

### Human factors integration

There are two aspects to human factors integration (HFI):

- Integrating human factors methods and procedures into the organisation itself - all employees become aware of the meaning of human factors and how it is used within company systems and processes.
- Integrating human factors methods and procedures into specific projects - human factors analysis and design is carried out at the right time within a team working together on engineering, design, managerial and human factors issues as a whole.

### Why human factors integration?

For systems to operate safely and effectively, they should be designed to support the people who operate them. Human factors (HF) is regarded by the UK Health and Safety Executive (HSE) as having an essential contribution during the development and operation of systems. Experience shows that it is ineffective to address HF as an afterthought. HF is not a stand-alone activity. Best practice is achieved only when HF is integrated into the mainstream of systems development (Reference 1).

“Human factors integration helps to ensure that human factors methods and principles are applied appropriately and consistently during systems development in order to achieve a safe and effective design for end users (Elder et al, 2001).”

Source: RSSB Website <http://www.rssb.co.uk>

Control of Major Accident Hazards (COMAH) Regulations require that top-tier establishments demonstrate a structured, systematic approach to managing human performance within site safety reports. This is best addressed through HF integration within projects, but also into the company's safety management system.

### Has your company integrated human factors?

If the answer to any of the following questions is 'No', then your organisation should take steps to intergrate HF into its existing procedures.

	Yes	No
1. Are employees generally aware of the meaning of 'human factors' and its subject matter via, for example, training or guidance material?		
2. Are internal or external advisers available and used by the organisation to provide support to HF initiatives?		
For any new project (build or modify a facility, introduce a new process, begin a major campaign of maintenance etc), would your organisation:		
3. Develop a HFI plan showing HF activities to be done at each stage in the project from initial concept to operation?		
4. Appoint a 'champion' for the HF work to be done?		
5. Make available HF specialists to advise and to train project teams in HF?		
6. Carry out regular HF audits throughout the project?		
7. Maintain a log of HF issues that arise and ensure that these are closed out within a reasonable time?		
8. Ensure that HF specialists exchange relevant information with other members of the project team concerning, for example: workspace requirements; design of controls, displays and tools; operator workload and number of staff required for key tasks?		
9. Invite end users of equipment to participate in the design or assessment of facilities?		
10. Build prototypes or mock-ups for testing/training?		

# What should my company do about it?

Management should realistically assess its current approach to using HF. To do so, they could use the maturity and capability scale provided in Reference 2. On that scale, companies range from those barely aware of HF (and that typically carry out HF studies only in response to accidents), to those that take the initiative to pursue best practice. Your company should determine how to take the next step towards best practice. The most appropriate way ahead seems to be to integrate HF procedures and methods into the company's existing procedures and methods. There are many ways of achieving this; this briefing note suggests one.

## 1. Policy

The organisation should set out a policy or vision for HF. This will express the company's overall intentions relating to HF, for example: 'To improve overall system performance and reliability, by optimising personnel performance, health, and safety through effectively integrating HF engineering principles into a project lifecycle.'

## 2. HF champion and working group

High-level management in the company should show their commitment to this policy. This can be achieved by appointing a HF 'champion' to drive it forward. The champion should have influence within the company to ensure that any changes required to embed HF into the organisation's current practices are taken seriously and adequately resourced. He or she is likely, therefore, to be a manager and their HF champion role will benefit from support to drive the new initiative forward – see 'action plan'.

## 3. Action plan

The workforce should be closely involved in integrating HF into the organisation both on a day-to-day basis and also within specific projects. One means of achieving this that has been successfully used (Reference 3) is to produce a HF framework – a broad outline of HF subject areas and links between them – and train workforce members in each of those subject areas. This enables the workforce to take ownership of HF and begin to raise awareness and apply its principles at the operational level of the organisation. With appropriate training and mentoring, it has been shown that the workforce can quickly identify improvements in, for example, work design, procedures and training.

# Human factors integration plan

Each project should have a project plan. This will specify the various activities required to deliver the project and will typically refer out to the schedule of activities at each phase of the project from concept, option selection, system design to project completion. The project activities will typically result in the production of reports describing progress on defining and developing project deliverables.

A first step in HFI is to ensure that the project plan refers to HF as well as system design and development activities. It should be noted that some of these activities may already be included in the plan or in other procedures but not referred to under the banner term of HF.

## CASE STUDY 1

With development costs estimated to be £2.4 bn, the BOWMAN radio system was intended to replace the existing Clansman system and take the British Army into the Integrated Digital Battlefield.

