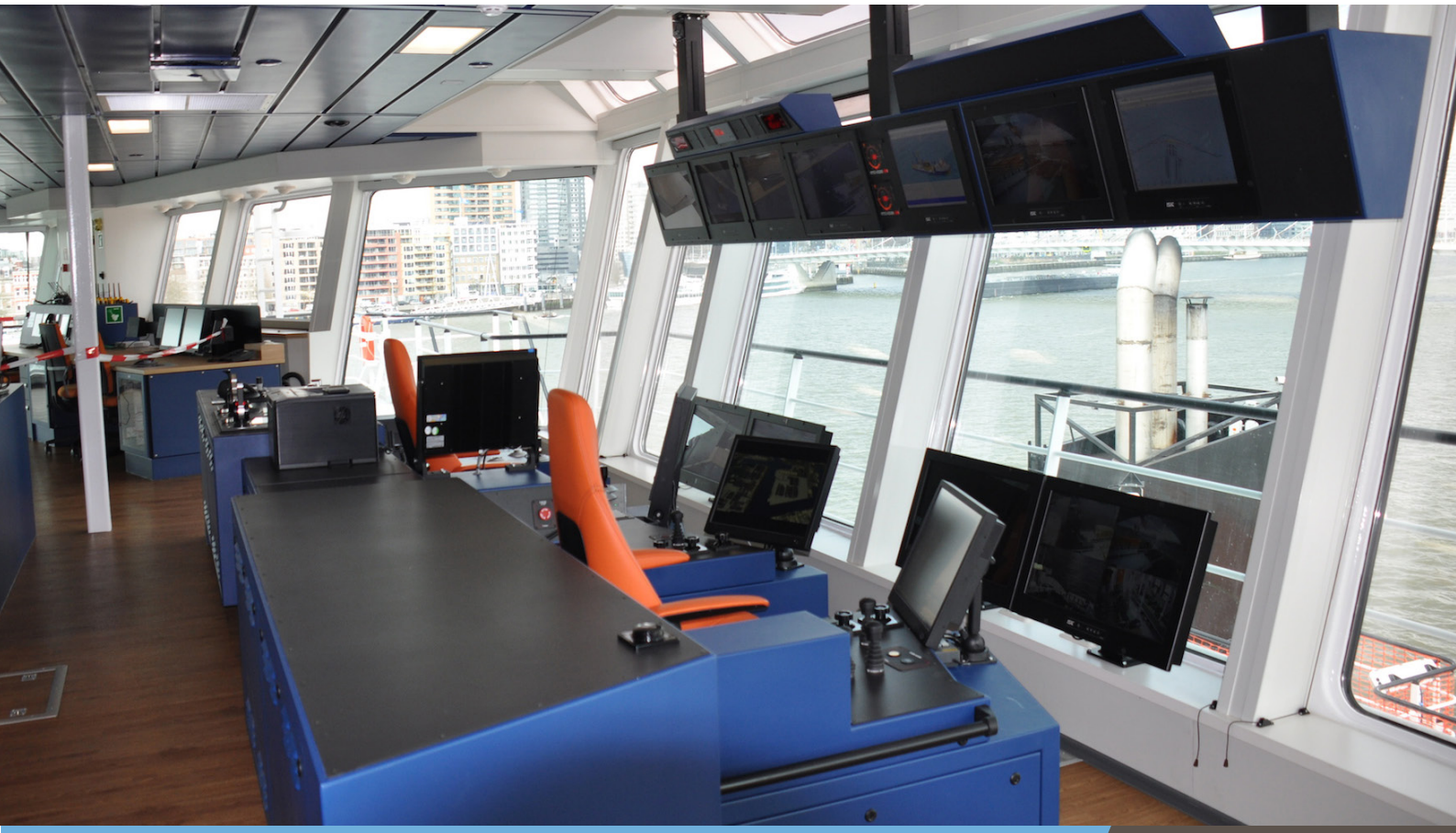
ERGOS

Human Factors Engineering



Workspace I HMI & Controls I Crew Development I Interior Design I BS & GA Review

Maritime Human Factors

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Maritime Human Factors

Human Factors (HF) and Ergonomics are synonyms, aiming to optimize the fit between the human operator and the work environment, to achieve efficient and safe operation in a healthy and comfortable way. 'Maritime Human Factors' simply refers to the field of application: ships, offshore assets and similar work environments concerning sea, lakes, rivers, canals and harbours.

