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The study on manning issues of Chinese dry cargo ships

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THE STUDY ON MANNING ISSUES OF CHINESE DRY CARGO SHIPS

By

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Declaration

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

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Date: 10th July 2014

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Abstract

Title of dissertation: **The Study on Manning Issues of Chinese Dry Cargo Ships**

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This paper is a study on manning issues of Chinese dry cargo ships which are special refer to the container ship, bulk carrier and general cargo ships, and the specific issues are involved that the decline of manning levels impact on the safety of ships.

Looking back over the past few decades, the ship's manning levels are reduced dramatically. The ship's automation is the primary factor to contribute this tendency, further, increasing ship operating costs, high quality seafarers, company participation to management, and comprehensive conventions and regulations, etc. These are all associated factors.

Meanwhile, IMO and ILO have developed particular statutes regarding safe manning to ensure the seafarers to get a safe work on board ships. Even Chinese government also updated the Minimum Safe Manning Regulation in 2004 based on the related issued of pillar conventions from IMO and ILO. However, many signs have already revealed that the evolutionary manning levels cannot meet requirement in present practice. Prevalence of crew fatigue is a very clear ground.

In addition, some selected Chinese seafarers participated in a survey concerning some manning issues which provided a good support in this study. Also the result were collated and evaluated for the prevailing manning practice in China.

In view of the detailed description and discussion and examined results, the author concluded that undermanning has been affected the safety of ships. Further, a number of recommendations are addressed for relieve crew's fatigue and enhance safety of ships.

KEYWORDS : Safe manning, Undermanning, Fatigue, Dry cargo ships.

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List of abbreviations

1/E	First Engineer
2/E	Second Engineer
2/O	Second Officer
3/E	Third Engineer
3/O	Third Officer
A.B	Able bodies
AIS	Automatic Identification System
AUT	Automation
BRC	Bridge Remote Control
BRM	Bridge Resource Management
BSN	Boatswain
C/E	Chief Engineer
C/K	Chief Cook
C/O	Chief Officer
COLREG	Convention on the International Regulations for Preventing Collision at Sea
DWT	Dead Weight
E/E	Electrical Engineer
ERM	Engine Resource Management
FIT	Fitter
FOC	Flag of Convenience
GMDSS	Global Maritime Distress and Safety System
GT	Gross Tonnage
HP	Horsepower
ILO	International Labour Organization

IMCO	Inter-Governmental Maritime Consultative Organization
IMO	International Maritime Organization
ISM	International Safety Management
ISPS	International Ship and Port Facility Security
ITU	International Telecommunication Union keeping for Seafarers
KW	Kilowatt
LL	Load Line Convention
LT	Local time
M/B	Mess Boy
M/M	Motor Man
MAIB	Marine Accident Investigation Branch
MARPOL	International Convention for the Prevention of Pollution from Ships
MLC	Maritime Labour Convention
MMC	Merchant Marine Circular
MSA	Maritime Safety Administration
MSC	Maritime Safety Committee
MSMC	Minimum Safe Manning Certificate
MST	Master
O.S	Ordinary Sailor
P/C	Political Commissar
PRC	The People's Republic of China
PS	Pferdestarks
PSC	Port State Control
RO	Recognised Organisations
SMD	Safe Manning Document
SOLAS	International Convention for the Safety of Life at Sea
STCW	International Convention on Standard Training Certification and Watch

UK	United Kingdom
UMS	Unattended Machinery Space
UNCLOS	United Nations Convention on the Law of the Sea
VTS	Vessel Traffic Service
WHO	World Health Organization
WMU	World Maritime University
SMS	Safety Management System
SSO	Ship Security Officer
SSP	Ship Security Plan
SSA	Ship's Security Assessment
ITF	International Transport Workers Federation
OOW	Officer On Watch
PMS	Planned Maintenance Survey System
COSCO	China Ocean Shipping (Group) Company
CSL	China Shipping Line

Chapter 1 Introduction

"The sea is selective, slow at recognition of effort and aptitude, but fast in sinking the unfit!"

(Capt. Felix Riesenberg[1].1936)

1.1 Preamble

Shipping has already become an important international activity which connects the world into an integrative body. Various types of ships sail in the oceans and call ports in different countries, they not only perform the traditional transport only, but also facilitate the culture and customs exchange among different nationalities, and share the achievements of human wisdom. Ship, as a simple means of transportation, have turned into an indispensible modernized carrier integrated with advance science and technology, whether its software or hardware equipment, ships have reached an unprecedented level of advanced. Even so, in order to ensure the safe navigation, a series of acronym is created by different organizations around the world, these can illustrate how much attention being paid to the ships over the couple of decades, for example, SOLAS, STCW, MARPOL, LL, COLREG, ISM, ISPS, MLC, BRM, ERM, UMS, VTS, etc. So many conventions and regulations are to realize a long-standing theme - ship safety which is broadly understood as the safety of the ship, safety of

[1] Felix Riesenberg (1879–1939) was an American merchant mariner, explorer, administrator, and a prolific author of maritime professional, historical, and fictional literature in the early 20th Century.

cargo, personnel security and marine environment clean. Some of them came into being after the serious accidents. However, maritime disasters still inevitably occur, such as the case of MS Herald of Free Enterprise[2]. Why did these accidents still happen? On this issue Bryant (1991, p.1) states that:

> *While casualties can never be completely eliminated there is nevertheless a growing feeling that present rates of casualty are still unreasonably high. When everything else has been looked at and tried – newer designs, better technical aids, the increase in ever more sophisticated regulations and enforcement systems at every level – one thing remains about which there is, almost universally, agreement as to the underlying cause of casualties – the human factor.*

Meanwhile, Error is just one way of describing the human performance and it is the term used when no other explanation can be found for a system failure (Senders & Moray, 1991, p.19). Absolutely, ships have turned into a sociotechnical system currently which is composed of ship, sea environments, seaman, shipping context, etc. (Baumler, 2014, p.17). The sociotechnical system is established to stress the reciprocal interrelationship between humans and machines and to foster the program of shaping both the technical and the social conditions of work (Baumler, 2014, p.51). Human factor contributes a large proportion in maritime events. Further survey indicated that human errors is the dominant factor in maritime accidents, and some people even believe that human error should be accounted for a hundred per cent of the cause of the accident, because, in the final analysis, whatever the failure of structure, equipment, mechanical as well as other aspects, these all are related to the human behaviour.

[2] MS Herald of Free Enterprise was a RORO passenger and car ferry owned by European Ferries. On the evening of 6th March 1987 capsized shortly after sailing and in the approaches to the Belgian port of Zeebrugge en route to Dover, England. The accident resulted in the deaths of 193 people.

Among human factors, fatigue has been recognized as significant safety dangers in shipping industry, it is a long-standing issue which attracts high attention of all parties concerned and has provoked some studies in this aspect. Fatigue decreases the cognitive functions of the seafarers, impairs task performance and thus declines their ability to operate the ship safely (Jones et al. 2005; Jackson et al. 2013).

One supportive research programme[3] from Cardiff University shows that fatigue is now almost filled the seafarers practical work, it may lead directly to reduce seafarers work performance as well as damage the working atmosphere, even result in ill-health and reducing life-span (Smith et al. 2006, p.5). In the accident chain analysis, these factors are bound to become an important part of human error. In present ship practice, a wide range of factors make the seafarers who are no longer an ordinary worker, but a tired overtime tools. Seafarers are human being and could make mistakes, especially under the condition of fatigue.

The report of bridge watchkeeping safety study from the UK Marine Accident Investigation Branch (MAIB) shows that most of the accidents can be attributed to human error, particularly, on selected collisions and grounding cases in coastal waters involving merchant vessels over 500 GT, the main cause of one third of grounding accidents is fatigue (MAIB, 2004). The fatigue research project of Cardiff University shows that there are many factors lead to fatigue (Smith, 2003). And also ITF has always fought with fatigue. Bielic and Zec indicated that minimal manning level resulted from increased ship automation has led to crew facing passive jobs and this working style can cause seafarers mental fatigue (Bielic & Zec, 2005). Therefore, we have understood that fatigue may result in human error and it has a close link

[3] A research program was completed by the British Occupation and Health Psychology Research Centre at Cardiff University, the report has increased concerns about the shipping industry job fatigue problems which are threatening seafarers , ships and the environment.

with safe manning. Whether under-manning or low-manning both easily lead to fatigue. Safer ships need safe manning, more clearly, realistic manning.

Safe manning was put forward by the relative undermanning. In shipping industry, safe manning means to equip the ship with sufficient and qualified seafarers who will make the ship away from danger and risk, and certify completing the voyage mission in order to gain the profit for the owners. Therefore, from literally understanding, on board ship, safe manning is divided into two parts of elements which are adequate and competent. A glance on the trend of manning level of the ships in past decades, as far, we can easily recognize that ship crew size is gradually declining for many years with the science development and technology innovation. Certainly, saving manning cost and gaining more profits as the hidden factors contribute to this decline as well. On the other side, ship size is going bigger and bigger, the speed of ship goes more faster, the seafarers' working pressure including commercial pressure increase exponentially. Although, some claims support that many new technologies are equipped on ship to replace seafarers' workloads, however, it does not relieve fatigue for the ship's crew members. Dr. Yaakov Garb also considered that this reduction has increased the concerns about under-manning and overwork, which can compromise ship safety and functioning and lead to hazardous levels of crew fatigue (Garb, 2011).

China has a flexural coastline which extends 18,000 Kilometers from south to north. Marine transportation is the extremely important part of Chinese economic system. After decades of development, China has become an integral part of the world economy and the demand of transportation capacity by sea has kept increasing as well. Meanwhile, as an important part of the seaman power in maritime industry, the number of ship crewmember has dramatically increased. As the country with the

most seamen's number in the world, China has 1.65 million registered crew members. Among them, 1 million are engaged in the domestic inland waterway transport, the other 650,000 are international seafarers who constitute one third of the total number of the world seafarers, and they bear 93% of China's foreign trade transportation task (Chinanews, 2013). Therefore, the seafarers perform a very important role in shipping industry, they are the dominant factor to ensure ship safety. As a marine ship master, according to my personal experience of more than ten years working at sea, I believe that ship manning especial manning level plays a key role in ship safety and under-manning unavoidably leads to more chances of getting fatigue.

1.2 The objective of study

Firstly, this paper aims to enable readers especially from the maritime domains to understand the importance of safe manning in the shipping industry.

Secondly, the literature reviews of this dissertation enable Chinese marine captains and crew members to understand the principles and procedures of manning of ships, and encourage all Chinese seafarers to actively participate in the formulation of manning issues.

In this paper, some questionnaires and interviews have been done to Chinese seafarers, and the purpose is to obtain first-hand information and have a picture of current manning situation from the seafarers' perspective, and to explore the existing manning issues especially whether the current manning level of ships could meet the needs of shipping practices. this dissertation discuss the present situation of manning particular the manning level issue and explain the potential link between low manning level and fatigue,

Finally, this paper also serves to remind those shipowners, management companies and the competent authorities to re-establish the awareness of safe manning, and the voices from the seafarers could be heard and taken into account to some extent. Consequently, a free, genuine and positive communication mechanism could be established among ship owners, ship managers, maritime administrations and seafarers, whether manning quality or quantity both could be taken into consideration carefully so that safe manning could be managed realistically.

1.3 Significance of the study

No doubt, the basic principle of manning the ship is to ensure the ship safety. So far, IMO[4] had developed the guideline of the principle of safe manning guiding coastal states to establish their own manning level. Following this guideline, China has also developed its own manning standards. However, do those principles perform a good role in the practice? All answers are powerless except the voice from the seafarers, their voice are really worth the shipping industry to recheck the manning standards especially manning level prudently.

The author himself is a marine master who has over ten years of maritime practical experience, especial for dry cargo ship (Container ship, Bulk carrier, General cargo ship). During the period of my sea career, I personally experienced the process of crew manning level declining. As a seafarer working at the frontline of shipping, I have seen so many tired faces of our crew while they were still on duty; I have heard so many times of their complaints about fatigue, and also such a proportion of marine accidents are associated with crew fatigue. To my point of view, working onboard of ship is one of the most stressful jobs, modernization shipping with advanced

[4] International Maritime Organization Assemble Resolution A. 1047(27) Principles of Minimum Safe Manning.

technology does not give the reason of reducing manning level, the increasing new IMO conventions and regulations on one hand ensure the safe shipping but on the other hand contradictorily impose extra risk to ship safety in terms of adding on so many works. For example, the implementation of ISM code and ISPS have affected the seafarers' life profoundly, the increased workloads are burdensome to seafarers. In this regard, regardless of whether these conventions or regulations are helpful to the safe navigation, just those endless paperworks make the work more onerous to ship officers. However, the voice from seafarers is too weak to be treated seriously, we see more often the manning level being cut down concerning of the modernization which is benefited to shipowners and management company who could cut down their payment accordingly, while we seldom see the shipping company to increase the manning level proactively, most of the companies only follow the rule of minimum requirement of manning level rather than decide it on the basis of need.

Generally speaking, in my opinion, the prevailing manning level could no longer meet the rapid changing context of ship. In short term benefit, ensuring the safety of ship and pursuing the best profits are often conflicting, because manning of the ship is one of the highest expenses for the ship owner or ship manager, and who believe reducing the manning level is a significant approach of cost economy. But in the sight of a long-term extension, compared with long-run safe operation of ship, the cost of manning the ship would not be regarded as the highest expenditure items, because the consequences of accidents are tremendous and could not be measured just by money, in particular, concerning the destruction of the marine environment and ecosystems. Therefore, it is very important and necessary to re-assess the manning issues and seek an optimal criterion on the manning level of ship so that safe manning could be maintained sustainably.

1.4 Research Methodology

This research combines qualitative and quantitative research methods to illustrate and discuss present manning issues. The methodology consists of three main ways: First, a literature review to the existing IMO statutes and some national regulations and practices. Second, the research conducts a survey and interview by asking some concernedly key opinion pertaining to the safe manning among nearly 300 crew members, and about 200 pieces have been chosen to support the further analysis, while the others have not been considered due to uncompleted answers. Through the email communication, questionnaires, and in-depth interviews, the author got mainstream preference of individual participants. Third, the assessment of current situation on the basis of feedbacks has been made, and the author also constructed ship's particular scenarios in this paper, to restore the critical scenes of ship practice, so that the actual matters can be more clearly analysed.

The structure of the research paper has been divided into 8 chapters. The first chapter gave basic introduction of the background, the objective of the study, significance research, research methodology and limitation of the research. It mainly explains why we need to further examine the manning issue and clarify the purpose of this study. In order to facilitate the explanation and further discussion, a literature review of the international and domestic legal framework are to be described in chapter 2 and chapter 3 respectively. The subsequent chapter 4 will introduce manning practices in China. Chapter 5 illustrates and analyses the influence and consequence of reducing manning level. The particular survey is in the chapter 6 and further discovered problem related to China manning in chapter 7. Last part is conclusion and study recommendations.

1.5. Limitation of the Research

The study on manning level of Chinese ships is a quite complex and practical issue, this subject covers the type of ship, size of ship, trading area and other many characters. A comprehensive and deep research requires a lot of data collection and scenario analysis as an argument, therefore the capital, time and the support from the maritime authorities, all these are indispensable foundation. However, limited by the abovementioned factors, this research simply collects available data and analyses the situation and present issues from the perspective of seafarer. It is a purely personal academic research, no any organization or other person to supply financial sponsorship for it. Meanwhile, even the author has the awareness about manning issue long time before due to sea experience, while the actual study on this topic is just limited within several months. These factors have become the obstacles to the research. Also most support information are from Chinese seafarers who were surveyed and interviewed by the author, the response of questionnaires were only collected from a limited number of Chinese seafarers in relative short periods, most of them are from the campaign of dry cargo ship, such as bulk carriers, general cargo ships and container ships, even though they are carefully selected and have considerable work experience at sea. Although their responses and opinions may inevitably have been one-sided account and may not cover the entire shipping industry, anyhow the author believes, as one key role of the shipping, seafarers could give a picture of the reality and reveal the existence of low manning level of ships indeed.

Chapter 2 The International legal framework of safe manning

In ancient sailing, ship manning relied mainly on the judgment of experience. Usually, the captain had absolute right to nominate whom would be picked up for the ship and decide how many crew members to be equipped on board. In 1850, the event in term of legislation of ship manning was first noted in England where the specified number of certificated deck officers would be carried on English ship as per the ship's tonnage. In the middle of twentieth century, the ILO played a major role in terms both of manning and regulation of working hours. In 1960, IMCO[5] convened the fourth international convention of SOLAS, the only manning legislation resulting from that convention was a vague requirement that all ships should be "sufficiently and efficiently manned" (Harwood, 1992). The safe manning is a function of the number of qualified or experienced seafarers necessary for the safety of the ship, crew, passengers, cargo and property and for the protection of the marine environment (IMO, 1981). There is no doubt that ship safe manning is one of the important factors directly affect the ship safety, low level of manning means lack of man power and unavoidably makes seafarers fatigue in various workshop on board ship, as well as destroys the normal procedure of maintenance of the ship, and even lower the efficiency of watch keeping. The prevailing method related to the safe manning is that the administration issues the minimum Safe Manning Document

[5] IMCO, Inter-Governmental Maritime Consultative Organization. A specialized organization is responsible for improving maritime safety and the prevention of marine pollution from ships. It was established in 1948 and became operative in 1958. In 1959, it became a specialized agency of the United Nations. Later, it was renamed as IMO in May, 1982.

(SMD) to shipowners or ship operators who has submitted the standard application according to the guideline from IMO resolution, and as evidence, the SMD serves to verify the particular ship which is sufficiently, effectively and efficiently manned and should meet the requirement of administration at all times.

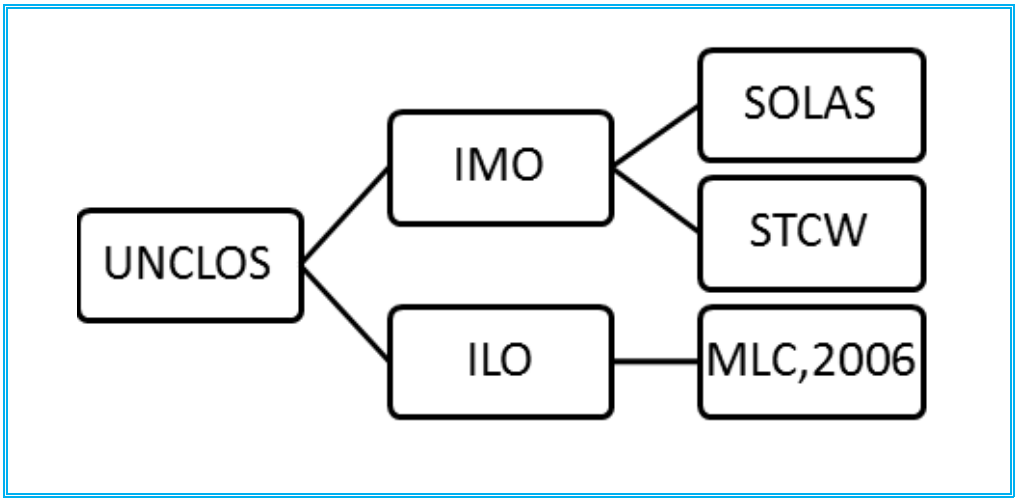


Figure 1 – The legal framework of safe manning of ships
Source: By author, 2014

2.1 Relevant provisions of UNCLOS 1982

With respect to the provisions concerning safe manning levels of ships are contained in UNCLOS 1982[6], which requires every state shall fix the conditions for the grant of its nationality to ships, and also establish a genuine link between the state and the ships. Obviously, Article 91 of UNCLOS requires ship to meet the manning requirement of flag state from the perspective of ship registration, which was explained in more detail in the United Nations Convention on Conditions for Registration of Ships, 1986[7]. Furthermore, Article 91 also requires the state of registration shall ensure that the manning of ships flying its flag is of such a level and competence. These describe the relationship between the state of registration and

[6] Article 91 Nationality of ships and the article 94 Duties of the flag State
[7] Paragraph 6 of article 9 Manning of ships

ships flying its flag. The manning of ships is a precondition and necessary condition for the ships to obtain the legal flag. In addition, UNCLOS 1982[8] specifys the duty of flag states who are required paying the necessary attention for the manning of ships.