Problems arose, however, when combat tests indicated the system was 'not-fightable'. Assessments indicated that the radio was too fragile, inflexible and liable to become tangled in webbing. Most crucially, however, it was too heavy for most soldiers to use. A report found the MoD had prioritised performance rather than having a user-friendly system.

BOWMAN entered service in 2004 with 27 provisos and a number of functions removed (e.g. ability to communicate with air support). This case study illustrates issues with HFI, impacting upon project quality, costs and schedule:

- Personnel – assessors reported radio required too much training before competent use.
- HF engineering – reported to be too complex for use.
- Health hazards – too heavy for use.
- Specification – radio unable to communicate with systems used by air support e.g. Apache helicopters.

Source: *The Ergonomist* (published in September 2009) – see the IEHF website <http://www.ergonomics.org.uk/articles/bowman-combat-infrastructure>.

At each stage where some form of HF input to a project is set out in the plan, the project team or HF champion should ensure that the work is carried out, or specifically justify in project documentation why it is not to be done ('covered elsewhere', 'not applicable', etc). In support of this effort, for large or complex projects they should usually develop a specific HFI plan as part of the project documentation. This should indicate:

- Areas to be addressed (see 'key areas' below).
- How all those involved in the project will cooperate and communicate with each other on HF.
- The scope of HF work to be done, highlighting departures from any standard plan.
- Resources needed – internal and external HF specialists, as required.
- Links between HF activities and other project activities (programming).
- Milestones (important inputs and outputs).
- Constraints – things that cannot be changed (e.g. existing equipment).
- How problems will be recorded and resolved.

## Key areas

The key areas of HF can be summarised in many different ways. The HSE describes the scope of HF as concerned with: the job equipment and environment; the individual; and the organisation. The seven 'domains' set out in the



MoD's MAP10 (Reference 4) are also useful. The key areas, however, may be described differently by different organisations, and each should use descriptions that they are comfortable with. Generally, however, the subject matter of HF comprises:

- Personnel – the number of staff required to fill designated roles and the required capabilities of those staff.
- Organisational matters – management systems, work patterns, culture, and supervision.
- Design – of the workplace, of interfaces within the workplace and the working environment – temperature, noise, etc.
- The task – nature of the task/job design, team working.
- Support – procedures, job aids and means of ensuring staff competence.

The company should identify the relevant legislation and standards that need to be satisfied in relation to the above areas.

El *Guidance on managing human and organisational factors in decommissioning* (Reference 5) describes HFI in decommissioning and illustrates the wide range of HF that should be considered at various stages in the project lifecycle.

## CASE STUDY 2

A gas terminal in the UK was being expanded to accommodate additional processing facilities. Project managers elected to develop an HFI plan early in the project time line, and, through this, were able to identify gaps in HF design areas that may otherwise have seriously impacted upon project delivery. In one example, the client wanted to combine two distributed control systems (DCS) into one central control room (CCR). An assessment of the proposed design (including topics such as operator tasks, alarm design, use of colour/labelling/text/screen layout and input devices) found gaps between end user requirements and the design proposals. For example, alarms were not distinct, colours used to indicate process stability issues were different and the layout would have made operation extremely difficult. The client recognised that HFI saved them substantial redesign costs in addition to potential schedule disruption:

- System safety – early capture of issues prevented the commissioning of an inherently unsafe DCS and what would have required costly fixes if found later.
- HF engineering – design of DCS ensured it matched the requirements of the operators.
- Personnel – consulting operators made design changes a participative process.

## References

1. HSE (2002), *Human factors integration: Implementation in the onshore and offshore industries*, Research Report 001, HSE Books.
2. HSE (2002), *Framework for assessing human factor capability*, Offshore Technology Report 2002/016, OTO 02016, HSE Books.
3. Simcock, R. (2009), *Embedding human factors into organisations – time for a new approach?*, The Ergonomist, No.464, Ergonomics Society.
4. MoD, *Maritime acquisition publication No. 01-010 Human factors integration (HFI) management guide* (Formerly STGP 10), Issue 4, Sea Systems Group, Defence Procurement Agency.
5. Energy Institute (2010), *Guidance on managing human and organisational factors in decommissioning*, <http://www.energyinst.org/humanfactors>.

## Further reading

- McCafferty, D.B. et al (2002), (American Bureau of Shipping) *Effective integration of human (and organizational) factors into health, safety and environmental management systems*, Working Group 5 – 2nd International Workshop on Human Factors in Offshore Operations, 8-10 April 2002.
- Miller, G.E. (1999), *The past and projected role of human factors engineering (HFE) in the commercial maritime industry*, <http://www.bcpe.org/newsletters/detail.asp?RecordID=76>.

For background information on this resource pack, please see Briefing note 1 *Introduction*.