Analysis of Workload Soldier Warship Unit Ship Fast Koarmatim Using Nasa TLX Methods (Task Load Index)

Giani Ferianto[1], Ahmadi[2], Okol S Suharyo[3], Arica Dwi Susanto[4]
[1]*Indonesian Naval Technology College, Bumimoro-Morokrembangan, Surabaya 60187, Indonesia*
[2]*Indonesian Naval Technology College, Bumimoro-Morokrembangan, Surabaya 60187, Indonesia*
[3]*Indonesian Naval Technology College, Bumimoro-Morokrembangan, Surabaya 60187, Indonesia*
[4]*Indonesian Naval Technology College, Bumimoro-Morokrembangan, Surabaya 60187, Indonesia*

Abstract

Various activities and duties of soldiers in the ship when the War Ship carrying out operations task very possible occurrence of excessive mental workload on the personnel that can result in individuals and organizations. Moreover, added the condition of the ship is small, narrow and easily falter if buffeted by sea waves have an impact on soldiers inconvenience and directly affect their workload. This study will identify the indicators that could be expected to cause excessive mental work load on soldiers in the War ship level rank strata and between departments that have mental workload is higher, by using the method NASA TLX. The population in this study is the personnel warrior War ship with a total sample of 43 people. NASA TLX method is preferred because it is easy to apply and has several advantages in terms of the validity and accuracy of the results. The results of this study indicate that there is a high mental workload on some of the indicators in the NASA TLX of strata rank and each department. The average value of mental work load higher officer of NCO and enlisted men. While the Department of Engineering showed a higher workload than other departments. Advice that can be given is to provide a proportional mental workload when carrying out activities on the ship as prevention of excessive workload and reduce the risk of accidents. Additionally DSP adjustments, especially when carrying ship cruise or duty operations at sea.

Keyword - *NASA TLX, Workload, Warship*

I. INTRODUCTION

The Indonesian Navy has the main duty of performing the tasks in the field of defense, enforcing the law and maintaining security in the territorial sea of national jurisdiction in accordance with the provisions of ratified international law, carrying out the tasks in the development of marine forces and implement the empowerment of marine defense areas. It is as stipulated in Law Number 34 Year 2004, Article 9. The task of the Navy, in general, includes: implementing state defense, protecting the nation's safety, carrying out military operations, and maintaining regional and international peace. To carry out its main function, the Navy mobilizes all Warship of the Republic of Indonesia spread throughout the archipelago, in the western region under the command of the Commander of Western Fleet and in the eastern region under the command of the Eastern Fleet Commander.

The warship of the Republic of Indonesia is one of the main elements of marine aspect operational which is part of the Integrated Fleet Weapon System. The grouping of ship in the three forces is the striking forces, patrol forces and supporting forces to function as the fighter in the appropriate way. The small ship unit owned by the Indonesian Navy is fast hitting vessels equipped with turbine engines so it is very necessary in carrying out the tasks of the Sea Combat Task Force to defend the territorial waters of Indonesia.

Running a warship required an organizational system to support the operational task of maintaining the waters and borders of the Republic of Indonesia. In this case, the number of warships personnel will determine the effectiveness of regional guarding. Based on this, the imbalance or lack of personnel can have an impact on the performance and mental decline of the soldiers because the workload is increasing when performing tasks that are not its capacity.

Work is the number of jobs intended for workers in period of time (Dasgupta 2013). The workload describes the interaction between an operator performing the task and the task itself. In other words, Stress exists in every organization both big and small workplace and organization has become very complicated because it exists (Qureshi 2013). Work performance relates to the workplace, it most often refers to work standards that are in line with good quality and productivity (Omolayo 2013). Political production and deviation are considered minor temporary deviations of property and personal aggression are considered serious deviations (Radzali 2013). Lack of balance between workload and capabilities and limitations of individuals within various jobs can affect them public health (Beheshti MH 2015). Based on previous research, more research on the problem of work life balance has been done because of awareness from the effects of a demanding work environment in today's competitive world of the new age (Omar 2015). This study aims to validate the perceptual constructs that have been identified teacher workload. In particular, this study is to determine the structure of these factors teacher perceptions about workload by using exploratory factor analysis (Harun 2015). Ship resistance is the basic parameter, where the