2.2 The regulations of ship manning levels in SOLAS

International Convention for the Safety of Life at Sea, well known as SOLAS, is one of the oldest maritime statutes, which covers a wide range of measures to improve the safety of shipping. Regarding the safe manning, SOLAS[9] requires that contracting governments shall ensure their flag ships "*from the point of view of safety of life at sea, all ships shall be sufficiently and efficiently manned*". Furthermore, it also requires a safe manning document shall be issued for each ship from its flag state (SOLAS, 2012). To reach the requirement of safe manning in international instruments, it depends on national legislation. Each ship registered by the government of flag state would be issued a Minimum Safe Manning Document based on the approved manning level of ship (Schröder, 2007, p.18). This certificate will be kept on board ship and to prove that the particular ship reaches the necessary requirement of safe manning. A specimen of Minimum Safe Manning Document is presented in Appendix A

In addition, since the International Safety Management Code (ISM Code) has been introduced in chapter IX of SOLAS convention, the issue of safe manning has been highlighted again. There are at least two key points pertaining to the safe manning in ISM Code. One point is the basic objectives[10] and the other one is the

[8] Paragraph 3 of article 94, Duties of the flag State
[9] Regulation 14, chapter V Safety of navigation SOLAS (2012)
[10] Paragraph 1.2.1 of ISM Code.

responsibilities of the company[11]. The company should ensure that each ship is manned with qualified, certificated and medically fit seafarers in accordance with national and international requirement (ISM, 2002).

Furthermore, the presence of the International Ship and Port Facility Security Code (ISPS Code) has evolved the new Chapter XI-2 in which special measures have been developed to enhance maritime security. This code aims to establish an international framework involving co-operation between contracting governments, government agencies, local administrations, and shipping and port industries to detect or assess security threats and take preventive measures against security incidents affecting ships or port facilities. The objectives are to be achieved by the designation of appropriate officers/personnel on each ship, in each port facility and in each shipping company to prepare and to implement the security plans (ISPS, 2003). The minimum safe manning of a ship is a significant recommendation[12] in this code.

2.3 Safe manning in STCW

The SOLAS convention is more inclined to develop the requirement of sufficient manning which is mapped to the manning level of ships, meanwhile, the requirement of efficient manning is largely performed by STCW, in which contains very detailed rules on the issue of competence of the crew in the respect of training, certification and watchkeeping for seafarers. While the convention also implies some particular provisions about the crew manning level requirements[13], the most typical solution is to utilize the hour of work/rest of each crew member to allocate the manning level of the ship. Those records of hours of work/rest should be maintained in a standardized

[11] Paragraph 6.2 of part A of ISM Code
[12] Paragraph 4.28 Manning level of part B of ISPS Code
[13] Section A-VIII/1 of STCW

format[14] in the working language or languages of the ship and in English, which as the evidence to monitor and verify the compliance with the provisions (STCW, 2010, p.272). The template of rest hours records is attached in Appendix B. In addition, the Convention requires that a copy of watch schedules in working language or languages of the ship and in English should be posted where they are easily accessible.

2.4 Safe manning under the MLC, 2006

The Maritime Labour Convention (MLC), 2006, widely known as the "seafarers' bill of rights", is committed to create a decent work environment for seafarers. As the ILO Director-General Guy Ryde said, "This Convention is a milestone in maritime history." The comprehensive Convention covers almost every aspect of seafarers' working and living conditions including the principle of safe manning. The MLC, 2006 has also the requirement[15] of hours of work and hours of rest which is consistent with the STCW. In addition, it has more specific regulation[16] about ship manning level, its purpose is to ensure that seafarers work on board ships with sufficient personnel for the safe, efficient and secure operation of the ship (MLC, 2006).

2.5 Safe manning under the PSC Inspection

Herein, the ship manning has been introduced in uppermost conventions in shipping industry, and these facts are enough to prove that ship manning matter a great deal with ship safety. To make sure that all these regulations concerning the ship safe manning are effectively implemented at a sound level, the key element relies on the

[14] IMO/ILO Guidelines for the development of tables of seafarers' shipboard working arrangements and formats of records of seafarers' hours of work or hours of rest may be used.
[15] Standard A2.3 – Hours of work and hours of rest
[16] Standard A2.7 – Manning levels

effective flag state survey and certification of ships, and it could be reinforced by the global cooperation, especial the Port State Control (PSC) inspection for the foreign ships. As far, the PSC has already become an extremely important approach to ensure the safety of ships. Enforcement by port states is presented in the UNCLOS 1982[17], it has set out the legal framework for Port State Control. In addition, IMO assembly resolution 1052(27)[18] provides guide principles for Port State Control and it indicates that Port State Control should establish conformity with the flag State's safe manning requirements when performs manning inspection to foreign ship. On the other hand, the MLC 2006 specifies the port state responsibilities[19] and sets out the procedures of inspection in port. The MLC 2006 emphasizes the crew working and living conditions onboard of ship and urges Port State Control to pay attention to this matter and check whether ships conform to the requirements. Furthermore, a developed guideline for port state control officers conducting the inspections under the MLC 2006 was adopted in September 2008 which is a more detailed technical supplement for the regulation of PSC inspection in port (ILO, 2009).

2.6 The principle of safe manning

IMO's resolution assembly has issued the principles of safe manning and urged member states to take the necessary approaches to ensure that every seagoing vessel is equipped with sufficient and qualified seafarers in order to ensure the safety of ship and protect marine environment. The resolution A. 481(12) was adopted on 19 November 1981. This is the earliest resolution pertaining to the principle of safe manning and is the foundation of subsequent principles. It recognized the importance of the requirements of the pertinent IMCO, ILO, ITU and WHO instruments relevant

[17] Article 218 Enforcement by port States
[18] Appendix 11, Minimum Manning Standard and Certification
[19] Regulation 5.2 Implementation and enforcement responsibilities

to maritime safety and protection of the marine environment (IMO, 1981).

Later, the resolution A. 481(12) was revoked, the new resolution A. 890(21) was adopted on 25 November 1999 and introduced by Maritime Safety Committee (MSC) based on the provisions of SOLAS regulation 13[20] of chapter V with respect to the issue of an appropriate safe manning document or equivalent as evidence of minimum safe manning. The new resolution recommended that government should establish the minimum safe manning levels for ships flying their state's flag, also increase Annex 3 on the basis of previous Annex 1 and 2 in resolution A. 481(12) (IMO, 1999).

Further, the International Ship and Port Facility Security Code (ISPS Code) was represented by the MSC, it not only amended existing chapter V of SOLAS, but also re-classified the chapter XI into part 1 and part 2. In term of principle of safe manning, the previous resolution A. 890(21) was amended by the resolution A. 955(23) on 5 December 2003, which mindful of the provisions of SOLAS chapter XI-2 and the International Ship and Port Facility Security (ISPS) Code relating to the security of ships and port facilities, also the resolution A. 955(23) established clearly the more comprehensive goal of safe manning of ship, it would enhance maritime safety, security and protection of the marine environment (IMO, 2003).

For more rational manning of ships, the IMO has developed a new guideline for the principle of minimum safe manning resolution, which is assembly resolution A. 1047(27). This new manning regulation has been adopted on 30 November 2011, and took effect on January 1, 2014. It is an integration of the resolution A. 890(21) and A.

[20] Resolution A. 890(21) was adopted on 25 November 1999 and, at that time, regulation V/13 was the relevant regulation in the 1974 SOLAS Convention. Subsequently, on 5 December 2000, the Maritime Safety Committee adopted, through resolution MSC.99(73), amendments to the 1974 SOLAS Convention which replaced the then existing chapter V. These amendments entered into force on 1 July 2002. As a consequence the relevant regulation is now regulation V/14.

955(23). Since these old resolutions were replaced by new one A. 1047(27), the principle of safe manning becomes more specific and more comprehensive which especially gives very detailed guidelines for all concern related to the issue of minimum safe manning, also the title of principle has been given a particular strong support, because the title is no longer safe manning but minimum safe manning (IMO, 2011). In a companion move, the associated amendments to SOLAS regulation 14, chapter V were approved by MSC 88 in Dec 2010, to require flag States to take the principles in the resolution into account in a transparent procedure when issuing Safe Manning Documents. No doubt, the IMO's assembly resolution A. 1047(27) is a significant recommendation in present maritime practice, it gives the legislative basis to the member states and administrations from international legislation, A lot of states and administrations formulate their national laws and regulations regarding manning levels based on this resolution.

2.7 IMO Assembly Resolution A. 772(18)

The resolution A. 772(18) is also a resolution related to the safe manning in IMO. It was adopted on 4 November 1993. With respect to the resolutions above mentioned such as A. 480(12), A. 890(21), and A. 1047(27), this resolution is from the perspective of the implication of fatigue for ship manning and ship safety to explain the importance of safe manning. So its title is named by 'fatigue factors in manning and safety'. This resolution introduces the general concept of fatigue, and classifies the crew's fatigue factors from the aspects of ship, crew, management and environment. The purpose of this document is to identify the factors of ship operation which may contribute to fatigue, and also to classify those factors to indicate the extent to which the factors may be related. And it aims to increase the awareness of the complexity of fatigue and to encourage all parties involved in ship

operations to take these factors into account when making operational decisions. The related contents are presented in the annex of this recommendation (IMO, 1993).

2.8 The other issue – Seaworthiness

The seaworthiness is a significant concept in maritime safety. It refers to a state of the vessel as well as means the ship's ability to resist risk. The seaworthiness requires not only the hull, machinery in such aspects as design, structure, performance, and state that resist usually appear in the contract voyage or can reasonably foreseeable risks, but also covers the manning of ship and other aspects (Si, 2007, pp.99-100). Therefore, Seaworthiness involves largely to commercial maritime law. The Hague and Hague-Visby Rule[21] require the carrier to exercise due diligences to make the ship seaworthy and properly man the ship under the charter party. The deficiency on safe manning can make a ship unseaworthy. The port authorities can stop an unseaworthy ship to sailing until it is seaworthy (Mukherjee, 2013, p.48).

[21] Rule 1 of Article III: Responsibilities and liabilities of Hague and Hague-Visby Rule

Chapter 3 Legislation of safe manning in China

3.1 General review

Chinese government has recognized the importance of safe manning of ships. As the member states of IMO, China[22] always want to follow the international rule on the manning of ship, but nevertheless, the International shipping still did not issue an unified standard due to the difference of national economic and social system as well as ship types and technical standards. In order to ensure that ships navigate with sufficient and qualified crew members to keep the safety of ships, ensure the safety of people and property and prevent marine pollution of the environment, Chinese government has issued legally binding for the safe manning of ships from a different perspective.

First of all, the principle of safe manning has been presented in the Maritime Traffic Safety Law[23] of the People's Republic of China in 1984. It requires every ship shall recruit enough qualified crew members in accordance with the standards. And also, the Maritime Law of the PRC, 1992 has particular clause[24] to rule *the carrier shall exercise due diligence to make the ship seaworthy, properly man, equip and supply the ship……* Later, on the basis of domestic rules including Maritime Traffic Safety Law and the Inland Water Traffic Safety Management Regulations, and relevant

[22] Not include Hong Kong, Taiwan and Macao area
[23] Article 6 of chapter III
[24] Article 47 of section 2 Carrier's responsibilities

international conventions particular IMO Assembly Resolution A. 1047(27), the Ministry of Transport of People's Republic of China issued the Ship Minimum Safe Manning Rule of the PRC in August 1997 and took effect on May 1, 1998. This is the first official professional regulations on safe manning in China. Then, taking into account the rapid development of Chinese fleet in late of 1990s, the Ministry of transport has further improved the ship manning system. In June 18, 2004 the new rule was re-issued and came into force on August 1, 2004. (Hereinafter referred to the Rule 2004) Further, the Crew Regulations of the PRC has already adopted On March 28, 2007, the 172th executive meeting of the State Council and took effect on September 1, 2007. Promulgating and implementing the "Crew Regulations" provide the maritime administration a support of administrative penalties for illegal inadequate implementation of ship manning.

3.2 Ship minimum safe manning rule

According to the internal and external condition of the ships and other factors, the Rule 2004 has developed various minimum safe manning standards of deck department, engine department, radio personnel and section of passenger transport on sea-going ships and inland river vessels, respectively. The Rule 2004 establishes a sufficient basis for Chinese crew manning, which covers a lot of elements and applies for various types of ships and different conditions, anyhow, it can be read from the following aspects:

3.2.1 The scope of safe manning

Except military vessels, fishing boats, sport boats and non-operating yachts, the Rule 2004 shall apply to all ships which are entitled to fly the flag of the People’s Republic of China.

3.2.2 The standard of safe manning

Manning standard under this rule is the minimum manning requirement for merchant ships flying Chinese flag. Shipowners or ship operators, ship managers should man their ships with sufficient and competent seafarers in accordance with the requirements of this rule, but does not exempt the shipowners' liability to increase seafarers if necessary for ensuring safe navigation and operation of the ship.

3.2.3 The principle of safe manning

The principle of minimum safe manning under the Rule 2004 can be divided into three elements:

- **The principles of comprehensive survey**

Determining minimum safe manning of ships should take the consideration of ship's type, gross tonnage, technical condition, power of ship's main propulsion unit, trading area, voyage periods, sailing time, navigable environment and crew duty watch, rest scheme, etc.

- **The principle of 'no lower than' minimum standard.**

During the voyage, the composition and quantity of seafarers should satisfy the minimum requirements in accordance with the minimum manning rule.

- **The Principle of appropriate adjustment of manning levels**

The Shipowners or ship operators are entitled to decide the composition and quantity of crew members in accordance with the relevant specification of annex 1, annex 2 or annex 3 of this regulation when the ship sails under normal circumstances. However, the maritime administration may not approve the reduction or full reduction of minimum manning level if the administration believes that the reduction could not guarantee the safety of the ship. On the other hand, shipowners can also increase manning level as it is needed, but the total crew members should not exceed the

capacity of rated manning of lifesaving equipment which are approved by recognized organizations.

3.2.4 Safe manning management

In view of management of ships' safe manning, it mainly reflects in the certificate management. Any ship fly Chinese flag, shall obtain a Minimum Safe Manning Certificated by Maritime Safety Administration. Even, Foreign vessels sailing in China territorial sea and internal waters and waters under the jurisdiction, they also should hold a minimum manning certificate issued by its flag State. Ship master has obligation to keep custody of this certificate and ready for survey at any time and renewal of certification.

3.2.5 Exemption certificate

Whenever the crew on board ship in case of death or unable to fulfil their duties or other special circumstances need to replenish crew in position, the shipowner or crew manning company may apply to the maritime administration agencies for special exemption certificates. For the officers, the period should not exceed 6 months, but the captain and chief engineer for special free certificate only in the event of force majeure can only be issued for a period not exceed 3 months, in addition, be issued in any case not appropriate radio personnel certificates of special exemption certificate.

3.2.6 Supervision and inspection of safe manning

Each ship whether flying Chinese flag or foreign flag shall submit the Minimum Safe Manning Certificate for the processing of port formalities when enters or leaves Chinese ports. Each ship shall recruit sufficient and competent seafarers who have

adequate knowledge and capability to maintain and operate the ship safely during berthing. For 500 gross tonnage and above (or 750 kilowatts and above) seagoing ships and 600 gross tonnage and above (or 441 kilowatts and above) inland waterway ships, the ship master and chief mate, chief engineer and second engineer shall not simultaneously disembark the ship. For any domestic ship without holding a manning certificate or actual manning scale below its requirement of certificate, the maritime administration should take appropriate measures and prohibit it from leaving until the ship meets the requirements. For foreign ships, the administration may take the same measures or require the shipowners to supply a written approval for its actual manning level from the competent authorities of the flag states. Ships and/or individual who violate the safe manning rules should be given administrative punishment according to the law. Any staff of maritime administration shall burden the administrative punishment if he violates rules or even be sentenced to jail if he constitutes a crime when performing their duties of supervising. Ship Minimum Safe Manning Rule of the PRC (2004)

3.3 The basic manning scale under ‘Rule 2004’

The coastal structures of China contribute to the diversity of Chinese shipping. Inland waterway transport and coastal cabotage are very developed, the ocean transport is also an important pillar of the Chinese multilateral economy. For the sake of covering all kinds of context of transportation, the Manning Rule 2004 has developed different manning levels based on the difference of trading area, type of ships, size of ships and the extent of automation. The particular requirement covers the cargo ship, passenger ship and tugboat. Due to the limited research resources, we only study dry cargo ship of 500 GT and above which engages coastal cabotage and ocean transportation. For these subjects, no matter what kinds of ship or trading area,

The principle pattern includes the master, chief officer, deck officers, rating for navigation watch, and chief engineer, first engineer, duty engineers, and rating for engine watch, while the deck officers and ratting for navigation watch may be reduced from basic deck component, and duty engineers and/or ratting for engine watch may be removed from engine departments, that is because the existence of an exemption clause in Manning Rule 2004, some of shipowners may conduct the deviation from basic requirement of this Rule.

