ANALYTICAL COMPARISON OF DIFFERENT TANKER SIMULATORS
BY UTILIZING AHP METHOD

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ABSTRACT

Tanker ships are more complex vessels than other types of ships and they need specialized trainings for seafarers. Tanker simulators are widespread used at Maritime Education Institutions for completing theoretical education. Istanbul Technical University Maritime Faculty (ITUMF) has two different tanker simulators that are used both for undergraduate level Maritime Faculty students and master and officers whom are joined several training programs under the Continuous Education Centre of ITUMF. These simulators have different hardware and software characteristics. Because of these differences several factors, such as capacity, reality, functionality, visuality, availability of fast time simulation etc., are affecting the efficiency of training between these two simulators.

The Analytic Hierarchy Process Method (AHP) is a mathematical method that is used for analyzing complex decision problems with multiple criteria. In this study, the factors which are important for efficient learning on tanker simulators are examined in hierarchical structure and a comparison has done among two simulators taking into account above mentioned factors. The factors are weighted by utilizing AHP. After observing of strengths and weaknesses of simulators, several decisions have done such as which simulator will be used on different levels and different type trainings. The aim of this study is to improve tanker simulator trainings and maintaining safe operation of tanker ships.

Keywords: Tanker Simulator, AHP Method, Training

1. INTRODUCTION

Tanker ships are more complex vessels than other types of ships and they need specialized trainings for seafarers. Large quantities of crude oil, liquid chemicals and liquefied gases are carried by several tankers all over seas. Liquid cargoes have different properties and tanker ships are complex ships than other types of ships. Carriage of liquid cargoes contains different hazards both for human life and marine environment. There are several cargo operations which are regularly done on tankers such as loading, discharging, inerting, tank washing, sampling, gas freeing etc. Tanker ships are under several risks which may occur during the loading and unloading. Care should be paid to minimize this risk as far as practicable in each cargo handling case, based upon the best knowledge and technology on the construction and equipment of the ship and the properties of the cargoes intended to carry (Arslan & Er, 2008). Some cargoes which are carried by tankers need heating, some need refrigerating/freezing, some must be kept under inert conditions, some need to be carried in stainless steel tanks, and some are flammable, explosive or give off noxious vapor (Hanninen & Rytkonen, 2006) and these properties require careful consideration during the cargo planning process and loading. Therefore tanker training has become critical issue in maritime industry. The Tanker simulators are widespread used at Maritime Education Institutions for completing theoretical education. Istanbul Technical University Maritime Faculty (ITUMF) has two different tanker simulators that are used both for undergraduate level Maritime Faculty students and master and officers whom are joined several training programs under the Continuous Education Centre of ITUMF. These simulators have different hardware and software characteristics. Because of these differences several factors, such as capacity, reality, functionality, visuality, availability of fast time simulation etc., are affecting the efficiency of training. The Analytic Hierarchy Process Method (AHP) is a mathematical method that is used for analyzing complex decision problems with multiple criteria. In this study, the factors which are important for efficient learning on tanker simulators are examined in hierarchical structure and a comparison has done among two simulators taking into account above mentioned factors. The factors are weighted by utilizing AHP. After observing of strengths and weaknesses of simulators, several decisions have done such as which simulator will be used on different levels and different type trainings. The aim of this study is to improve tanker simulator trainings and maintaining safe operation of tanker ships.
2. METHOD USED IN THIS STUDY
The AHP is a mathematical method for analyzing complex decision problems with multiple criteria. It is developed by Saaty (Saaty, 1977). By utilizing the AHP, factors can be weighted and rated quantitatively and it can deal with qualitative attributes as well as quantitative. AHP is used in many fields, such as planning; selecting the best alternative; resolving conflicts; and optimization problems with other techniques, such as linear programming, fuzzy logic, quality function deployment. (Vaidya and Kumar, 2006). Brad used AHP in 1986 as a multi-objective methodology for selecting sub-system automation options (Brad, 1986). Braglia used AHP for analyzing multi-attribute failure mode analysis (Braglia, 2000), and Ceha and Ohta used AHP for evaluating of air transportation network (Ceha and Ohta, 1994) and Ghodsypour and Brien applied AHP with linear programming for supplier selection problem (Ghodsypour and Brien, 1998).

This study illustrates the pair wise comparisons that are carried out within two tanker simulator by using evaluation criterias. The comparison making group is consisting with 2 of tanker training lecturer in ITUMF whom are experienced an several types of tankers; 2 Unlimited Master and 2 Chief Officer whom are experimented on tankers; 1 Training Manager of tanker management company and 2 naval officer whom are trained on both tanker simulators. The comparison scale vary from 1 to 9; 1/1 indicates equal intensity, while 9/1 indicates extreme or absolute intensity. The pair-wise comparison scale is indicated in Table-1.

In the pair wise comparisons, priorities of evaluation factors can be obtained using the pair wise comparison matrix as the input of the principal eigenvalue method (Shimno et al, 2006).