entire propulsion system depends - both propellers (and geometry) as well as propulsion engines (power, rotation) (Żelazny 2014). For example, the GOMS model is human-specific information processor model for HCI observation (Ramkumar 2016). Mental workload is an important measure to understand human-machine interaction in the work environment and more and more studies in the literature about mental load measurements are taken into account (ŞEKER 2014). Emergency management is a complex process that requires different coordination actors, with different cultures, goals, and worldviews. (Coelho1 2015). Getting a level of mental workload during a forced task is a difficult procedure (Al e x CA o 2009). Currently, with technical developments, the level of civil aircraft accidents has declined gradually. According to NASA statistics, however, more than 75% of accidents are related to human performance (Yiyuan 2011). Mental workload is an important measure to understand human-machine interaction in a work environment and a growing number of studies in the literature on the measurement of mental workload are noticed (ŞEKER 2014). The technological revolution has gradually remove human operators from many people complex system from the frontline level controls and actions they are delivered through mass of computer and intervening Microprocessors (Anju L. Singh 2010). The purpose of this article is to fix this problem; situation by providing practitioners with a general overview of the prominent human error perspectives in the literature.

Examples of frameworks that characterize each approach are provided, as well as a critique of the strengths and weaknesses of each perspective (Wiegmann 2000). The term workload illustrates the difference between the capacities of the human information processing system In this study, it became clear that six adverse environmental factors impacts the amount of stress facing employees in hot and humid conditions (H & H) working environment: temperature, humidity, radiant heat, workload, clothing, and airspeed. Other factors may be significant affect stress levels, (Ghahramani 1999). For increased productivity in the manufacturing industry, worker efficiency plays an important role. Worker productivity is highly dependent on the ergonomic design of the workstation. Ergonomically efficient at workstation design shows better interaction between human-machine systems (Shinde 2012). The technological revolution has gradually removed the human-operators of many complex systems from front-line levels of control and having their actions relayed via an intervening mass of computers and microprocessors (Singh January 2010). Educational interventions targeting children and young people are another means by which harm from drugs, alcohol, and other health behaviours can be minimised across the lifespan (Moss 2017). That is expected to satisfy the expected performance and that capacity is available for actual performance. Henry R. Jex defines mental workload as "the operator 's evaluation of the attention load margin (between their motivated capacity and the current task demands) while achieving adequate task performance in a mission - relevant context. Workload can be measured through psycho physiological index, behavior and subjective judgment.

The workload can be identified by several factors including physical factors, mental time, performance and effort as well as the level of stress experienced by the crew. These factors are basically anticipated by the division of watch time. The one method that can be used to measure workload is NASA TLX (Task Load Index). NASA - Task Load Index (NASA-TLX) is a subjective measurement method to find out the workload of the worker's mental work. As the study shows that NASA TLX can help the measurement of workload.

Research on workload by soldiers has been basically investigated. However, there is still an opportunity to assess and measure the workload of warship soldiers on duty in the area of operation, where workload measurements are carried out on the duty of the sea and onshore during the voyage according to the shift-share of the vessel using NASA TLX calculations to analyze the magnitude of the load differential work between soldiers who served in the area of operation and who are in the base. With the conditions of the warships that are not so vast and easily faltered by the sea waves, personnel and crew must be able to adjust both physically and mentally while carrying out duties in the area of operation. Moreover, operational warship is always active and demands continuous alertness in the field of operation, coupled with the demands of shift vessel time that suppresses and affects the workload of soldiers warship.

Based on the description described, the purpose of this research are; measuring the workload of warship Soldiers as a whole who was in the operation area; identify shift phases of excessive shipbuilding time while carrying out duty on duty and onshore; analyzing differences in personnel workload according to rank level and each department.

II. MATERIALS METHODS

This research includes the type of qualitative research where the data is taken directly from the respondents is warrior warships. The research step begins with the formulation of problems and research objectives. Then followed by library study and field study followed by data collection of both primary and secondary data, followed by the weighting of mental load indicator which is a step from NASA TLX method. The tools used in this study include questionnaires and NASA TLX software. In the design of this questionnaire is made based on activities carried out regularly by war ship soldiers in accordance with the existing schedule. Division of Questionnaire NASA TLX mental indicator is distributed to the respondents during the voyage. How to adjust, physical needs, needs time, performance, level of effort and frustration. In NASA TLX, the process of data collection and questionnaires has two processes, namely, the respondent must fill in the column about the NASA TLX rating first and then fill in the weight of the comparison. NASA TLX Rating, there are 6 (six) indicators that should be marked by respondents, where these six indicators

measure the level of stress in each indicator. Comparative weighting at this stage is one aspect that should be filled by respondents, where respondents mark each comparison, to show which is more dominant between the comparisons of each other, this comparator consists of 15 comparison, where the beginning there is six indicators exist in NASA TLX, so each indicator is between each other.