Table 1 - Basic manning requirement of cargo ship

<table>
<tr><th colspan="5">Deck Department</th></tr>
<tr><td rowspan="3">Ships of 3000GT and above</td><td>Master</td><td>1</td><td>Chief officer</td><td>1</td></tr>
<tr><td>Second officer</td><td>1</td><td>Third officer</td><td>1</td></tr>
<tr><td>Rating for navigation watch</td><td>3</td><td colspan="2">Voyage does not exceed 300 nm or consecutive voyage time is not more than 36 hours, and can reduce one Third officer and rating for navigation watch.</td></tr>
<tr><td rowspan="3">Ships over 500 GT but under 3000 GT</td><td>Master</td><td>1</td><td>Chief officer</td><td>1</td></tr>
<tr><td>Second or Third officer</td><td>1</td><td>Rating for navigation watch</td><td>3</td></tr>
<tr><td colspan="4">Continuous sailing time is not more than 36 hours, a rating for navigation watch can be reduced; continuous sailing time is not more than 8 hours, 2nd or 3rd officer can be further reduced.</td></tr>
<tr><th colspan="5">Engine Department</th></tr>
<tr><td rowspan="3">Ships of 3000 KW and more</td><td>Chief engineer</td><td>1</td><td>First engineer</td><td>1</td></tr>
<tr><td>Second engineer</td><td>1</td><td>Third engineer</td><td>1</td></tr>
<tr><td>Rating for engine watch</td><td>3</td><td colspan="2"></td></tr>
<tr><td colspan="5">(1) Ships with continuous sailing time less than 36 hours can reduce Third engineer and one rating for engine watch.
(2) Ships with AUT-0 automated cabin can reduce Second engineer, Third engineer and two rating for engine watch.
(3) Ships with AUT-1 automated cabin can reduce Third engineer and two rating for</td></tr>
</table>

engine watch. (4) Ships with BRC semi-automatic cabin can reduce 2 rating for engine watch.				
Ships over 750 KW but under 3000 KW	Chief engineer	1	Second engineer	1
	Rating for engine watch	2		
Ships with continuous sailing time more than 16 hours should increase one Third engineer and one rating for engine watch (Automation engine room and BRC semi-automated engine except)				

Source: Ship Minimum Safe Manning Rule of the PRC (2004).

In summary, the Manning Rule 2004 provides a comprehensive guideline of safe manning to ship's owners and shipping companies, who are the responsible principal of implementation of this rule. Meanwhile, MSA of China is entitled to issue ship minimum safe certificate to shipowners or ship operators and supervise their performances. The ship manning certificate is the preliminary evidence, and safe survey and FSC inspection are further approaches to ensure the safety of the ship. Nevertheless, the final judgement of the amount of crew members relies on not only the Rule 2004 but also many other factors relating to the ship. In this point of view, the Rule 2004 has clearly stated, "when determining the minimum manning level of the ship, the impact of various internal and external factors should be taken into considered.'

Chapter 4 Ship manning practices in China

Back to the 1960s and 1970s, ship manning scales are significantly reduced in China. As we understand that the decline of manning level is mainly caused by the modern technology which has been widely applied to shipping industry. China has joined various maritime conventions as one of the member States of the IMO. Therefore, following the international trend and based on the IMO guidelines and other international statutes, combined with the feature of Chinese fleet and transportation structures, China has built its own ship manning policy. The manning level has been cut down depending on the size and type of ship, trading area and other factors and this rule is further developed in course of time. The minimum safe manning regulation gives flexible choice to shipping companies and allows them to refine and quantify the manning level of their ships within the specified rules on the basis of ensuring ship safety and protecting environment. On the other hand, this regulation also confers Chinese Maritime Safety Administrations powers to acknowledge specific manning level of each ship and supervise shipping companies' performance in this aspect.

4.1 The impact of global manning change on China

Focusing on the manning changes in the world in recent decades, it may conclude that the change is a result of the combination of factors change, which include the scientific and technological progress, the development of the world economy, introduction of international rules, improvement on shipping management,

enhancement of seafarers training and improvement of overall quality of the seafarers, as well as the decline of the seafarers in developed countries. For an ordinary general cargo ship, the manning scale was reduced from more than 50 crew members to about 20 staff on board since 1960s to the present. In fact, this process was not just simply reducing the number of crew, but a comprehensive and integrated development of the various factors which make the ship a scientific change. The massive technological change and innovation of shipping made the old manning scale superfluous and manning reform came into being in shipping industry. There is one typical example demonstrating this trend very well, that is the first Triple-E Mærsk Mc-Kinney Møller. When she commenced her maiden voyage in July 2013 in Busan, South Korea, although this gigantic container ship can accommodate 34 crew members theoretically, the fact was that it only recruited as few as 13 seafarers who were certainly carefully selected highly qualified crew members, while in regular service approximate 22 persons will make out the crew (Maersk, 2013). China has a significant long history of maritime power, especially in recent years, China's economy has kept rapid growth, and shipping plays an absolute important role in this change. With the global economic integrating, international maritime activities have created a close-knit between China and western world. Furthermore, the shipping industry is a very international industry, its survival and development is bound to be affected by the international environment. As far, China has turned into one of the most important parts of world economy, therefore, facing with the global ship manning trend, China has to take steps to carry out ship manning reform.

4.2 Chinese manning reform lags behind the world

Despite China's manning reform has been constrained by many factors which include the legislation, technical condition, management, education, etc. But nevertheless,

Chinese government and shipping companies had realized the importance of the progressive reform of science and economy and further followed the footsteps of the developed countries. Regarding the ship manning reform, our steps lagged far behind the developed countries at that time and this was closely related to Chinese national conditions.

Firstly, in the old time, the economic base of China was quite behind the western countries, it was impossible to renew all of the old ships in a short period, so the degree of automation and technical level in overall fleet was relative low. And secondly, Chinese crew worked onboard of ships in a single parallel mode due to the institutional segregation of duties, that means deck crew and engine crew worked separately and never overlapped each other, while the developed countries have adopted dual duties system and this provides the possibility of integrating the works of different departments such as deck and engine or mechatronics works together. The third reason has related to the Chinese crew. As we know that China has owned quite large number of ship crew but they earned low wages at that time, therefore the proportion of crew costs for shipping companies was not so high compared with developed countries, and seafarers' payment was not so sensitive issue to shipowners. Finally, the shipping companies did not establish an effective shore-based support at early stage, most of the maintenance and repair jobs had been undertaken by crew in the field rather than on shore. In conclusion, all these abovementioned factors made Chinese fleet keep the old manning scale for quite long time.

4.3 Manning reform process in China

Anyhow, China has promoted ship manning reform with the circumstances and conditions change. In generally, this process has been divided into four typical

phases. The first phase was in the 1980s, the Ministry of Communications of PRC (currently named as Ministry of Transport) began to reduce ship manning and the particular manning scale decreased from an average of 55 to 37 crew members. The steam engine was replaced by low-speed diesel engine which was contributed to the main change, and the improvement of deck handling equipment was another important technical support. Under this background, ship innovation made manning reduction unavoidable and it involved mainly the rank of rating crew.

The second stage started in the late 1980s, based on the introduction of the Unattended Machinery Space and Automation technology, the number of recruited seafarers was reduced further from 37 people to 30 people. A few ships with high degree automation has manned with only 28 people and even less than 25 crew members for composition.

The sign of third phase is the first Ship Minimum Safe Manning Rules which was issued in September 1997 by the Ministry of Communications of PRC. According to the development status of the ship, especially considering the improvement of ship handling due to the degree of automation, for instance, the integrated control system between bridge and engine control room, automatic winch and windlass, automatic hatch, automatic detection of fire-fighting system, etc. the number of deck and engine rating crew has been further decreased, and manning scales have been optimised for about 20 persons or even less (Zheng & Wu, 2002, pp.103-104).

In the early twenty one century, Phase four came into being with the progressive amendments of STCW and other international conventions, and the change of domestic economic situation has further pushed shipping innovation ahead, many Chinese laws or regulations have been amended so as to adapting to the new world. On the basis of manning rules 1997, the new minimum safe manning rule of 2004 came into force.

4.4 Manning practices on Chinese ships

The Rule 2004 is merely a principle guideline of safe manning rather than the evidential document to support the shipowners to save costs and reduce manning scale in the actual manning of ship, the shipowners cannot simply follow the requirements of SMD to fix the numbers of crew members to a particular ship. In view of the importance of this issue, the levels of crew members in actual ship are much higher than the requirement of Safe Minimum Manning Certificate. This fully demonstrates that the shipowners or operators have realized the importance of safe manning for the safety of ships. Here we have selected a few specific ships to enumerate what specific ship manning levels on Chinese ships. The information was directly collected from ship masters who are the author's friends or colleagues and currently work on board ships. The author has elucidated the purpose of the survey to them and emphasized that it is a purely personal activity only for the research of practical manning in China. In order to cover these masters, ships' name are hidden.

Table 2 – Manning scales on Bulk Carrier

Sample 1		Manning					
Type of ship	Bulk Carrier	MST	1	2/E	1	Cadet	2
GT	92,248	C/O	1	3/E	1	FIT	1
Power	18,660 KW	2/O	1	E/E	1	M/M	3
UMS	Yes	3/O	1	BSN	1	CK	1
Trading area	World wide	C/E	1	A.B	3	M/B	1
Crew members	24	1/E	1	O.S	2	P/C	1
Sample 2		Manning					
Type of ship	Bulk Carrier	MST	1	2/E	1	Cadet	2
GT	30,777	C/O	1	3/E	1	FIT	1
Power	11,149 PS	2/O	1	E/E	1	M/M	3

UMS	Yes	3/O	1	BSN	1	CK	1
Trading area	China coast[25]	C/E	1	A.B	3	M/B	1
Crew members	22	1/E	1	O.S	1	P/C	1

Source: survey by author in May, 2014

The above manning scale is a very popular pattern on Chinese Bulk Carriers no matter what size is involved. This manning pattern mainly concerns safety of ship and running cost. In fact, for HANDYSIZE[26], HANDMAX[27], PANAMAX[28], or CAPASIZE[29] bulk carriers, equipping 22 to 24 crew members including the master has become favourite choice by recognized shipowners whether the vessel performs ocean going or coastal transport.

Table 3 – Manning scales on General Cargo Ship

Sample 3		Manning					
Type of ship	General Cargo Ship	MST	1	2/E		D/C	1
GT	3,597	C/O	1	3/E	--	FIT[30]	1
Power	3,300 HP	2/O	1	E/E	--	M/M	1
UMS	No	3/O	--	BSN[31]	1	CK	1
Trading area	Near ocean[32]	C/E	1	A.B	2	M/B	--

[25] Coastal waters is the Bohai Sea, Yellow Sea and East China Sea from the shore waters of less than 200 nautical miles, the Taiwan Strait, the South China Sea is not more than 120 sea miles from the coast (east coast of Taiwan, Hainan east coast and south coast no more than 50 sea miles from the shore of the sea) – Source from The Technical Rules of Statutory Inspection for People's Republic of Chinese Ship. (China MSA, 2011)

[26] Handsize refers to bulk carrier between 100,000 to 400,000 DWT.

[27] HANDMAX refers to bulk carrier between 400,000 to 600,000 Dwt.

[28] PANAMAX refers to bulk carrier between 600,000 to 750,000 DWT. The size is not more than 274.32 in length and 32.3 in mould width.

[29] CAPESIZE refers to the bulk carrier beyond 80,000 Dwt. Due to the size limitations, such a ship cannot pass through the Panama Canal but take the route of Cape of Good Hope instead

[30] Who has certificate of rating as able seafarer engine

[31] Who has certificate of rating as able seafarer deck

[32] It is recognized by Chinese traditional navigating convention, usually water covers the area north to Russia, south to Indonesia, east to Japan, west to Malacca.

Crew members	13	1/E	1	O.S	--	P/C	1
Sample 4		Manning					
Type of ship	General Cargo Ship	MST	1	2/E		D/C	1
GT	1,980	C/O	1	3/E	--	FIT	1
Power	1,000 KW	2/O	--	E/E	--	M/M	1
UMS	No	3/O	1	BSN	1	CK	1
Trading area	China coast	C/E	1	A.B	2	M/B	--
Crew members	10	1/E	1	O.S	--		

Source: surveyed by author in May, 2014

In particular, we selected the relative small general cargo ships to illustrate the prominent rule of the decreasing of the ship manning as the decline of the ship size. Compared with large size general cargo ship (10,000 GT and more), these small ships have no fixed cargo handling gears on the main deck with one or two cargo holds and the operation is relative easy. This kind of ships usually sails along the coast or near ocean due to the limited volume of oil tanks. Considering the size and sailing area, usually there are only two deck officers and one engineer on board, captain and chief engineer have to participate in duty watch on the basis of generally manning.

Table 4 – Manning scales on Container Ship

Sample 5		Manning				D/C	1
Type of ship	Container	MST	1	2/E	1	FIT	1
GT	55,534	C/O	1	3/E	1	M/M	3
Power	51,390 KW	2/O	1	E/E	1	E/C	1
UMS	Yes	3/O	1	BSN	1	CK	1

Trading area	World wide	C/E	1	A.B	3	M/B	1
Crew members	23	1/E	1	O.S	2	P/C	1
Sample 6		Manning					
Type of ship	Container	MST	1	2/E	1	D/C	--
GT	7,197	C/O	1	3/E	1	FIT	1
Power	4,109 KW	2/O	1	E/E	1	M/M	1
UMS	Yes	3/O	1	BSN	1	CK	1
Trading area	Near ocean	C/E	1	A.B	3	M/B	1
Crew members	19	1/E	1	O.S	1	P/C	1

Source: surveyed by author in May, 2014

The listed data of manning scales in above table once again proves that ship size is a major factor in determining the Manning level. In general, ship size is associated with the trading area because fuel reserves capability is the basis of determining the ship routes. With the decrease of the ship size, manning level declines as well. Reducing the post of sailors and mess boy is the most effective way to save costs within the dimension of the regulatory requirements. In addition, electrical engineer has no position onboard inshore sailing ships. Cadet is not an essential post and their low payment has little effect on the ship cost. However, there is one very special post, political commissar (P/C), onboard some Chinese ships particular state-owned ships who is mainly responsible for the ideology work.

4.5 Political Commissar, an embarrassing post on Chinese ships

Go through the practical manning scale in above mentioned table, a distinctive post was nominated on Chinese ships, that is political commissar (P/C) who is unique and important on Chinese merchant ships. The so-called Political commissar, a typical

noun with Chinese characteristics, is designed to do ideological and political work as the instructor of crew. Whether inland riverboat or in the offshore and ocean-going vessels, many are provided with a political commissar position. This post was created under the planned economic era, but still exists in the "Merchant society" under market economy.

The Chinese shipping companies has regulated that political commissar should kindly assist ship master to manage the ships safely. The main function of political commissar is to coordinate the relationship of crew members and give instruction on ideology. Actual, the position of political commissar has been weakened on board ships regardless of the authority, status, salary, benefits, or the respect from the crew. Even so, political commissar holds a tolerant attitude to accept the change of reform from the enterprises, they are still loyal to their duties, and perform their roles and functions to adapt to new needs of "Merchant society". Because political commissars are not maritime college graduates and professional seafarers, most of them come from veterans and also face employment pressure in middle age, so they just desire a steady job.

At present, the necessity of political commissar post is a contentious issue. Some seafarers believe that it is necessary to set the political commissar on board ships while some make dissent voice. Supporters have stated their perception as the political commissar can motivate the enthusiasm of the crew, coordinate the relationship among crew and between different departments and establish the hierarchy on board. In addition, political commissar also plays the role of supervising and monitoring the captain to prevent him abuse the power. However, the opponents hold the contrary views that they have seen the power-sharing between captain and political commissar, it is contradict to the rule that captain own overwhelming

authority onboard of ship. Furthermore, some of political commissars are the relatives of the shipowners and they are allocated as the owner's representative on board and actively involve many matters, this unavoidably affects the authority of the captain, restricts the crew's personal interests and their freedom of personality development, suppress their personal desires. On the other hand, most political commissars do not hold competency certificate, do not have any nautical practical skill, so they cannot share the crew's work load in practice. Their function associated with safety of ships is quite minor but they are paid with a high salary just next to the captain's, so hiring a political commissar not only increases ship running cost but also makes things more complicate. The controversy from the practice is worth checking this scheme, however, as the outcome of planned economy, the political commissar with Chinese characteristics will no doubt continue to exist for a while on ships flying Chinese flag.

4.6 Manning reduction of Chinese ships

As a seafarer, the author has personally experienced the manning reduction process. I started my sea career in year of 2000 and ship manning scale at that time was far beyond the number of present manning practice. In 2002, the author was a Third officer working onboard a HANDMAX bulk carrier which was manned with 28 crew members. However, in 2012, as the ship master, I took over a CAPESIZE bulk carrier in COSCO Dalian shipyard, there were only 23 crew members onboard this new delivered ship. In addition, in this study, the author has also interviewed some friends with seafarer's background including twenty marine captains and five chief engineers. The interview was conducted through gathering chat, telephone consultation and Internet chatting during the period of May and Jun of 2014 (The specific content of the interview refers to Appendix C). These captains and chief

engineers attending interview are around 40 to 60 years old and have abundant work experiences on general cargo ship, bulk carrier and container ship, they all have undergone the decline of manning levels on board Chinese ship over the past two decades, so it may say that they are the witness of this change. In particular, the figure below also reveals clearly the changing of manning scales on HANDYSIZE bulk carrier, about 10,000 GT general cargo ship and FEEDMAX[33] container ship.

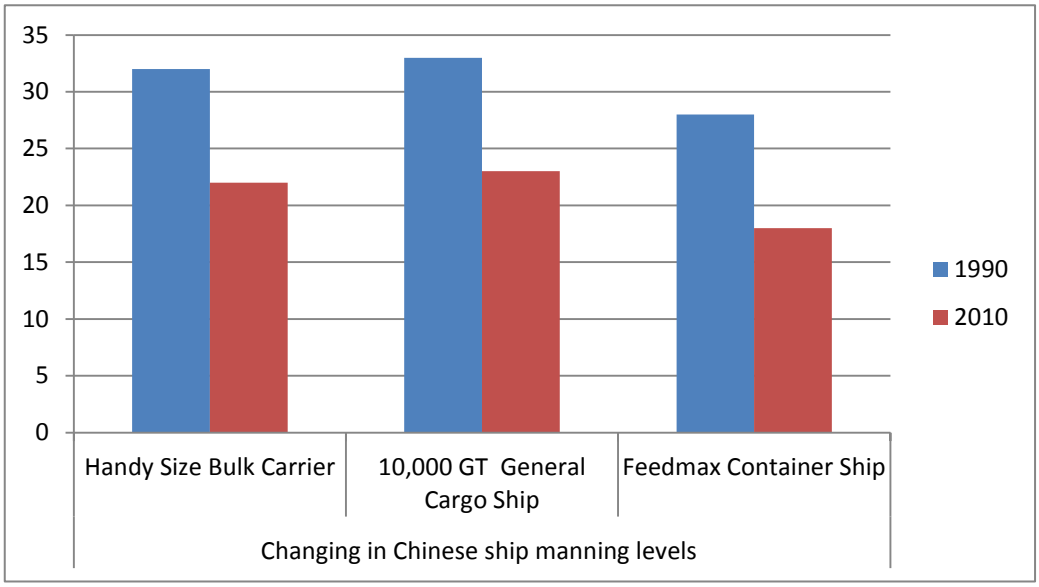


Figure 2 – Changing in Chinese ship manning levels between 1990 and 2010

Source: from interview of marine captains by author in 2014

It is evident from the information provided that the manning scales in 2010 were much lower than 20 years ago no matter what kinds of ships, and the decline in the size of crew members exceeded 30 per cent compared with the past. With regard to the limitations of samples data, it cannot cover all fleet ship during those periods, but it represents the general tendency of manning levels change. Comparing the present crew list with the one before 20 years, it can figure out the actual changes in the structure of the crew, such as the Radio Officer, Assistant Officer, Assistant Engineer,

[33] Feedmax refers to large feeder container vessels, generally refers to the standards contained in the container volume at 500-1000 slotting container ship.