Most HF studies focus on human performance 'at work'. In a maritime context, the work environment is often a living environment as well. On most seagoing vessels and off-shore platforms people work, sleep, eat and recreate, usually for a considerable period of time. Each of these functions results in specific requirements for the vessels design. This can be challenging, since most functions are carried out at the same time, often 24/7 and in a shared space.

The position of the crew is not always handled with the attention and expertise it deserves. So how can HF be effectively incorporated in the design process?

Basic Human Factors standard
A basic level of Human Factors attention is enforced by flagstate regulations, often referring to SOLAS and IMO standards. Sometimes the fleet owner improves this level by adding additional Human Factors standards and guidelines to the building specification.

Users are the experts
Further attention for Human Factors may be provided by having a captain or crew members delegation participating in the project team. They bring in much useful practical experiences. However, they might lack specific expertise.

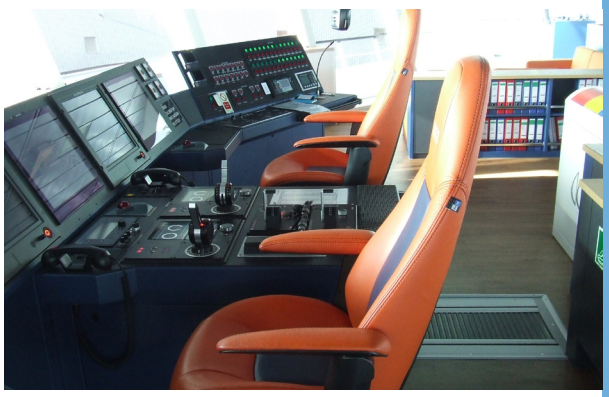
State-of-the-art Human Factors
For the best results a *Maritime Human Factors Professional* should be a member of the project team. A HF Professional contributes to all project phases, but most cost effective in the Basic Design phase, when important decisions on accommodation arrangement and bridge design are made.

Benefits of Human Factors
- Optimized handling and control.
- Optimized field-of-vision.
- Optimal crew size as a result of job integration. A reduced crew also results in smaller support crew and smaller accommodation facilities.
- Attractive and ergonomically well-designed ships are a joy to work on: this is important to acquire crew members and keep them motivated.

Maritime Human Factors services

ErgoS Human Factors Engineering offers practical and efficient services to fleet owners, engineering contractors and shipyards.
Contributions can take place in each phase of the project and vary from 4 to > 400 days per vessel or platform. Having a team of 3D designers, ErgoS offers state-of-the-art 2D and 3D modelling, visualization, animation and virtual reality deliverables. Our services include:

General
- Task analysis
- Human Factors review of General Arrangement
- HF review of design proposals from yard or suppliers
- HF rules & regulations compliance check
- Human Factors Class compliance check
- Verification and validation analysis, CRIOP
- User Interface design / Interaction design
- CCTV camera system design
- Interior design, including selection of wheelmark approved materials
- 3D modelling & animation
- Full size mockups (workplaces and control panels)
- User participation



Ships bridge / wheelhouse
- Bridge design
- Bridge shape / contour design / field of vision study (3D)
- Bridge workplace arrangement & detailed design
- Bridge doors, windows and window wiper arrangement
- Bridge detailed furniture design
- Bridge operator chair & deck rails specification
- Bridge console controls & displays arrangement

ECR, control rooms and control cabins
- ECR design
- ECR Human Factors / Ergonomics review
- ECR (detailed) workplace design
- ECR detailed furniture & console design
- ECR console controls & displays arrangement

