

# COMPREHENSIVE REVIEW OF THE STCW 78 CONVENTION AND CODE: SOME CONCEPTS AND TRENDS

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## ABSTRACT

The 38th session of IMO's Sub-Committee on Standards of Training and Watch-keeping (STW 38) was held from 22 to 26 January 2007. One of the main STW 38 agenda items was *Comprehensive review of the STCW Convention and the STCW Code*.

The paper analyzes the information background before the development a set of new amendments to STCW 78 by textual information from articles and other documents published in 585 media, internet and IMO materials, which are thematically close to maritime education and training (MET), human element, situation awareness (SA), safety and security issues. Leximancer software is applied for the research.

*Keywords: STCW Convention, Leximancer, safety, security, situation awareness, education, training.*

## I. INTRODUCTION

The International Convention STCW 78 (as amended in 1995) is the primary mandatory international instrument determining the MET and Certification Standards for Seafarers in the World. During the next two years IMO will carry out a holistic review of STCW 78 and all amendments. While the Convention is directed first of all to review the mandated training of seafarers, it is becoming clear that the Convention will also need to address the training needed for competent shore based personnel who are involved in maritime safety management, environmental protection, security and MET. The dynamic development of the shipping industry will challenge the IMO to align the STCW regulations to these emerging industry needs and public interests. As a result MET institutions are no longer in a position to keep utilizing any MET techniques and

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pedagogy that do not address the demands for competency and knowledge assessments in the newer definitions of a competent and knowledgeable mariner, afloat or ashore.

Extracts from the last STW Sub-Committee report: “Comprehensive review of the STCW Convention and the STCW Code is included by MSC 81 in the STW Sub-Committee’s work program aiming at ensuring that the Convention meets the new challenges facing the shipping industry today and in the foreseeable future, the Secretary-General hoped that the Sub-Committee would respond to the Committee’s expectations and, among other things, would take into account new and innovative training methodologies, including the use of simulators in training and e-learning to ensure that properly trained and competent seafarers were available to man and operate the ships in the service of seaborne trade,” (STW 38/17, 2007). The main objective of this paper is to explore if the relationships between some main trends and concepts in shipping industry and MET are considered in mass media before the new set of amendments to STCW 78 is developed by IMO.

To reach the stated objective of research we used Leximancer software. What is Leximancer and why do we use it? Leximancer is a data-mining tool that can be used to analyze the content of collections of textual documents and to visually display the extracted information. A big amount of textual information cannot be read and analyzed without special software. So, it is the main reason to use Leximancer.

*Concepts* in Leximancer are collections of words that travel together throughout the text. So, in this paper concepts are sets of associated words that are extracted automatically by the system. Researchers can also interact with this process, creating concepts that are of interest to them. (Leximancer Manual, 2002). The following concepts as *STCW*, *MET*, *SA*, *workload*, *overload*, *fatigue*, *safety* and *security* were selected for research.

Concepts *STCW* (minimum standards) and *MET* (possible enrichments of minimum standards) were intentionally separated to explore the appropriate level of discussion in different documents and articles.

In this context, we need to take into consideration that STCW Convention is one of the four pillars of the international regulatory regime (together with the SOLAS, MARPOL and ILO 186 Conventions) aiming at quality shipping, that is why the topic is extremely important.

## 2. LITERATURE OVERVIEW

Let’s note the following information from media:

- i. INTERTANKO records all reported incidents involving tankers reported by Informa and the press. The most significant occurrence in 2006 was the **64% increase in the number of incidents**, (INTERTANKO,2007).

We should take into account that tankers form 25 % of the world commercial fleet.

- ii. UK officers' union Numast has urged the government to limit the duration of Crew Equivalence Certification (CEC) following a series of casualties on UK ships that the union claims have revealed a decline in crewing standards, (Fairplay Daily News, 2006).
- iii. The results of research revealed that 71% of human errors were SA related problems. Of the SA errors identified during the manual coding process, 58.5% were level 1 SA errors (Failure to notice significant events), 32.7% were level 2 (Failure to comprehend the events detected), and 8.8% were level 3 (Poor at prediction of consequences), (Grech & Horberry, 2002).
- iv. 61% of officers often or always experienced fatigue when on duty, (Gander, 2005);
- v. Shipping Industry is very close to Pareto optimal border! In Pareto optimal system no further Pareto improvements can be made without allocation of additional resources, (IRMETS, 2005).

