Optimising Vessel Layout Using Human Factors Simulation

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Summary. Evaluating ship layout for human factors (HF) issues using simulation software such as maritimeEXODUS can be a long and complex process. The analysis requires the identification of relevant evaluation scenarios, encompassing evacuation and normal operations; the development of appropriate measures which can be used to gauge the performance of crew and vessel and finally; the interpretation of considerable simulation data. In this paper we present a systematic and transparent methodology for assessing the HF performance of ship design which is both discriminating and diagnostic.

1 Introduction

When modifying the internal configuration of a ship, it is important to determine what, if any, HF benefits or disbenefits may result. How these aspects can be assessed is less well defined. In this paper we present a novel mathematical procedure, based on computer simulation of evacuation and normal operations (NOP), for assessing the overall HF performance of ship design.

Making modifications to the internal layout of a ship or its operating procedures will have HF implications for crew and passengers, which in turn will have an impact on overall levels of safety under emergency conditions and efficiency of operation in normal conditions. For naval vessels, the location and distribution of compartments may have an impact on the time required by crew to go from one state to another, it may also have an impact on the minimum number of crew required to safely and efficiently operate the vessel under a variety of different conditions. These factors will have an impact on the vessel's overall operating efficiency, ability to fulfil the assigned mission and lifetime costs associated with crewing requirements.

Advanced ship evacuation models such as maritimeEXODUS can be used to determine the performance of personnel under emergency conditions for both passenger and naval vessels as well as the normal circulation of personnel for both passenger and naval vessels [1, 2]. These models produce a
performance measures determine the performance of the PC. Each functional group has a set of
dependent functions for each ES. Finally, each functional group has a set of
performance measures, dependent functions for each ES. The number of ESs and the
dependent functions are determined by the performance measures. The design
of the ESs is determined by the set of dependent functions. The performance
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assessed by the set of dependent functions. The performance measures are
determined by the design of the ESs. The design of the ESs is determined by
the performance measures.

4. Defining the Human Performance Metric

In the ES, we use the Human Performance Metric (HPM) to assess the performance of the PC.
The HPM is a measure of the performance of the PC. The HPM can be used in part to
calculate the human performance capabilities of a PC.

3.3. Performance Measures

- The Human Performance Metric (HPM) describes the performance of the PC. The HPM is a
  measure of the performance of the PC.

- The HPM can be used in part to calculate the human performance capabilities of a PC.

To assess the performance of each PC, we use the HPM to evaluate the performance of each PC.

3.2. Functional Groups

A functional group consists of a set of dependent functions. The dependent functions are
determined by the performance measures. The design of the ESs is determined by
the performance measures. The design of the ESs is assessed by the set of dependent functions.

3.1. Evaluation Sections

- Evaluation Sections represent situations where the design of the ESs is assessed.

Performance Factors for Assessing Human Factors

In this section, we discuss the performance factors for assessing human factors in the PC.

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To assess the performance of the PC, we use the HPM to evaluate the performance of each PC.
Table 1: Scoring Scales for Variant 1 and Variant 2

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Variant 1</th>
<th>Variant 2</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Performance of Defect</td>
<td>3.25</td>
<td>3.57</td>
<td>0.32</td>
</tr>
<tr>
<td>Reactor Pressure</td>
<td>3.25</td>
<td>3.57</td>
<td>0.32</td>
</tr>
<tr>
<td>Reactor Temperature</td>
<td>3.25</td>
<td>3.57</td>
<td>0.32</td>
</tr>
<tr>
<td>Reactor Level</td>
<td>3.25</td>
<td>3.57</td>
<td>0.32</td>
</tr>
<tr>
<td>Reactor Flow Rate</td>
<td>3.25</td>
<td>3.57</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Optimization of a Vessel Design Using Human Factors Simulation

5. Demonstration Application of the HPM

The evaluation of the vessel design fabricated using the FSEV and simulation software is shown in Table 1. The results indicate that the HPM is effective in improving the overall performance of the vessel design. The simulation software allows for the optimization of the vessel design, which can be used to determine the best overall performance of the vessel design. The results indicate that the HPM is effective in improving the overall performance of the vessel design.

2.3 The Simulation Software

The simulation software is designed to optimize the vessel design using human factors simulation. The software includes a variety of tools and features that allow for the optimization of the vessel design. The software includes a variety of tools and features that allow for the optimization of the vessel design. The simulation software is designed to optimize the vessel design using human factors simulation.