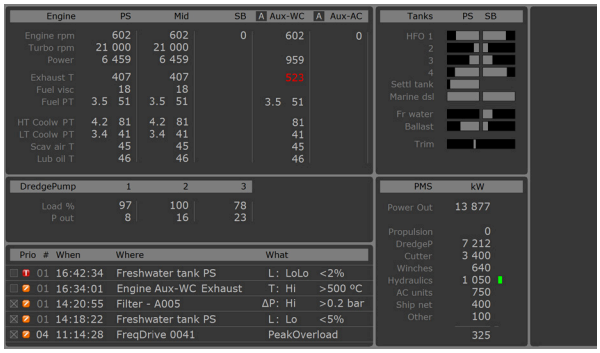
Accommodation
- Accommodation design
- Routing and arrangement analysis
- Cabin arrangement, design and optimisation
- Galley, messroom, recreation room, gym and office design.

Deck
- HF optimalisation of deck arrangement
- Shelters
- Crane cabin design

HMI - Human Machine Interaction

An effective way to keep the operators' cognitive workload within acceptable limits, is by using ergonomically designed User Interfaces.
Some basic characteristics are:

- The amount of distinct User Interfaces is kept to a minimum. In this case 'less is often more'.
- The User Interface design allows the operator to have a maximum of situational awareness at a minimum of cognitive workload.
- If User Interfaces are used in bright daylight, but also in dusk and night situations, separate day/dusk/night colour schemes are provided. An alternative way is to use special marine-spec monitors with 0-100% backlight dimming – or a combination of both options.
- Alarm rates are low (typical max. 1 per 10 min).
- The ratio between font size, screen size and viewing distance is designed according to common Human-Computer-Interaction guidelines (like in ISO 11034).



- Essential information is displayed permanently to the operator, and always at the same location.
- Well-designed User Interfaces can often be recognized by a simple, sober and stylistic appearance.
- Information redundancy (same information is displayed on two or more instruments, often in various formats) is avoided.

Note that on a ships bridge, direct vision of the environment outside is in many situations the best possible and most reliable User Interface of all. This means that the position and size of TFT screens should never obstruct the outside view.

Optimal crew design

Technology pushes towards autonomous ships, minimal crews, and remote real time control of locks, bridges, and oil & gas production facilities. A crew is a team of operators performing operational tasks on deck, at the bridge, in the control room, or at the crane cabin. In addition, there will be management and maintenance activities.

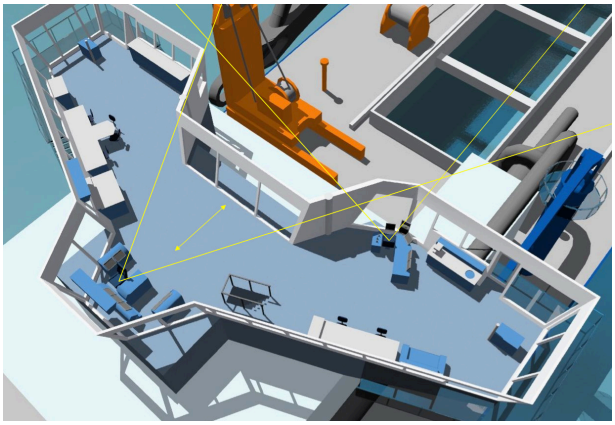
Any Human Factors contribution starts with a task analysis to get insight in human operator tasks. This information is the key for a good estimate of workload, communication requirements, and on how to organize all tasks efficiently.

Crew reduction is possible by automation of specific tasks, removing 'non-value adding tasks', or improved planning of tasks. Effects of automation need to be investigated. It is not uncommon, that project estimates are rather optimistic.

Once the number of crew members is established, we are able to determine the number of workplaces, space requirements, the number of systems/screens, and console size. It will also result in a draft layout of a bridge or control centre, reflecting relationships – communication – between users: the work organization.