Taking into account the above notes (i-v) we produced an analysis of 585 collected documents and papers from different maritime sources as per Table 1, using Leximancer software.

**Table 1. Sources of information**

	<b>Source</b>	<b>Index</b>	<b>Year</b>	<b>Number</b>
a.	Internet publications on <i>workload</i> on seafarers	WP	2004-2005	69
b.	Casualty reports (IMO, MAIB...) and Situation Awareness Internet publications	Casualty	2004-2007	118
c.	The International Maritime Human Element Bulletin, (The Nautical Institute)	Alert No.1-14	2003-2007	14
d.	Lloyd's List (articles on manning)	LL	2004	33
e.	INTERTANKO News, No. 18- 43	INTERTANKO	2006	25
f.	IFSMA Newsletter No. 24- 51	IFSMA	1999-2006	29
g.	Seafarer's International Research Centre	SIRC	2001-2006	39
h.	IMO STW Sub-Committee, 34 Session	STW34	2003	47
i.	IMO STW Sub-Committee, 35 Session	STW35	2004	34
j.	IMO STW Sub-Committee, 36 Session	STW36	2005	45
k.	IMO STW Sub-Committee, 37 Session	STW37	2006	62
l.	IMO STW Sub-Committee, 38 Session	STW38	2007	63

The conceptual features of the following concept chain: *MET-STCW-workload-overload-fatigue-SA-security-safety*, were extracted and explored.

One of the main principles approved by STW 38 for comprehensive review of Convention sounds as *do not down scale the existing standards* or by other words not to lower the safety level of shipping industry.

Taking into account this principle, we put a question if there are any relationship between such very important parameters of shipping as *safety* and *security*, such Human Element components as: *fatigue, MET level, workload, overload, SA* and *STCW* Convention as per mass media and IMO STW Sub-Committee papers. All these parameters are used as concepts in this research.

In this paper we follow SA ideology from (Loginovsky et al., 2006) and suppose that the loss of SA by OOW followed by inappropriate decision making and then inadequate performance of actions is the main reason of lowering the safety and security level on board the vessel. In the beginning of development of new set of STCW 78 amendments it is important to explore the media information background and understand how different bodies of maritime society feel and discuss this very important for industry issue.

### 3. CONCEPTS AND TRENDS

#### 3.1. AN EXAMPLE: 69 INTERNET PUBLICATIONS ON WORKLOAD ON SEAFARERS

After processing the scripts (a) from Table 1, the following map was extracted:

The map on Figure 1 displays five important features of information about the texts.

These features in Leximancer terms, are:

- Concepts and their frequency (the most frequent concept is the most important in set of texts. It is a *workload*). The most important themes are also *workload* and *vessel*.
- Relationship between concepts (how often concepts occur close together within the text. It reveals the degree of their impact in the discussing theme). The strength of direct association between concepts is indicated by the brightness of the link between concepts on the map. Concept *workload* relates to *SA, work* and *information*, Fig.2.
- Centrality of concepts (number of times a concept co-occur with other defined concepts). The most central are *vessel, workload* and *SA*;
- Contextual similarity (the more closer together the concepts appear the more contextual similarity they have). So, *workload, information* and *SA* are the most contextually similar concepts, Fig.2.

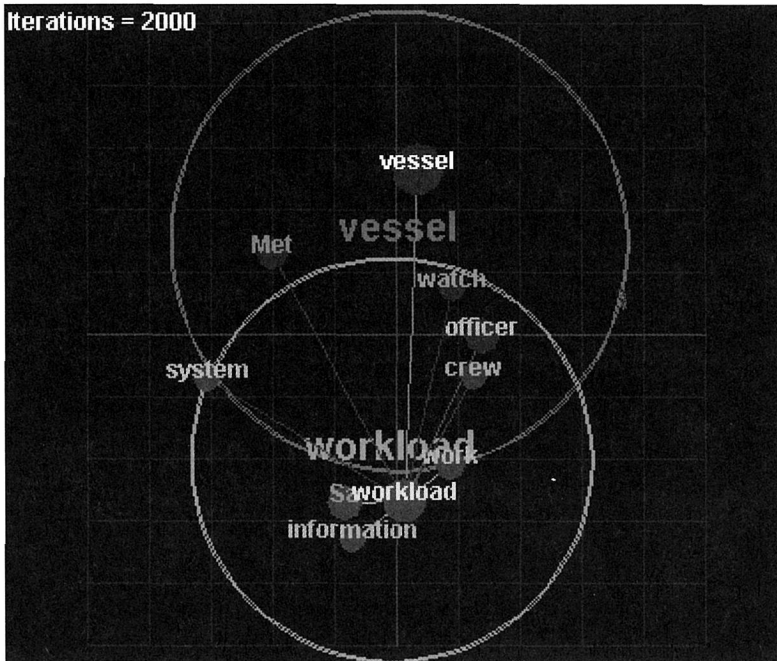


Fig. 1. Contextual map (WP scripts)

