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Chapter 2 Accidents in Seafaring 28-11-00

WHO defines, accident as "an event independent of human will caused by an outside force acting rapidly, which results in bodily and mental injury." An accident has been defined as that occurrence in a sequence of events which usually produces unexpected injury, death or property damage.

Consequences of accidents are wastage of life and working efficiency, disruption of family life and tragic effect on the individual. It has been estimated by a retrospective study, that more than 75% of maritime accidents are caused by the human error only and many of them are caused by lack of awareness and very seldom by the faulty equipment. The Australian Department of Transport and Communications reported in
1992 that mechanical structural failures were blamed for the remainder.
Marine engineering has introduced sophisticated equipment and systems into the working environment and successful operation of these advanced systems often places high information loads and
decision-making demands of the worker. Although various regulations with amendments are being introduced and enforced for seaworthiness however still there is need to stress more on human element so that the human stress factor in engineering may be practiced in the frame of work design.

Different problems arise according to the job, which could be resolved by taking into considering the following human functions:

- with input sensing;
- decision making;
- and motor action.

Humans receive the information at working, through sight, hearing and touch. Visual sense is always dominant during work and focuses a link between machine and operator. Both sides are to be considered prior to selecting or designing a workstation that involves any visual task. Visual angle, brightness (the amount of the light reflecting from the working desk, luminance contrast (brightness of the visual target relative to the brightness of the back ground), and glare (unwanted light in the visual field) must be regulated for the error-free reading. On the other hand human eyesight with advancing age should also be under considered.

The speech is the most common type of display where large amount of information is conveyed in a minimum period of time, and for the accident free setting it is essential to design the environment as to be compatible to the ability of the worker to hear. The threshold parameters for noise level of long and short-term work must be undertaken into consideration for designing the module.

The following principles should be under taken when auditory displayed are installed in the work environment.
1. The frequency of the signal should be well within the limit (300-5000 hertz).
2. The frequency of sound should be different from other sound sources so that it is not masked.
3. The intensity of the signal should be at least 50 decibels (if the ambient environment is noisy it should be higher).
4. The intensity and /or and frequency should be varied to prevent perceptual adaptation.

The human ability, processing the input information with existing knowledge provides a basis for decision making and for motor action.

Research has shown that the capability of humans to process information is very time limited. Where as the sense organ can receive information at millions of bits per second, the ability of brain to interpret, initiate, process, and initiate

a motor response is limited to about 5 to 10 bit per second (McCormick EJ 1976). The implications of this information are important in term of job design. If the information content of a job exceed the capacity of worker, an overload situation is created and error becomes inevitable.
Further more if an accident occurred on a job with excessive information processing requirements, it would be inappropriate to blame this accident on workers "error." Instead accident should be blamed on design error. In analyzing a job, it is important to identify points in the work cycle that requires human decisions. It is particularly important to identify situations where a wrong decision could lead to an accident. In these situations, it is essential to simplify or eliminate the decision making-task or to redesign the job to minimize the undesirable consequences of the wrong choices. (Armstrong TJ, Langolf GD 1983). During work on board many times a situation arises where prompt decision and action is needed which depends upon the capability of the worker to incorporate the input resources of the ship environment, compatibility of tool, equipment, with the human dimension, capabilities, limitations and expectations. Human factors are errors of judgment in guiding ships, especially in tight locations or shallow water, causing collision with vessel or other property.
An accident occurs when factor of human element is under estimated for a desired task, apart from inadequate training, poor operating procedure, a lack of diagnostic skill, misleading instrumentation, poor control room design, and mismanagement. A study carried out by the Institute of Shipping Economics in Bremen, Germany looked at 330 merchant ship accidents, involving 481 ships, that occurred between 1987 and 1991 concluded that 75% of them were due to two factors - too heavy a workload being put on the crew, especially in port, and inadequate training.

The control panel may be so designed that the decision may be made accurately, without any delay to assure safe operation . Work station may be so framed as to cause minimum visual and postural discomfort if the worker work for a long period of time. Adjustment may be made to his metabolis demand to the hot and humid environment of the ship and low temperature and weather condition. Work station may be accompanied with the essential tool, to prevent cumulative trauma disorder. A compensatory period of rest and work may also be adjusted at work station as to prevent fatigue an overwhelming cause in the seafaring accident.

The WHO definition of health is that "Health is a state of physical, mental and social wellbeing and not merely an absence of a disease" depict many dimensions where a human factor is encountered in causing an accident.

- A worker must be medically fit and of appropriate age i.e., not less than 18 years of age, must have a sound health, with required standard of eye sight and hearing for a recommended intensity of sound, and with all the bodily functions normal.
- He must be fit psychologically and without any ailment, which may inter fare in carrying out any delicate task, related to the safety of the vessel. He must be alert, initiative in work, trustworthiness, with a sense of responsibility, reseaoning and judgement.
- A worker should be socially well off and be paid an appropriate wages or as recommended by the ILO. For relaxation of his work an appropriate recreational facilities may be provided. He should be guarantied that in case of illness or injury sufficient medical treatment will be provided with in-compensatory loss. Lake of these factors can develop mental injury and consequently may be the cause of an accident.

When an accident happens, the subsequent investigation often shows that not only those on board but have made mistakes also by the company operating the ship.
There were perhaps many collisions like titanic before 1912, with icebergs since then many preventive steps were taken for safety of life at sea and no such accident occurred in past. The supertankers Amcocardiz went aground in 1974 because her steering system failed a difficulty that could have been overcome if there had been back up steering systems. Double bottoms on tankers not only reduces the likelihood of fouling of the environment during ballasting operations, but would also decrease the likelihood of rupture of ships in disasters. Many deaths occurred in fires, because crews jump over board without flotation devices and drown in the sea. Finally the first-aid training was given to the rest of crew other than Captain.
The equipment failure is one of the overwhelming identifiable factors, which contributed to various mishaps in merchant shipping. Fire because of ignition of explosive vapour levels of either cargos or fuel is one of the major problem. Designing of working desk through sensing devices i.e., adequate ventilation or filling holds with noncombustable gasesas flammable liquids or gases are pumped out.

2.1 Factors Causing Accidents in Seafaring

ACTING FORCES

- Mechanical
- Radiation
- Electricity
- Fire
- Direct affect of harmful gases, acids and alkalis
- Substandard vessel in type, size and built

ENVIRONMENT

1. Microclimate

-Work place hazards
Engine room
Deck
Galley
Cargo hatches
Office accommodation
Places requiring high vigilance
Places with accumulation of toxic gases, and
Places with Deficiency of oxygen
- Ship rolling & pitching
- Temperature
- Noise
- Vibration
- Illumination
- Inadequate ventilation

2. Macroclimate

- Storm
- Dew
- Rain
- Ice
- Extreme cold/ hot weather
- Humidity

OCCUPATIONAL TASK leading to the falls, slip, fall of tool from height

- Type of work

- Delicate task
- Physical heavy work
- work load with mental stress
- Continuous working
- Shift working
- Hazards from handling of plant and mechanical equipment and machinery

- Disorganization of work
- Working without skill & competency
- Working without protective devices and equipment
- Working without complying special safety instructions and regulations

Susceptible person

- Advanced age
- Fatigue with limited resting hours
- Lack of awareness
- Lack of leisure activities
- Substandard evaluation in physical and psychological medical fitness

- Fitness for duty
- Drug and alcohol abuse
- Psychosocial factors

Ship may be called as a sailing industry with rolling and pitching. Accidents can be major disasters such as ship wreckage, fire on the ship, running aground or those observed in routine working atmosphere. Many accidents happen during operation of loading and discharging of general cargo.

The ship carries passengers having communicable and infected diseases, while general cargo handling as well as the handling of explosive and dangerous cargo, chemicals in bulk and various gases all can cause accidents on ships. Atomic radiation hazard in nuclear powered ships may have its long lasting adverse effects on human life and sea.

In the past, eventful frequency rate of seafaring accidents were at the top of the list of morbidity and mortality, but with adaptation of various legislation, recommendations and use of modern technology, this has reduced substantially.

The average percentage of accidents in the total morbidity structure is 18.8 (borders values = 10-30). Accidents among fishermen are twice as much as among seafarers. Of seafarers the accidents are most frequent among the youngest (age 20) and the oldest (age 60) of which 20% = officers and 80% = other crew members. Factors such as type, size and age of a vessel have also to be taken into account while studying accidents among seafarers.

The older the ship lesser the safety for the seafarers. The positive factor may be ship's movements caused by rough sea, more slippery decks caused by spoiled cargo, ice or rain, snow bed, storms, blurred vision due to fog, thunders, and affects caused by macro climatic changes. Work in engine room, particularly repair work, chipping, painting handling of engine parts, during several movements of the ship is also sometimes associated with higher accidents risk. A large number of accidents are caused by handling of the ropes, hooks and cargo lifting equipment. Moreover, hazards to pilot ladder cannot be excluded. Environmental factors such as noise vibration insufficient illumination, change in the temperature, electric - burns, chemical gases inhalation and other additional risk factors and over fatigue may result in causation of accidents.

There may be little refuge from onboard fire, explosion, ruptured tanks, and leaking hulls. Like most occupational settings, the majority of known health hazards appear deceptively simple. Most reported deaths and injuries at sea are acute and traumatic. Physical and mechanical hazards serve as the casual basis for most of these. Slips on ladders, falls into holds, entanglement in lines, crushing by shifting cargo, caught by machinery, thermal burns, and falls overboard are among the more commonly sited causes. What is less well known, though perhaps more feared, is cancer, loss of cognitive function, or major physical impairment due to exposure to hazardous chemicals. In recent years, another major concern poorly characterized is illness due to communicable diseases or hazardous biologic agents. Heavy object moving due to storms, collision and running aground sometimes are cause of major casualties in seafaring.