Carpenter, Deck Fitter, Pump Man, Electrician, Purser, Ordinary Cook, these titles no longer appear on the crew list any more. In addition, the number of sailors[34] and oilers has been cut down as well.

4.7 The root causes of manning reduction

Although, the Ship Minimum Safe Manning Rules has been reissued in 2004, but this renewed rule has not changed the principle of manning. In fact, the decline of manning scales reflects the transformation of the shipping industry for the past couple decades. Automation is a primary factor to affect the manning levels. After more than 60 years of development, ship has developed automatic control by the integration of phase information and intelligence and computer (Wang et al. 2011, p.1). The ships automation, to a great extent reduces the workload of crew members. Also the running costs are the ongoing expenses connected with the day-to-day running of the ships, especial on the bunker charge and manning costs. In the just past decade, the price of bunker oil quadrupled, soaring oil prices also make shipowners complained.

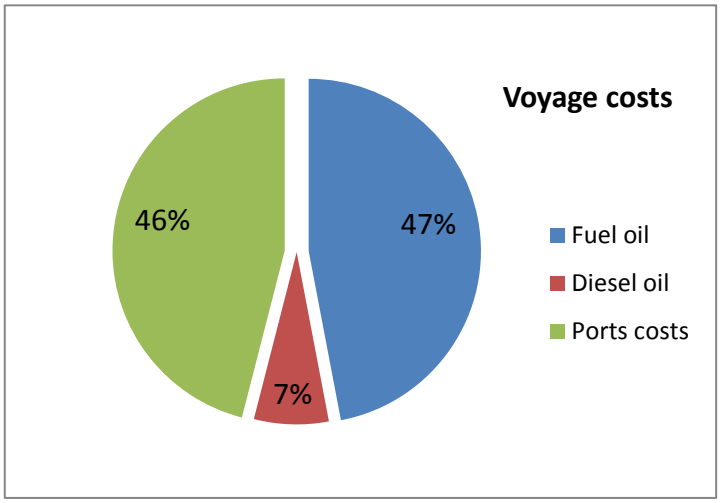


Figure 3 – Voyage costs
Source: M. Stopford, 2007

[34] Sailors include able seaman and ordinary sailor.

Rotterdam	2003	2004	2005	2006	2007	2008	2009	2010	2011
IFO380	153	180	277	260	463	248	442	452	621
IFO180	160	196	299	280	483	293	462	465	642
MDO	235	455	545	490	680	585	595*	659*	-

* Antwerp

Korea	2003	2004	2005	2006	2007	2008	2009	2010	2011
IFO380	173	235	325	282	505	380	477	483	682
IFO180	177	255	346	312	530	400	488	493	692
MDO	275	445	595	565	765	700	655	720	980

Los Angeles	2003	2004	2005	2006	2007	2008	2009	2010	2011
IFO380	150	260	340	283	470	370	465	470	680
IFO180	161	267	405	302	480	480	495	480	710
MDO	290	485	720	582	820	695	695	720**	980

Date in 2011 are in August

** Houston

Figure 4 – Bunker price
Source: Nakazawa, 2014

The manning costs include all direct and indirect charges incurred by the crewing of the ships, such as basic wage, overtime allowance, insurance premium, pensions, victuals, medical care and repatriation expenses, etc. For a particular ten-year-old CAPESIZE bulk carrier, total manning costs may account for up to half of operating costs (Stopford, 1997, p.161). Even this sample bulk carrier was flied a Liberian flag and not a Chinese ship, also, the surveyed time was in 1993, however, it can be a very good case to be quoted, because in normal, the same type of ships have common operation procedure no matter what kind of flag of state. Also, China has a lot of ships engaged in international transportation, the operating costs incurred is very similar. Therefore, reducing the size of crew is a constant solution to cut the cost by shipowners or management companies.

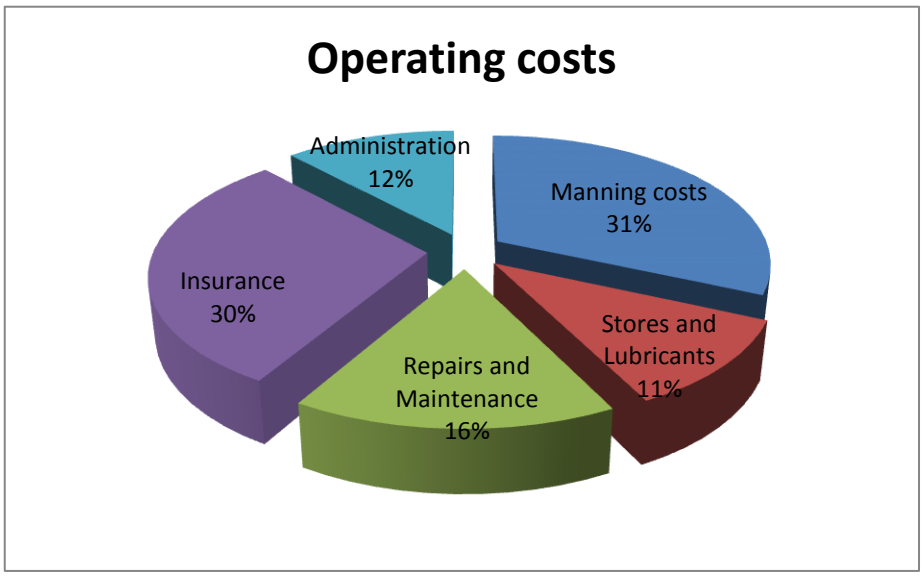


Figure 5 – Cost analysis of operating a ship
Source: M. Stopford, 2007

The next affected factor is open registry regime or Flag of Convenience (FOC). The international shipping is now virtually in the hands of the developing world and that the process is irreversible (O'Neil, 1999). This is absolutely one of the most typical issues in contemporary shipping. this dramatic change in the very constitution of international shipping has largely been caused by the rise of the open registry system. On this premise a central question is whether it is necessary to compromise safety standards in order to realise the most alluring aspect of the open registry system (Mukherjee, 2013). But anyway, at this stage, the low cost taxation, substandard of registration motivates ships to fly convenient flag, and moreover, FOC or open registry could avoid being blockaded and captured in political factors concern. The impact of open registry pushes governments to diminish manning standards to get more registered ship, China is one of them.

In addition, the changes in the organization of the ships make ships no longer a simple individual transportation, but a comprehensive system. This system includes

ships, company management, shore-based support, port services, etc. This kind of integration shares a part of the traditional workload of crew members so as to reduce manning of ships. Further, the rapid development of modern science and technology brings more safe ship structure, more stable and efficient equipment, and more professional workshops, these developments assist the crew members saving a lot of maintenance work. Therefore, the size of crew members declines.

Chapter 5 The Impact of Reducing Manning Levels on the Safety of Ships

Standing on modern shipping perspective, ship is no longer a simply transport but more like a system, or rather a sociotechnical system which includes the hard system and soft system. Ship and crew are all located in the centre of multiple and complex interaction (Baumler, 2014). It indicates the important role of crew in this system, and also demonstrates the importance of crew manning on board ships. The ship's operators must then effectively manage their crew. Any mismanaged crew, no matter how large, will have more than its share of problems (Stevenson, 1996). This means that the shipowners or ship operators have responsibility to ensure the particular ship manned with adequate crew for safe operation.

Whether reducing manning levels will influence the safety of ships? Actually, this is a very controversial issue. For instance, we can find out many topics on the home website of ILO and ITF, the mainstream view is that reducing the number of manning makes seafarers extend working hours and increasing crew fatigue, and also reduce the opportunities of practical training. Meanwhile, low manning level makes ships running in poor maintenance condition, and it will further deteriorate the security situation of the ship. This view convince seafarers, they have strongly expressed their aspirations and complained about the heavy hard works. However, another contrary opinion is given by shipowners and management companies, they

think differently because they believe that the improvement of seafarers' safety awareness and equipment working stability are primary reasons to guarantee ship safety. They pointed out that minimum well-trained seafarers can bear great responsibility and manage automation systems without any problem.

The author absolutely stands on the seafarers' side and supports the view that reducing ship manning really imposes an impact to the safety of the ship. Because the shipping industry is developing too fast, new ideas, new technologies, new requirements require seafarers to make a rapid adaptation. Meanwhile, seafarers' works become more onerous and the documents are piling higher and higher. So the ship manning should be adjusted systematically according to the development of the ship. Anyhow, under the background of reducing manning of ships globally, some safe and security issues related to ships and seafarers expose for long time.

5.1 Low manning levels easily lead to seafarer fatigue

Nowadays, in the shipping industry generally believes that the workload of seafarers has greatly increased due to several reasons such as increased paperwork, faster port turnarounds, atrocious weather, homesickness, uncomfortable working environment and reduced manning levels, and other pressures which reflect current economic demands. That leads to the high potential for fatigue in seafarers and those who are exposed to a large number of risk factors are the most liable to be fatigued (Smith, A & Allen, P & Wadsworth, E 2006).

Fatigue can be defined in many ways. However, it is generally described as a state of feeling tired, weary, or sleepy that results from prolonged mental or physical work, extended periods of anxiety, exposure to harsh environments, or loss of sleep (IMO,

1993). Fatigue impairs seafarer's performance and diminishes alertness and further threatens the safety of ships. No matter how well we train our people, however well we equip our ships, if people are fatigued they are dangerous (MAIB, 2004). The technical and specialized nature of shipping industry requires constant alertness and intense concentration from its workers. Fatigue is also dangerous because it affects everyone regardless of skill, knowledge and training (IMO, 2011). Seafarers' fatigue is a significant factor to impact on the safety of the ships. The marine disasters are the most powerful evidence to support this point. For instance, Exxon Valdez[35] and SHEN NENG NO.1[36], these two cases have caused oil pollution to the U.S. and Australian waters and damaged local ecological system seriously. A subsequent investigation revealed that the irresistible fatigue destroyed the deck officers' judgement and further caused the ship running aground.

5.1.1 Fatigue on seagoing ship

Fatigue is a 24/7 problem in shipping industry. It can be said that since the moment of seafarers sign on the ship until they end their agreement and off the ship, fatigue has been accompanied with the crew members always. People would have such experience after a day or two long journey, they often feel so tired with muscle pain, lethargy, and need to sleep to replenish their strength, compared with seafarers, that is quite tiny thing. Ship crew normally works on board ship from at least several months to even over a year. During the accident investigation, the Maritime Accident Investigation Branch (MAIB) even found one crew who had not took any leave over

[35] The Exxon Valdez was a large oil tank. On March 24, 1989. she hit Prince William sounds bligh reef resulting in a spill of some 41,000 to 119,000 m3 of crude oil. The pristine white Alaskan shoreline was devastated. It is thought that this was one of the most devastating human-caused environmental disasters in history. It was certainly the largest spill ever within US waters.

[36] SHEN NENG NO.1 is a Chinese bulk cargo ship, on 3 April 2010 ran aground on the Great Barrier Reef in Australia and some of the oil leak on the Great Barrier Reef and the surrounding ecological environment pose a contamination.

two years (MAIB, 2004). Could you imagine how seafarers work onboard ship under various pressure but without any weekend or a single day off?

Many researches have been done involved in the subject of seafarer fatigue, for instance, European Commission has funded a 'Horizon Project' on investigating the impact of fatigue on the cognitive performance and decision-making of ships' watchkeeping officers. Centre for Occupational and Health Psychology of Cardiff University also has constantly undertaken many researches on fatigue, among them, one six-year research programme conducted the form of a literature review, a survey of 1,856 seafarers, diary studies and objective testing on board, the research results finally were published in November 2006. The major finding revealed that fatigue impacted on the seafarers' performance and safety of ship. (Smith & Allen & Wadsworth, 2006)

Table 5 – Major finding in Cardiff Research Programme

No	Major finding
1	One in four seafarers said they had fallen asleep while on watch.
2	Almost 50% of seafarers taking part in the study reported working weeks of 85 hours or more.
3	Around half said their working hours had increased over the past 10 years, despite new regulations intend to combat fatigue.
4	Almost 50% of seafarers taking part in the study consider their working hours present a danger to their personal safety.
5	Some 37% said their working hours sometimes posed a danger to the safe operations of their ship

Source: Cardiff Research Programme, 2006

When the ship sails at sea, the seafarers have to put up with noise, heat, vibration, harsh weather condition and heavy traffic pressure, especial in China coast, they cannot sleep and eat very well. When the ship is in anchorage, some special missions have to be carried out at this stage, such as the drill and exercise, aloft and outboard work as well as machinery and equipment inspection and testing, so they do not have enough time for rest. When the ship is at berth, the supervision of the cargo operation and berth watch become the primary tasks for crew. These works have already consumed most of the crew working time. Meanwhile, such as taking bunker, receiving provision and store, disposing garbage, changing crew, these businesses all occupy lots of time from crew members. In addition, the throngs of external inspection disrupt the crew rhythm of life on board. Overtime has been become a quite normal routine. Most of seafarers believe that ship in berth is like a battle, the captain and crew are dealing with those all kinds of inspectors and visitors on the condition of sacrificing their normal rest time. In these all scenarios, the seafarers are keeping a state of very high tension and this deteriorates seafarers' tired feeling.

5.1.2 Fatigue from the ISM and ISPS

Even, IMO family posts up the guidelines on ship management for the safe operation of ships, that is remarkable statute of ISM Code which aims to provide an international standard for the safe management and operation of ships as well as for pollution prevention. For implementing the Code, the company has already developed their own safety management system (SMS). These systems are specific to the implementation of the ship, the captain and crew members have to do a lot of works, such as reading a lot of cumbersome procedures even which are not corresponding to the real condition. It is good that seafarers must follow the systematic requirements to take each step and keep good records, while this also

leads to endless checks and paperwork, particularly when conducting internal audit, some small oversights which can be solved readily may be raised to the level of the ISM Code and SMS and require the captain to carry out training, discussion, demonstration and some other necessary actions to close those tiny deficiencies as per the cumbersome procedures. Therefore, an unavoidable fact is that ISM aims to keep ship safety but increase too much workload to crew and thereby makes crew fatigue. But unfortunately we could not find out any specific technical support in the Code and company SMS to overcome the growing workload.

Another timely regulation is ISPS Code which was adopted in 2002. The Code require ships to establish a copy of recognized Ship Security Plan (SSP) and carry out a proper Ship Security Assessment (SSA). In addition, SSP should contain a nominated Ship Security Officer (SSO) and the specific security duties which are allocated to the crew members. Meanwhile, IMO Assembly amended the resolution A. 890(21) to A. 955(23) on principle of safe manning to verify the emergence of ISPS Code. However in new resolution, we only realize that the security duty has been endued to seafarers, but we could not see any manning change to meet the new requirement. In practice, the ISPS Code shares more workload from seafarers, no matter what circumstance of ports, the ship should keep the security watch as per security levels, a number of useless security documents have to be filled, also the master or SSO will be kept visiting by numerous interview, inspections and very often their rest time could not be guaranteed. ISPS absolutely increases the workload of seafarers and makes crew fatigue.

5.1.3 Fatigue Impact on the Seafarers' Performance

IMO Assembly resolution A. 772(18) has classified fatigue factors into related

groups, such as management ashore and aboard ship, and responsibilities of administration, ship specific factors, crew specific factors and external environmental factors. In addition, workload is to be considered regarding the seafarers' fatigue, the workload is a determining factor related to the reliable operation of the seafarers and human being, because the workload has quite close relationship with the worker's performance and ability of control. In fact, the workload is not entirely negative, the moderate load is good for people to improve the efficiency of the best state, and enhance their ability to discover and correct the errors, otherwise works without challenges make people respond with low efficiency. On the contrary, if the workload is too heavy and even over loaded, that will directly result in fatigue and reduce working efficiency.

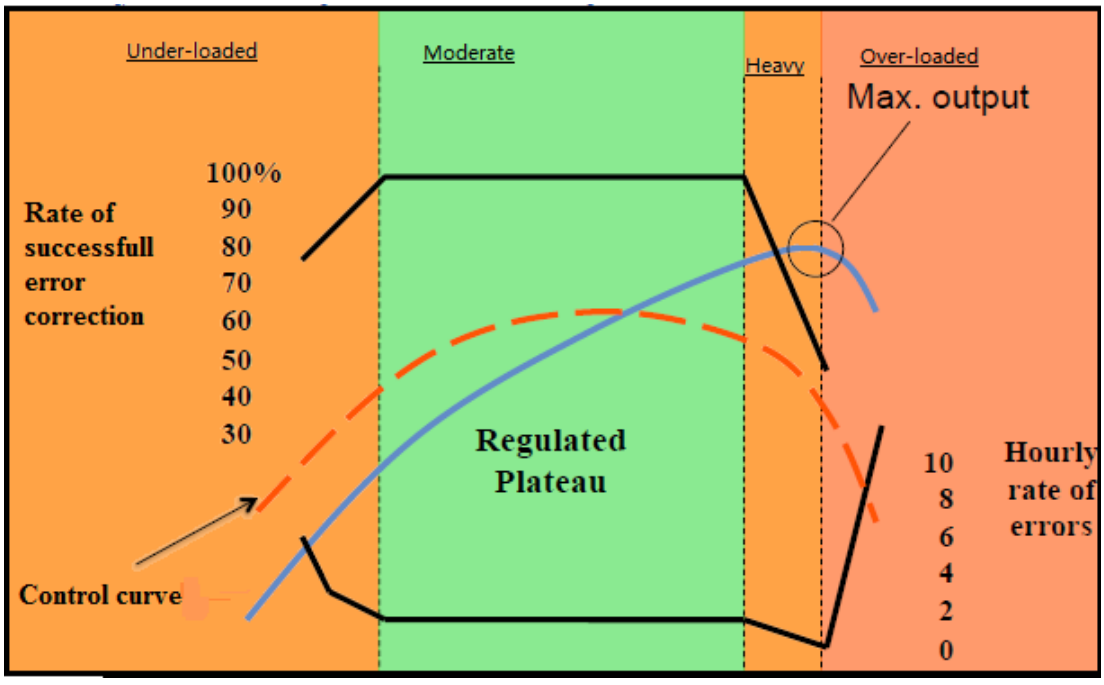


Figure 6 – Relationship between workload and efficiency
Source: R. Baumler, 2014

This diagram clearly illustrates the relationship between the workload and human performance. The different curve represents different parameter index changes in the

figure. For instance, the curve of output performance is low in the region of under loaded, it keep going up with the workload increasing even into the heavy workload area, but the output reaches the peak value and starts to fall when enters over-loaded zone. Also, in the region of under- loaded, there has a little high probability of errors but low error correction capability instead. As the workload increases to the moderate area, the two data reach the perfect level position, less chance make errors but more chance correct it. While in the heavy and overloaded zone, recording errors increase significantly and the error correction capability dramatically decreases, this fully reveals that working in overloaded region is quite harmful.

On board ship, the seafarers' workloads easily fall into the state of heavy or over loaded, and particularly the night watch is a big challenge for the officers on watch (OOW). Medical research has shown that working at night can lead to compromised levels of safety with productivity inevitably also likely to suffer (Folkard & Tucker, 2003). Similarly, focusing on the working patterns and shift schedules, ships usually prevail with 4/8 shift system. Risk of an accident is higher when working at night and to a lesser extent working in the afternoon compared to the morning (Folkard et al. 2005).

