



Eye-tracking heatmap, displaying visual attention distribution, at the Full Mission Bridge Simulator

Understanding and optimising human operator performance

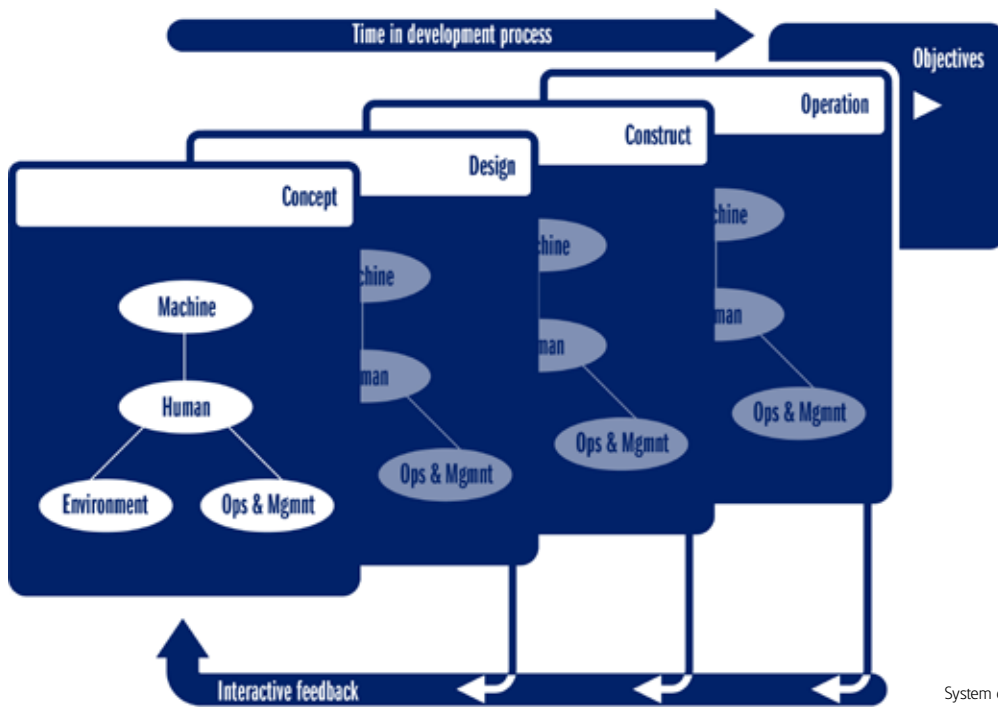
The maritime domain covers a huge variety of operations, from 400 m plus size container vessels to fast rigid hull inflatable boats to inland barges and gas carriers. However, there is one common factor in all of these operations: the human operator plays a vital role in making the operation effective and safe.

When a new type of operation is developed or an existing operation is changed by adding new technology for instance, it is vital to ensure that the human operators are able to perform their future tasks effectively.

MARIN supports a human-centred design approach for operations - meaning that the human element is taken into account from the very start of the concept definition phase, up to the moment the operation is executed. In many cases the human operator is seen as the cause of an incident, but far more often the operator saved the day by taking actions in unforeseen and unpredictable situations. A well-designed operation can make the human element the strongest link in the chain, but at the same time, a bad design can also make it the weakest link.

Human-centred design A human-centred design approach starts by defining the task of the operator and his or her responsibilities in an operation. Who are the team members to cooperate with, which technology is available to support him and which actions can he take? Which goals should be achieved? These questions are important to answer in order to define user requirements in an early (concept) stage in the development lifecycle of a new ship, maritime system or, in the broadest sense, a future operation. Well-defined user requirements are necessary for a system design able to cover all the functionalities of a future operation. Including (potential) end-users in the development process allows the design team to get early input from an operational point of view, thereby avoiding incorrect assumptions. Developing

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System development life cycle

a prototype of a future operation is a good way to involve future users and to ensure all the user requirements are met.

Safety assessment A safety assessment can help to define weak spots in an operation and this provides important input for the user requirements. MARIN uses a Formal Safety Assessment (FSA) including a Human Reliability Assessment (HRA), which is a proven manner to zoom in on potential risks. Expert opinions, with the addition of factual data, provide a way of estimating the risks beforehand. Having these risks

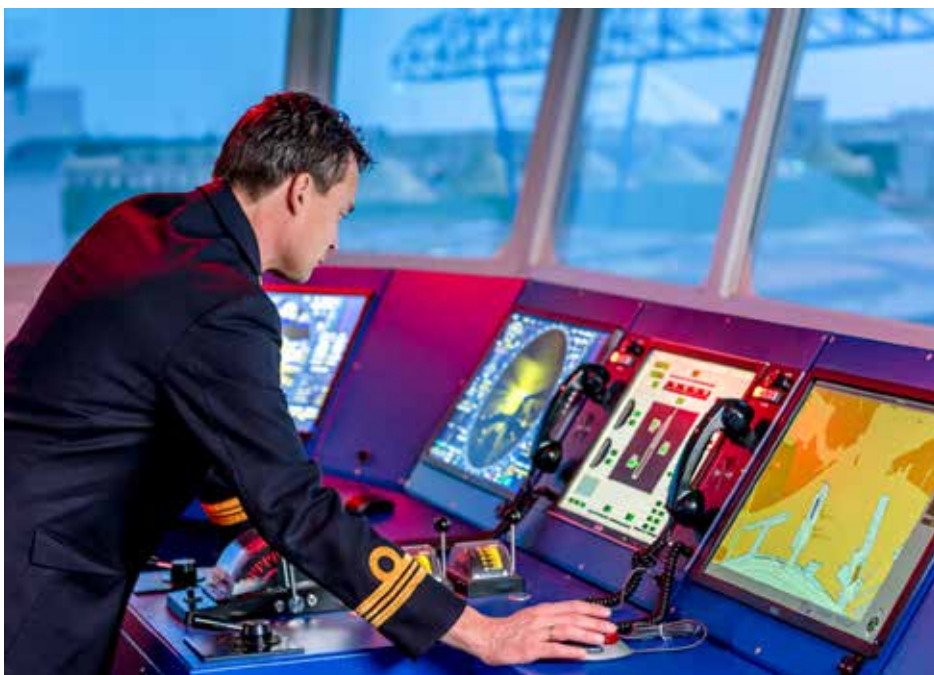
defined, the user requirements can be adjusted and the design can be altered.

Human Performance measurements

Once a prototype has been developed, this offers a practical opportunity to assess the operability of this prototype with end-users in a simulator. As part of a human-centred design approach, the human performance is key in such a simulator evaluation. Objectifying the human performance is possible by using human factor measurements such as eye-tracking. Additionally, the performance (achieving the goals) of the participants can be

determined by data recording key parameters. MARIN has developed a toolbox for the integrated analysis of recorded data from simulators. Additionally, it is important to retrieve opinions, observations and suggestions from the participants. Combining both subjective participant input and objective analysed data from the toolbox provides a good insight into whether the prototype enables end-users to perform the designed operation effectively and safely, or whether the design should be adapted.

Training Once the design is sufficiently mature, the next phase is to prepare the future operators. MARIN has defined a training method to develop specific training courses. This starts by defining the training needs for the (future) operators. Next the required competences are defined and a selection of the available training opportunities is made. Content is then developed for both theoretical and practical training. MARIN's well experienced instructors are also available to provide training or to train the instructors.



The human-centred design approach covers all lifecycle stages - from concept, design and construction to operation. Nevertheless, applying just a single step from this approach may already serve your needs when optimising an operation. Either way, MARIN can assist clients in making sure the human factor is the strongest link in the chain. ▢