Others are the overturning of a crane; explosion of fire due to ignition of dust, gas, vapour or celluloid, causing damage. Electrical short circuiting or failure of electrical plant resulting from an explosion or fire may sometimes become more hazardous.

Accidents in shipping trade can be classified as:

-due to the handling of goods;

-lifting machinery;

-hazards from plant and machinery associated with assembly, commissioning, operation,

maintenance, modification, repair and dismantling

-to persons falling;

-blows by a falling body;

-the use of hand tools;

-stepping on;

-striking against objects.

Of the fatal accidents, nearly one third are due to falls, sometimes from a height, but often while walking on the slippery deck. Many of these mishaps are attributable to lack of suitable appliances, such as ladders, or the wearing of unsuitable shoes. The mishandling of goods is responsible for over a quarter of the nonfatal accidents and is often associated with faulty supervision, or with the employment of persons who lack the necessary experience, strength or ability to do the work safely.
Once the ship reaches the age of 15 years, calamity rates rise substantially, especially for equipment failure and unseaworthiness. The ships loss rates was relevantly three times greater than the world average during the first year or two after the ship has changed name because unsafe and old ships were sold to someone instead to scrap. The smaller and older a ship is, the more accidents are registered because older vessels are also less equipped with modern technology and safety measures. Old design have tendency to rolling and pitching more. Moreover, rusty old stair - way and wall need continuous repair and painting often leading to accidents. As newly built ships need less maintenance, it reduces the extra work load on seafarer.
The chief surveyor of the Association was quoted earlier this year as blaming this decline on owners carrying out the "absolute minimum maintenance and repairs to their vessels" and "a decline in expertise and experience among crews (which) is spreading to the superintendents and others who attend on behalf of owners."

Moreover, airconditioning system in modern ships with adequate space for resting hours, provision of leisure activities and suitable working environment for working group has reduced the incidence of accidents.

In seafaring, protection of sea and the harbour environment is an important aspect and an integral part of the whole activity. This also requires new training and knowledge of all members of the staff on board and in the harbour.

2.2 Accident Proneness

The statistics of the majority of accidents collected and examined show that accidents are very unevenly distributed among those exposed to risk. With equal exposure to risk, roughly three-quarters of recorded accidents happen to one quarter of the people exposed. This phenomenon is known as accident proneness, a term coined by Farmer (1932) and now is in use worldwide. The probable number of persons who are accident-prone ranges from 10 to 25 percent of the total but may vary in seafaring.

In considering the psychogenesis of accidents Jung (1928) said:

“Accidents of every sort, in greater number than the public would ever guess, are of psychological origin. Ranging from insignificant mishaps like stumbling, bumping oneself, burning the fingers, etc., to automobile accidents and catastrophes in the mountains, instances may be found of psychological causation.”

Unfortunately, shipping companies do not subject their new employees to psychological tests before assigning them to one occupation or another. Accident proneness is greatly influenced by the mental attitude of the subjects.
It has been concluded that the fishermen show higher rates of accident, nearly double, as compared to the seaman of merchant ships while oil tankers crew reported lesser accidental rates than at cargo ships.

Younger seamen are more prone to the accidents mostly when they join the sea service due to poor adaptation of work and taking risky chances than the older ones. As with the younger age the senior seamen in the old age are also more

prone to the accidents than those in the middle age due to early fatigue senile degenerative changes and with mental and physical decline.

It has been reported that the majority of accidents occur during day time between 8 AM to 5 PM counted as the working hours. Moreover, there is a correlation between length of service at sea and number of accidents.

The majority of accidents happen on deck (approximately 43%), in the engine room (approximately 41%) and in the working area of the catering staff (approximately 16%).

Nearly 80% of the injured seamen do heavy physical work. The remaining 20% are crew members with light physical duty, e.g. the ships officers. Within the group of officers, the engineers are more frequently injured than the deck or catering officers.

2.3 Reportable Accidents causing Injury and Death

In order to asses the likelihood of harm in working places causing accidents, it is the responsibility of the ship safety official to report for serious injuries, accidents and dangerous occurrences to the inspection agencies, health and safety authorities as to publicize the events in order to take adequate control and preventive measures for specific hazards in future. It has been noted that the ship officials are not reporting the relevant information, as they are worried, as they may not be blamed. Port Health Department Karachi in year 2000, circulated the medical Performa in 100 ships, for collecting the said information. No ship official reported for an occurrence of serious nature.

Medical Performa for ships

All working seafarers, regardless of its nature, places bear both physical and mental stresses. As long as these stresses are kept within reasonable limits, work performance will be satisfactory and the worker's health and well-being will be maintained. However, if stresses are excessive, undesirable outcomes may occur in the form of errors, accidents, injuries, and a decrement in health.
Port Health department Karachi port has started a programme "Medical Emergency and its Management at Sea" and thus desires to update the following information. The medical emergency arises as a result of accident, injury or disease. Sometimes it has been observed that pre-existing symptom free disease is erroneously underestimated at medical fitness examination of seafarer before joining the vessel and with passage of time it manifests itself with presenting signs and symptoms for which the medical emergency arises. Your cooperation for answering the following questions from the logbook or as per your experiences on the ships would be appreciated.

1. No. of events where accidental injuries occurred and medical help required.

Due to

- Lifting/carrying by hand
- Lifting/carrying mechanically
- Fall over board
- Exposure to fumes
- Entering into the enclosed space
- Rope or hawser breaking
- Poor lighting
- Ship rolling and pitching
- Cleaning/painting/chipping
- Mooring or anchoring
- Adopting awkward positions
- Others

Places

- Deck

Type of the Injuries

- Electric injuries
- Burns
- Fractures/ Dislocation of joints
- Heat stroke/cold injuries
- Head injuries
- Drowning
- Wounds
- Foreign body in the eye
- Inhalations of gases or insecticidal poisoning
- Others

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2. Illnesses

- Mention number of cases with diagnosis by the attending physician or by the person responsible for medical care on vessel.
- Heart attack
- Diseases of Urinary tract infections
- Stones in the urinary tracts causing retention of urine and complicating acute pain,
- Respiratory illnesses,
- Shock
- Motion sickness
- Hernia
- Haemmorhoids
- Fistula-in-anu
- Depression
- Eye infections
- Acute abdomen
- Backache
- Vericos ulcer
- Skin infections
- Diseases of the gastrointestinal infections such as acute appendicitis, food poisoning, diarrhoea, hyperacidity or peptic/duodenal ulcer/hepatitis
- ENT infections and Common cold
- Cardiovascular accidents (stroke causing monoplegia/hemiplegia/paraplegia)
- Sexually transmitted diseases such as Gonorrhoea, AIDS, Hepatitis
- Dental problems

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3. Type of vessel and year of built ----------

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4. Number of events where radiomedical advice were obtained for managing the acute medical emergency at sea

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5. Number of events where the ship was tilted to the nearest port for saving the life of injured/sick seafarers

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----------6. Numbers of the accidental injuries/sickness for which seafarers were advised.

- Rest for one day
- Rest for more than one day
- Seafarer was hospitalized
- Advised repatriation

The statistical data (Department OF Transport London) show the following sequence:(1) contusions 34%, (2) wounds (Predominantly lacerations) 22%, (3) fractures (predominantly closed fractures) 19%, (4) strains (predominantly of the ankle) 17%. The remaining 8% include burns, injuries involving foreign bodies, injuries to the eyes and internal injuries.

A report issued under Merchant Shipping Notice NO.1294 vide Merchant shipping (safety official and reporting of accidents and dangerous occurrence) Regulation 1982 as amended by (SI 1984) for notification of various reportable accidents are those which caused either a death or an injury which prevented a person from carrying out his normal range of duties or activities for more than three days. The number of these accidents to crew were:

	1984	1985
No. of accidents to crew	1,077	1969
Total No. of Seamen at risk	49,800	44,500
No. of crew injured		
Reportable Accident rate per thousand	22	22

Types of accidents connected with

	1984	1985
Slip/Fall-same level	23	25
Slip/Fall-different levels	16	16
Manual handling	14	15
Lifting gear/hatches/ ropes/hawsers	14	15
Other machinery/implements	11	12

(a) Slips and falls accounted for 423 accidents in 1984 and 387 accidents in 1985; they were mainly caused by wet or oily decks uneven or defective flooring, carrying loads up by ladders or stairs, slopping off machinery and jumping off or over hatches or pipes. They were often associated with people hurrying.

(b) Manual handling accidents accounted for 154 accidents in 1984 and 145 accidents in 1985; they were caused mainly when objects were either lifted incorrectly, or were too heavy or cumbersome to be carried by one man.

Activities associated with accidents.

	% 1984	% 1985
Movement about ship	24	21
Lifting/carrying by hand	16	16
Clearing/painting/de-rusting	9	8

(a) Thus nearly half the accidents occurred while people were either moving about the ship or lifting or carrying something by hand, or simply de-rusting, painting or cleaning (including swabbing the decks): whereas towing operations, work on pressurized systems and electrical equipment and fittings together accounted for just 3 percent of accidents.

(b) Many ship accidents resulted from falls or slips due to movements of ship or when the injured person was moving quickly over a wet deck, e.g., in the galley area.

(c) Lifting items by means of a crane or other equipment caused 8 percent of the accidents in 1985 (6 percent in 1984) and was significantly associated with offshore supply and standby vessels.

(d) Only 3 per cent of the accidents occurred as a result of a leisure activity .

Places where Accidents were caused.

	1984	1985
Other “On deck” areas..... 21	22	
Focsle and after mooring deck..... 13	14	
Engine room/workshop..... 16	16	
Stairs/non-portable ladders.....	9	9
Galley and its store room.....	7	8
Other crew accommodation.....	8	9

(a) Usually when a person was reported as fallen from stair or a ladder it was due to his proceeding without sufficient care, or when carrying a cumbersome object; sometimes one or more treads were slippery.

