HANDING OVER THE BRIDGE WATCH – CRITICAL SPAM PERIOD OF BRIDGE RESOURCE MANAGEMENT

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ABSTRACT

The notion of hand-over on board ships is not completely defined by legislation or regulations. Indeed, the content of the hand-over is described by the ship procedures that are part of the International Safety Management Code (ISM), Ship Safety Management System (SMS) and Master's Standing Orders etc. However, there is not a single document defining the duration of the hand-over. The development of marine technologies has made handing-over procedures more complex and time consuming. Meanwhile, the organizational structure of the navigation watch has remained the same, resulting in the hand-over practice being shorter than needed.

Handing over the bridge navigational watch depends on a number of factors, including the type and size of the vessel, quality of the company and ship SMS, ships trading area, traffic density, weather conditions, state of the sea and seaworthiness of the vessel, experience and qualifications of the officers.

A survey was conducted to 30 deck officers in order to gain insights into the variations of duration of handing over the bridge watch with regard to the prevailing conditions.

Keywords:
Hand-over, bridge navigational watch, checklists, safety, officer of the watch, Safety Management System, simulator

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1 INTRODUCTION

The hand-over is a maritime term referring to handing over and taking over the navigational and engineering watch. The same expression is used for taking over the duty at the beginning of the watch and when joining the ship, i.e. signing on. During the hand-over period, the joining officer or rating is familiarized with the relevant information's that are important for the safety of navigation.

Previous and present research has revealed that handing over process is an important safety factor. The hand-over period is typically short due to reduced time that vessels spend in ports. The reduced ship's turn-round time has been considerably affected by the development of marine technologies. In addition, research results have proved that the hand-over procedure heavily depends on the education level and qualifications of officers [1].

With regard to the ways of duty handover on board ships, the handing/taking over the duty may be performed:

- between crew members in charge of the same duty, and between crew members (same rank) signing off and signing on,
- at the beginning or end of the watch.

The handover between off signing and on signing crew member (same rank) is carried out periodically, when boarding and leaving the vessel. Unfortunately, due to the fast turn-rounds in ports, the handover is performed within a limited time period that is shorter than necessary.

While at sea, handing over is carried out at the beginning or end of the navigational or engine watch, or when the master or the chief engineer takes the command due to maneuvering or emergency.

Considering the place where the hand-over occurs, there are three types:

- bridge navigational watch (24 h),
- cargo control room/deck watch,
- engine watch.

Handing over the bridge or engine watch between two officers is performed according to ship Safety Management System (SMS) procedures/checklists.

With regard to ship operations, there are differences among:

- handing over the watch when under way,
- handing over the watch in port,
- handing over the watch at anchor,
- handing over the watch during maneuvering.

Handing over the watch when the vessel is underway, in port, at anchor and maneuvering is performed in line with the procedures/checklists defined by SMS, Master's Standing Orders and Master's Night Orders.

In respect of the light conditions, there is a considerable difference between:

- daytime watch hand-over, and
- handing over the watch at night.

Completing checklists for hand-over the watch during a night watch implies the monitoring of equipment and devices in low light conditions and, at the same time, carrying out the procedures. Alterations of the dark (look-out) and light (writing) requires frequent vision adaptation (light-dark-light), i.e. increased period needed for completing the paperwork and temporary inability to perform a proper lookout.

Considering the prevailing circumstances, there are two types of hand-overs:

- while under regular circumstances,
- while under exceptional circumstances.

Regardless of the prevailing circumstances, the two procedures must be performed at all times: Handing Over the Bridge Watch and ECDIS Setup Checklists. Depending on prevailing conditions, SMS Code provides additional procedures/checklists for specific situations such as: reduced visibility, meting heavy weather, helicopter operations, navigation in coastal waters, navigation in ice, etc. Given the complexity of navigation, it is likely that vessels may meet a number of these circumstances which require completion of large number of procedures/checklists.