Table 6 – Watch Schedule

Watch	**0000-0400**	**0400-0800**	**0800-1200**	**1200-1600**	**1600-2000**	**2000-2400**
Deck	**2/O**	**C/O**	**3/O**	**2/O**	**C/O**	**3/O**
Engine	**2/E**	**1/E**	**3/E**	**2/E**	**1/E**	**3/E**

Source: by author, 2014

In addition, due to the development of port facilities, the rate of cargo handling is extremely fast in many ports around world. Short port stay and frequent ports call

have become a main trend. More serious condition is that the 6 on / 6 off schedule has prevailed on the berthing duty, and many crew complained it and said they had suffered lack of sleep from this watchkeeping cycle. And long term pilotage takes place in some ports. These factors often disrupt the seafarers' normal circadian rhythms. However, No one will care about the crew fatigue state except themselves. Furthermore, after the intensive works at port, then the ship proceeds to the sea starting another hurry trip without any stop and directly puts some duty crew into the heavy workload and even over loaded situation.

When people are in the state of fatigue, the body is going to transit from awareness to shallow sleep. So, physical performance declines, attention is difficult to concentrate, body and mind respond in slow pace. Fatigue will reduce the seafarers' efficiency and output performance, and hinder the seafarers' perception and judgment, and lower the ability of error correction. Also fatigue makes seafarers to conduct some unsafe behaviours in an unconscious state, endanger marine and personal safety and cause accidents. Especial for a particular OOW, fatigue makes their whole body discomforting, decreased attention, lack of confidence, lethargy, movements sluggish, need to deliberately control them not falling in sleep. Many routine works are interrupted by the slow response. For instance, OOW often neglect the error alarm, forget to fix the ship's position, forget to entry the logbook and acknowledge master night order, etc. In this fatigue situation, the OOW are difficult to meet the mission requirements under the statutes. Here came the author's personal experience about fatigue. In 2006, the author was chief officer on a feeder service container ship which engaged in the passage covering European ports and African ports. While the ship called Rotterdam, so many works had to be completed by crew members, such as working out stowage plan, fixing the containers' security gear, doing lashing job, moreover, long passage of pilotage, frequent ports call, those cumulative fatigue

made author fall asleep on the watch, and even fell on the floor of bridge. The author realized that human being cannot sleep on standing pose because knees would bent automatically. This is not a rare case, falling asleep is common for OOW at night watch especially on the condition of fatigue.

5.2 Irregular maintenance and repair works under low manning levels

Maintenance and repair works are the routine on board ship, the proper maintenance and repair can reduce operating risk, avoid plant failures, provide reliable equipment, eliminate defects in operating pant and maximise production, get optimal operating performance and further achieve least operating costs (Cheng, 2013, p.113). Most of these routine works still need to be done by crew members on board. Even though the new materials, new technology and new design have been introduced into the shipping industry, also the designated workshop contributes to many service jobs while ship in the berth, it may reduce a certain works for the crew. However, this similar model only occurs in a few companies and some vessels, most of ships cannot reach this standard. For instance, in China, only COSCO and CSL have some vessels to run under this mode, other companies do not have abundant capital and high level management to support it. Therefore, no doubt, the seafarers are still the main body to deal with maintenance and repair. Reducing manning has affected the important programmes of the ship on this aspect in a certain extent.

A planned maintenance survey system (PMS) has been become current popular maintenance mode and prevails on board of ship. In original, PMS is for machinery items which may be considered as an alternative to the continuous machinery survey system, but this system has extended to the entire equipment including deck and engine presently. Usually in accordance with PMS and specific equipment of ship,

the company establishes the maintenance and repair plan which is classified into annual plan, quarter plan and month plan, the whole program is then sent to the captain who is responsible to organize crew members to implement it ultimately. However, because of low manning levels, a lot of daily works could not be completed on time and have to be postponed in next stage.

Take a HANDYSIZE bulk carrier as an example, there are about 7 or 8 rating crew in deck department, when the crew do the deck cleaning and derusting works, the number of sailors who can attend the duty watch reduce, the staff can be freely allocated is only 3 or 4 people, some ships even are more less. Compared with the earlier stage, about twice of the manpower can carry out maintenance works. The same situation happens in engine department. For instance, the author had a talk with one chief engineer who had serviced on a feeder container ship, the topic is about the engine staff overhaul the cylinder of engine with type of MAN.B&W-8S35MC[37]. The feedback from C/E was that carrying out this work must be especially prudent, port stay time and the manpower must be took into account. On this Chinese ship, conducting this job needs at least 6 hours under the effort of the C/E, 1/E, another engineer, Fitter, and one M/M. In this staff assignment and time allocation, it is still likely to cause the overtime and breach the regulation of rest hours of STCW. Therefore the C/E and other staff had to consider to complete the work as soon as possible, this probably leads to work distraction and even deviation.

5.3 Low-manning affects seafarers' emergency response capabilities

Emergency situation may happen at any time when ship sails at sea. So it requires the seafarers to possess the abilities to cope with these emergencies, such as ship fire,

[37] MAN.B&W designed a type of main engine which has 8 cylinders, super long stroke, 350mm of diameter, mechanical control mode.

explosion, grounding, collision, or other major accidents. As well as they can safely operate ship while ship lost power or significant damage to the critical equipments. Moreover, when seafarers are injured, the ship master can organize all crew members to carry out the effective medical care or transport the wounded to rescue parties without prejudice to the normal manning levels of ship. In fact, the seafarer is not a separate entity, especially in emergency situations, the seafarer should be an integrated team. Captain should place each one in the proper positions so as to deal with the emergencies in the quickest and most effective way. However, reducing the crew members has impacted on the overall resilience of the crew members.

Here gives an real exercise example from my experience. For a particular feeder container ship which adopts the COSCO's emergency instruction plan, while taking exercise of boats launching, it needs total 19 crew members in all to be allocated different tasks as per the plan.

Table 7 – Muster List

Location	**Person**	**Duty**
Bridge	MST, 2/O,	Operate ship, communication.
Engine	1/E	Engine watch
Port side Muster Station	C/O, P/C	Command on site, operate davit
Starboard side Muster Station	C/E, BSN	Command on site, operate davit
Port main deck	M.M	Manage lashing, Control heading line
Starboard main deck	M.M	Manage lashing, Control heading line
Port poop deck	Cook	Manage lashing, Control after line
Starboard poop	Boy	Manage lashing, Control after line

deck		
Port life boat	3/E, E/E, A.B, M.M	Rig embarkation ladder, Operate life boat in the water
Starboard life boat	3/O, 2/E A.B , A.B,	Rig embarkation ladder, Operate life boat in the water

Source: by author, 2014

The muster list is drawn based on the author's real experience. The principle of allocating duties to each crew is to follow the policy of safety and rationality. After several demonstrations, we believe that was an optimal arrangement. However, in the exercise, there should be two persons on watch in the engine room, but due to the lack of manning, actually only one engineer was in position. While on the main deck and aft poop deck, the post who control security lines should also be equipped with two people in each location, but it can only be allocated by one person. Moreover, there was not any crew for standby to deal with any unexpected condition. So, this was only one case to reveal the condition of insufficient manning. In other scenarios, still have the same situation that low manning scale make the crew over resilience and execution decline.

Chapter 6 Survey Finding

The issue of safe manning in China is a practical research topic, it takes a lot of evidence to analyse the present manning situation, and further prove whether the China's policy of ship manning is applicable to the reality. Therefore, the first-hand information from the crew is the most convincing evidence. Fortunately, during the author's research, many Chinese seafarers have been undergoing training courses Dalian Maritime University, which provided a good opportunity to do the survey and interview. At the same time, the author's former colleagues has become a very good interview object, they also provided a positive support.

Table 8 – Overview of the survey

Time /Location	May 2014 to June, Dalian
Target	Chinese seafarers on vacation or on board ship
Methods	Interview, questionnaire, on line chatting, telephone communication
Purpose	● Examine the status of Chinese ship manning ● Analyse the problems of Chinese ship manning ● Collect the seafarers' suggestion regarding the safe manning
Content	● Personal data and background Name, age, rank on ship, type of ship, basic information of ship ● Experience at sea Comments on manning levels, recognized manning problem, fatigue, duty pattern, work/rest hour record, suggestions ● Miscellaneous comments
Conclusion	● Got overall response ● Aware of the lack of manning levels ● Analysis of particular scenarios ● Gain recommendations

Source: by author, 2014

6.1 Specific details of respondents

A total of 291 copies of questionnaires were obtained through interviews, phone calls and online, 25 copies were incomplete information and other 66 answers came from the liquid cargo tank, passenger ship and special ship, so those papers have finally been abandoned by author, and the remaining 200 copies of the questionnaire were used as statistical information. In order to obtain real response from all participates, their real names were not required signing. The specific questionnaires are attached in appendix D

6.1.1 Rank distribution of respondents

Rank	Num.
MST	16
C/O	41
2/O	73
C/E	6
1/E	30
2/E	34
TTL	200

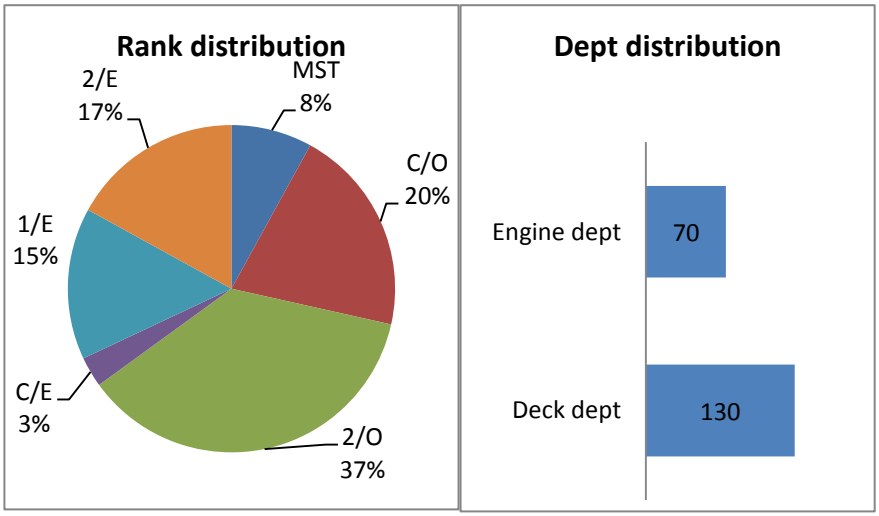


Figure 7 – Rank distribution of respondents
Source: by author, 2014

These respondents are a selection of officers including the ship master, also, the master has been shifted into the deck department, therefore, the respondent from deck department were nearly twice as much as the engineer department engineers. Even on board ship, the deck and engine are two relatively separate departments, because whether marine equipment or specific works, the two departments are quite

different, so the watchkeeping arrangement is different as well. This will inevitably lead to the crew from different departments for watch arrangements and fatigue perception and response of manning will be different. Although, the captain and chief engineer who are not involved in watchkeeping in most of the ship, but they are makers of ship duty plan, and the crew's work hours and rest time are controlled and supervised by them, their responses are also very important.

6.1.2 Age profile of respondents

Age	Num	Pent
26-29	46	23%
30-35	93	46.5%
36-40	40	20%
41-45	14	7%
46-49	7	3.5%
TTL	200	100%
Average age - 37.5		
Median value - 37.5		

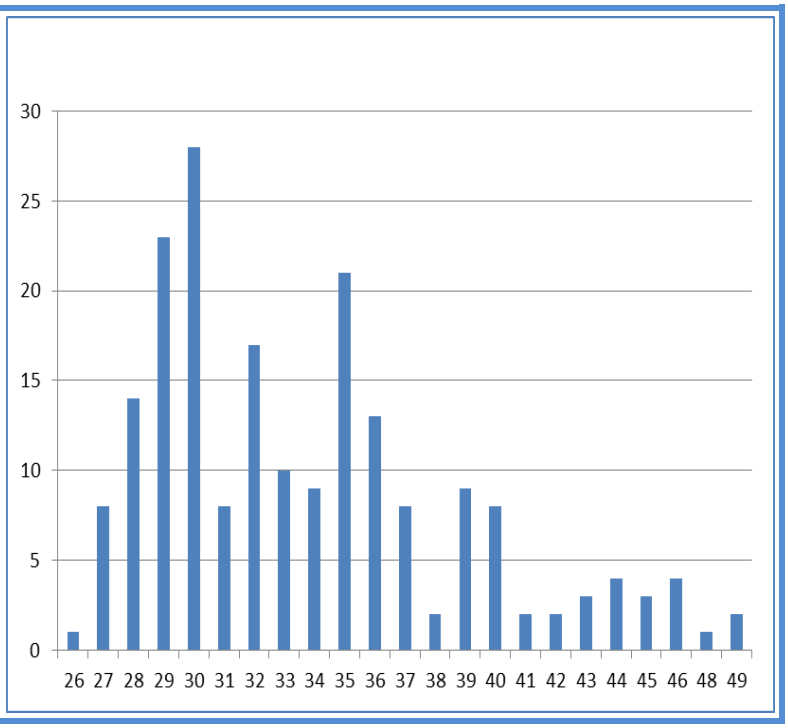


Figure 8 – Age profile of respondents
Source: by author, 2014

The analysis of collected data and illustration of bar chart reveal that in all the surveyed crew, age distribution is from 26 to 49 years old, the youngest is a only 26 years old second officer, two oldest people are chief officers. The average age is 37.5 years old, and between the ages of 30-35 seafarers accounted for almost half of all respondents. The age structure of the distribution list, just illustrate that the

respondents are at their peak age of the prime of life, in a normal board works, they complained that they are utterly worn out when working onboard of ship. Their feedbacks state that they are easily getting tired and further show that the actual ship manning is unreasonable, it should be an objective evaluation considering their age and experiences.

6.2 Target ships information

The chart below shows that most of selected respondents come from bulk carrier, it's already more than half in value, the crew numbers from general cargo ship are almost the same percentage as from the container ships. Anyway, all seafarers selected to participate in the survey are from dry cargo ships, which has coincided with this paper's study on the safe manning of Chinese dry cargo. Refering to the collected basic data, the vast majority of vessels are 3,000 GT or even far more, only three vessels is up to 3000 GT, this matches the research objects in this survey.

6.2.1 Overview of ships' particular

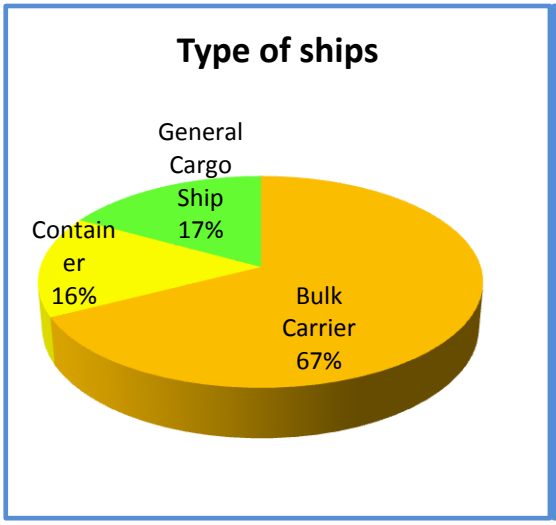


Figure 9 – Type of ships
Source: by author, 2014

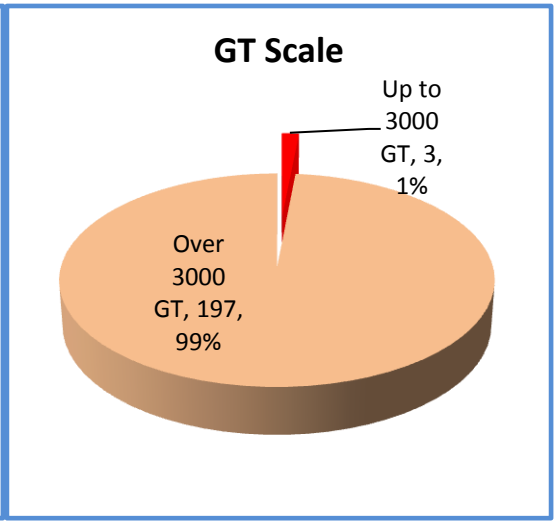


Figure 10 – Gross Tonnage of ships
Source: by author, 2014

6.2.2 Trading Area

Regarding the classification of trading area of surveyed ships, the author also divided it into three categories according to the Chinese tradition and practices, that is world-wide, near ocean and China coast waters respectively. This sorting scheme is different with the official legal inspection rules for ships and offshore facilities, and here the concept of 'near ocean' is not attributed to the ocean routes, because whether ship size, ship condition or even manning levels are quite different compared with oceangoing vessels. Meanwhile, the detailed data analysis is also given in figure 11, it is clear that more than half (66 percent) the respondents engaged in ocean routes, which is a reflection of the trend of China's economic globalization. Followed by the ships about 60 engaged in near ocean, these ships, especially regional feeder container ship and small general cargo ship, normally sail from Chinese ports extending to Japan, S. Korea, N. Korea and Southeast Asia area depending on the ship size and conditions. In this survey, the crew engaging in China coastal transport are not too much, they provided only 18 vessels' information.

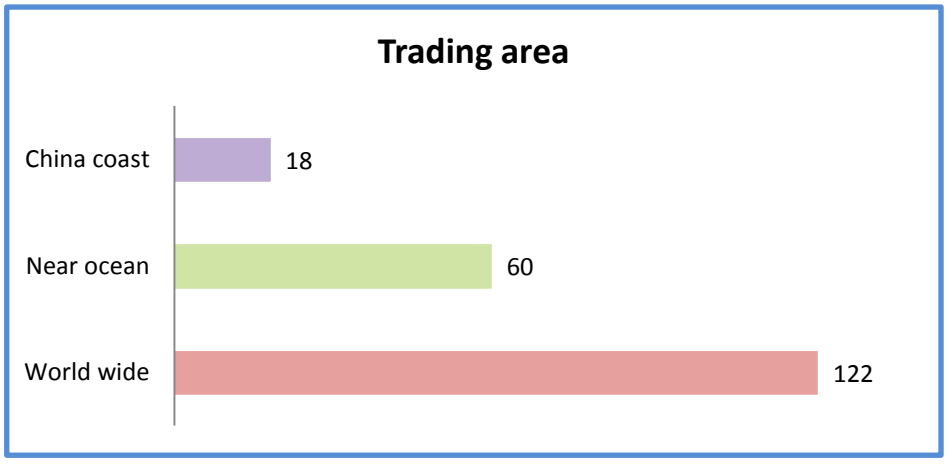


Figure 11 – Trading area of ships which respondents serviced
Source: by author, 2014

6.3 Major findings

The aforementioned basic information about the surveyed participants, is the base of this part of the analysis on manning levels. The primary principle of the questionnaire should be precise and concise, because a gobbledegook will make respondents feel bored, and also, it should not occupy friendly volunteers a quite long time during the survey. Following this philosophy, in the main part of the questionnaire, as per the author's several years of marine experience, the author specially designed 13 questions which cover the situation of current manning levels, fatigue, overtime, 6/6 duty pattern, work/rest hours record and actual feedback mechanism on manning policies and the recommendations or advice from seafarers, etc. Although these issues are relatively simple, but they are definitely clear. The author believes that it can truly reflect the seafarers' points from the real works.