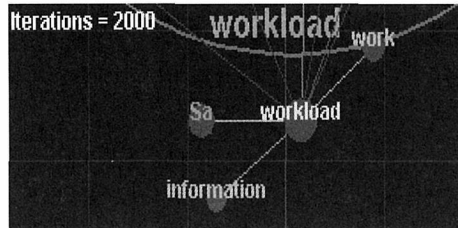


Fig. 2. Relationship between concepts

### 3.1. CONCEPTS AND THEIR FREQUENCY

Table 2 contains frequency of selected concepts in per cent relative to the main concept in the set of texts (a)-(l). Number 100 shows that this concept is the dominant (the most frequent and that is why most important) in this set of papers.

We should emphasize that with research ideology, the concept *STCW* is in free mode of traveling through the set of texts. No additional seed words are used. It is a seed word itself and this concept develops automatically. In principle the concept *MET* ideologically is close to *STCW* but it is formed by the following key words *as education, training, skills, learning, understanding, programs, ...etc.* That is why we can see different results.

**Table 2.** Frequency of concepts

Source % Concept	WP (a)	Cas (b)	Alert (c)	LL (d)	INT (e)	IFSMSA (f)	SIRC (g)	STW34 (h)	STW35 (i)	STW36 (j)	STW37 (k)	STW38 (l)
<i>fatigue</i>	13	7	8	23	5	11	8	7	5	4	4	7
<b>MET</b>	33	22	50	0	6	39	39	51	100	100	100	100
<i>overload</i>	4	2	0	0	0	3	0	0	0	0	1	0
<i>Sa</i>	48	20	85	96	2	57	30	100	24	98	89	50
<i>safety</i>	21	100	24	25	18	53	23	16	17	19	14	17
<i>security</i>	7	1	4	0	9	26	4	29	16	18	26	14
<b>STCW</b>	2	0	1	0	0	1	1	6	4	4	7	4
<i>workload</i>	53	11	1	15	0	1	1	0	1	1	2	0

The boxes ticked in the table show the most frequent (important) concepts discussed by selected sets of papers.

So, the results from Table 2 are the following: the concept *MET* is the most important in sources (i)-(l). *SA* is in the first place in (h) and *safety* is the first in (b).

### 3.2. RELATIONSHIPS BETWEEN CONCEPTS

The relationships between Concepts are determined by relative frequency (probability). Below on Fig. 3 it is possible to see some results of data processing of all the selected texts (Table 1).

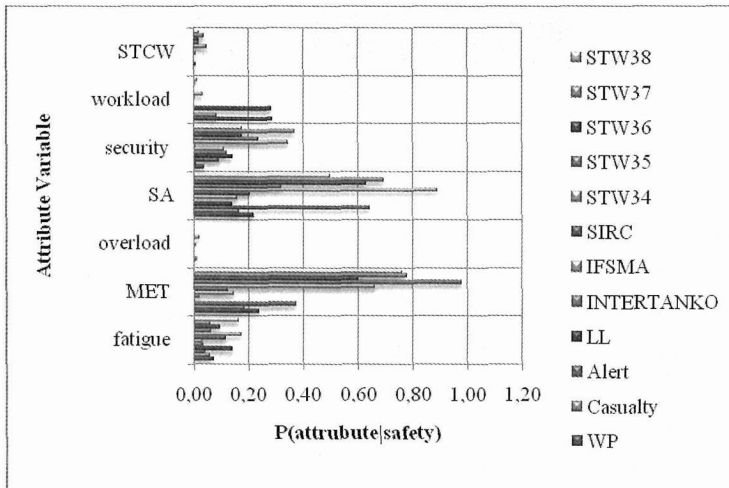


Fig.3. Relationships between concept safety and some its attributes

Figure 3 shows that intratext information mined from set of texts is as follows:

- Concept *safety* has probabilistic relationships with all the concepts proposed for investigation.
- *MET* and *SA* occur more frequent with *safety* than *fatigue*, *overload* and *workload*.
- *STCW* as a concept has a very low frequency in all the scripts (automatic identification);
- By all the papers, the concept *security* relates to *safety* more frequent than to *fatigue*, *workload* and *overload*.
- *STW* Sub-Committee paid great attention to *SA* though the words *SA* and *safety* never sounded in *STW* documents together. It is intratext mined information.
- Concept *overload* is not paid attention by almost all the sources.