(b) Most of the accidents in the crew accommodation occurred when the person was getting in or out of a bunk, or slipped in the shower room, or tripped over a door-sill.

Causes of accidents (1984-85)

The report form provides space for four causes to be recorded, but most reports gave only one or two causes. (Average 1.6 causes in 1984 and 1985).

	% 1984	% 1985

Negligence/carelessness.....	27	26
Unsafe deck surfaces.....	18	18
"Other" unsafe working methods.....	14	13
Carrying/lifting, too much incorrectly.....	9	10
Failure to wear protective clothing and equipment.....	8	5
Alcohol.....	6	4
Ship movement.....	10	8

(a) Negligence/carelessness-Where this was mentioned, it was usually given as one of two or more causes and in nearly all cases it was that of the person injured.

(b) Unsafe deck surfaces-during 1985 in 11 percent of the accidents, decks were slippery due to water: in 5 percent, they were slippery due to oil or grease etc. and in 2 percent, they were unsafe for other reasons.

(c) Unsafe working methods-this cause includes the incorrect use of, or, unsatisfactory lifting devices and unsafe procedures for unscrewing jammed nuts and valves.

(d) Lifting/carrying incorrectly-Many of the reports suggested that either two or more persons should have been involved, or that mechanical lifting should have been used.

(e) Failure to use protective clothing equipment-In most cases the reports implied that the relevant protective clothing and equipment was available on board.

(f) Inadequate supervision or lack of training-one or both of these causes were mentioned in connection with only 5 percent of the accidents in each year, but the nature of many other accidents and the associated comments of masters and safety officers, suggest that there is a need for stricter control of working methods and for more practical instructions.

Main Injury suffered by crew:
% of injured crew

	1984	1985
Death.....	2	1
All fractures.....	24	24
All sprains/strains/hernias.....	22	20
Crush injuries.....	9	7
Bad bruising and cuts/lacerations	30	32

Type	No. of deaths	Activity	No. of deaths
fire	1	leisure	1
Access to or from a ship	1	moving about ship	1
Slip/falls		mooring or anchoring	1
• same level	1		
• over board	1		
Involving rope / hawser	1	lifting/carrying by hand	1
Hit by object he was not using	1	lifting/carrying mechanically	1
Other	1	going through a door or similar vertical opening	1

		Other activities	1
Total	7	Total	7

Place	No. of deaths	Causes where one or more of the following was mentioned	No. of deaths
After mooring deck	2	Alcohol	1
Other "On deck" Areas	1	Negligence /Carelessness	1
Engine room or work shop	1	Tension	1
In other cargo spaces	1	Failure to use proper protective clothing or equipment	1
Crew accommodation	1	Non-comprehension of superiors instructions	1
Other causes	1	Rope or hawser breaking	1
		Not using means of access authorized by access regulations	1
		Ship movement	1
		Sea washing on board	1
Total	7	Total	9

(a) The number of crew who died due to an accident or were "missing at sea" were 14 and 2 in 1984 and 7 and nil in 1985.

(b) Crush injuries frequently involved fingers being damaged in doorways, or fingers or toes being hurt when a seafarer was lifting or moving something, or was guiding an object into place. Quite often the item causing the injury was suspended cargo or the lifting equipment itself.

On/Off duty.

In 1984, 86 per cent and in 1985, 85 percent of the crew who suffered a reportable injury were on duty at the time.

The number of these accidents to crew was:

	1985	1986
Accidents.....	969	773
No. of crew killed or injured.....	983	783
Total No. of seamen at risk...	44,500	33,300
Reportable accident rate per thousand.....	22	23

Types of accidents

Accidents connected mainly with:	% 1985	% 1986
Slip / fall-same level.....	25	22
Slip-fall-different levels.....	16	20
Manual handling.....	15	15
Lifting gear/hatches/ropes/hawsers..	15	13

Other machinery/implements.....	12	12

(a) Slips and falls accounted for 387 accidents in 1985 and 321 accidents in 1986; they were often associated with people hurrying, or carrying loads on ladders or stairs, or with water or oil on decks.

Activities associated with accidents

	% 1985	% 1986
Movement about ship..... ..	21	21
Lifting/carrying by hand.....	16	18
Cleaning/Painting/de-rusting.....	8	7
Using portable tools or implements.....	6	8
Mooring or anchoring.....	7	6

(b) Almost half the accidents occurred while people were performing basic tasks: lifting or carrying something by hand, or de-rusting, painting or cleaning, or simply moving about the ship.

Places where accidents were caused:

	% 1985	% 1986
On deck(includes 14% in 1985 and 12% in 1986 on forecastle head or after mooring deck).....	36	32
Engine room/workshop.....	16	15
Stairs/non-portable ladders.....	9	12
Galley and its storeroom.....	8	9
Other crew accommodation.....	9	7

(a) Many of the accidents in the crew accommodation resulted form tripping over doorsills.
(b) Accidents from falling on stairs or ladders were usually associated with carelessness or when carrying a cumbersome object.

Cause of accidents (1985-86)

The report form provides space for four causes to be recorded, but most reports gave only one or two causes (Average 1.6 causes in 1985, 1.5 in 1986).

	% 1985	% 1986
Negligence/carelessness of injured persons.....	26	29
Unsafe deck surfaces/flooring.....	18	17
Lifting/carrying, too much/ incorrectly.....	10	12
“Other” unsafe working methods.....	13	11
Ship Movement.....	8	10

(a) Negligence/carelessness of an injured person accounted for or contributed to 225 accidents in 1986 (254 in 1985).

In addition 24 accidents (3 per cent of the 1986 total) were attributed atleast in part to the negligence or carelessness of someone who was not injured. Carelessness was by far the most common cause of accidents but there continued to be slight fall in the percentage of accidents attributed to unsafe working methods. Thirty accidents (4 percent of all accidents in 1986) related to failure in using protective clothing.

(b) Unsafe deck surfaces or flooring-83 of these accidents (11 percent of the 1986 total) occurred when decks were wet; grease and oil accounted for another 26 and other causes such as defective flooring for the remaining 24.

(c) Lifting / carrying incorrectly-many of the reports again suggested that heavy or awkward loads were being lifted by one person when two or more should have been involved, or that mechanical lifting should have been used.

(d) The number of alcohol-related accidents fell again to 28 (3 percent) of which three were fatal. In 1985 there were 38 (4 percent) and in 1984 there were 61 (6 percent).

Main Injury suffered by crew:
% of injured crew.

	1985	1986
Death.....	1	2
All fractures.....	24	23
All sprains/strains /hernias.....20	20	
Bad bruising.....20	18	
Cuts and lacerations.....12	13	
Crush injuries.....7	6	
Burns/scalds/chemical poisoning.....5	5	
Torn cartilage/ligaments/muscle.....4	4	

Type	No. 0f deaths	Activity	No. of deaths
Falls overboard	4	Access	4
Access to or from ship	5	Moving about ship	2
Involving lifting devices	2	Towing operations	1
Involving rope/hawser	1	Mooring or anchoring	1
Exposure to fumes	1	Lifting mechanically	1
		Painting	1
		Using fixed machinery	1
		Others	2
Total	13	Total	13

Place	No. 0f deaths	Causes; where one or more of the following were mentioned	No. 0f deaths
Other “on deck” areas	5	Alcohol	3
Point of access	4	Negligence/carelessness	2
Working over side	1	Failure to use protective clothing or equipment	2
After mooring deck	1	Uneven surface/defective flooring	2
Pump room	1	Unsafe means of access	2
On a ro/ro deck	1	Sea washing on board	2
		Inadequate supervision	1
		Unsafe working methods	1
		Over exertion	1
		Rope or hawser breaking	1
		Other slippery surface	1

		Poor lighting	1
		Ship movement	1
Total	13	Total	20

(a) As a result of accidents thirteen crew died in 1986 as compared to the seven in 1985 and sixteen in 1984. None of the accidents involved multiple deaths in either 1985 or 1986. The 1986 deaths arose as mentioned.

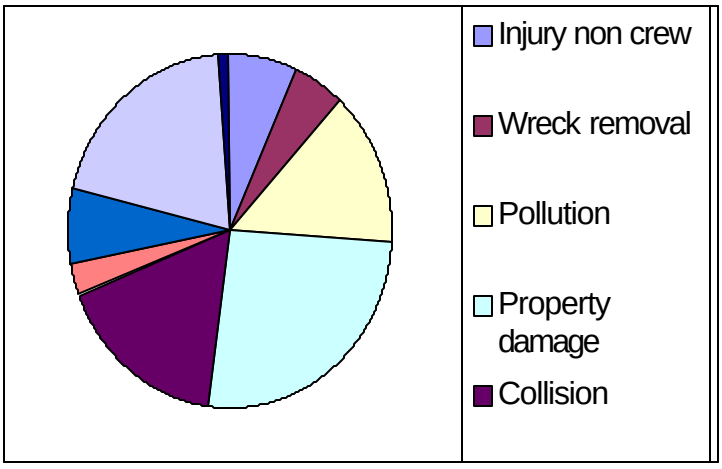
On/ off duty

In 1985, 85 percent and in 1986, 89 percent of the crew who suffered a reportable injury were on duty at the time.

2.4 The Potential for Loss of Life

The potential for loss of life incident obviously is greatest when large number of people are involved. This situation occurs:

(1) in passenger ships;
(2) in offshore drilling rigs;



The UK P&I club placed the following defination: 'Very high value claim amount paid at least US $1,600,000. Crew injury 7%. (Source: Seaways April 1999)

(3) in ships or port areas or closed to land when the effects of the accident may be felt beyond the confines of the ships, e.g., ships carrying explosives, liquefied gas, chemicals in bulk and low flash point oil cargoes.

Similarly, the potential for severe pollution is greatest in vessels carrying large volumes of pollutants.