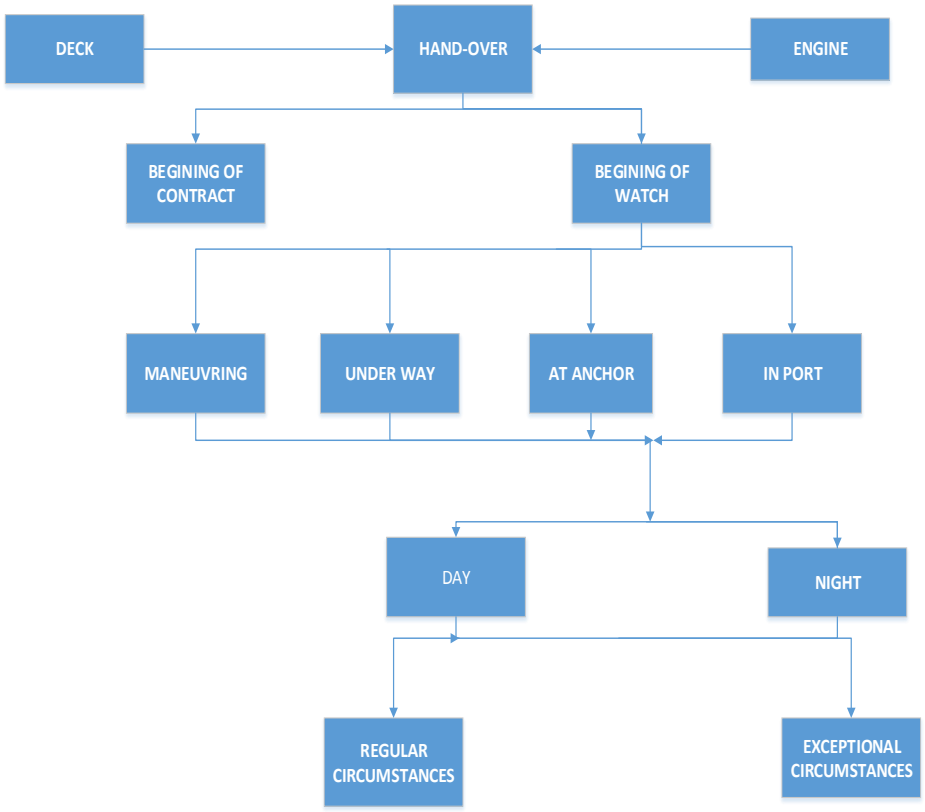

Figure 1 – Simplified diagram of watch/duty hand-over on board vessels (Source: Authors)

The Officer of the Watch (OOW) has to comply with the rules of SMS Navigational Policy prescribed by the shipping company, perform the Bridge Resource Management (BRM), carry out the watch hand-over in an efficient and safe way, be familiarized with the bridge procedures, execute the passage planning, monitor the ship movements at all times, etc. A proper hand-over of the bridge navigational watch is carried out when all relevant information has been exchanged between the outgoing and ingoing OOW [2, 3]. The ship's Safety Management System (SMS) defines numerous procedures/checklists aimed at enhancing the safety and quality of the watch hand-over. The number of these procedures vary with the purpose and type of the vessel. The procedures laid out by the SMS which are in practical use [2, 3] include:

- Handing over the bridge watch checklist
- ECDIS setup checklist
- Restricted visibility checklist
- Heavy weather checklist
- Anchoring and anchor watch
- Navigation in coastal waters checklist
- Navigation in ice.

Owing to the development of technology, automation and digitization of the ships the number of crews have been reduced. Today, officers have less manual work but more tasks involving the bridge equipment monitoring [4, 5]. The ingoing watch officer does not have a specified time period for familiarizing with the situation on the bridge and in the vessel's environment. He or she has to complete numerous SMS procedures, which extends the period necessary for efficient taking over [6].

An example is the report on ship collision issued by the Japan Transport Safety Board on 26th May 2017. The collision of a container ship and a fishing vessel resulted in death of one crew member [7].

Conclusions and recommendations arising from this and similar sea accidents state that all deck officers have to strictly comply with the all standards regarding Watch keeping, defined by ISM, STCW and COLREG (Collision Regulations) conventions, ship's Safety Management System (SMS), Master's standing orders and Master's night orders.

The procedures laid out by the ship's SMS strictly define the actions that a deck officer must take prior to taking over the bridge navigational watch. However, as it has been already emphasized, the maritime legislation and regulations fail to define obligatory hand-over time period necessary to complete all required procedures so that handing over the bridge navigational watch would be carried out in a proper way.