3D Models

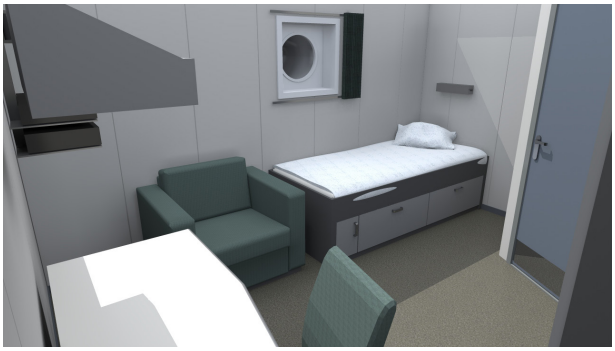
During initial design, it is always difficult to get a good impression of a work environment. In particular for complex systems, 2D drawings do not suffice. To answer this type of questions an analysis using 3D computer modeling is useful. We use the industry standard AutoCAD for this purpose. It is possible to generate pictures and movies from every conceivable position. These can be used for example to simulate the field-of-vision from the bridge, a crane cabin, or on a heli deck.



Interior Design

An attractive interior design helps to create a pleasant atmosphere on board. This applies not only to luxurious cruise ships, but also to cargo ships, special purpose ships, oil & gas production platforms, etc. Well designed furniture and a carefully selected colours and materials have a positive effect on the crews/operators comfort, usually without additional investment cost.

Before



After

Topsides

Oil and gas offshore topsides are similar to seagoing ships: they are designed as a self-supporting working and living environment at sea. Therefore, much of the information found in this leaflet applies to ships and topsides as well.

Concerning Human Factors, topsides have a slightly different focus:

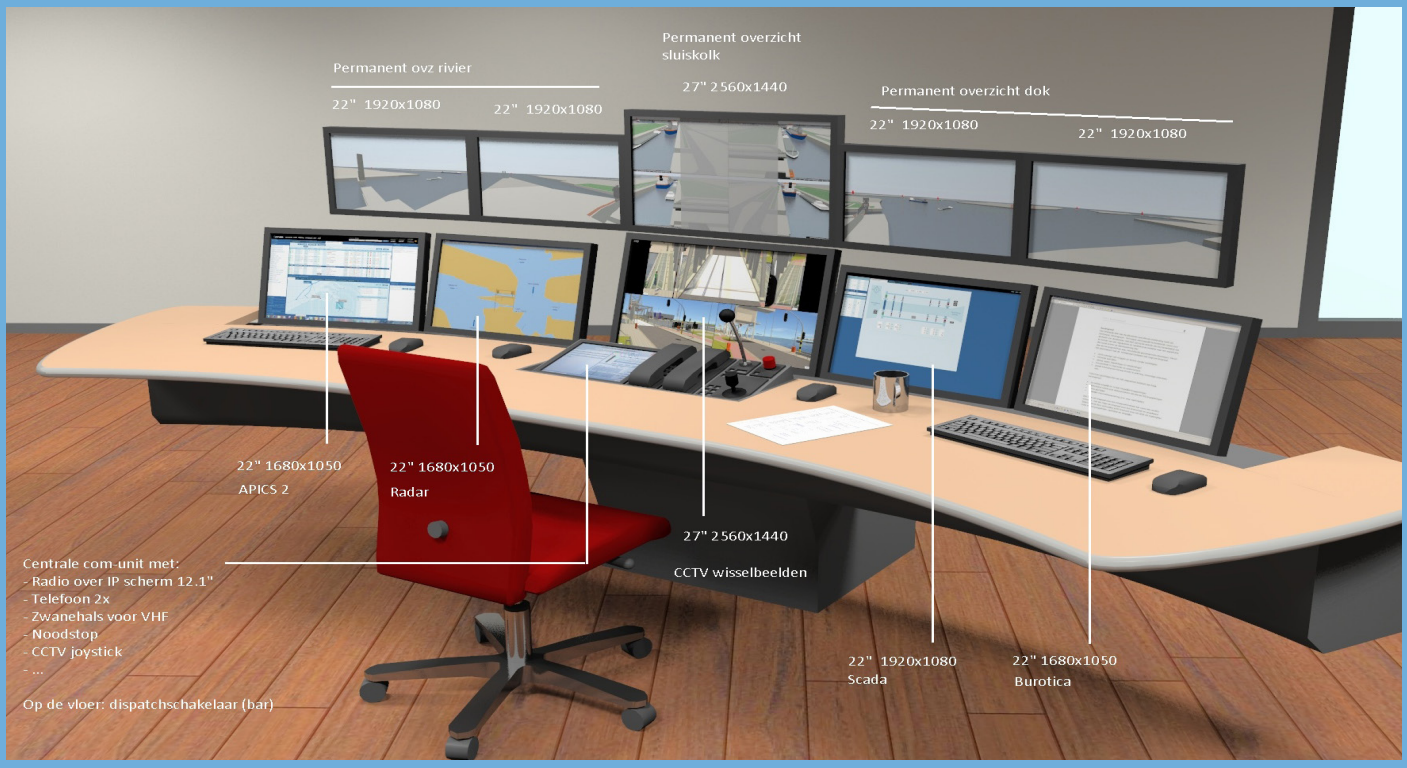
- The control room is usually the centre of the platform, typically combining multiple functions like process supervision, command centre, helicopter traffic control, radio room, logistic centre, office, meeting room and emergency room.
- There is much more focus on safety, because of the intrinsic risks of oil and gas handling.
- The topside design has to comply with specific offshore rules and regulations
- Lack of space is a common problem on the smaller topsides. This problem can be minimized by a clever combination of functions, and a 'space emphasizing' design.