6.3.1 Levels of satisfaction for current manning scales

For instance, at the beginning of the questionnaire, the author entered into the theme bluntly, the first question is to allow participants to make judgments based on their own experience on board ship, whether your ship manning levels meet the needs of practical work? The answer could also be expected, no matter what type of ship, what size of ship, which area engaging, for this issue, in all 200 questionnaires, only 32 answered satisfied, including 9 navigation officers, accounting for only 7 percent of all surveyed deck officers, 23 engineers accounted for 33 percent of all engineers involved, while the remaining 168 people's answer are not satisfied. We guaranteed that our survey had not been arranged beforehand, a lot of the crew are a stranger to us. Therefore, their answers are supposed to be honest and the figure reveals that in the random survey, 84 percent of the seafarers thought that their ship's current manning levels cannot meet the operational needs, especially for deck department, 93

percent deck officers said ‘No’ to the prevailed manning policy.

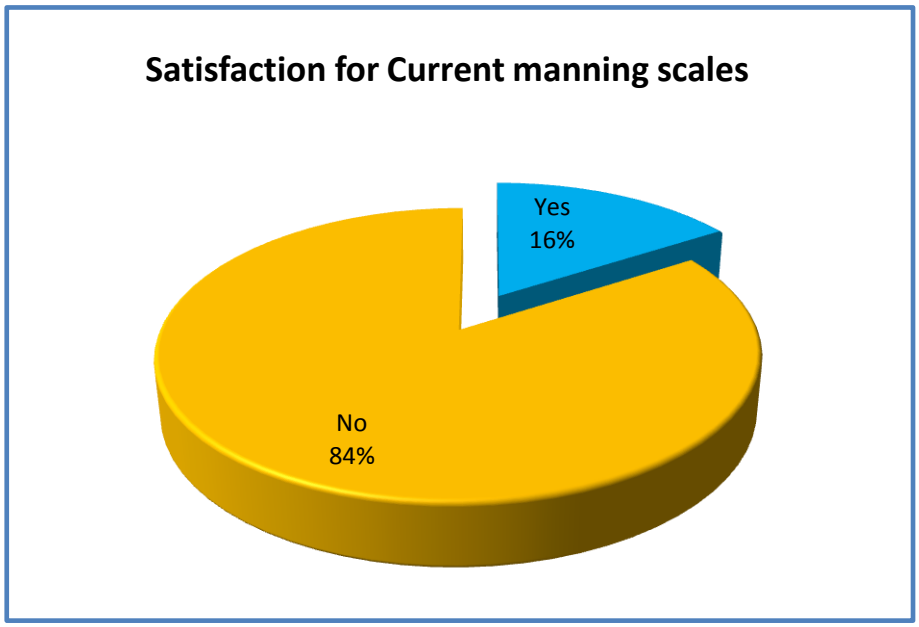


Figure 12 – Satisfaction of current manning scales
Source: by author, 2014

6.3.2 Crew Fatigue and Overtime

Also, the subsequent inquiries about fatigue and overtime continue to support first issue. As the figure 13 and 14 show, in the survey of engine department, no one never do overtime, the staff taking occasional overtime work accounts for 57 percent, 31 percent usually work overtime, even 12 percent always work overtime. The situation in deck department is more serious than engine department, including the master, no one said that they has never worked overtime, the officers usually and always worked overtime accounts for 70 percent, the remaining 30 percent only occasionally were required to work overtime. It is conceivable that in such work environment, the seafarers’ fatigue is bound to produce, also next fatigue investigation reflected the real fatigue matters. There are 76 percent of engineers who feel tired in practice, and the scale to deck department, raises to 92 percent.

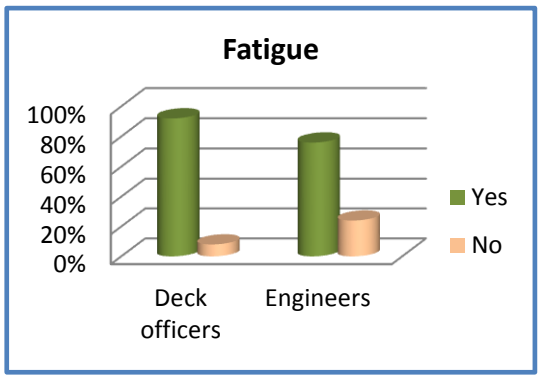


Figure 13 – Fatigue investigation
Source: by author, 2014

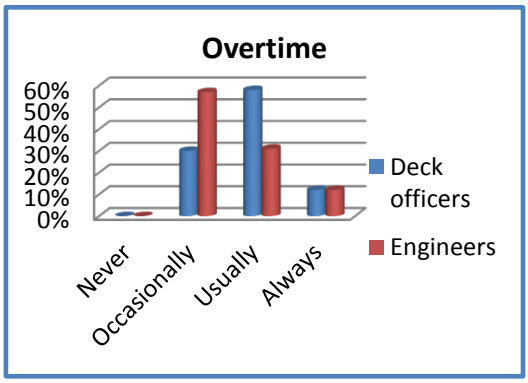


Figure 14 – Overtime investigation
Source: by author, 2014

6.3.3 Scenarios Analysis

Since nearly 90 percent of participants gave a negative response to the current manning levels on board, then we have to investigate and analyse the further details, so that we could find out in which circumstances, the current manning scales could not meet the work requirements. Therefore, the author put several scenes into the questionnaire and let the participants tick their choices. The subsequent statistical result was corresponding to the real situation. It can clearly be seen from the figure 15, the berth watch is the highest choice in all design scenarios, which has been selected 111 times, followed by the mooring & unmooring operation, has been ticked 104 times, also most of the two options were selected by deck officers, it illustrated that these two scenarios brought considerable pressure to deck works, while the third one is anti-piracy duty, 69 times, it contributed to deck and engine two departments. The choice of engineers more inclined to take bunker and stores and maintenance. The captain, chief engineer and chief officer, their opinions are more prone to external examination and paper work. In addition, items of cargo monitor and crew sick also drew a quarter of respondents, and the rest of the options from the 40 began to decline, at least only a few, for the few options believe those scenarios are not easy to cause the main situation of the lack of manning, it can be properly adjusted to

improve.

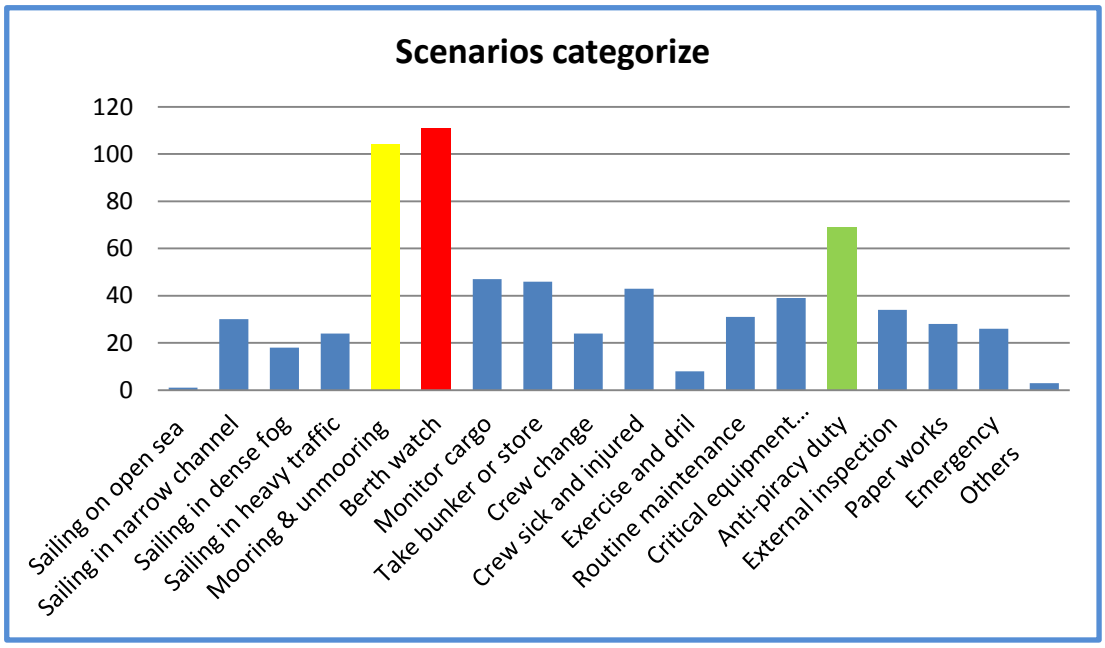


Figure 15 – Surveyed scenarios categorize
Source: by author, 2014

6.3.4 6-on/6-off Shift Pattern

Owing to the 6/6 shift pattern usually is carried out on deck department, the particular survey was only conducted among all participant deck officers, the result shows that only 13 percent of officers can accept 6/6 shift system, and the rest are opposed or strongly opposed this views.

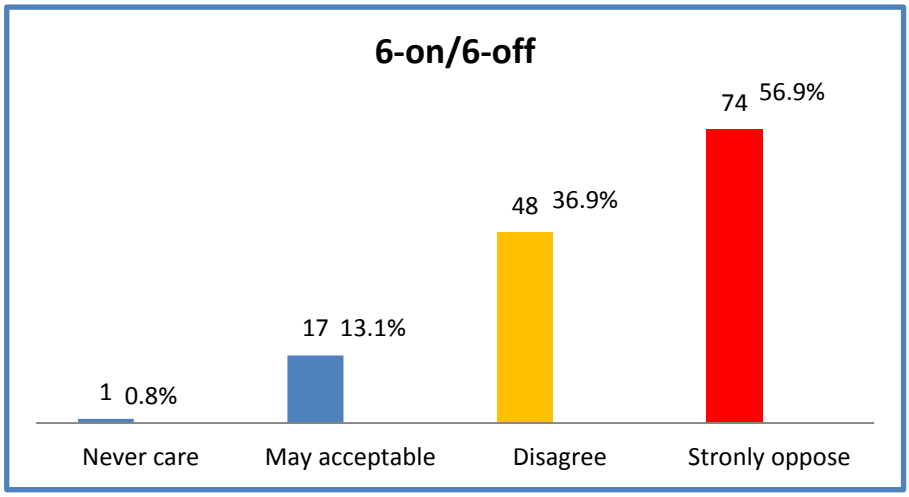


Figure 16 – Officer's attitude to 6/6 shift pattern
Source: by author, 2014

6.3.5 Rest Hours Record

The record of rest hours has closely linked to the standards of watchkeeping, also, it is an evidential document which can truly reflect the seafarers' work and rest arrangement. A real record can save the crew from fatigue, can evaluate the ship's organization of work and manning arrangement, while it can be an effective approach to supervise the seafarer's working condition by the flag state and port state. Therefore, the authenticity of records is extremely important. However, many participants' answers revealed that their records cannot match with actual condition. For instance, among all surveyed 130 deck officers, only 26 percent of staffs believe their records are true, and the remaining 74% of the people think that their records are false, the situation of the engineers is a bit better, basic is half to half.

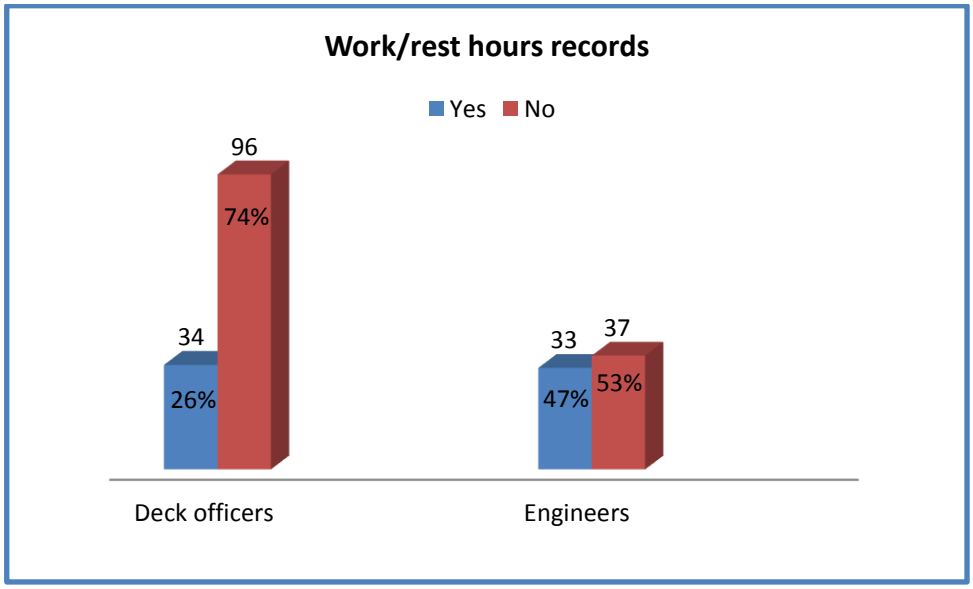


Figure 17 - Authenticity of work/rest hours records

Source: by author, 2014

6.3.6 Scenarios of manning levels increasing

In the survey, 56 senior officers and engineers enumerated circumstances they met in the actual work to increase the ship manning. The company superintendent or nominated service engineers boarding ship is the most case of increased manning. They usually assist the ship staff to repair or maintain the critical equipment. While the ship passes through high risk area, for the consideration of safety, the company will hire security arm guards to escort the ship. Also, under the requirement of ISM, the company auditor will board and engage in internal audit for several days. Sometimes, the company also sends some new graduates on board and trains them. While key officers are changed in short stay port, sometimes, the company will fix two officers on the ship for well familiar with the equipment. In addition, two officers mentioned that able seamen and oilers were increased before selling ship, because the shipowners want to improve the ship's appearance in the short term. Strictly speaking, some increased members are not in the list of manning, even the

manning level increasing, it is only a short term. Here there is only one captain, gave a gratifying answer, he mentioned, due to lack of manpower and crew fatigue, at his strong request, the company has arranged one more sailor on board.

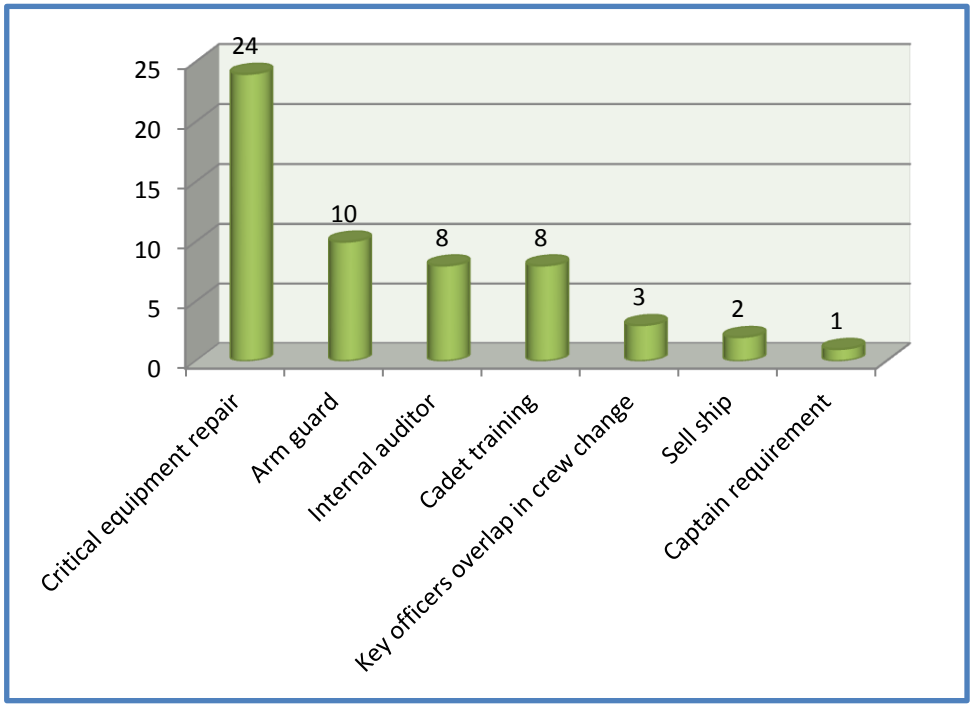


Figure 18 – Scenarios of manning increase
Source: Survey by author, 2014

6.3.7 Feedback mechanism of manning

This particular question is whether you have manning levels on board feedback mechanism? Just at the sight of the question, many crew believe that the work and rest hours record is a feedback mechanism, honestly, those records are indeed considered, but in this questionnaire, the author hopes to seek other particular feedback mechanisms beside rest hours record. Survey results show that only 48 crew members' answers are yes, accounted for 24%, while the remaining 152 crew say no or they do not know the existence of this mechanism at all.

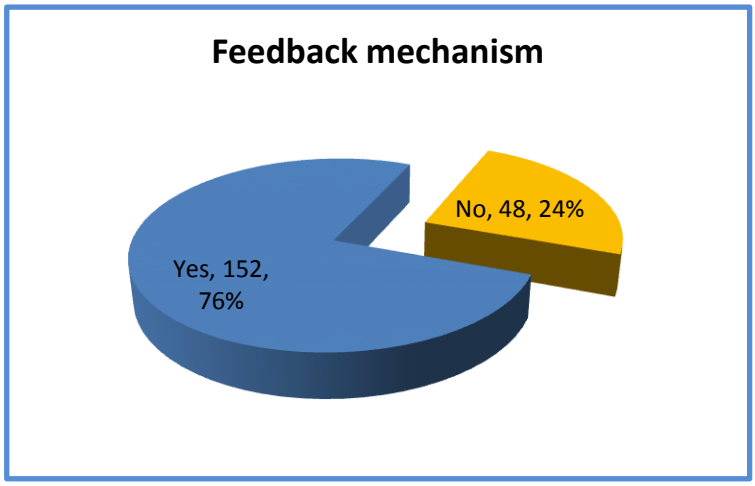


Figure 19 –Feedback mechanism
Source: by author, 2014

6.3.8 Seafarers' opinion of increasing manning levels

The answers to this question are four options which represent different degrees, according to the distribution of options from the respondents, it reflects their attitude to manning increase. Among all 200 participants, nobody disagree with the issue of increasing manning on board ship, no matter what kinds of ship they served. Except 10 persons ticked the option of not sure, the remaining 190 people have agreed to increase manning levels on present ships, accounting for 95%, of which there are 74 people's requirements are very strong, they are mostly from deck department.