Researches show that the handing over period on the same vessel largely depends on the prevailing sailing circumstances, e.g. weather conditions, traffic density, area of navigation, navigating with the pilot on board, navigation at night, and so on. Obviously, the complexity of the circumstances implies that the hand-over period should be much longer than it actually is in practice. Studies have proved that the human eye adaptation to the reduced light, i.e. night watch is around 15 minutes [8, 9]. Naturally, the hand-over period will be much longer, considering the time needed for completing procedures required for safe and efficient taking over the bridge navigational watch. Just a brief exposure to light will result in the repeated process of eye adaptation and additional extension of the handing over procedure.

2 HYPOTHESIS

Advances in marine technologies have increased the ship safety and made navigation easier, on the other hand, the development has increased the number of devices that require monitoring (AIS, ECDIS, BNWAS etc.).

In practice, handing over the bridge navigational watch lasts 15-20 minutes. Neither the convention on Safety of Life at Sea (SOLAS) nor any other conventions, have provided guidelines regarding the duration of the watch hand-over. Given the changing illumination (day/night) and eye adaptation period, hand-overs may be extended. In addition, extraordinary circumstances, such as navigation in ice, reduced visibility, heavy weather, etc., the handing over procedure can be even more difficult and longer.

Considering the amount of compulsory procedures, 15 to 20 minutes is an insufficient hand-over period, especially when under way in difficult circumstances or in dense sea traffic areas.

3 METHODOLOGY

Thirty seafaring deck officers with sea-time experience of at least 36 months have been surveyed in order to find out relevant insights. They all attend the Special Education Program for seafarers for acquiring certificate/license for Chief Mate on ships of 3.000 GT or more.

The research was performed at the Faculty of Maritime Studies in Split through the years 2016 and 2017 with the aid of Transas Bridge 5000 simulator. A variety of sailing and meteorological conditions were simulated.

Prior to the research, the seafarers ran through a 60-minute familiarization with the devices featured in the simulator / navigation bridge. The procedures prescribe by ISM and Bridge Procedure Guide, used in the survey, are compatible with simulator.

Each seafarer attending the Special Education Program was timed, i.e. time measurements were performed to find out how much time each seafarer needs to complete all the required procedures/checklists and carry out the hand-over in a proper and safe way, as described by international conventions. The timing was performed for hand-over bridge watch during daylight. Fifteen minutes have been added for hand-overs at night for eye adaptation to the reduced light.

To make the presentation of the gathered results easier, the applied procedures have been marked as abbreviations, as follows:

- C/L 1 - Handing over the bridge watch Checklist,
- C/L 2 - ECDIS Setup Checklist,
- C/L 3 - Restricted visibility Checklist,
- C/L 4 - Heavy weather Checklist,
- C/L 5 - Anchoring and anchor watch,
- C/L 6 - Navigation in coastal waters Checklist,
- C/L 7 - Navigation in ice.

The respondents were marked by numbers 1 – 30. The time necessary for completing all 7 procedures was measured for each respondent.

4 RESULTS AND DISCUSSION

The tables below show the results obtained by measuring time for each procedure completed by each respondent separately. Furthermore, the times for completing all procedures were added to obtain the total day watch time. Supplementary 15 minutes were added to obtain the total night watch time for each respondent.

Table 1- times needed for completing C/L 1-7 (day/night watch)

