



The importance of the Human Factor

The human factor has always been an important area of research at MARIN, and here Report outlines the many ways the organisation is involved.

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It is widely reported that 70% to 80% of maritime accidents are caused by human error (Health and Safety Executive, 2003). Technical improvements in vessel design or operational equipment leads to improved safety and a subsequent decrease in accidents but as a result, the contribution of human errors as one of the main causes of maritime accidents shows a relative increase.

The human factor can be explored in several different ways. A manoeuvring simulator makes it possible to study workload and performance in relation to task demand. An operator's performance is a result of the combination of the actual task, combined with elements like fatigue and cognitive processing. Both task demand and operator state are influenced by environmental factors.

When it comes to task related considerations, it is necessary to ask questions such as: Is the operator working alone or within a team? How are the tasks distributed? What is being communicated? (Is there commercial pressure? A good safety culture?) The availability of information at the bridge is also an issue. Meanwhile, the operator state is influenced by working hours, shift patterns, duration of the operation, motions, daylight and so on.

Systematic approach A systematic approach is necessary to unravel all the components that play a role in the safe execution of a complex operation. By using a combination of both subjective and objective measures such as rating scales, a reaction time test and heart beat and performance measurements, MARIN is able to measure workload and performance in both a manoeuvring simulator and on board.

When looking at the affect of increasing task demand on workload a study took place whereby pilots trained for a complex journey before they had to sail a new built vessel in real life. Training focused on the more demanding parts of the journey. Based on his experience the instructor classifies the runs as easy, moderate or difficult. Results showed that in the difficult runs performance decreases and workload increases.

After training, measurements are also executed on board. In general, the results indicated a higher workload level was experienced when compared to the simulator. The effect of longer working hours and the pressure of the real operations are clearly seen in this result.

The pilot's contribution in this experiment increased their awareness of human failure, especially related to fatigue. During the next real operation they scheduled more recovery moments to increase alertness.

Hierarchic Task Analysis MARIN also deploys Hierarchic Task Analysis (HTA), which is a systematic method to categorise tasks and is useful to indicate time needed, frequency of tasks, who does what, how much pressure people feel they are under etc. Both the task and the working environment/system are taken into account.

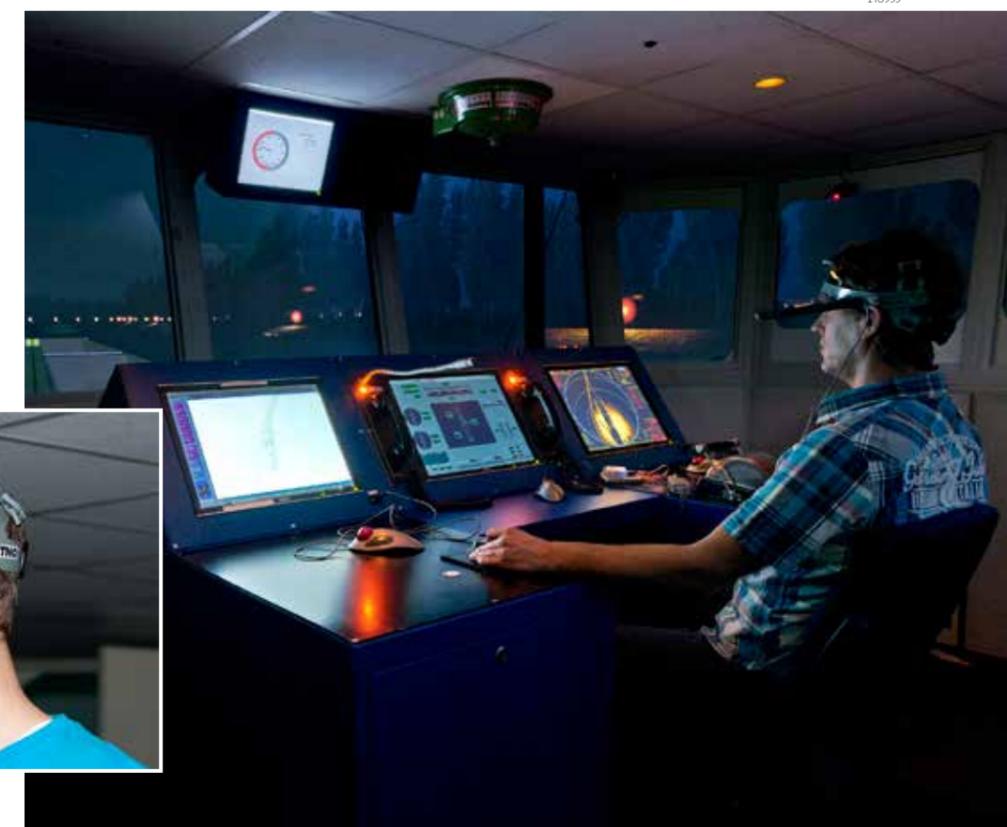
In another important study, MARIN examined how variations in working strategy express workload differences. Changes in workload were studied for both pilots and skippers, while sailing along the same channel. MARIN found that both experienced a higher workload when there were no bank lights. But due to differences in vessel and bridge design, skippers and pilots developed different working strategies. The skipper, whose vessel is more sensitive to wind, mostly uses the radar for course keeping and completes the

picture with information from outside, while the pilot mainly used the outside view.

Pilots were more accustomed to controlling the process and anticipated future actions, while the skippers were busier with reacting to events such as correcting the sideways velocity after passing the first vessel and detecting the second vessel on the radar.

Human Factor Observatory From all of the research MARIN recognises that it can be difficult to translate answers from a simulator setting to on board situations. Therefore, collecting on board data and comparing these measurements with data from the simulator is essential.

To overcome this gap MARIN is working towards a "Maritime Human Factor Observatory": an environment to study behaviour of maritime personnel, using the above-mentioned methodology but with the addition of task registration, eye tracking and other tools. Observations will not only take place in an advanced simulator but also on board using mobile toolkits. ▢



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