These high risk areas will now be considered in some what greater details and the Organization's recognition of these potential hazards examined.

2.5 Passenger Ships

In addition to taking account of the potential hazard due to the large number of persons on board, passenger ship legislation must incorporate provisions covering the wide spectrum of the travelling public from the very young to the very old; from the able-bodied to the incapacitated and the invalids.

It must recognize that passengers are unlikely to be familiar with the ship or even any ship; may never, for example, have worn a life jacket; and that their very presence presents a hazard in terms of the increased fire risk they bring to a ship. Even a man willing to put his life at risk by going to sea, or even crossing the Atlantic in a small boat expects to be transported with safety when travelling as a passenger and even if the ships sinks, passengers are expected to be saved. These factors and the difficulties in evacuation in the event of an accident, have led to extensive legislation some aspects of which are dealt with elsewhere.

Millions of people travel annually by sea route ranging from inter-island passages through short international voyages on passenger ferries to long international voyages or on cruise liners. It was thus inevitable that IMO would direct much of its early attention to passenger ship legislation.

This work has been well documented and successful. It has been agreed also that legislation cannot be expected to prevent all accidents but it can mitigate their effects. Fire constitutes the greatest hazard on passenger ships and IMO has made steady progress.

All IMO subcommittees are, of course, involved with passenger ship safety and bring their particular expertise to bear on each problem accepted by the Maritime Safety Committee as needful of study.

2.6 Accidents Prevention and Control

For prevention of accidents in seafaring, cause must be determined as accidents do not just happen, they are caused. The etiological factor causing accident willful or otherwise are related to the human factor where an error has to be identified enormously encountering the responsibilities as laid from top to the bottom and positively clue would have been be able to trace for a person who did the mistake and require more specified approach for its prevention and control in this regard.

Causes	Number
Collision of contact	63
Fire or explosion	126
Groundings	62
Machinery	29
Weather	187
Others	153
Totals	620

LIyod's Register of shipping casualty returns for 1992-96

Causes	Number
Foundered	83
Missing	2
Fire/explosion	22
Collision	29
Wrecked/standard	36

Contacts	1
Others	6
Totals	179

LIyod's Register of shipping casualty returns for 1996

In fact the quoted figures do not a give a complete exposure however what comes out of these is that except a few exceptions most of the incidents are caused due to navigational errors. Although fire and explosions are counted as man made mistakes. Some losses was definitely out of human control such as losses due to storm and un-occasional rough weather yet losses of these nature could have been avoided by taking alternate routes and adopting precautionary planning measures. The Institute of Underwriters (ILU) gave a figure for six losses, which revealed that it was due to mechanical failure. But in order to confirm the enquiry report one shall have to go case by case and overall opinion from expert is also to required. If some one accept the apology even human mistakes are there to be put on some one shoulders for the mechanical fault for ship sea unworthiness.

Thanks goes to the efforts of IMO, as various conventions were held ratifying various regulations for maritime safety. IMO's most important task is to make sure that the people who sail on these ships, whether they are passengers or crew members, arrive at their destination safely. It necessitates the upgradation of international safety standard. It has been observed that standards improved in some countries but overall there was almost certainly, a serious reduction in safety levels, an increase in the casualty rate and more accidents involving heavy loss of life.

IMO is taking positive steps to prevent this from happening by becoming more pro-active rather than reactive in improving international safety legislation. Emphasis is being placed on the fact that no single unit in the safety chain can act alone but, instead, all must work in concert to achieve the common objective. There is urgency to play their role for ship builders, classification societies, shipowners, ship managers, characters, insurers, seafarer's unions, specialists of maritime medicine, government administrations and IMO itself to bring about safer shipping and regain the confidence of the public without always trying to put the blame on others for any failures (O'Neil 1991).

It is because shipping has changed so much during the last thirty years that it become difficult to assess the effectiveness of IMO measures. However, the indications are that there has been a reduction in the percentage of ships involved in serious casualties or lost at sea. It is generally agreed that the entry into force of IMO conventions and other measures during this period has played a significant part in this improvement. However, there is no guarantee that it will continue.

One of the most important ergonomic tasks of modern shipbuilding is to determine the factors of "coexistence" between shipbuilding criteria and anthropometric parameters of seafarers. These ergonomic provision factors condition the safety of seafaring.

The result of study by Voitenko (Oddesa) showed that some anthropometric characteristics of crews differ from the known. The study conducted allowed to determine some disproportion between spatiallinear characteristics of habitat zones and average statistical anthropometrical data of seafarers. The data obtained determines the necessity to develop unified ergonomic methods, to work out and issue the International Anthropometric Atlas of Seafarers.

It is important to strengthen the seafarer's psychological training and take mental health measures. The prevention and treatment measures should be done more effectively in order to decrease the diseases and accidents among the seafarers.

Ship designers should pay particular attention to optimal design of engines, fitments, ladders, stairways and passages to ensure personal safety. Regretfully, anthropotechnics are, so far, applied too rarely in the design of ships. Movement of the ship is practically unavoidable at sea. As 13% of the occupational accidents are directly or indirectly caused by rough seas, only urgent repair work should be carried out under these circumstances.

Seafarers should care for their own health and safety and for the health and safety of others. Any serious or imminent danger should be reported immediately to the appropriate officer. Proper use should be made of plant and machinery, and any hazard to health and safety (such as a dangerous substance) should be treated with due caution. When ever required, seafarers should use the appropriate protective clothing and equipment provided for them and afterwards return it to its proper place. No seafarer should do anything that would place another person at risk. For example, no one should disconnect, remove or interfere with any safety device without proper authority.

Good behavioral patterns by Captains, deck officers and engineers contribute a lot towards general acceptance of good safety practice and awards or rewards for accident free work can be a stimulating means of accident prevention. The aim of accident prevention on board ships must be "Education for self-protection" as any accident to anyone on board threatens not only to the health of the seaman himself but also to others.

For further study and analysis the data of morbidity and mortality in seafaring is very important. Merchant shipping (safety official and report of accidents and dangerous occurrence) Regulation 1982 as amended by SI 1984 should be observed with strict compliance.

Prevention of alcohol abuse results in prevention of accidents, hence consumption of alcohol should not be taken heavily or should be avoided.

The hospital medical facilities at shore differ comparatively to the treatment by a lay man on ship, whenever an acute emergency arises in accidents. There are various institutes where medical first aid training are given. To handle medical emergencies a medical kit should be available on board. Handling of emergency cases should begin shifting of patient from the site of accident to the ships medical room or to the hospital ashore for which helicopter facility may be required.

Initially symptomatic treatment may be given until the ship reaches the nearest port. A person medical in-charge should have a good know- ledge of diagnosing the fracture in case of accidents and its first aid treatment other than the medical emergency. Although, Ship Captain's Medical Guide, International Medical Guide for Ships and IMO's Medical First Aid Guide for Use in Accidents Involving Dangerous Goods solved many health problems for lay man, but even with many problems remained unsolved. It is also advised to keep these books on every sea going vessel and should be included in curriculum for first aid medical course for medical men on ship.

C134 Prevention of Accidents (Seafarers) Convention, 1970

Convention concerning the Prevention of Occupational Accidents to Seafarers (Note: Date of coming into force: 17:02:1973.)

Noting that, for the success of action in the field of accident prevention on board ship, it is important that close co-operation be maintained in their respective fields between the International Labour Organisation and the Inter-Governmental Maritime Consultative Organization, and

Noting that the following standards have accordingly been framed with the co-operation of the Inter-Governmental Maritime Consultative Organization, and that it is proposed to seek its continuing co-operation in the application of these standards,

Article 1

1. For the purpose of this Convention, the term seafarer covers all persons who are employed in any capacity on board a ship, other than a ship of war, registered in a territory for which the Convention is in force and ordinarily engaged in maritime navigation.

2. In the event of any doubt whether any categories of persons are to be regarded as seafarers for the purpose of this Convention, the question shall be determined by the competent authority in each country after consultation with the shipowners' and seafarers' organizations concerned.

3. For the purpose of this Convention, the term occupational accidents covers accidents to seafarers arising out of or in the course of their employment.

Article 2

1. The competent authority in each maritime country shall take the necessary measures to ensure that occupational accidents are adequately reported and investigated, and comprehensive statistics of such accidents kept and analyzed.

2. All occupational accidents shall be reported and statistics shall not be limited to fatalities or to accidents involving the ship.

3. The statistics shall record the numbers, nature, causes and effects of occupational accidents, with a clear indication of the department on board ship--for instance, deck, engine or catering--and of the area--for instance, at sea or in port--where the accident occurred.

4. The competent authority shall undertake an investigation into the causes and circumstances of occupational accidents resulting in loss of life or serious personal injury, and such other accidents as may be specified in national laws or regulations.

Article 3

In order to provide a sound basis for the prevention of accidents which are due to particular hazards of maritime employment, research shall be undertaken into general trends and into such hazards as are brought out by statistics.

Article 4

1. Provisions concerning the prevention of occupational accidents shall be laid down by laws or regulations, codes of practice or other appropriate means.

2. These provisions shall refer to any general provisions on the prevention of accidents and the protection of health in employment which may be applicable to the work of seafarers, and shall specify measures for the prevention of accidents which are peculiar to maritime employment.

3. In particular, these provisions shall cover the following matters:

(a) general and basic provisions;
(b) structural features of the ship;
(c) machinery;
(d) special safety measures on and below deck;
(e) loading and unloading equipment;
(f) fire prevention and fire-fighting;
(g) anchors, chains and lines;
(h) dangerous cargo and ballast;
(i) personal protective equipment for seafarers.

Article 5

1. The accident prevention provisions referred to in Article 4 shall clearly specify the obligation of shipowners, seafarers and others concerned to comply with them.