Candidates	Time required for completing checklist (h:mm:ss)							Total time / day watch	Total time / night watch
	C/L 1	C/L 2	C/L 3	C/L 4	C/L 5	C/L 6	C/L 7		
1	0:12:49	0:08:37	0:03:47	0:03:41	0:03:24	0:03:38	0:04:34	0:40:30	0:55:30
2	0:12:24	0:05:25	0:03:57	0:05:16	0:02:35	0:03:55	0:04:08	0:37:40	0:52:40
3	0:15:41	0:05:00	0:04:16	0:04:49	0:03:59	0:05:06	0:04:10	0:43:01	0:58:01
4	0:15:11	0:09:52	0:05:20	0:04:04	0:03:55	0:06:51	0:03:49	0:49:02	1:04:02
5	0:15:04	0:05:48	0:05:39	0:03:49	0:03:50	0:03:52	0:04:48	0:42:50	0:57:50
6	0:14:28	0:05:21	0:03:44	0:03:39	0:02:48	0:03:32	0:03:43	0:37:15	0:52:15
7	0:12:34	0:06:10	0:04:14	0:04:21	0:02:44	0:06:50	0:04:55	0:41:48	0:56:48
8	0:13:48	0:05:08	0:03:58	0:05:10	0:03:14	0:04:04	0:04:18	0:39:40	0:54:40
9	0:09:36	0:07:16	0:05:50	0:05:22	0:03:32	0:06:46	0:03:31	0:41:53	0:56:53
10	0:12:56	0:09:49	0:04:39	0:04:24	0:02:55	0:06:41	0:04:22	0:45:46	1:00:46
11	0:11:46	0:08:50	0:05:16	0:04:10	0:03:51	0:04:35	0:04:03	0:42:31	0:57:31
12	0:11:39	0:06:43	0:05:34	0:03:23	0:02:30	0:05:00	0:04:13	0:39:02	0:54:02
13	0:10:20	0:05:07	0:05:48	0:03:19	0:02:56	0:03:41	0:03:37	0:34:48	0:49:48
14	0:11:34	0:07:53	0:04:09	0:05:57	0:03:29	0:06:52	0:04:06	0:44:00	0:59:00
15	0:09:37	0:09:19	0:05:06	0:04:48	0:03:33	0:03:45	0:03:32	0:39:40	0:54:40
16	0:14:57	0:06:56	0:05:37	0:04:03	0:03:46	0:04:00	0:04:54	0:44:13	0:59:13
17	0:09:03	0:08:14	0:05:40	0:04:07	0:03:02	0:06:26	0:03:30	0:40:02	0:55:02
18	0:10:45	0:05:14	0:05:43	0:05:05	0:02:58	0:04:46	0:03:41	0:38:12	0:53:12
19	0:15:39	0:06:35	0:03:30	0:03:14	0:03:27	0:04:01	0:03:42	0:40:08	0:55:08
20	0:09:42	0:08:19	0:04:36	0:05:27	0:03:21	0:05:20	0:03:55	0:40:40	0:55:40
21	0:14:16	0:09:34	0:05:21	0:04:08	0:02:37	0:05:22	0:04:19	0:45:37	1:00:37
22	0:15:16	0:07:57	0:03:15	0:04:09	0:02:52	0:05:47	0:04:52	0:44:08	0:59:08
23	0:15:45	0:06:19	0:05:59	0:05:26	0:03:44	0:06:11	0:03:52	0:47:16	1:02:16
24	0:11:38	0:06:15	0:05:04	0:04:35	0:02:40	0:04:54	0:04:39	0:39:45	0:54:45
25	0:13:26	0:06:45	0:04:22	0:04:57	0:02:49	0:05:35	0:04:35	0:42:29	0:57:29
26	0:10:08	0:09:06	0:04:33	0:05:56	0:03:00	0:04:02	0:04:57	0:41:42	0:56:42
27	0:13:35	0:05:36	0:05:22	0:04:14	0:03:28	0:03:59	0:04:14	0:40:28	0:55:28
28	0:09:24	0:06:48	0:03:14	0:03:30	0:02:31	0:04:15	0:03:38	0:33:20	0:48:20
29	0:09:26	0:05:16	0:03:34	0:04:42	0:03:26	0:03:36	0:03:57	0:33:57	0:48:57
30	0:14:43	0:08:01	0:04:21	0:03:11	0:03:41	0:03:30	0:04:16	0:41:43	0:56:43

The results displayed in Table 1 indicate that the minimum time needed for handing over the bridge navigational watch by completing all 7 procedures amounted to 00:33:20 for day watch and 00:48:20 for night watch. The maximum time for performing the same task was 00:49:02 for day watch and 01:04:02 for night watch. In both cases, the period of time needed for hand-over was over 30 minutes, which is longer than the period of time for actual handing over on board ships.