The sample determination was carried out by experiment design by grouping the object of research in two parts: personnel in charge of sea guard and land guard while performing duty in operation area. Each part will be taken different amount according to the population of each part (object). Data processing is done by using the NASA-TLX method The steps of measuring the mental workload using NASA-TLX are as follows:

a. Weighted the results of the questionnaire.
b. Rating.
c. Calculation of WWL value.
d. Categorization of workload assessment

After getting the results of data processing using the NASA-TLX method, then next is to do the analysis of the data processing results. Categorization of workloads can be divided into several criteria, among others, the value of 0-29 in the category of low workload, 30-49 medium workload category, 50-79 high workload, and the last 80-100 into the high category once.

III. RESULTS

Taking and collecting data is done by distributing questionnaires to respondents and giving the explanation in advance about the procedure in filling the questionnaire so that the respondents can fill out the questionnaire correctly and in accordance with what is desired in the process of settlement using NASA - TLX method. The number of personnel during the last voyage of the respondents in this study based on strata rank, can be seen in table 1 as follows:

Table 1. Data Respondents

RESPONDEN Strata/rank	amount	C.O	Department			
			Operation	Electronics	Machine	Logistics
Officer	8	1	3	2	2	-
Sergeant	7	-	2	2	2	1
Enlisted	28	-	9	4	7	8
TOTAL	43	1	14	8	11	9

(Source: prepared data questionnaire)

Based on table 1 it can be shown that the respondents involved in this study were 43 people. Furthermore, like the guard system in the warship in general, this battleship has the same guard system based on Typical Navy PDD on ship maintenance procedures in the war ship. However, it is tailored to the needs of the guard and the number of personnel available to maximize the duties and efficiency of personnel usage as stipulated in the Regulation of Permanent Property Commander (PKST), the commander of the warship which regulates the vessel system of both the duty of the sea and the shore. The lack of warriors in the warship also requires adjustment of the special guard division of the pre-determined officers during the voyage of daytime late-night guard (A), daytime duty division (B) and morning night duty division (C). Making the system work basically aims to create quality work.

For Officers Pavilion consisting of 2 officers who served as Officers and Assistant Officers Assistant held every 4 hours guarding, then will be replaced by the next guard division and so on. Unlike the guard officers on the machine guard division, the guard system for officers on the warship is carried out flexibly. Due to the relatively small number of officer capacity, Officers Enginer is often backed up by Senior. Furthermore, for the guard division at the Logistics Department is implemented according to the policy of the Head of Logistics Department and the Implementing Officers. The Logistic Guard System (Keeping Cook and Keep the Pantry) on a warship, divided into three divisions on guard for every single meal or more commonly a division guard carries out a full day (three meals). And will take turns continuously during the voyage in the area of operation regardless of the Keep of the Sea and Keep the Land. The system is designed to reduce the fatigue that arises because of physical circumstances that are no longer able to perform activities.

Based on all workload calculations performed by the department's respondents, the overall calculation of each part and the average final results of each level can be seen in table 2 below:

Table 2: Results Total of All Respondents

DEPARTEMENT	∑MD	∑PD	∑TD	∑OP	∑EF	∑FL	AVG WWL	σ
OPERATION	216	178	204	198	225	154	70,52	5,30
ELECTRONICS	236	143	220	139	259	124	68,88	7,21
MACCHINE	239	195	182	165	200	204	72,82	9,98
LOGISTICS	199	144	239	170	165	122	64,22	7,97

Based on table 2 shows the differences in workload on each respondent from each department and indicator. As for the phases of the shift time of the excessive ships while carrying out the duties of the sea and duty onshore, among others, in conditions where there are vacuum personnel officers. It becomes one of the unsafe and uncomfortable conditions. Moreover, as officers are required to lead and complete all tasks with the maximum and optimal. This is what makes the workload high, and if not able to control themselves will be bad on performance and consequently tend to be emotional and make the atmosphere of the family on the ship to be not conducive.

The heavy handling phase includes conditions where it is associated with a weather that has the potential to cause seasickness so as not to be able to drive a ship or to navigate the vessel. In addition, the watchdog time like Late Night or Day will be felt long felt every personnel keep the pavilion, because at this time the body feels tired and takes time to rest after a day working to maintain the condition of the ship, plus bad weather like waves and wind taut that makes the condition of the ship is unstable will make the watch time will be more pronounced and give the load that feels heavier.