All of this confirms the findings and results from (2005, IRMETS), that “the industry needs some Coordination Instrument” for regulatory activity and to maintain integrity between all the basic concepts influencing *safety*. In this context *SA* may be considered as one of the important concepts influencing *safety*. That is why it is obvious to propose to transfer concept *SA* from intratext status to explicit one to be included in new *STCW* amendments

The concept *fatigue* has relative relations with the concept *MET*. But nevertheless it is impossible to find any direct link of *fatigue* and *MET* in the set of 585 of researching documents. There is no one sentence where the concept *fatigue* co-occurs together with the concept *MET*, except *MSC/Circ.1014* context. But this relation also exists at intratext level.

It is common knowledge that nowadays the mental and cognitive workload on seafarers increases. It means also that *STCW 78* standards level should meet this trend.

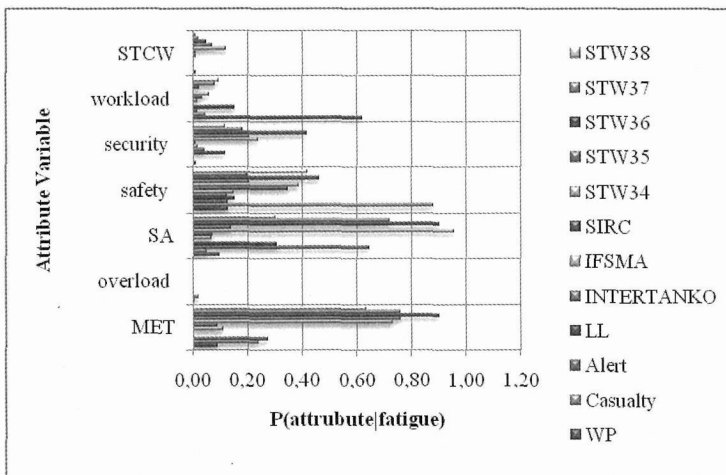


Fig.4. Relationships between concept *fatigue* and some its attributes

Increasing workload demands all the functions on board the vessel to be executed faster without any compromising the quality. It means also, that general SA level should be higher than, say 10 years ago, so the principle “do not down scale the existing standard” should be less flexible, that means the MET STANDARDS are to meet the shipping industry trends and they are to be enriched.

Practically there is no any relationship between *fatigue* and *overload*, though the both concepts are in texts. It indicates to some “needless delicacy” of some authors not to show the real situation in industry. The synonyms for *overload* are applied quite rarely. The concept *workload* was used more frequently in casualty reports.

Research confirms the strong relationship of *fatigue* and SA that is obviously. *Fatigue* does not promote the OOW’s SA improvement. The less attention was paid to relationship between *safety* and *security*, but these concepts are related to each other in any case.

The investigations show that information background of all the above sets of texts form an integrated system with its links and gaps. That is why it is important to understand the advantage of similar system review of STCW 78.

Fig. 5 shows the relative frequency of concept *MET* together with *safety* and *workload* extracted from different sets of scripts. It is important to note that, in spite of the fact that in STW37 package relative frequency  $P(MET/workload)$  is very close to 0.8, nevertheless it is impossible to find any sentence where it was mentioned directly.