2. Generally, any obligation on the shipowner to provide protective equipment or other accident prevention safeguards shall be accompanied by provision for the use of such equipment and safeguards by seafarers and a requirement that they comply with the relevant accident prevention measures.

Article 6

1. Appropriate measures shall be taken to ensure the proper application of the provisions referred to in Article 4, by means of adequate inspection or otherwise.

2. Appropriate measures shall be taken to ensure compliance with these provisions.
3. All necessary steps shall be taken to ensure that inspection and enforcement authorities are familiar with maritime employment and its practices.
4. In order to facilitate application, copies or summaries of the provisions shall be brought to the attention of seafarers, for instance by display in a prominent position on board ship.

Article 7

Provision shall be made for the appointment, from amongst the crew of the ship, of a suitable person or suitable persons or of a suitable committee responsible, under the Master, for accident prevention.

Article 8

1. Programmes for the prevention of occupational accidents shall be established by the competent authority with the co-operation of shipowners' and seafarers' organizations.

2. Implementation of such programmes shall be so organised that the competent authority, shipowners and seafarers or their representatives and other appropriate bodies may play an active part.

3. In particular, national or local joint accident prevention committees or ad hoc working parties, on which both shipowners' and seafarers' organizations are represented, shall be established.

Article 9

1. The competent authority shall promote and, in so far as appropriate under national conditions, ensure the inclusion, as part of the instruction in professional duties, of instruction in the prevention of accidents and in measures for the protection of health in employment in the curricula, for all categories and grades of seafarers, of vocational training institutions.

2. All appropriate and practicable measures shall also be taken to bring to the attention of seafarers information concerning particular hazards, for instance by means of official notices containing relevant instructions.

Article 10

Members, with the assistance as appropriate of intergovernmental and other international organizations, shall endeavour, in co-operation with each other, to achieve the greatest possible measure of uniformity of other action for the prevention of occupational accidents.

2.6.1 The Safety Movement

Safety is an important component for the marine business. The management of risk factors is a serious issue today. In fact the whole issue of "safety measurement" is controversial, as accidents are gauged by frequency and severity rates: “They (accidents) are the most abused and misused measurement of safety as they are subject to many variables and forms of manipulation. But their gravest weakness is that they are the measurement of "unsafety" rather than safety. Safety professionals have the following statement about that kind of measurement: What is the sense in measuring if the loss must occur before you can act? That is reaction - not control.”

Reduced training for cost-saving purposes in many shipping organisations can be a leading cause in accidents where the topic of human factor is not stressed according to its gravity. By means of propaganda and education the Safety Movement has done good work to reduce accidents. It has spread to all shipping trades. It aims at protection through the education of workers by means of posters and lectures, advice to the employer as to safety methods. By means of posters placed in prominent positions in engine room or at working environment, the attention of the workers is called to the grave results of accidents which may be due to their inattention, carelessness or failure to carry out instructions.

The posters are changed from time to time so that they may attract fresh attention and keep alive the worker's interest in accident prevention.

2.6.1.1 Suitable Topics for Accident Posters

Slogan such as "Be careful," "Take Care," should be avoided; there is good evidence that warnings of unknown and unspecified dangers tend to produce nervousness and reduce the level of skill and may lead to accidents. Cautionary statements should therefore be supplanted by definite description. An instruction "Careful", "Danger within", is ineffective and should be replaced by "Put out any bare lights" and "extinguish cigarettes," "High Explosive Within."

Incidentally, the basic objections to these so called horror posters are that instead of the appropriate response, emotional ones are evoked. These horror posters are known to affect skillful behaviour adversely.

2.6.1.2 Search into Methods of Prevention

Doctors, engineers, physicists, ship owners and International agencies must constantly collaborate to improve schemes of safety and to devise new methods to protect the worker against injury. Certain automatic engineering devices which guarantee safety are now common in use.

Since IMO's primary task is to improve maritime safety, it would be logical to assume that the Organization's success or failure would be reflected in the annual casualty statistics. However, the changes that have taken place since 1959 have been so far reaching that a straight forward comparison of the number of ships or tonnage would be misleading.

2.6.2 Regulations For Safety and Health on Ships

(a) For securing the safety of ships and person on ships;
(b) for protecting the health of persons on ships;
(c) for giving effect to international agreements which are related to any of the masters mentioned in the preceding paragraphs and to which the state is a party.

2.6.3 Maritime Regulations For Safe Ship's Operation are Meant For

(a) The design, construction maintenance, repair, alteration inspection, surveying and marking of ships and their machinery and equipment;
(b) the packaging, marking, loading, placing moving inspection, testing and measuring of cargo and anything on a ship which is not cargo machinery or equipment;
(c) the carrying out of any operation involving a ship;
(d) the use of the machinery and equipment of a ship and of anything on a ship which is not cargo, machinery or equipment;
(e) the manning of ships, including the employment on ships of persons qualified to attend to the health and safety of persons on the ships;
(f) the arrangements for ensuring communication between persons in different parts of a ship and between persons in the ship and other persons;
(g) the access to presence in and egress from a ship and different parts of it, of persons of any descriptions;
(h) the ventilation, temperature and lighting of different parts of a ship;
(i) the step to be taken to prevent or control noise, vibration and radiation in and from a ship and the emission in or from a ship of smoke, gas and dust;
(j) the steps to be taken to prevent, detect and deal with outbreaks of fire on a ship;
(k) the steps to be taken to prevent any collision involving a ship and in consequence of any collision involving a ship;
(l) the steps to be taken in a case where a ship is in distress or stranded or wrecked for the purpose of saving the ship and its machinery equipment and cargo and the lives of persons on or from the ship including the steps to be taken by other persons for giving assistance in such a case;
(m) the removal by act of jettisoning or otherwise of its equipment and of other things from a ship for the purpose of avoiding removing or reducing danger to persons or property;

(n) the steps to be taken, in a case where danger of any kind occurs or is suspected on a ship for removing or reducing the danger and for warning persons who are not on the ship of the danger or suspected danger;
(o) the making of records and the keeping of documents relating to ships and the keeping and use on a ship of information to facilitate the navigation of the ship.
The application of IMO codes is in some cases even more universal, though these instruments are voluntary. It has been estimated that all gas carriers now in service have been constructed according to the standards laid down in IMO codes and the same applies to bulk chemical carriers. In 1986 the codes dealing with gas carriers and chemical tankers both became mandatory under SOLAS.

There are several reasons for the wide acceptance of IMO measures. One is the measures themselves, which are recognized as being sensible and practical as well as of high standard. Another is the fact that they are mandatory in so many countries that it is commercially important for ships to conform to them if ships are not built to IMO standards it may be impossible to operate them internationally. As a result, IMO conventions and codes often have a wider impact that the statistics indicate. Ships are subject to inspection by authorities of other Contracting Parties and since those provisions are now being enforced more and more rigorously it is becoming increasingly difficult for substandard ships to escape detection.

2.6.4 The safety official

The employer is ultimately responsible for the safety of all persons on board ship. However, immediate responsibility for the overall safety of the ship and of those on board rests with the Master. Under him each individual member of the ship's crew has a duty to ensure safety in those matters within his own control, whether supervising or carrying out a task, or in reporting or remedying defects which might impair safety. All the safeguards and other facilities provided for the safety should be used.

The development of the necessary degree of safety consciousness and the achievement of high standards of safety depend on foresight, good organization and the wholehearted support of management and of all members of the crew. It is therefore important that arrangement should exist on every ship whereby the ship's complement can cooperate and participate in establishing and maintaining safe working conditions.

There is considerable scope in the shipping industry for reducing the number of deaths and injuries resulting from accidents by improving safety in the everyday working and leisure environment. That should be the prime concern of the safety officials on board ship.

The term "safety official" includes safety officers, safety representatives and other members of safety committees. Merchant Shipping Regulations (Safety Officials and Reporting of Accidents and Dangerous occurrences Regulations S1 1982 No.876 ("SORADO" Regulations) lay down requirements for the appointment and duties on ships, Safety Officers and safety committee and for the election of safety representatives with specified powers. These requirements should help to ensure that all company policies reflect a commitment by top management to give seafarers, as far as possible, protection atleast equivalent to that given to industry ashore.

2.6.5 The Safety Committee

The safety committee is the forum on board ship in which the Master and the appointed and elected safety officials and others meet to discuss matters relating to occupational safety. In all ships to which the Regulations apply, it is desirable for the Master to establish a safety committee. However, a statutory requirement for a safety committee only exists on those ships where safety representatives are elected.

The ship's safety committee should include the Master, the safety Officer and every safety representative elected in accordance with the rules.

The Master must record the appointment of a safety committee in the official logbook. Other committee members should include the safety Officer, every safety representative and other persons necessary for the proper conduct of the business (e.g., Chief Officer, Chief Engineer or Catering Officer). Care should be taken to keep the committee sufficiently compact to maintain interest and to enable it to function efficiently.

2.6.6 Advice to Safety Officer

The Safety Officer is required by the Regulations to try to ensure compliance with the provisions of this code and of the employer's occupational health and safety policy; and to investigate notifiable accidents to persons on board ship or during access, as well as every dangerous occurrence and all potential hazards to occupational health and safety and to make recommendations to the Master.

The Safety Officer is also required to stop any work which he reasonably believes may cause a serious accident and to inform the Master immediately (or his deputy) who is responsible for deciding when work can safely be resumed.

Finally, he has a duty to carry out any occupational health or safety investigation or inspection required by the safety committee.

The Safety Officer should be on the lookout for any potential hazard and the means of preventing accidents. He should try to develop and sustain high level of safety consciousness among the crew so that individuals work and react instinctively in a safe manner and have full regard to the safety not only of themselves but also of others. He should aim to become the ship's adviser on occupational safety to whom the Master, officers and ratings alike will naturally turn for advice or help on safe working procedures aboard ship.

It is not possible to give definite checklist of everything to look for but safe access, the environment and working conditions are major items.