Limited pavilion space compared to the number of personnel on guard makes some people have to stand during the duty within 4 hours, and some people must be exposed by a strong sea breeze when doing visual monitoring, of course, this will gradually affect the health conditions concerned. Sometimes before or after performing guard duties, personnel on duty booths continue the work to carry out ship maintenance that will make the physical needs will be even greater. The weight or lightness of a job is not solely due to the quantity of work but also the mental pressure that the employer puts on the job.

The average Weight Workload (WWL) according to the stratification level can be seen in figure 1. From the table of recapitulation of the result of Weight Workload (WWL) weight calculation according to the rank of officer of war ship, the warship also has high workload category with the average value of load work amounted to 76.57. This implies that officers have higher levels of the workload than non-commissioned and enlisted soldiers, although they are still within the same category level. With fewer personnel conditions than DSP, impact on existing soldiers to double positions. So this can be shown through the average value of the officer's workload. Because of the existing conditions, there are several officers who are vacant officers that require officers to double positions.

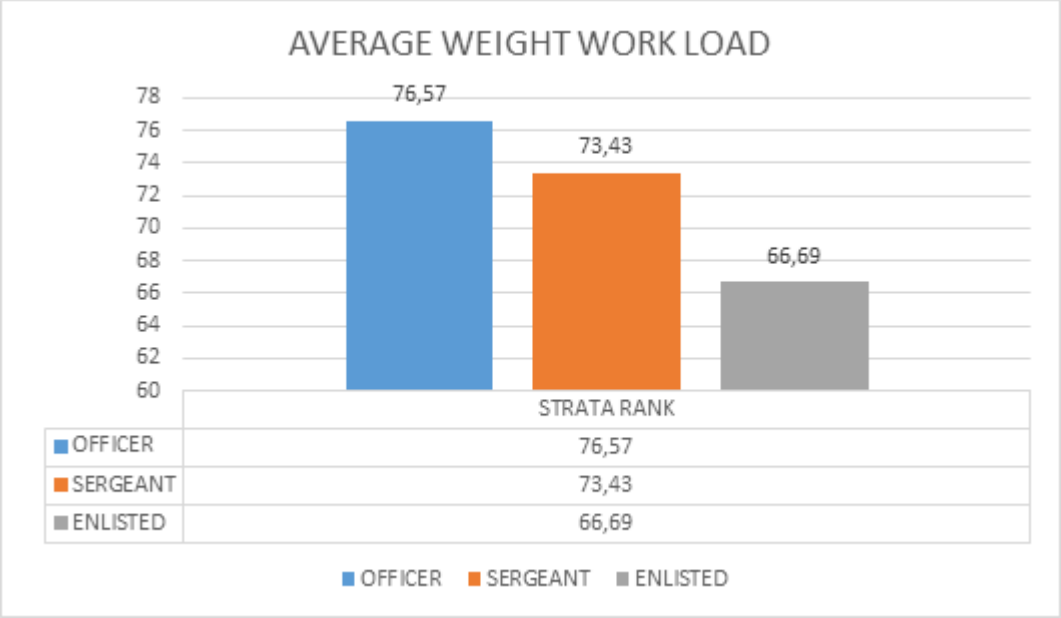

Fig. 1. Average Weight Workload by Strata Rank

Of all the calculations performed by respondents where the number of 43 respondents consisting of each stratum of rank consists of officers, commissioned and enlisted, which has a number of different respondents, then obtained the overall calculation of each part and the final average results. For the results of the average Weight Workload (WWL) as a whole in each Department, the graph is shown in Figure 4.5. Of all the calculations performed by respondents where the number of 43 respondents consisting of each department consisting of the Department of Operations, Machinery, Logistics, and Electronics which has a number of different respondents, then obtained the overall calculation of each part and the results of the average end which are owned. Average Weight Workload calculation results Each Department of personnel keeps the warship machine also has a high workload level category with an average workload value of 72.82. This implies that as with all other departments, warship machine personnel have a higher level of a workload than other department personnel though still within the same category level.

