

OFFSHORE TECHNOLOGY

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A photograph of an offshore oil rig at sunset. The sun is low on the horizon, creating a bright orange and yellow glow that reflects on the water. The rig's silhouette is visible against the bright sky. The water is dark blue with a shimmering reflection of the sun.

**New Offshore Sectors
Building on Experience
Managing HSE
People Matter**



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Human Factors in Offshore Projects: Good Engineering Process not Black Art

Ian Randle, Hu-Tech

Dr Ian Randle is a Human Factors Engineer who has been involved in Offshore Oil/Gas projects for the past 18 years. He has seen the discipline move on from a simple 'ergonomic review' at the tail end of detailed design to an integrated process where most effort is directed at Front End design. In this article he describes a practical approach to integrating Human Factors into the project process based on his experience in large and small projects across five continents.

Human Factors (HF) is often poorly understood and considered esoteric and inaccessible to project teams. Due to this lack of understanding it has hitherto failed to become properly integrated into the design and engineering process.

However recent approaches to HF have succeeded in making it practical and accessible to projects by fitting the HF activities into the engineering process. To help to explain this approach and how it fits into a typical offshore project some guidance in the following paragraphs has been provided.

When operational an offshore installation will be a complex system of components each contributing to the overall capture, processing and offloading processes.

The processes will not function without

the necessary engineered components (such as pumps, pipes, valves and vessels) and each of these is carefully designed-in by a discipline engineer to ensure that it provides best performance and reliability.

However these processes will not function without Human Operators, even on lightly manned facilities. The Human Operator is an essential component in the engineered system, we have not been able to design them out, and therefore they need to be consciously designed-in in the same way as any other component in the system. This is the function of the Human Factors engineer, to ensure that the Human Operators are properly designed into the system and working within their specification to achieve best performance and reliability.

We work alongside the other discipline engineers to ensure that the operators and their interactions with other components are properly considered as the design progresses.

There are a number of approaches which have been developed to apply HF to engineering projects. The most fully developed and comprehensive model comes from the Defence industry, in which the HF activities are based around 6 or 7 'HF Domains' (including staffing, personnel,

training, human factors engineering, health hazards and system safety).

However from experience this may not always be the most appropriate approach for use in Oil/Gas projects for the following reasons:

- The scope and level of complexity can be beyond that which is easily achievable in many oil/gas capital projects
- The HF activities may not cleanly map onto the project engineering process. HF may therefore be run as a parallel stream of activity, with outputs that are not always easily understood by the project engineers and which can not always usefully influence the Basis of Design and Project Specification.

A more pragmatic approach is called for which is based on what is practically achievable from within the project's time and cost constraints and which provides the HF effort where it adds most value. Such a process is described below.

The HF activities are not based around the '6 HF Domains', but are focussed on identifying where HF effort is most required and can be practically applied. We start early in Front-End design and identify where HF can add most value to the project based on the project team's experience and lessons learned from previous projects. This 'HF screening' is used to help identify where previous designs have got it right, and where the design can be improved. At this stage we also ensure that the design teams have a full and proper understanding of end-user requirements by involving experienced operations and maintenance representatives.

The majority of HF effort is within the Front-End engineering phase, where there is most opportunity to influence design. The output of the HF activities will be practical set of Design Requirements for the



Human Factors Engineering:

The Human Operator as a Component in an Engineered System



Most HF activity should occur in Front-End Design

If we don't consider the Operator until late in the design process it can be difficult to fix our mistakes

project engineers, main contractors and equipment vendors, which will become integrated in the specification for the main equipment items. The key HF requirements therefore form part of the equipment and plant specifications, rather than being a parallel set of requirements which somehow need to find their way into the design. This also means that HF requirements are identified before the project enters the Detailed Design or Execute phase.

The HF activities in the detailed design phase are largely focussed on verifying that the Design Requirements have been met (for example in Model Reviews), and in helping to devise practical solutions or compromises if the requirements can not be fully or easily achieved.

A HUMAN FACTORS PROJECT PLAN:

The following provides an outline of the approach and the main tasks to be undertaken.

1. Raise HF Awareness.

It is important to gain support and understanding for a HF programme amongst the project teams at an early stage. To help do this short HF Awareness seminars should be presented to the design and engineering teams of the owner and main contractor. These should show in a practical, interactive and accessible manner the contribution which HF will make to the project; how the HF activities will be organised; and their roles within it.

2. HF Screening of major equipment items.

The purpose of the Screening is to identify the specific items and systems requiring further HF design attention. This will narrow the scope of the HF effort to where it is most required. The screening can be undertaken via a workshop attended by the relevant discipline

engineers and operations/maintenance and HSE representatives. A structured approach is used in which the main equipment items (or groups of items) are considered in terms of a number of factors including: the equipment criticality, task complexity, novelty, lessons learned/known problems, scope for change, user requirements etc.

Where equipment items will be of standard design and no particular HF issues are raised, this will be screened and excluded and no further HF input into the design will be required in this phase of the project. However, when (for example) a novel design is being introduced or there are known issues with the operability/maintainability or safety of a piece of standard equipment, this will be screened and marked for further attention.

The equipment items which have been marked will go forward into the next task stage in which the HF issues will be considered in more detail and the design requirements identified.

3. Identify Design Requirements.

Workshops are run for the equipment which has been marked for further attention. A high-level task analysis may be undertaken to better understand the functional requirements and HF issues in operation, maintenance, inspection etc.

The design requirements to address the issue will be identified in the workshop according to one of 3 levels:

- a. Design standards or published guidelines (internal and/or external) will adequately address the issue (e.g. valve accessibility guidelines, manual handling guidance). The relevant guidelines or standards will be identified and specified for use by the design teams and/or equipment vendors.
- b. Specific design requirements are identified during the workshop and recorded (e.g. ensure that goods can

be transferred from container laydown areas to all stores by mechanical means or by level transfer on trolleys/pallet trucks).

- c. A more detailed HF study will be required as part of detailed design to address the issue.

These design requirements form part of the layout and equipment specification to be implemented in detailed design.

4. HF input into Project Specification and Invitation To Tender (ITT) Documents.

The design requirements identified above are fed into equipment/layout specifications for use in FEED and detailed design by the main contractor and in ITT documentation for equipment vendors.

5. Review and verification.

Review designs produced by main contractor and vendor during detailed design to verify that the specified HF requirements have been met. Much of this process can take place in model reviews.

The key HF requirements are identified in FEED and are integrated into equipment and plant specifications

CONCLUSION - MAKE IT EASY AND THEY WILL DO IT

Engineering teams working on projects will be under time and resource pressure and do not contribute well to activities which they may see as adding to the time and complexity of their work. For this reason the HF process is designed to minimise the time and resource impact on discipline engineers whilst ensuring their participation in the process. They are involved identifying the HF requirements, this increases their buy-in and helps to ensure that the requirements are properly understood and implemented during the detailed design activities. |

Contact information

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