<table>
<thead>
<tr>
<th>Intensity of importance</th>
<th>Definition</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>1</td>
<td>Equal importance</td>
<td>Two activities contribute equally to the objective</td>
</tr>
<tr>
<td>3</td>
<td>Moderate importance of one over another</td>
<td>Experience and judgment strongly favor one activity over another</td>
</tr>
<tr>
<td>5</td>
<td>Essential or strong importance</td>
<td>Experience and judgment strongly favor one activity over another</td>
</tr>
<tr>
<td>7</td>
<td>Very strong importance</td>
<td>An activity is strongly favored and its dominance demonstrated in practice</td>
</tr>
<tr>
<td>9</td>
<td>Extreme importance</td>
<td>The evidence favoring one activity over another is of the highest possible order of affirmation</td>
</tr>
<tr>
<td>2,4,6,8</td>
<td>Intermediate values between the two adjacent judgments</td>
<td>When compromise is needed</td>
</tr>
</tbody>
</table>

3. TANKER SIMULATORS IN ITUMF
ITUMF has two different tanker simulators that are used both for undergraduate level Maritime Faculty students and master and officers whom are joined several training programs under the Continuous Education Centre of ITUMF. These simulators have different hardware and software characteristics.

3.1. Specifications of Simulators
Normal and emergency tanker operation trainings are carried out in accordance with governing international rules by both simulators. Trainings include operational planning, loading/discharging operations, ballast operation, tank cleaning, aeration, pollution control, cargo selection, stability control etc… These trainings are available both for students and to the industry as regulated by STCW-95 and STCW A-V1. The specifications of these simulators are illustrated in Table-2:
Table 2: Specifications of Simulators

<table>
<thead>
<tr>
<th></th>
<th>Transas</th>
<th>Ship Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foundation Date</strong></td>
<td>2003</td>
<td>2005</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>6</td>
<td>24 (12+12)</td>
</tr>
</tbody>
</table>
| **Software**           | Transas LCHS 2000/LCC Petroleum Tanker Simulator  
                        | Transas LCHS 2000/LCH Chemical/Product Tanker Simulator  
                        | Transas LCHS 2000/LNG Liquified Natural Gas Tanker Simulator  |  
                        | Ship Analytics Suezmax Crude Oil/Product Tanker Simulator  
                        | Ship Analytics LCHS Chemical Tanker Simulator  
                        | Ship Analytics LNG Membrane Tanker Simulator  
                        | Ship Analytics LPG Carrier Tanker Simulator  |
| **Fast Time Simulation** | Available                      | Not Available                     |
| **Ship Stability Control&Calculation** | Available | Available |
| **Double Screen/monitor** | Not Available                  | Available                         |

Transas Tanker Simulator is shown in Fig.1 and Ship Analytics’ is shown in Fig.2.

Figure 1: Transas Tanker Simulator
4. APPLICATION RESULTS and CONSIDERATIONS

In this study, evaluation criterias for tanker simulators are observed and the factors are clustered in hierarchical structure as shown in Fig 3. The hierarchical structure has consisted from four clusters. Main cluster is body cluster; second cluster is consisting from main evaluation groups: hardware and software; third group which indicates sub evaluation criteria and last cluster is ‘decision’ cluster. Physical conditions of simulators are evaluated under ‘hardware’ main cluster. Capacity of simulator rooms; quality of hardware; ergonomics of simulator rooms and technical service availability criterias are evaluated under ‘hardware’ main criteria. User friendliness of software; availability of fast time simulation; visuality and reality of software and availability of different types of ships and cargoes are evaluated under ‘software’ main criteria.

Fig.4 indicates the results of comparison among two simulators according to criterias. According to results, software of Transas Simulator is better than Ship Analytics’ but hardware of Ship Analytics Simulator is better. Visuality, fast time simulation availability, user friendliness are advantageous specifications of Transas Tanker Simulator. Hardware quality, capacity, reality are advantageous specifications of Ship Analitics Tanker Simulator.
Taking into account the below mentioned AHP computation results, following practical results are suggested for efficient tanker training at ITUMF: Transas Simulator’s priority is more than Ship Analytics Simulator. Transas Simulator is more user friendly and visual but Ship Analytics has more capacity and more realistic. Visuality is important factor for training. Use of Transas Simulator for small groups of undergraduate level beginner students will be better at early stages of training. Then Ship Analytics Tanker Simulator should be used for continuing trainings. Use of Ship Analytics Tanker Simulator will be better for advanced users such as master and chief officers whom are joined several training programs under the Continuous Education Centre of ITUMF. Combined use of both simulators for trainings will be more effective. Weaknesses of simulators should be converted into strengths such as increasing capacity of Transas Simulator.
5. CONCLUSION

It is clear that tanker operations are more complex and dangerous when compared to other types of ships. Working on a tanker needs extra knowledge, skills and precautions. Tanker simulators are widespread used at Maritime Education Institutions for advanced tanker trainings. The aim of this study is directly concerns with the utilizing Analytic Hierarchy Process identification for selecting better simulator for tanker trainings and observing the strength and weaknesses of available simulators. First level of strategy making is to observe the present situation and sources. It is clear that if the importance of evaluation criterias observed and quantified well, tanker trainings will be planned well. The main aim of this study is to improve tanker simulator trainings and maintaining safe operation of tanker ships y utilizing AHP method.

6. REFERENCES