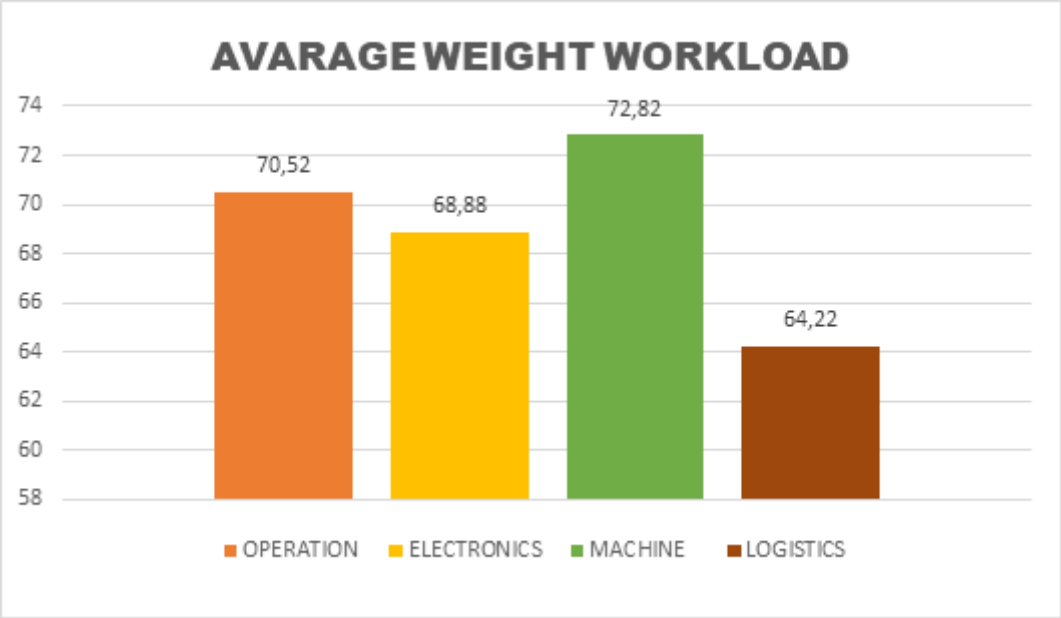

Fig. 2. Average Weight Workload Each Department

Figure 2 shows that the workload of soldiers in the machine department is higher than the others. This is because with a relatively narrow room, workplace or engine room is noisy and narrow became the reasons that affect the workload of the soldier. Furthermore, followed by soldiers operating departments and electronics that have a working area on the Pavilion. Then the lowest average workload is owned by the logistics department. But everything is still in the category of high workload.

In general, based on the results of research indicates that the workload of warship soldiers have different levels of different. Based on the frustration indicator indicates that the level of stress and pressure of the officer's group at that time was more dominant. This is different from the NCO soldier group who is the "driving force" in the implementation of tasks in the area of operation. As an extension of the officer's hands must understand and complete all orders then forwarded to his subordinates in this enlisted soldier (this is related to Effort or effort). Further physical activity is more likely to be performed as an example behavior for others in order to work together. The success of an officer's leadership can be seen when the elaboration of NCO members can continue and accomplish the task smoothly and together with others. Of the six indicators of NASA TLX, enlisted respondents outperformed others on the Temporal Demand (TD) indicator. This indicator is clearly affecting enlisted soldiers in general, because it must accept the various pressures of both officers directly and non-commissioned according to the rank hierarchy. Accepted pressure requires the speed and alertness of soldiers to carry out orders. Moreover, as explained earlier, some enlisted members must fill the position at the NCO level, requiring extra skills to fill the void. And it is such a thing that makes the TD of enlisted soldiers to be higher than other respondents.

The existence of workload and rather excessive demands from the leadership also led to the magnitude of Physical and Mental Demand and the magnitude of the Effort but did not cause excessive levels of stress, that is by doing positive activities in entertaining themselves to avoid stress and the attention of the officers to provide solutions to the problems faced. This is very important to minimize the occurrence of Human Error in carrying out tasks that could endanger the safety of war ship and for the success of war ship in carrying out the task of shipping operations.

IV. CONCLUSION

Based on the results of the study, the conclusion of this study indicates that the workload on the whole department in the warship is very high. Limitations of space and comfort in the vessel provide a higher workload in the phases of guard personnel activities, machine guard personnel, logistics guard personnel and electronic guard personnel. Each department is required to always show alertness to all obstacles encountered. From the difference in value, it shows a not-so-significant difference between the average value of warrior warriors with an average Weight Workload score but the difference in the average number between the two remains, this is due to the magnitude of the mental needs that the soldier has to keep the engines and aircraft on board in order to stay in good condition so that the voyage can run smoothly and the task can be completed as planned.

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