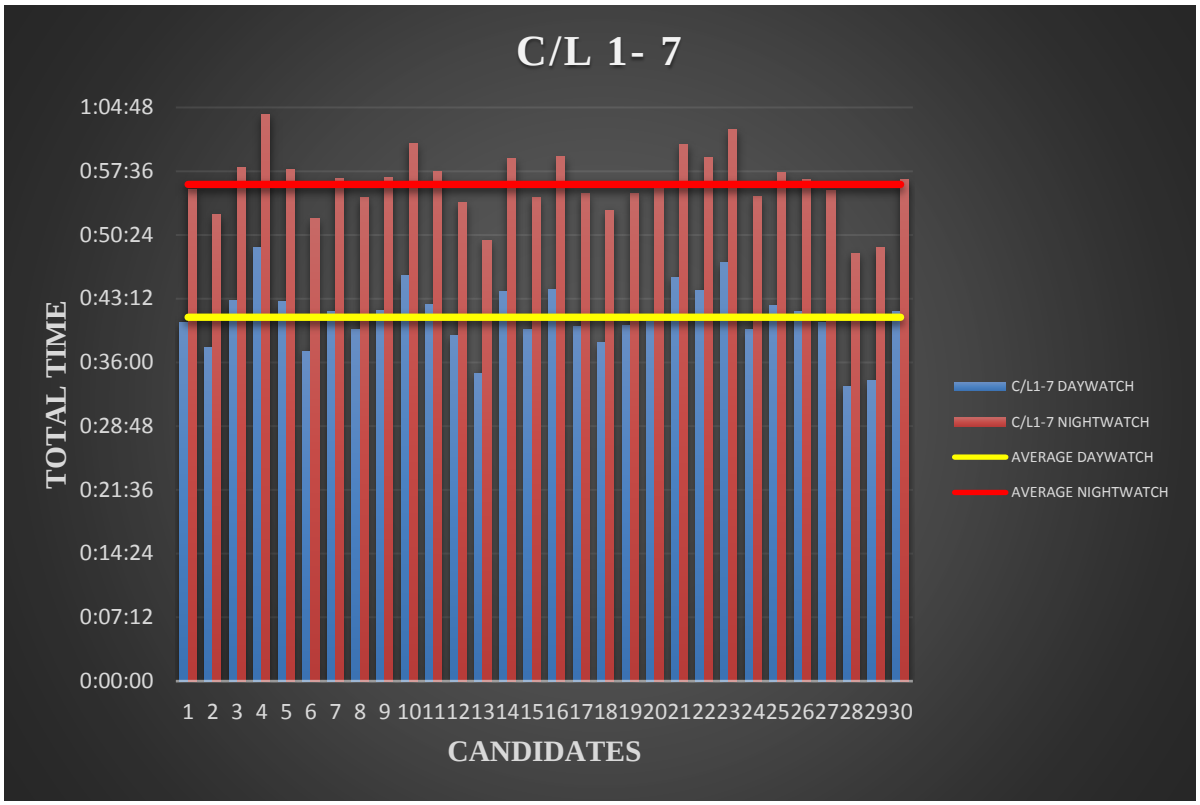

Figure 2 - Time for completing C/L 1 - C/L 7 (day/night watch), n=30 (Source: Authors)

Figure 2 shows the periods of time needed for carrying out the handing over the bridge watch by applying all 7 procedures. In reality this situation is not impossible. Completing all procedures required 00:41:06. This value was increased by 15 minutes (eye adaptation to darkness during night watch), producing the average night hand-over time of 00:56:06. Over 24 hours, the handing over workload of a deck officer would amount to over 90 minutes. Despite the limited sample of respondents (n=30), it can be noted that the time needed for carrying out the handing over the bridge watch in an efficient and safe manner does not correspond to the actual hand-over time in practice.