HEALTH SURVEILLANCE
(Implementation of EC Directive 89/391
MERCHANT SHIPPING AND FISHING VESSELS
(HEALTH AND SAFETY AT WORK) REGULATIONS 1997
MGN 20 (M+F) Marine Safety Agency

1. Duty of employers

1.1 Employers must provide workers with such health surveillance as is appropriate taking into account the risks to their health and safety which are identified by the assessment undertaken in accordance with the regulations.

2. Purpose of health surveillance

2.1 Health surveillance is a means of identifying early signs of ill health caused by occupational hazards so that action can be taken to protect individuals at an early stage from further harm. For example:
- where a worker's exposure to a hazardous substance is approaching the agreed limit, the worker should be removed from exposure before any harm is done;
- if symptoms of minor ailments (e.g. skin rash) are detected, action should be taken to prevent them becoming major health problems.

2.2 In addition, the results of health surveillance can provide a means of:
(a) checking the effectiveness of health control measures;
(b) providing feedback on the accuracy of health risk assessment;
(c) identifying and protecting individuals at increased risk.

2.3 Health surveillance is not a substitute for measures to control risks to health and safety. Control measures should always be the first consideration to reduce risk. Nor is it the same as medical examinations which are intended to assess fitness for work (for example pre-employment, sickness resumption or periodic examinations). However, where relevant, health surveillance should be conducted, for example at pre-employment assessment, where a base-line reference can usefully be established.

3 Application

3.1 Health surveillance should be introduced where risk assessment (see Chapter 1) identifies that :
(a) a particular work activity may cause ill health;
(b) an identifiable disease or adverse health condition is related to the work;
(c) recognised testing methods are available for early detection of an occupational disease or condition - e.g. audiometry, skin inspection where dermatitis is a hazard;
(d) there is a reasonable likelihood that a disease or condition may occur in relation to particular working conditions;
(e) surveillance is likely to further the protection of workers' health.

3.2 All workers should be subject to whatever health surveillance is appropriate for the work activities they are involved in. Examples of circumstances in which it may be useful include :
- exposure to hazardous substances;
- working with vibrating tools;
- exposure to high levels of noise;
- use of substances known to cause dermatitis (e.g. solvents); and
- exposure to certain dusts (e.g. asbestos);

4 What to do

4.1 Once it is decided that health surveillance is appropriate, it should be maintained whilst the worker remains exposed to the hazard(s) in question. A worker's health surveillance records should where possible be retained, even when the worker changes employment.

4.2 Health surveillance may involve one or more of the following, as applicable:
(a) inspection of readily detectable conditions (e.g. skin damage) by a person acting within the limits of their training and experience;
(b) enquiries about symptoms;
(c) hearing checks (audiometry);
(d) medical examinations or company health checks;
(e) testing blood or urine samples.

4.3 The frequency of such checks should be determined either on the basis of suitable general guidance (e.g. skin inspection for skin damage) or on the advice of a qualified occupational health practitioner. The workers concerned could be given an explanation of the purpose of health surveillance and an opportunity to comment on the proposed frequency of such health surveillance procedures, either directly or through their safety representatives.

4.4 Where medical surveillance is required, and it is necessary to take samples or record other personal information, it is essential that confidentiality is maintained in respect of individual
- health records containing clinical information.

2.6.7 Substances Hazardous to Health

Many substances found on ships are capable of damaging the health of those exposed to them. They include not only substances displaying hazard warning labels (e.g., on dangerous goods cargoes and ship's stores) but also, for example, a range of dusts, fumes and fungal spores from goods, plant or activities aboard ship.

Whenever crew members work in the presence of substances hazardous to health the employer or the Master should ensure that any risks from exposure are assessed (see them). The assessment should include consideration of necessary precautionary measures both for crew members and other effected groups (e.g., stevedores and maintenance personnel). Failure to protect workers exposed to hazardous substances in this way could result in prosecution.

Employers should instruct, inform and train crew so that they know and understand the risks arising from their work, the precautions to be taken and the results of any monitoring of exposure.

Prevention of the hazard by not having the substance is always better than control; but failing this the measures should achieve adequate control, be used and be maintained in efficient order. When adequate control is not feasible by any other means, then as a means of last resort personal protective clothing and equipment should be provided and used accordingly.

For certain substances (e.g., where the risk to health is through inhalation) very specific control measures apply; for example, where the substance is asbestos dust, or a dangerous gas, or is in an enclosed or confined space. Where the risk is of a lower order, effective controls will often be the simplest way however, e.g., awareness of the problem and an organized working method be adopted to reduce exposure.
A number of accidents involving bulk carriers have occurred as a result of inadequate loading and unloading and that safe practices could prevent such accidents in future. It contains recommendations to provide guidance to shipowners, masters, shippers, operators of bulk carriers, charterers and terminal operators for the safe handling, loading and unloading of solid bulk cargoes. In cases where failure of the control measures could result in serious risks to health, or where their adequacy or efficiency is in doubt, the exposure of crew members should be monitored and a record be kept for future reference.

2.6.8 Personal Safety (Protective Clothing and Equipment)

Merchant Shipping Regulations “MS (Protective Clothing and Equipment) Regulations, SI 1985" No.1664, require employers to ensure that every employee engaged in a specified work process, or who may be at risk from such a process, is supplied with suitable protective clothing and equipment. Overalls, gloves and suitable footwear are the proper working dress for most of the work about the ship but these may not give adequate protection against particular hazards in particular jobs.

Many people have sustained serious back and other injuries during manual lifting or carrying operations as a result of accidents, poor organization or unsatisfactory working methods and employers should always aim to find safer practicable alternatives to such operations on board ship.

No one should place tools where they can be accidentally knocked down and may fall on someone below, nor should tools be carried in pockets from which they may easily fall. When working aloft, it is often best to wear a belt designed to hold essential tools securely in loops.

During such type of work as chipping, paint spraying, dropping anchor, use of cold chisels and scaling etc., there is a risk of recurring eye injury, therefore, in these and similar operations, goggles must be worn.

Welding provides another course of injury to the eye, caused by flying sparks, together with strong light emitted from the equipment.

Welding and flame cutting operation should be properly supervised and kept under regular observation. In order to minimize risk from electric shock, electric welding power sources for shipboard use should have a direct current (DC) output not exceeding 70 volts, with a minimum ripple.

Don’t even watch a welder at work without wearing the appropriate goggles or face shield.

Other sources of injury are splashing chemicals, e.g., acids, alkalis, boiled water, aerosols, fuel oil additives, etc.
When grinders are used causing a dusty atmosphere, face masks should also be worn.

2.6.8.1 Cotton Overalls

Always wear cotton overalls in the engine room. White is the preferable colour to wear because other colour dyes may irritate the skin in tropical conditions. Under no circumstances nylon overalls be worn, as in the event of a fire the fabric melts and clings to the skin causing severe burns.
The overalls must fit properly, have long sleeves (and rolled up), be kept clean and have no holes, tears, etc. The front should always be kept fastened up, no matter how tempting it is to undo it in hot weather.

2.6.8.2 Safety Helmet

Safety helmets of an approved design must be worn when:

- In Drydock, at all times.
- When performing heavy maintenance tasks.
- When working inside boiler furnaces.
- When working inside crankcases.
- In all emergencies.

2.6.8.3 Shoes

Engine room shoes or boots must have reinforced toe caps and leather or oil-resistant non-slip rubber soles. They must fit properly.

2.6.8.4 Gloves

It is advisable to wear thin leather gloves at all times whenever in the engine room. For handling and working with items at high temperature wear thick asbestos gloves.

2.6.8.5 Ear Plugs or Muffs

It is strongly recommended that acoustic woolen plugs or ear muffs of an approved design are worn always in the engine room when the vessel is under way.

2.6.8.6 Goggles or Safety Glasses

- Goggles or Safety Glasses of an approved design must be worn when
- Working on the lathe, drill, grinder or shaper.
- Handling chemicals or solvents.
- Any circumstances where eye injury is possible.

2.6.8.7 Manual Handling

This is probably one of the most common jobs which you are likely to be called upon to perform. It is also the one which causes the majority of back injuries. The human backbone is reasonably strong in vertical position but whenever it bends and a load is imposed, the way is open for injury to result. Moreover improper manual handling can also cause hernias.

For manual handling the following method for lifting objects may be advised.

- Take up the position with your feet slightly apart.
- Bend your knee joint.
- Applying a firm grip on load.
- Keep your back straight.
- Press the load against your chest and straighten your leg simultaneously and gradually.

2.6.8.8 Dust Masks

It is recommended that masks of the gauze filter type are worn when cleaning inside tanks, vessels and boilers. It must be understood, however, that these masks afford no protection at all in areas containing toxic gases.

2.6.8.9 Breathing apparatus

It is used where normal respiration becomes impossible. The set is easy to operate, to wear and to handle. It is particularly used in restricted area, such as cargo tank and other enclosed spaces. In the event of difficulty the apparatus may be withdrawn. The set consists of cylinder contained in a bag made of thick terylene fabric which is supported on the back of the wearer by a harness and belt. The high pressure air in the cylinder is fed into the manifold through the cylinder valve and a flexible hose used with a 1200 liter 3000 P.S.I cylinder, the set has a duration of approximately 30 minutes at a consumption of 40 litre per minute.

2.6.8.10 Hand Cleaner

A solvent type hand cleaner is recommended. If this is not available, a barrier cream should be applied before work and the hands washed with a borax/soap solution after work.

2.6.8.11 Hand Tools

Hand tools are also a cause of numerous injuries caused by improper use and lack of mainten- ance. One of the most common cases of imp- roper use is using the wrong size of spanner to loosen or tighten nuts and bolts. Oversize spanners slip off the head of the nut or bolt whenever force is applied and injury is caused usually in the form of abrasions to the hands, but in some cases, more seriously. Loose hammer head is another common fault in hand tools, sometimes flying off, injuring personnel or damaging equipment. Make sure that the heads of cold chisels are properly dressed and do not allow them to “spread;” because hammers will slip them off and injure your hand. Store tools neatly and treat them with care.