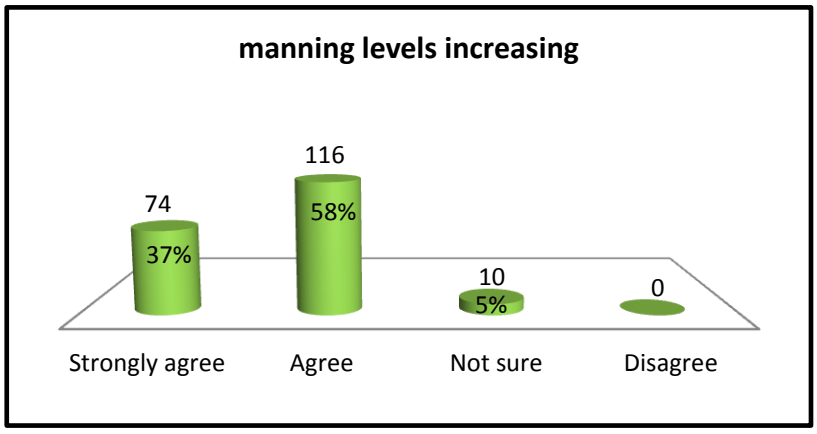


Figure 20 – Opinion of increasing manning levels

Source: by author, 2014

6.3.9 The position should be enhanced

The respondents are free to express their suggestions in this question. The analysis of results indicated that crew's proposal combines the scientific and economic approaches. Enhancing the staff of deck department is a strong desire, especially third officer, junior officer and deck rating. The engineers basically can satisfy the actual work, but some engineers want to take more engine rating especially for small vessels with less oilers. In addition, most participants understand increasing chief officer will lead to more manning costs, so only two persons took this choice.

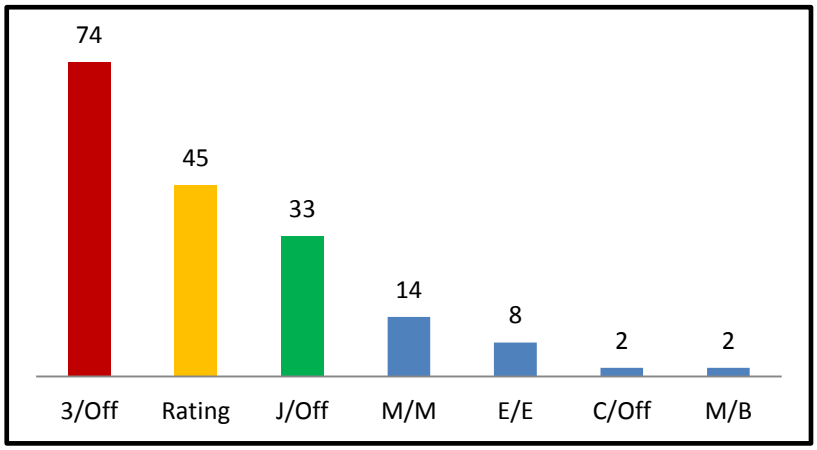


Figure 21 – Position to be increased
Source: by author, 2014

Chapter 7 The Situation of Undermanning in China

Recalling the previous chapter, it reveals that the principles of Chinese ship safe manning is in compliance with various international conventions, also China MSA has developed their own standard which is the Ship Minimum Safe Manning Rule of the PRC. Since this standard was established in 2004, it has undergone for a decade. During this decade, the world shipping situation has changed tremendously, as new technology continues to progress, the new requirements are also binding on the ship, therefore, the crew working structure should change as well. Herein, a question need to be considered, whether the rules a decade ago still apply present rapid developing ships? The answer for this question should concern shipping practices and the seafarers' voice.

7.1 Low manning levels cannot meet practical work

In fact, many signs have exposed the seafarers' discontent for current manning system, whether these seafarers are engaged in ocean shipping or sea cabotage. Undermanning causes increased workload. The work time record and rest hour record are the most direct evidence, there are so many deviations in the real rest hour record now. The work overtime and fatigue have become a common condition on board ship, especially in the scenarios of berthing, holds clean, external survey and critical equipment maintenance. More works but fewer crew members, this current situation inevitably increases workload and pressure, then increase the chances of making errors. So manning scales is a hot topic for crew members and it causes a lot

of complaints. These descriptions are the author's personal experience during past ten years. Moreover, the specific findings in previous survey among Chinese seafarers also disclosed that the principle of minimum manning standards set by our government and implemented by our owner, these deviated from the essential principle. Because the safe manning rule is produced by the authoritative experts with scientific methods, the ultimate goal is to be applied to the ships and to ensure the safety. However, the direct answer of crew shows that the rules are not applicable.

7.1.1 The prevailed berth watch shift pattern makes seafarer fatigue

Apart from few ships, most of Chinese dry cargo ships are operated by a captain and three deck officers, this pattern can be replaced by one captain plus two officers based on the size and trading area of the ship. The practical figures indicate due to the difference of responsibilities and watch arrangement, under the current manning levels, the deck officer is more tired than the engineer. The main issue is involved the berth watch pattern in deck department. Why the seafarers believe they need more manpower on the berth watch? The root cause is based on the main responsibilities of deck department. In practice, while ship is on berth, the responsibilities of engine department mostly occur inside of ship. Engine staffs usually can adjust their watch schedule to copy with the high workload, because UMS system and separated control room allow them to have some rest time to relieve the high workload. However, deck staffs always conduct the interface with external parties, they have to drop themselves into quite busy operation. During berthing, ensuring safety of ship, cargo handling and ISPS watch are three major missions among all deck staff. These works will consume a lot of physical strength and energy of duty staff. Captain and chief officer are always on call situation during ship at berth, there is not obvious boundary

between their work and rest, especially when their time are occupied by couple of visitors. Neither to say the chief officer, sometimes the cargo dispute makes him stand up all night. In addition, because chief officer is in charge of cargo operation and does not participate on berth watch, his eight hours of duty is shared by second officer and third officer, which is annoying 6-on/6-off shift pattern. Meanwhile, with the modernization, intensification and specialization of ship as well as the development of port facilities, ship berthing time is getting shorter and shorter, especial for the feeder service container ship, sometimes, in some ports, even just several hours on berth, which often leads to deck officers directly from berth watch to watch on bridge while the ship depart from ports. Even the ship does not sail immediately, but deck officers still have full tasks on the pier, such as the ballast water operations, cargo verification, holds cleaning, lashing checking, security watch, voyage plan preparing, fire patrol, gangway watch, etc. There are lots of deviations from the requirement of rest hours of STCW, it easily causes crew fatigue. Also, a research scenario was introduced by MAIB，it shows that cumulative fatigue that develops over a three week period for the chief mate working 6 on 6 off on a ship that is in port every 4 days. (MAIB, 2004)

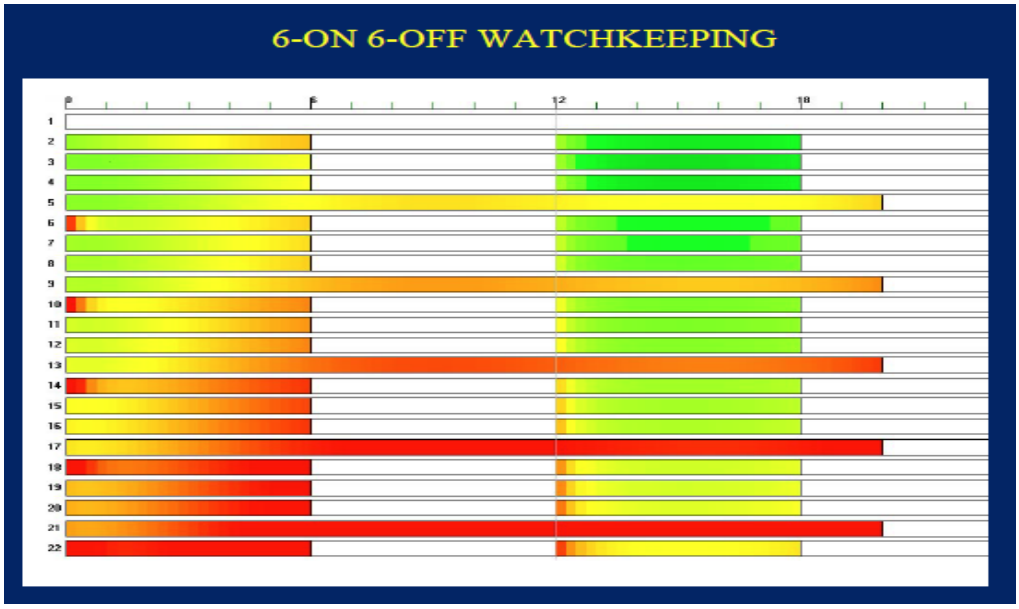


Figure 22 – Cumulative fatigue on 6-on 6-off watchkeeping
Source: MAIB, 2004

7.1.2 Case study on watch at berth

This particular case was got from an old friend who is the captain of container ship, which is engaging the typical feeder service. For feeder ships, port calls are normally very frequent, often more than 20 monthly. the crew members suffered significant tiredness during berthing. Here I list a timetable of the ship to calculate the crew's rest hours and work time. The calculations mainly involved second officer and third officer and demonstrate how 6/ 6 duty pattern impacts on crew fatigue?

Table 9 – Target ship's particular

Name of ship	D	Crew list		
Type of ship	Container vessel	MST - 1	P/C - 1	C/O - 1
Gross Tonnage	7462	2/O - 1	3/O - 1	BSN - 1
Propulsion Power	4109 KW	C/E - 1	1/E - 1	2/E - 1
Trading area	China-Japan-S. Korea	3/E - 1	E/E - 1	FIT - 1
SMD require	14	A.B - 3	M.M - 1	O.S - 1
Crew members	19	CDT, 1	CK - 1	M/B - 1

Source: by author, 2014

Table 10 – Target ship's voyage memory

Voyage No.	Port	Arrival time[38]		Depart time[39]	
416S	WAKAYAMA	1015Lt[40]	2014.6.12	1405	2014.6.12
416N	TOKYO	1815	2014.6.13	0540	2014.6.14
416N	YOKOHAMA	0805	2014.6.14	1538	2014.6.14
416N	CHIBA	1815	2014.6.14	2140	2014.6.14
416N	BUSAN	0240	2014.6.17	1310	2014.6.17

Source: by author, 2014

[38] Arrival time refer to that ship's all mooring lines are fasten on bitts.
[39] Depart time refer to that ship's all mooring lines are clear from water.
[40] Lt means Japan local time.

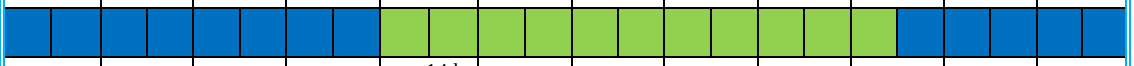
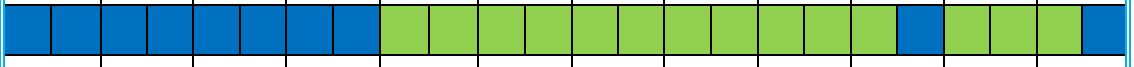
Table 9 shows an extremely tough port schedule, according to the given information, we can work out roughly the rest hours and work time for the second officer and third officer.

Table 11- Rest hour record for second officer

12 13th	13	14	15	16	17	18	19	20	21	22	23
											
00 14th	01	02	03	04	05	06	07	08	09	10	11
											
12	13	14	15	16	17	18	19	20	21	22	23
											

Source: by author, 2014

Table 12- Rest hour record for third officer

08 13th	09	10	11	12	13	14	15	16	17	18	19
											
20	21	22	23	00 14th	01	02	03	04	05	06	07
											
08	09	10	11	12	13	14	15	16	17	18	19
											

Source: by author, 2014

In the above two tables, the blue part represents the working hours, green for the rest time. In fact, the calculation was a very ideal state, also did not include some overtime such as second officer to prepare next passage, and third officer involved in standby engine before sailing. Suppose during these selected time, they are caught by store taking or external inspection or pilotage postponing, tug delay and so on, their rest time will be less. Even so, we can also see from the table, from 12:00 on the 13th to 12:00 on the 14th this 24 hours, the second officer's rest time is divided into four sections, and the longest continuous rest period is only five and a half hours. Third officer from 20:00 on the 13th to 20:00 on the 14th, rest time is divided into four

sections, the longest continuous rest is only five and a half hours. Obviously these have violated the STCW convention[41].

Due to the effective cargo operation and short port stay, crew fatigue on container ship is a very critical issue, taking COSCO as an example, in 2013, COSCO executed MLC internal audit to his seven container ships which sailing in Far East, the findings show that the deck officers of these ships, their rest hours violated minimum requirement of MLC during ships on call port of Shanghai, Ningbo, Yantian, Shekou, Hong Kong, Xiamen (COSCO, 2013).

The same will happen on the bulk carrier and general cargo ship as well, although the bulk carriers do not engage very frequent ports call, but 6 to 6 shift pattern is easy to make the officers' rest time violate the regulations. STCW convention require a minimum 10 hours of rest in any 24 hours (STCW, 2012), for the officers, long period berth watch costs their half day, in the remaining 12 hours of rest, they have to complete some necessary additional works, such as next voyage plan, regular maintenance of equipment, etc. In addition, their rest is often interrupted by extra activities which include draft checking, holds cleaning, external inspection, store receiving, etc. Finally, more and more works make the seafarers fatigue during ship at the dock.

7.1.3 Case Study on Mooring Operation

The second case demonstrates the mooing operation on a bulk carrier, because many seafarers consider that more ratting need to be put in this scenario. Also, mooring operation is a significant high risk team work, a minor error may make huge

[41] Paragraph 3, section A-VIII/1, chapter VIII of STCW

consequences, such as collision, personnel casualties, equipment damage, etc. Therefore, the sufficient manpower, effective organization and clear communication are the indispensable conditions. The background of the case is that the bulk carrier get port side alongside in port of Rotterdam with two tugboats, the tug lines are available. The mooring lines are handled in the mode of 4 heading lines plus 2 spring lines on fore deck and same 4 after lines plus 2 spring lines on poop deck. The spring lines in fore and after are to be sent on shore first.

Table 13 – Target ship's particular

Name of ship	S	Crew list		
Type of ship	Bulk carrier	MST - 1	P/C - 1	C/O - 1
Gross Tonnage	51209	2/O - 1	3/O - 1	BSN - 1
Propulsion Power	12240 KW	C/E - 1	1/E - 1	2/E - 1
Trading area	World wide	3/E - 1	E/E - 1	FIT - 1
SMD require	14	A.B - 4	M.M - 3	O.S - 1
Crew members	23	CDT, 1	CK - 1	M/B - 1

Source: by author, 2014

Table 14 - Crew allocation

Location	Crew arrangement	Responsibilities
Bridge	CAPT, 3/O, A/B1	Command the ship
Engine	C/E, 1/E, 3/E, E/E, M/M	Manage engine machine
Forecastle	C/O, BSN, A/B2, A/B3	Operate fore lines, take tug line
Poop deck	2/O, A/B4, O/S, CDT	Operate after lines, take tug line

Source: by author, 2014

The contents in table 13 are the typical tasks allocation in the tool box meeting of mooring operation. In this organization, the bridge team is a proper staffing, engine room are also equipped enough manpower, however, the crew on fore and after are relatively less. The below figure is the profile of forecastle and poop deck.

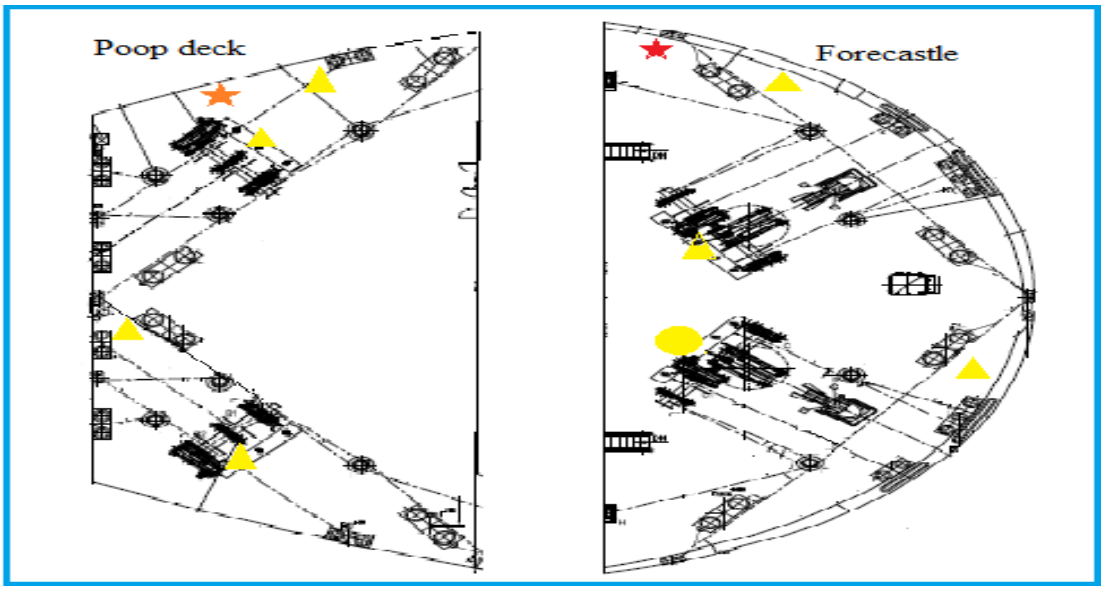


Figure 23 – Mooring layout

Source: by author, 2014

The red stars stand for officers on field, yellow dot and triangles represent bosun and deck ratings respectively. The optimal layout as marked in the figure, port side alongside, chief officer and second officer stand on the port side to direct deck ratings and exchange information with mooring men. Bosun's position usually is fixed because he is in charge of anchor. For the safety consideration, on the target ship, deck ratings usually are divided into 2 teams on fore and after, meanwhile, each team should post 2 people, one controls the winch or windlass under chief officer's order, the other one manages the heaving lines and cables. For this size of ship, one officer and 4 deck ratings are the optimal combination, because normally, the spring lines and head or after lines need to operate simultaneously. However, in the ship's crew allocation, there are only 3 deck ratings on fore and after, in the case of lack of personnel, someone must play multiple roles who need running back and forth across the cables, sometimes in order to alleviate the workload situation the officer rushes to help cable operations, but lose his advantage from the vantage points to effectively oversee and control the whole environment and may cause an accident.

In addition, the paper have to mention some relatively small ships sailing in the Chinese coast, these ships' gross tonnage is between 500 and 3000, basically the size is 60 to 90 meters in length and 8 to 13 meters in width, the speed can reach 8 to 10 knots. Crew manning is less than 14 normally, third officer and third engineer are usually absent on board, the captain and chief engineer are often involved in duty. More serious situation is, onboard this sort of small ships, only one person on watch even at night sailing, and without any company, the OOW often sits on the chair to watch and no doubt it is to fall asleep. Therefore, under-manning, poor conditions of accommodation, short port stay, frequent port calls, these factors make crew fatigue and Officers often fall asleep on their watch. These small ships with undermanning condition really threaten maritime traffic along Chinese coast line.