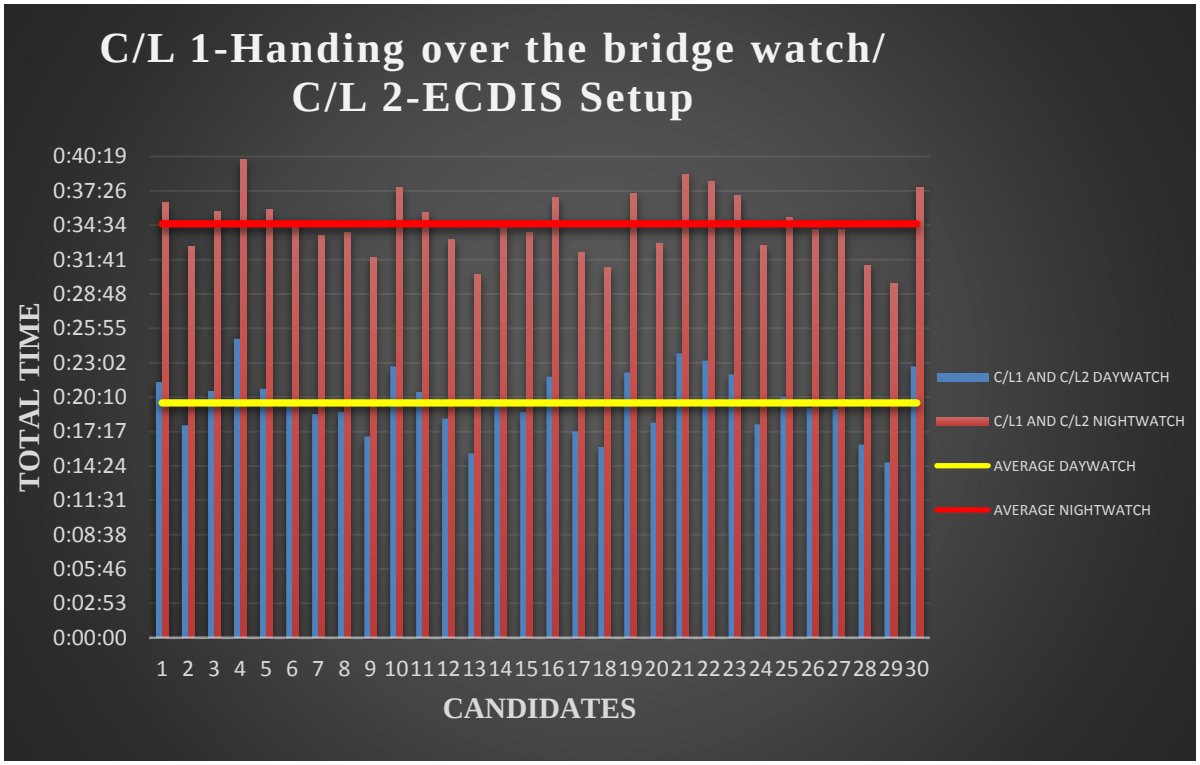

Figure 3 - Time for completing C/L 1 & C/L 2 (day/night watch), n=30 (Source: Authors)

Figure 3 shows the times needed for carrying out the handing over the bridge watch by applying the procedures C/L1 and C/L2 under normal circumstances. These two procedures are compulsory both in day watch and night watch hand-over. Considering the average time necessary for handing over the bridge watch by day (00:19:41), it can be concluded that the simulated situation corresponds to the real-life situation. When supplementary 15 minutes are added, allowing for the dark adaptation, it can be concluded that the time needed for handing over the watch exceeds 30 minutes.