2.6.9 Safety Measures

2.6.9.1 Decks

A large proportion of accidents on decks are caused by stumbling, slipping or tripping over some object or other, whilst hurrying along and not paying attention. Always look where you are putting your feet.

Slipping is sometimes caused by unsuitable footwear, good solid footwear, preferably with protective toe caps, should be worn. Shoes with metal studs must never be worn (especially on tankers) as they can cause sparks sufficient to ignite flammable vapour and cause an explosion. Similarly, radios must never be played on the decks of oil tankers.

Decks must always be kept clear and free from contamination, such as oil, grease and paint spillage, etc. If such spillages are caused, they must be cleared at the first available opportunity. On some ships it may not be possible to clear the spillage immediately (e.g., during cargo operations on tankers). In some cases sands(or sawdust, if available) may be sprinkled over spillages, as a temporary measure.

2.6.9.2 Galley

Oil and grease are substances found in all Galleys and sometimes they find their way onto the deck, where they can cause catering staff to slip and sustain injury. Any spillage should be cleared up immediately by pouring salt on the affected area then cleaning as soon as possible thereafter.

- As in all parts of the ship, sensible footwear is absolutely essential.
- Shoes or boots with leather soles and reinforced toe-caps are the most suitable for use in the Galley, as they give all round protection and also protect against slipping and bruising which could be caused by falling objects.
- It is also a wise precaution to keep one hand free when climbing ladders or gang way, to stop yourself from falling.

- In hot weather, always remember to take your salt tablets and drink plenty of water.
- Burners should be adjusted to prevent galley funnel fires and sparks from incandescent soot. Flues should be cleaned at regular intervals.
- The appropriate fire fighting equipment must be available at all times
- During cargo operation on board tank- ships, the Galley doors and ports opening directly onto or overlooking the tank deck, must be kept shut. Cleaning solvents should always be used in accordance with manufacturer's instructions and in an area that is well ventilated.
- Some domestic cleaning substances contain bleach or caustic soda (sodium hypochlorite) whilst some disinfectants contain carbolic acid (phenol). These substances can burn the skin and prove poisonous if swallowed. They should be treated with caution and should not be mixed together or used at more than the recommended strength.
- Food waste, empty food containers and other garbage are major sources of pollution and disease. They should be placed in proper storage facilities safely away from foodstuffs.
- The equipment out of order should be kept out of use and a warning notice displayed until it has been repaired. Deep fat fryers should be provided with suitable safety lids which should be kept in position when the fryer are not in use. Electrically operated deep fat fryer should be switched off immediately after use.

2.6.9.2.1 Tins

A very dangerous practice which is quite common is to open tins using a knife. This practice can cause severe injury caused by a knife slipping, apart from the damage it causes to the knife. Metal fragments from the knife and/or the tin can also enter the foodstuff causing injury to the unfortunate individual to whom it is served. A tin opener should always be used for opening tins and NEVER a knife.

2.6.9.2.2 Working with Stoves

Most accidents which happen when working with stoves are usually burns. All burns cause great pain and discomfort and can be fatal. For this reason great care is necessary when working with stoves.

When opening the door of an oven, always guard your face and be prepared for a blast of hot air to rush out whenever the oven door is opened.

Make it a rule to never bend over burners when lighting them. Fat should never be melted down in an oven, as it can be easily forgotten and catch fire.

Other injuries apart from burns can also be sustained in the galley caused by overhead obstacles, such as meat hooks. Overhead service hatch covers must be secured when in the open position and locked or bolted when closed.

2.6.9.2.3 Glass

If foodstuff comes into contact with broken glass, it must be discarded immediately.

Glass, like knives, must never be left submerged in washing-up sinks. Cracked or chipped crockery and glassware should be destroyed.

Glass is extremely dangerous and broken glass should never be picked up by hand. Use a dustpan and handbrush for lifting broken glass.

2.6.9.2.4 Microwave Oven

When microwave ovens are used and particularly with pre-frozen foods, it is important to ensure that the food is cooked thoroughly and evenly. The instructions issued by oven manufacturers should be followed carefully in conjunction with the information on the packaging of the foodstuff. No microwave oven should be operated if the oven door or its interlock is out of use, the door is broken or ill fitted or the door seal is damaged. Each microwave oven

should carry a permanent notice to this effect. Knives should be stored tidily in secure racks or sheaths when not in use.

2.6.9.2.5 Electrical Equipment

Never attempt to operate electrical equipment if your hands are wet. The electrode holder should be isolated from the current supply before a used electrode is removed and before a new electrode is inserted. This precaution is necessary because some electrode coatings have extremely low resistance. Even a flux coating which is normally insulating can become damp from sweating hands and thus potentially dangerous.

Adequate precaution should be taken to ensure that all the electric equipment and installations, including supply cables and connections, are safely operated and maintained.

The use of portable heaters should be avoided. However, if they are used with the ship in port (as temporary heating during repairs and as additional heating during inclement weather), the heaters should not be positioned on wooden floors or bulkheads, carpets of linoleum without the provision of a protective sheet of a noncombustible material. Portable heaters should be provided with suitable guards and care should be exercised when positioning the heater in relation to furniture and other fittings in the cabin or other space. Again, drying arrangements in relation to these heaters should not be permitted. Personal portable space-heating appliances of any sort should be used at sea and notices to this effect should be notified on the notice boards.

The construction and installation of electric heaters in merchant ships and fishing vessels should take due account, as appropriate, of the requirements of the relevant Rules and Regulations as expended by the various instructions and Guidance Notes where appropriate. Permanent electric heaters are normally supplied with installation instructions by the manufacturers and these should be carefully followed.

ALWAYS USE SAFETY GUARDS!

If equipment becomes faulty when being used, switch it off immediately and notify the person in charge who will arrange for repairs to be carried out. DO NOT TRY TO REPAIR THE EQUIPMENT YOURSELF. The risk of electric shock is greatly increased either by perspiration or in locations which are damp, humid or have large conductive (metal) surfaces. In such conditions power tools should be operated from extra low voltages supplies (not more than 50 volts AC with a maximum of 30 volts to earth or 50 volts DC).

2.6.9.3 Recommendation For Cylinder Storage on Ships

Where two or more cylinders of either oxygen or a fuel gas (such as acetylene) are carried the oxygen and the fuel gas should be stowed in separate well ventilated compartments that are not subject to extremes of temperature. The space in which acetylene or other fuel gas cylinders are stowed should have no electrical fittings or other sources of ignition and prominent and permanent “NO SMOKING” signs should be displayed at the entrance and within the space. Empty cylinders should be segregated from full ones and so marked.

Should a backfire occur the oxygen and acetylene cylinders should be closed as soon as possible. A regular watch should be kept on the acetylene cylinders and if one should become hot it should be immediately removed to the open, kept cool either by immersion or with copious amounts of water and the cylinders top valve opened fully. If this cannot be done with safety, consideration should be given to jettisoning the cylinder overboard. Any acetylene cylinder suspected of overheating should be treated with care because an impact could set off and internal ignition might cause an explosion.

Remember : PREVENTION ISALWAYS EASIER AND BETTER THAN CURE . ALWAYS BE ALERT!

2.6.9.4 Hatchways

Many serious (sometimes fatal) accidents have occurred when operating hydraulic sliding or folding hatches. All

personnel on deck must be forewarned before a hatch is opened or closed, in order that they may stand well clear. No maintenance work is to be carried out on hatches if there is any likelihood of them being operated.

Never cover, or partially cover, an open hatch with a tarpaulin

THIS IS A LETHAL MAN TRAP.

2.6.9.5 Entry into the Enclosed Space

A “dangerous space” is defined in the Regulations as any enclosed or confined space in which it is foreseeable that the atmosphere may at some stage contain toxic or flammable gases or vapours, or be deficient in oxygen, to the extent that it may endanger the life or health of any person entering that space.

The atmosphere of any enclosed or confined space may put at risk the health or life of any person entering it. It may be deficient in oxygen or contain flammable or toxic fumes, gases or vapours. Such an unsafe atmosphere may be present or arise subsequently in any enclosed or confined space including cargo holds, double bottoms, cargo tanks, pump rooms, compressor rooms, fuel tanks, ballast tanks, cofferdams, void spaces, duct keels, inter-barrier spaces, sewage tanks, cable trunks, pipe trunks pressure vessels, battery lockers, chain lockers, inert gas plant scrubber, blower spaces and the storage rooms for carbon dioxide, halons and other media used for fire extinguishing or inerting purposes. Should there be any unexpected reduction in or loss of the means of ventilation of those spaces that are usually continuously or adequately ventilated then such spaces should also be dealt with as dangerous spaces. When it is suspected that there could be a deficiency of oxygen in any space, or that toxic gases, vapours or fumes could be present, then such a space should be considered to be a dangerous space.

2.6.9.5.1 Precautions on Entering Dangerous Spaces

Increased vigilance may be needed when entry into enclosed spaces is
infrequent, such as on passenger ships or small general cargo ships. The following precautions should be taken appropriately before a potentially dangerous space is entered so as to make the space safe for entry without breathing apparatus and to ensure it remains safe whilst persons are within the space. Any closed space requires ventilation before entry and ventilation must be maintained during the time that work is being carried out.

1. A competent person should make an assessment of the space and a responsible officer to take charge of the operation should be appointed.

2. The potential hazards should be identified.

3. The space should be prepared and secured for entry.

4.The atmosphere of the space should be tested.

