Develop a plan to achieve and maintain usability throughout life HS.2.4.BP2 Identify the specialist skills required and plan how to provide them HS.2.4.BP3 Manage life cycle plan to address HS issues	HS.2.5.BP1 Plan and manage use of HF data to mitigate risks related to HS issues HS.2.5.BP2 Assess the extent to which usability criteria and other HS requirements are likely to be met by the proposed design HS.2.5.BP3 Evaluate the current severity of emerging threats to product system usability and other HS risks and the effectiveness of mitigation measures HS.2.5.BP4 Take effective mitigation to address risks to product system usability	HS.2.6.BP1 Advocate the user perspective HS.2.6.BP3 Assess the risks of not involving end users in each evaluation HS.2.6.BP4 Define a strategy and plan for user involvement HS.2.6.BP5 Select and use the most effective method to elicit user input HS.2.6.BP6 Take account of user input and inform users	HS.2.7.BP1 Develop a common terminology for HS issues with the organisation HS.2.7.BP2 Facilitate personal and technical interactions related to HS issues HS.2.7.BP3 Identify and use the most suitable data formats for exchanging HF data HS.2.7.BP4 Customise tools and methods as necessary for particular projects/stages HS.2.7.BP5 Identify emerging HS issues	HS2.8 BP1 Have a policy for HF data management HS.2.8. BP2 Perform research to develop HF data as required HS.2.8 BP3 Produce coherent data standards and formats HS.2.8 BP4 Define rules for the management of data HS.2.8 BP5 Develop and maintain adequate data search methods HS.2.8.BP6 Seek and exploit expert guidance and advice on HS issues

HS.3.1	HS.3.2	HS.3.3	HS.3.4
Context of use	**User requirements**	**Produce design solutions**	**Human factors evaluation**
HS.3.1.BP1 Define the scope of the context of use for the product system HS.3.1.BP2 Analyse the tasks and worksystem HS.3.1.BP3 Describe the characteristics of the users HS.3.1.BP4 Describe the cultural environment/organisational/management regime HS.3.1.BP5 Describe the characteristics of any equipment external to the product system and the working environment HS.3.1.BP6 Describe the location, workplace equipment and ambient conditions HS.3.1.BP7 Analyse the implications of the context of use HS.3.1.BP8 Present these issues to project stakeholders for use in the development or operation of the product system	HS.3.2.BP1 Set and agree the expected behaviour and performance of the product system with respect to the user HS.3.2.BP2 Develop an explicit statement of the user requirements for the product system HS.3.2.BP3 Analyse the user requirements HS.3.2.BP4 Generate and agree on measurable criteria for the product system in its intended context of use HS.3.2.BP5 Present these requirements to project stakeholders for use in the development and operation of the product system	HS.3.3.BP1 Distribute functions between the human, machine and organisational elements of the product system best able to fulfil each function HS.3.3.BP2 Develop a practical model of the user's work from the requirements, context of use, allocation of function and design constraints for the product system HS.3.3.BP4 Produce designs for the user-related elements of the product system that take account of the user requirements, context of use and HF data HS.3.3.BP5 Produce a description of how the product system will be used HS.3.3.BP6 Revise design and safety features using feedback from evaluations	HS.3.4.BP1 Plan the evaluation HS.3.4.BP2 Identify and analyse the conditions under which a product system is to be tested or otherwise evaluated HS.3.4.BP3 Check that the product system is fit for evaluation HS.3.4.BP4 Carry out and analyse the evaluation according to the evaluation plan HS.3.4.BP5 Understand and act on the results of the evaluation

HS.4.1	HS.4.2	HS.4.3	HS.4.4
Human resources strategy	**Define standard competencies and identify gaps**	**Design staffing solution and delivery plan**	**Evaluate system solutions and obtain feedback**
HS.4.1.BP1 Decide the goals, behaviours and tasks of the organisation HS.4.1.BP2 Define the global numbers, skills and supporting equipment needed to achieve those tasks HS.4.1.BP3 Decide how many people are needed to fulfil the strategy and what ranges of competence they need HS.4.1.BP4 Implement the HR strategy that gives the organisation a mechanism for implementing and recording lessons learnt HS.4.1.BP5 Feedback into future HR procurement, training and delivery strategies HS.4.1.BP6 Enable and encourage people and teams to work together to deliver the organisation's objectives	HS.4.2.BP1 Identify current tasking/duty HS.4.2.BP2 Analyse gap between existing and future provision HS.4.2.BP3 Identify skill requirements for each role HS.4.2.BP4 Predict staff wastage between present and future HS.4.2.BP5 Calculate the available staffing taking account of working hours, attainable effort and non-availability factor HS.4.2.BP6 Compare to define gap and communicate requirement to design of staffing solutions HS.4.2.BP7 Create capability to meet system requirements in the future (conduct succession planning) HS.4.2.BP8 Produce and promulgate a validated statement of shortfall by number and range of competence	HS.4.3.BP1 Identify and allocate the functions to be performed HS.4.3.BP2 Specify and produce job designs and competence/skills required to be delivered HS.4.3.BP3 Calculate the required number of personnel HS.4.3.BP4 Generate costed options for delivery of training and/or redeployment HS.4.3.BP5 Evolve options and constraints into an optimal implementation plan HS.4.3.BP6 Develop and trial training solution to representative users HS.4.3.BP7 Deliver final training solutions to designated staff according to agreed timetable HS.4.3.BP8 Identify any opportunities for redeployment	HS.4.5.BP1 Develop a strategy for data gathering HS.4.5.BP2 Provide means for user feedback HS.4.5.BP3 Conduct assessments of usability HS.4.5.BP4 Interpret the findings HS.4.5.BP5 Validate the data HS.4.5.BP6 Check that the data are being used