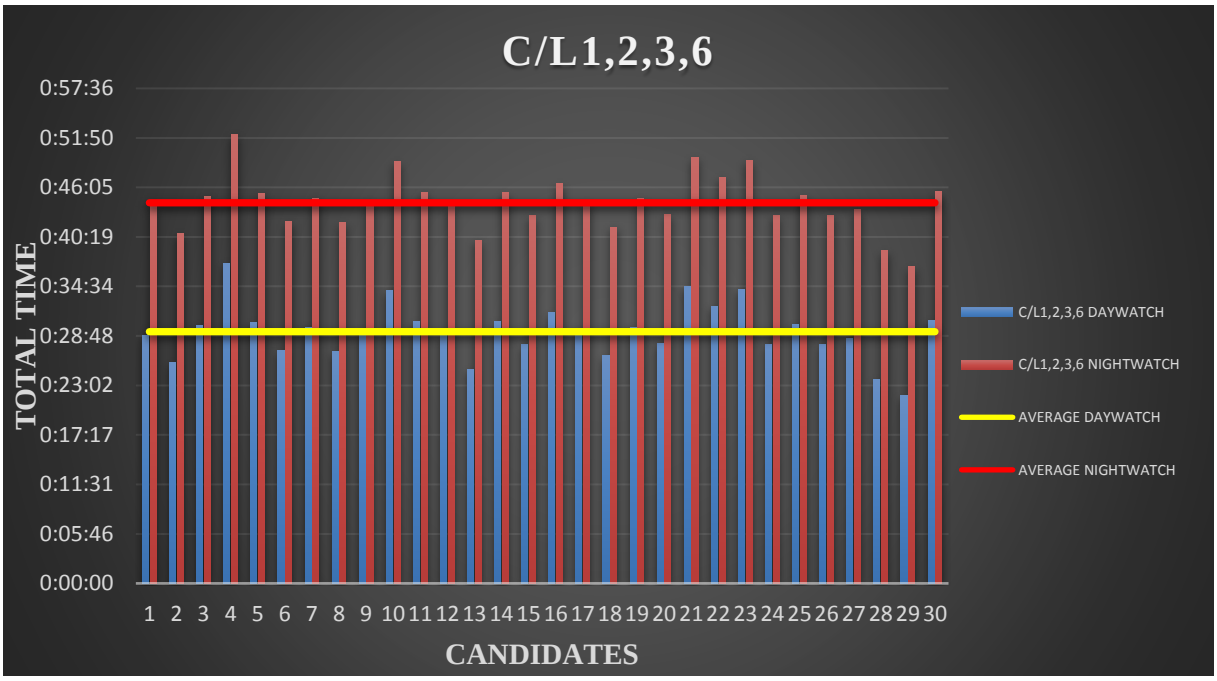

Figure 4 - Time for completing C/L 1,C/L 2, C/L 3 & C/L 6 (day/night watch), n=30 (Source: Authors)

Figure 4 shows the times for handing over the bridge watch in coastal water navigation in reduced visibility. In addition to the time required for performing the compulsory hand-over duties (C/L 1 and 2), the specific navigation conditions require supplementary time for completing procedures C/L 3 and 6. Under the circumstances, the hand-over period is 00:29:17 for day watch and 00:44:17 for night watch.

This is the time when a deck officer has to be well concentrated because of the vicinity of the coast, reduced visibility and typically increased sea traffic. After performing such a demanding watch, the officer has to perform the hand-over in a proper way as well. The handing over period is clearly extended because of additional procedures and may affect the due diligence of the tired officer of the watch.

5 CONCLUSION

Although the international conventions SOLAS, STCW and COLREG [3, 10] define that the officer of the watch (OOW) may use the watch keeping time only for performing safe navigation, the research has revealed that a deck officer spends up to 50 minutes for continuous completing the compulsory procedures during and after the hand-over of the navigational watch. The time dedicated to satisfying ship procedures reduces the officer's concentration, otherwise necessary for observing potential hazards in the vessel's environment. Moreover, navigation under complex circumstances (reduced visibility, heavy weather, etc.) tends to increase the procedures related to data checking and recording, thus extending the period of time necessary for completing the procedures and carrying out the hand-over of the bridge navigational watch.

The interviews with the surveyed seafarers who participated in the research confirm that, in practice, the formalities are fulfilled by carrying out ship procedures retroactively. In this way, the focus is on lookout duties and navigation itself, but the procedures are not properly satisfied.

The checklists are typically completed under more favorable circumstances (reduced sea traffic, improved visibility, calmer seas, and the like), to meet the requirements on keeping records and evidence. This practice is not desirable and is not in line with the legal assumption of due diligence.

The results of this research suggest that the ISM Code should be partly revised with reference to the checklists. Their use could be simplified to allow the implementation of their real purpose, i.e. reduction of human errors. Special attention should be given to the periods of time needed for completing the checklists and other forms of documentation.

It is also suggested that the ISM Code should have a digitized e-version connected with the instruments on the bridge and in the engine room. A large amount of data such as ship's position, speed, radar operation mode, ECDIS etc., can be entered automatically, allowing the flow of information from a detecting device directly to the computer. In this way the OOW can be informed without searching through the information presented by each individual device, and precious time may be spared for writing and eye adaptation (paper / screen), particularly during navigation at night. The very purpose of the ISM checklists include the informing of the officer of the watch, reminding him/her of the duties, simplified communication etc., all of which should result in increased safety at sea.

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