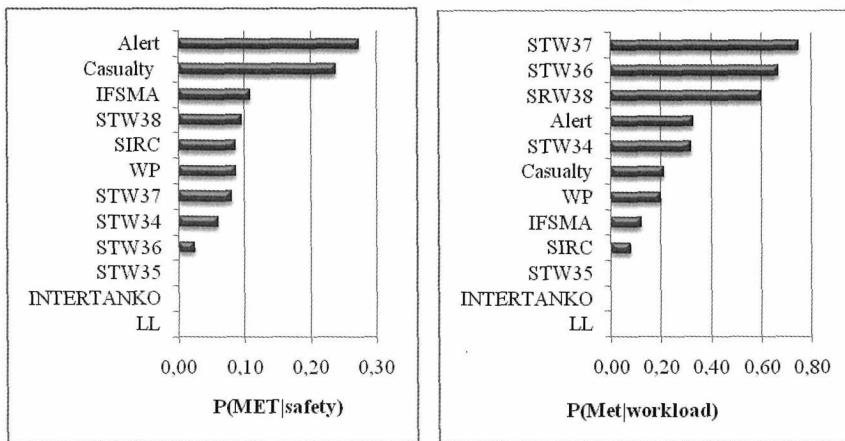


Fig.5. Relationships between concepts MET, safety and workload

It is obvious that well educated and trained seafarer can do every job easier, quicker, better and with less stress and workload. So, the *MET-workload-fatigue* integrated chain of concepts is one of the main to keep safety and it is inadmissibly to ignore it, especially when the mental load on seafarer increases in industry day by day. It is hardly to say that *workload* is not influenced by education, training, skills, and professionalism.



In principle this consideration matches very close with the following statement from (IRMETS, 2005): “Decreasing of seafarer’s qualification is equal to increasing his/her *workload*. It means the increasing the fatigue level and reducing the level of safety, security and as well the attractiveness of shipping industry.”

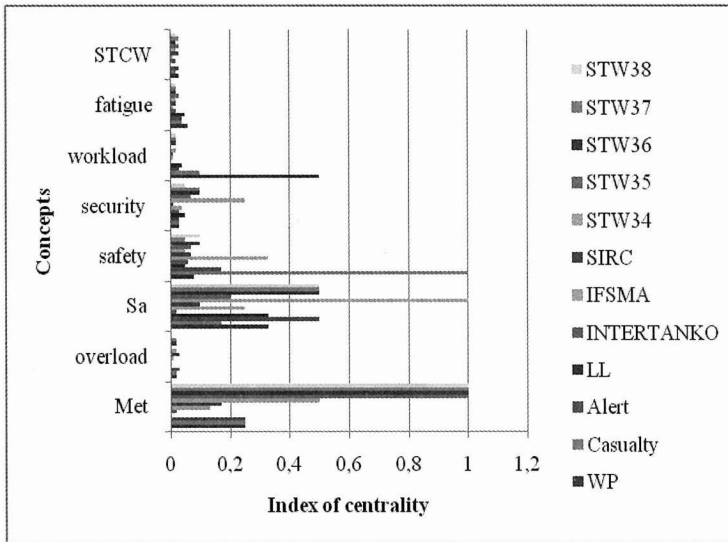


Fig.6. Centrality of concepts

The above graphs reveals that concepts MET, *safety* and *workload* are in the attention zone of the majority of papers.

### 3.4. CENTRALITY OF CONCEPTS

It is possible to change the number of concepts that are visible on the map, Fig.1. This allows to view only the most central concepts contained within the text. The centrality (C) of a concept is defined in terms of the number of times a concept co-occurs with other defined concepts. That is, a concept will be central if it is frequent and appears in contexts surrounded by the other concepts that Leximancer has extracted, (Leximancer, 2002). To make the demonstration of centrality more clear the inverse proportion  $C^{-1}$  is used, Fig.7.

We can observe the practical matching of frequency and centrality of concept MET in IMO papers, but the centrality of such concepts as *workload*, *fatigue*, *overload*, SA is rather low. The maximum level of centrality of intratextual concept SA is in STW 34 documents and *safety* is in “Casualty” papers.



other words industry needs joint investigations (and opened publication) on SA, general MET, and STCW. The researches on foresight of their contribution into safety, and on possible enrichment of STCW Convention and Code are also desirable.

Concepts workload and overload are close to MET, but they are beyond the SA theme.

Concepts fatigue and MET are of weak similarity because they are not investigated together. Industry needs such investigations also.

#### 4. FINDINGS AND RESULTS

The investigations show that information background of all the above sets of texts forms an integrated system with its links and gaps. That is why it is important to understand the advantage of similar system review of STCW 78.

There are concepts which are not discussed in media, but they are relatively and directly connected with safety and efficiency of shipping industry. One of these concepts is situation awareness. Intratextual concept SA fundamentally based on MET is to be included in into STCW 78 Convention and Code as an evident concept.

In the majority of researched documents and papers such important concepts as workload, overload, fatigue, security and MET and others are treated as independent and irrespective of other concepts. Taking into account the reduced and limited number of crew such an approach is not efficient.

Practically in all the researched materials the concept STCW has a low level of centrality, i.e. it is examined irrespective of other concepts and other IMO instruments. So, to raise the centrality level this concept should be considered more widely not restricting by the competences prescribed by STCW Code. The enrichment of concept education in STCW 78 Convention and Code is desirable.

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