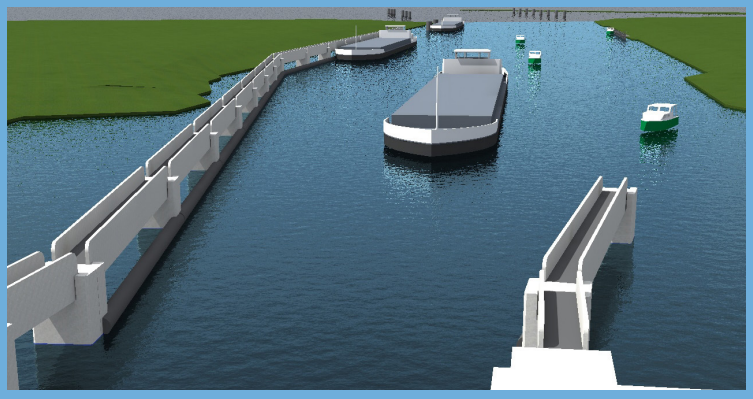
Another interesting aspect of topsides is related to 'remote supervision'. It is possible to significantly reduce manpower, by operating the platform from a onshore control room. Pilot projects at Total EP and Engie EP revealed this development is also feasible for existing platforms.
The focus lies on User Interface Design, by developing specific SCADA graphics and presentation standards for remote control.

About ErgoS

ErgoS specializes in Human Factors Engineering (HFE) of Control Centres. There are 8 Human Factors Professionals with a variety of educational backgrounds working at ErgoS, of which 5 are certified European Ergonomists. HFE aims for optimizing the work system, including operator workload, jobs, work organization, control centre layout, workplace layout, instrumentation, graphics, and the work environment.

Workplace design for remote control





CCTV

On off-shore vessels usually many activities take place. Most of them cannot be seen from the bridge (or other central areas). Modern digital cameras offer a way out.
We systematically develop camera plans, including CCTV-location, type of camera, and image pre-processing software.
It is one way to design towards safe-working with reduced crews.

Coast Guard & VTS-Centres

Maritime HF also applies to onshore control centres, such as VTS-stations, Coastguard centres, and remote lock & bridge control. Typical workstation include (maritime) communication equipment, radar-screens, and CCTV-images.

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Human Factors Engineers & Consultants

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