7.2 Shipowner contribute to undermanning

There is no doubt that the shipowners are very clear the importance of safe manning of ships, but the paradox is enhancing the manning scales will directly increase their running costs and affect the profits, especial under the background of global economic crisis. On the other hand, they are not completely without regard to the principle of manning increasing. We have seen the manning increasing in many scenarios, which was listed in surveyed statistics. These series of stories show that owner's principle of increasing manning is very tendentious, the ship's direct interest is their primary consideration, but the workload or crew fatigue are often ignored. In fact, they also want to seek a much better approach to save their expense as well as improve ship safety. Possibly, ISM is a favourite solution, because ISM does not need to pour more money on board to improve performance of equipment and increase manpower, it merely relys on the soft system to ensure the safety of the ship. However, in view of safe manning, we could barely see the procedure about manning

supervise and seafarers' feedback mechanisms in SMS, except the records of work and rest hours. Perhaps it may say that the shipowners have been avoiding the problem of undermanning. Even they heard seafarers' voice about fatigue and saw a lot of deviations in rest time records.

In addition, the intervention of shipowners resulted in that work and rest hours records do not match with the actual condition. Although, the existence of false records is caused by many reasons which involve the seafarer, ship owner and authority. However, the shipowners should take primary responsibility. In practice, the individual seafarer's attitude is not serious, they do not develop a good behaviour. Usually, after a day of high-intensity work, showering and sleeping are their aspirations and no one cares the work time record. Another wrong way is that all crew's time records are filled by department head, such records are even not the objective facts. Anyhow, no matter who fills it, and then these records will be finally verified by captain before submitting to the company, some captains even amend the deviation and make them meet the standard requirements. Production of captain's false practices is closely related to the company's management, because the company always want to see a perfect rest hours from ship master. While company receives a deviated record, some officers will catch the captain over and over again by telephone or email, they do not consider the captain's schedule arrangement at all. Then, company's policy, SMS files, safe circulars, international standards, piles of papers are distributed to captain, and ask the captain to organize the training and study, the subsequent training photos, training records should be sent to company for review. These useless paper works cannot resolve the fundamental problems, on the contrary, it not only bring a hard work to captain, also lose crew's confidence, they believe even no amount of deviations, the company just cope with the intangible system, and do not take effective actions such as increasing manning. In addition, the

work/rest hours records have become the flag state and port state inspections focus, in case any deviations arise, the ship will be detained and even be fined, which is any owner and captain do not hope to see, also the captain will be dropped into enormous pressure and heavy work. Anyhow, so many factors which led to the time records are no longer a real feedback of crew working situation.

Chapter 8 Conclusion and Recommendations

8.1 Conclusion

The issue of undermanning is universal in its effect, regardless of the size of ships or their flag. The general fatigue on a ship is directly caused by the manning problems, it is impossible to separate fatigue from undermanning Also, many overwhelming evidences have been proved that fatigue causes many accidents at sea and in port, in addition to the general reduction in safety (Lloyd, 2007).

International shipping has recognized the important issue related to safe manning, and subsequent statutes and regulations were produced by international organization, especially pillar conventions including SOLAS, STCW and MLC in the IMO and ILO. Then the assembly resolution A.1047 gives the flag state and ship owner a guidance to implement the principles of safe manning. Ensure the seafarers to get sufficient rest is fundamental principles of the safe manning, flag state administration should issue a minimum safe manning certificate to guarantee the bottom line of safe manning. In addition to the basic parameters of the ship, a lot of external factors should also be considered, which include the pattern of maintenance, cargo to be carried, frequency of port calls, length and nature of voyages, trading areas, seafarers training activities, visitors in ports, quantity of paper work, and security plan, etc.

However, many of these external factors frequently change in the moment, such as a

tramp chartering bulk carriers are often directed to high sea before the shipowners and charterers failed to reach a contract, even, the captain does not know the next voyage for specific information, the owner is unable to re-arranged manning according to specific characters. Therefore, although the resolution gives advice, but normally these recommendations in practice being executed is not in place. Meanwhile, the human resources of the flag state authorities are not able to give each ship flying their flag a detailed assessment before the permit is issued. Even in the later stage of the monitoring process, regardless of the flag state or the port State authorities, their boarding inspection still have some limitations, the inexperience inspectors are very difficult to discover the fatigue caused by insufficient manning. the crew members do not actively cooperate with the inspectors as well. And even if any deficiency of safe manning is figured out, the corresponding punishment of detain or fine still does not solve the problem of undermanning fundamentally.

In fact, the key body to ensure safe manning is absolute shipowner, because who not only well knows his ships, but also keeps close to the crew members. In today's shipping industry, the shipowners and crew are no longer mere employment relationship, but a close partnership, seafarer has become the representative of shipowners, ship owner have to confirm any sign about ship safety from seafarers such as the undermanning. Although, enhancing manning will lead to increased operational costs, but for the overall safety of the ship, it is still worthwhile investment. But in practice, many shipowners including Chinese shipowners are not inclined to increase manning levels under economic pressure, while the minimum manning rule has become a virtue of their reluctance to increase manning. On the contrary, shipowners always want to debarb the violation of safe manning, they shift the responsibility to the master completely, this action directly results in the appearance of false record.

China as a flag state government, its manning policy combines China domestic laws and ratified international conventions, as well as takes into account China coastal resources and business interests. The fundamental principle is adequate to protect the crew rest. After decade of practice, the minimum safe manning rules of PRC has been out of the reaction, it is no longer able to meet the needs of the rapid development of the ship industry. In this article, the author cited his years of sailing experience and the response of participants in survey, in order to reveal the situation of undermanning among Chinese ship. Nowadays, the captain is no longer a traditional marine master, who more like a lawyer, an accountant, a typer, and a guider. Increasing regulations, stringent requirements, frequent inspection, these bring more and more job to seafarers. The traditional model of one captain plus three officers already cannot satisfy the need of practical work, resulting in severe fatigue crew especially while the ship is in port, thereby affecting the safety of the ship departing from the port. Moreover, when we count the hours of work and rest, no working are counted as rest, while ignoring the rest of the quality of the crew, such as noise, vibration, light, odors, and even individual mood, etc. These factors also affect to some extent the rest of the crew. Let alone those small vessels with lower manning levels, due to lack of Manning, who often perform one bridge watch which for navigation safety influence is greater.

8.2 Recommendations

In order to response to the conclusions, recommendations are issued as follows:

- Enhance the standard of minimum manning, for the particular ships of 3000 GT and more, engages ocean passage, should be executed one master plus three officers and plus one more officer, who can be a junior officer but at least can

take the navigation watch, the special assessment should be carried out by ship master. Shipowner should replace the two-shift system with the three-shift system in port. In addition, to relieve the workload of maintenance, mooring operation, security watch, etc. Properly increase the number of ordinary sailor.

- For particular ships with 500 GT and more, regardless of size and sailing period, withdraw the special consideration of deck department in safe minimum manning rules, the pattern of one captain plus three officers and three deck ratings who can response navigation watch, should be executed.

- For particular ships which engage Chinese cabotage, shipowners may hire the temporary watch man in local area, also the employees must be qualified experience seafarers. The administration should give support.

- Enhancing the survey on the safe manning on board, SMD should be endorsed in annual inspection, meanwhile the survey details should be gone through, checking rest hours record and interviewing crew members should be the necessary approaches.

- Increase the punishment, once discover any deficiency of safe manning, the ship should be detained until the owner issue an effective solution to meet the satisfaction of administration, in addition, the shipowner will face huge fines.

- Before boarding for inspection, the administrative inspector or company auditor should take into account the manning levels and master and crew members' work and rest time during ship is in port. The safe inspection should be adjusted or cancelled if it may occupy the rest time of master and crew members.

- Company SMS should establish the framework for a manning management programme. While setting specific manning levels, the master's opinion should be taken into account. Encourage the master and crew to propose good suggestion regarding the safe manning, and refuse false rest hours work. In case the crew feedbacks reveal that manning levels cannot meet the needs of actual works, company should make an immediate assessment to improve it.

- Company should reduce administrative tasks on board ship, as far as possible to simplify SMS and upgrade the SMS with IT facilities, reduce the workload of seafarers.

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APPENDIX A

MINIMUM SAFE MANNING CERTIFICATE

Issued in compliance with the International Convention for the Safety of Life at Sea 1974 Chapter V Regulation 14(2), and the Merchant Shipping (Safe Manning and Watchkeeping) Regulations 2003

This is to certify that in accordance with the principles and guidelines set out in Resolution A .890 (21) of the International Maritime Organisation the ship named in this certificate will be considered to be safely manned, when it proceeds to sea with not less than the numbers and grades of the personnel shown in this document, subject to any conditions stated hereunder.

Vessel

Name of Ship
Port of Registry
Official Number
IMO Number
Type of Ship
Gross Tonnage
Registered Power

Trading Area

Personnel

Grade/Capacity	Minimum STCW Reg	Number of Persons
Master		
Chief Mate		
OOW Navigational		
Chief Engineer		
Second Engineer		
OOW Engineering		
Deck Rating		
Deck Rating		
Engine Rating		
Engine Rating		

Minimum Qualifications and Requirements: *All Deck and Engine Room officers, are to be in possession of a Certificate of Competence and an Endorsement issued by the appropriate authority in compliance with the STCW Convention 78, as amended.*
Furthermore all officers are required to be holders of an Endorsement issued under Regulation I/10, by the Malta Maritime Authority; stating that the holder is competent to serve in a capacity on board ship with trading patterns, tonnage and registered power indicated.
Any shortages from the specified number of personnel should be referred to the Merchant Shipping Directorate, Malta Maritime Authority for approval.

Special Conditions

Issued at Valletta Malta on the

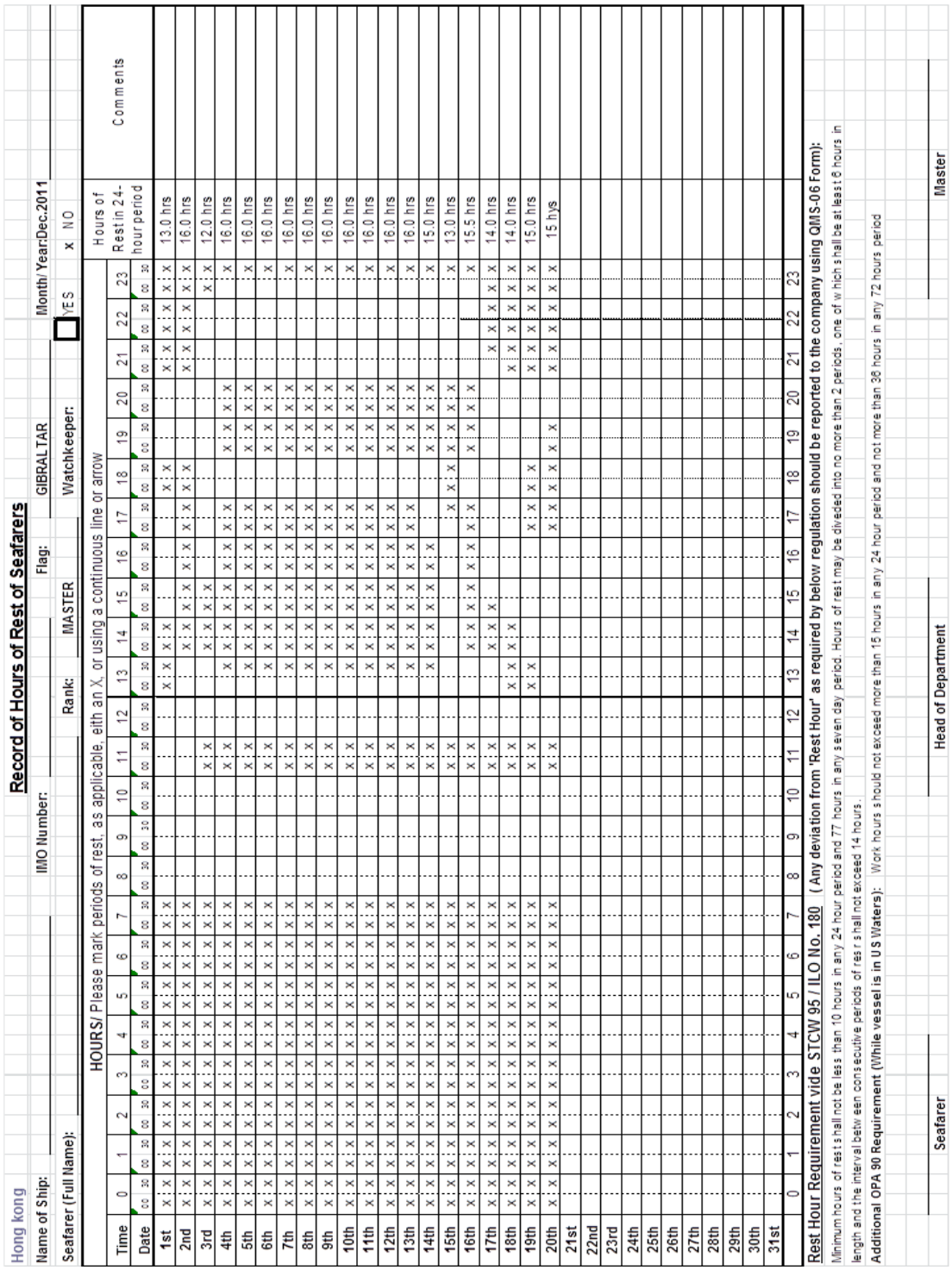
This Certificate is valid until the

Merchant Shipping Directorate

Merchant Shipping Directorate Malta Mariti me Authority Maritime House Lascaris Wharf Valletta VLT 01 Malta
Voice: +356 21250360, 99494317 Fax: +356 21241460 E-mail: mership.malta@mma.gov.mt

Source: http://www.gmint.com/gmint/filebank/specimen_14.pdf

APPENDIX B



Hong kong

Record of Hours of Rest of Seafarers

Name of Ship: _____ IMO Number: _____ Flag: GIBRALTAR Month/ Year:Dec.2011

Seafarer (Full Name): _____ Rank: MASTER Watchkeeper: ☐ YES x NO

HOURS/ Please mark periods of rest, as applicable, eith an X, or using a continuous line or arrow

Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Hours of Rest in 24-hour period	Comments
	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30	00 30		
1st	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x						x : x	x : x				x : x			x : x	x : x	x : x	13.0 hrs	
2nd	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x							x : x	x : x	x : x	x : x	x : x			x : x	x : x	x : x	16.0 hrs	
3rd	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x				x : x								x : x	12.0 hrs	
4th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
5th	x : x	x : x	x : x	x : x	x : x	x : x	x : x					x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
6th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
7th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
8th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
9th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
10th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
11th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
12th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
13th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				16.0 hrs	
14th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x			x : x	x : x				15.0 hrs	
15th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x							x : x	x : x	x : x				13.0 hrs	
16th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x	x : x	x : x		x : x	x : x				15.5 hrs	
17th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x			x : x	x : x						x : x	x : x	x : x	14.0 hrs	
18th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x		x : x	x : x							x : x	x : x	x : x	14.0 hrs	
19th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x		x : x				x : x	x : x			x : x	x : x	x : x	15.0 hrs	
20th	x : x	x : x	x : x	x : x	x : x	x : x	x : x	x : x				x : x						x : x	x : x	x : x		x : x	x : x	x : x	15.0 hrs	
21st																		x : x	x : x	x : x		x : x	x : x	x : x	15 hrs	
22nd																										
23rd																										
24th																										
25th																										
26th																										
27th																										
28th																										
29th																										
30th																										
31st																										
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		

Rest Hour Requirement vide STCW 95 / ILO No. 180 (Any deviation from 'Rest Hour' as required by below regulation should be reported to the company using QMS-06 Form):

Minimum hours of rest shall not be less than 10 hours in any 24 hour period and 77 hours in any seven day period. Hours of rest may be divided into no more than 2 periods, one of which shall be at least 6 hours in length and the interval between consecutive periods of rest shall not exceed 14 hours.

Additional OPA 90 Requirement (While vessel is in US Waters): Work hours should not exceed more than 15 hours in any 24 hour period and not more than 36 hours in any 72 hours period

Seafarer _____ Head of Department _____ Master

Source: collected by author, 2014

APPENDIX C

Interview of manning trend

A. Profile of the seafarer

1. Name:
2. Gender:
3. Age:
4. Rank:

B. Work description

5. What kinds of ship did you serve mostly?
6. How long had you been worked at sea?
7. When did you commence your seafarer's job?
8. What was your position on board in about year of 1990?
9. What types of vessels did you work in about year of 1990?

C. Crew manning

10. How many crew members on board approximately in about year of 1990?
11. How many crew members on board now?
12. What do you think the reasons caused the tendency of ship manning?

APPENDIX D

QUESTIONNAIRE

Name: _____ Age: _____ Rank: _____

Last served ship's type: _____ Flag of ship: _____

Gross tonnage: _____ Trading area: _____ No. of crew members: _____

1. Do you think your ship manning level can meet the needs of the work?
   你是否认为你船的配员水平能满足实际工作需要？
   □Yes □No

2. If no, in what scenarios, the manning level can't meet operational needs?
   如果你认为不能满足，在哪些情况下不满足？可以多选 ***(You can choose more than one option)***
   □ Sailing on the open sea 开阔水域航行
   □ Sailing in the narrow channel 狭水道航行
   □ Sailing in dense fog 雾航
   □ Sailing in heavy traffic 通航密度大
   □ Mooring & unmooring 系泊和离泊
   □ Berth duty 码头值班
   □ Monitor cargo 照料货物
   □ Take bunker or store 加油水、接收物料
   □ Crew changing 更换船员
   □ Crew sick and injured 船员生病或受伤
   □ Exercise and drill 演习
   □ Routine maintenance 日常保养
   □ Critical equipment maintenance 关键性设备保养
   □ Anti-piracy duty 防海盗值班
   □ External inspection 外部检查
   □ Paper works 文件管理
   □ Emergency 应急情况
   Others 其它情况 _____

3. Have you ever experience fatigue due to the low manning level?
   你是否经历过由于配员不足而导致的疲劳？
   □Yes □No

4. How about your overtime works on board ship? 你在船上的加班情况？
   □ Never 从来不加班
   □ Occasionally 偶尔加班
   □ Usually 经常加班
   □ Always 总是加班

5. What is your reaction relate to 6/6 duty pattern on berth duty?
   你对 6 对 6 值码头班的意见是什么？
   □ Never care 不在意
   □ May acceptable 可以接受
   □ Disagree 不同意
   □ Strongly oppose 坚决反对

6. Was your ship's work/rest hour record real and reliable?
   你船的工作、休息时间检录是否真实？
   □ Yes □ No

7. Have you ever met the scenarios of manning level increase?
   你是否遇见过船上配员增加的情况？
   □ Yes □ No

8. If yes, please list the brief description: 如果有请简单说明

   _____

9. Do you think the advanced ship should reduce the manning?
   你认为船舶先进了，配员就应该减少么？
   □ Yes □ No
   Why? 为什么？ _____

10. Whether has a feedback mechanism about manning levels on your ship?

你船上是否有关于配员水平的反馈机制？

□ Yes □ No

11. Do you agree to increase the Manning level of Ships?

你同意增加船舶的配员水平么？

□ Strongly agree 非常同意

□ Agree 同意

□ Not sure 不确定

□ Disagree 不同意

12. In your opinion, which positions should be increased in practice?

你认为在实际中哪个职位需要增加？

_____

13. Would you have other suggestions related to the ship manning level?

你是否有其它关于船舶配员的其它建议?

_____

Thank you for your time!