5. A “permit-to-work” system should be used.

6. Procedures before and during the entry should be instituted.

Where the procedures above have been followed and it has been established that the atmosphere in the space is or could be unsafe then the additional requirements including the use of breathing apparatus should also be followed. No one should enter any dangerous space to attempt a rescue without taking suitable precautions for his own safety since not doing so would put his own life at risk and almost certainly prevent the person he intended to rescue being brought out alive.

2.6.9.5.2 Identifying Potential Hazards

2.6.9.5.2.1 Oxygen Deficiency

If an empty tank or other confined space has been closed for a time, the oxygen content may have been reduced due to the oxygen combing with steel in the process of rusting. Lack of oxygen may occur in boilers or other pressure vessels particularly where oxygen absorbing chemicals have been used to prevent rusting. Depletion of oxygen may occur in cargo space when oxygen absorbing cargoes, for example, oil cake and other vegetable and animal oil bearing products, certain types of wood cargoes, steel products Other cargoes, which may not be considered dangerous in themselves, can cause oxygen depletion - these include grain and grain products; jute, cotton and other vegetable fibres; fishmeal; and scrap metal.etc. Oxygen deficiency can also occur in cargo holds e.g., when carrying ore concentrates even though the hatch covers have been removed and the discharge of cargo has commenced. After discharge of volatile cargo sufficient vapours may remain in tanks to cause oxygen deficiency. Fumigation with pesticides may also result in a dangerous atmosphere in enclosed spaces. Hydrogen may occur in a cathodically-protected cargo tank used for ballast but will tend to disperse quickly when tank covers are opened. Pockets of hydrogen may, however, still exist in the upper parts of the compartment, thus displacing the oxygen (as well as creating a possible explosion hazard). If carbon dioxide, steam or other fire extinguishing chemical has been discharged to extinguish or prevent a fire, the oxygen content of the space would be reduced. The use of inert gas in the cargo tanks of tankers and gas carriers or in the inter-barrier spaces of gas carriers results in only minimal amounts of oxygen being present. The special conditions of carriage for reactive substances may require cargo tank ullage spaces, adjacent cargo tanks, cofferdams inter-barrier spaces and void spaces to contain inert gas.

2.6.9.5.2.2 Toxicity of Oil Cargoes

Hydrocarbon gases are flammable as well as toxic and may be present in fuel or cargo tanks which have contained crude oil or its products. Hydrocarbon gases or vapours may also be present in pump rooms and cofferdams, duct keels or other spaces adjacent to cargo tanks due to the leakage of cargo. The components in the vapour of some oil cargoes, such as benzene and hydrogen sulphide are very toxic.

2.6.9.5.2.3 Toxicity of Other Substances

Cargoes carried in chemical tankers or gas carriers may be toxic. There is possibility or risk of leakage from drums of chemicals or other packages of dangerous goods where there has been mishandling or incorrect stowage or damage due to heavy weather. The trace components in inert gas such as carbon mon- oxide, sulphur dioxide, nitric oxide and nitrogen dioxide are very toxic. The interaction of vegetables or animal oils or sewage with sea water may lead to the release of hydrogen sulphide which is very toxic. Hydrogen sulphide or other toxic gases may be generated where the residue of grain and similar cargoes permeate into or choke bilge pumping systems. The chemical cleaning paint or the repair of tank coatings may involve the release of solvent vapours.

Flammability

Flammable vapour may still be present in cargo or other tanks that have contained oil products or chemical or gas cargoes. Cofferdams and other spaces that are adjacent to cargo and other tanks may contain flammable vapour should there have been leakage into the space.

Other Hazards in enclosed space

Although, the inhalation of contaminated air is the most likely route through which harmful substances enter the body, some chemicals can be absorbed through the skin. Some of the cargoes carried in chemical tankers and gas carriers are irritant or corrosive if permitted to come into contact with the skin. The disturbance or rust, scale, or sludge residues or cargoes of animal, vegetable or mineral origin, or of water that could be covering such substances may lead to the release of toxic or flammable gases.

2.6.9.5.3 Use of a Permit-to-work System

Entry into a dangerous space should be planned in advance and use should preferably be made of “permit-to-work” system. If, during the course of the operation, unforeseen difficulties or hazards develop the work should be

abandoned and the space evacuated so that the situation can be fully assessed. Permits should be withdrawn and only issued after the situation has been reassessed. “Permit-to-work” should be revised as appropriate. Details of the arrangements to be followed in a “permit-to-work” are described in the code of Safe Working Practices for Merchant Seamen which includes a specimen of a “permit-to-work.” On expiry of the “permit-to-work," everyone should leave the space and the entrance to the space should be closed or otherwise secured against entry or alternatively, where the space is no longer a dangerous space and declared safe for normal entry.

2.6.9.5.4 Procedures and Arrangements Before Entry

Access to and within the space should be adequate and well illuminated. No match boxes, welding or flame cutting equipment, electrical equipment or other sources of ignition should be taken or put into the space unless the master or responsible officer is satisfied that it is safe to do so. In all cases rescue and available resuscitation equipment should be positioned ready for use at the entrance to the space. Rescue equipment means breathing apparatus together with fully charged spare cylinders of air, life lines and rescue harnesses and torches or lamp, approved for use in inflammable atmosphere, if appropriate. A means of hoisting an incapacitated person from the confined space should also be readily available when appropriate. The number of persons entering the space should be limited to those who actually need to work in the space and who could be rescued should an emergency occur. Atleast one attendant should be stationed at entrance and should not be assigned any other duty till the work in such space is completed or other wise. Should an emergency occur the general (or crew) alarm should be sounded so that back-up is immediately available to the rescue team. Should there be any hazard due to chemicals, whether in liquid, gaseous or vapour form, coming into contact with the skin and/or eyes then protective clothing should be worn.

Holds and tanks (as with hatchways) present a hazard, as serious injury often results following a fall.

If air is being supplied through an air-line to the person who is unwell, a check should be made immediately that his air supply is being maintained at the correct pressure.

The gas protection suit shown here (Fig 2.6) is designed for work in highly toxic atmospheres, e.g., in cargo tanks, etc. During operations, the suit, enables the wearer to perform quickly without assistance. Entry is effected through a diagonal aperture which is sealed with a gas-tight waterproof zip fastener. Suit is also bounded with full vision face mask, pneumonic seal and speech diaphragm and allows easy fitting for self contained and air line breathing set.

2.6.9.6 Cargo

Many accidents are also caused when handling cargo. One of the most common causes of accidents is when cargo breaks loose and falls, causing injury to persons nearby. Never pass or stand directly under suspended loads. Always wear a safety helmet and safety footwear, as this will help reduce the risk of possible injury.

Straps and slings must be of the correct strength and length for the type of load to be lifted. They must be tight enough to prevent the load or part of the load from slipping.

2.6.9.7 Battery Room

Battery room should be well ventilated during recharging. Before entry one should be sure that there is no toxic or inflammable gas.

2.6.9.8 Handling Mooring Ropes

Mooring ropes are another source of injury if not handled correctly. The rules regarding their handling are simple but nevertheless essential for safety.

- Men handling mooring ropes must never stand astride of them or stand in the bight, when they are under tension or being operated.
- Where such ropes are being used for towing purposes, keep well clear of them, because if they break under strain, they could cause serious injury by whiplash.
- When handling ropes use good quality industrial gloves, as the heat generated could cause serious skin

burns.

- Check the area where you will be standing during rope handling and make sure that you will have a firm footing. Clean up oil or grease, as you could possibly slip.
- Someone with mooring winch experience should man the winch controls and he must remain there at all times when the machinery is operating.
- Broken strands in wire ropes can be dangerous, not only by causing serious injury but also by weakening the rope itself. Be vigilant and report “snags” to the Officer-in-charge.
- Wire can sometimes foul a reel when it is being run out so for this reason wire rope must never be “run out” directly from its reel. The safest method is to take sufficient slack and flake it onto the deck.

2.6.9.9 Ladders used in Seafaring

2.6.9.9.1 Portable Ladders

Portable ladders on the ships can sometimes be another potential source of injury, if proper measures are not followed.

- These are simple and easy to remember and to prevent the risk of serious injury.
- The base on which the ladder is to be pitched must be firm and not “wobbly,” i.e., on a loose plate, etc.
- A portable ladder should always be pitched at 65° -75° to the horizontal, as shown in figure
- 10.Ladders with rungs missing or broken ladders must never be used.
- Never hang on to a portable ladder and overreach, as you seriously risk losing your balance and resulting in fall.

2.6.9.9.2 Accommodation Ladders and Gang Ways

Many accidents are caused by not using the proper access to or from a ship.

Most modern vessels have provided suitable access to and from the quay side; but the following points are nevertheless considered important!

In all cases, a life buoy and line must always be kept ready for use at the point of access to the ship. Lighting is of prime importance and adequate lighting should always be maintained on the gangway or accommodation ladder throughout the hours of darkness. Safety nets should also be hung to prevent anyone slipping off the ladder and falling into the water.

It must also be remembered that due to the rise and fall of the tide and also cargo operations, the distance between the final platform and the quay will vary. The access must be adjusted accordingly.

Never at any time jump from the quay onto a ship or from a ship onto the quay. This can have disastrous results.

2.6.9.9.3 Rope Ladders

Rope ladders should be checked regularly to ensure that they are in good condition and that no fraying or damage to the ropes is evident. They must also be checked each time before use and must not be used if any of the steps are worn out.
Statutory regulations state that spreaders must be fitted to ladders in excess of 3 metres in length. These spreaders prevent the ladder from twisting.
Special attention must be given to the attachment of rope ladders and they must never be attached to ship’s rails as it will add to the burden from the weight of the ladder and men. When rope ladders are secured to rails, an appropriate boarding ladder must also be mounted between the rails and the deck.

2.6.9.9.4 Pilot Ladders

Though many of the problems related to naval construction have been resolved by good planning, certain unexpected

difficulties regarding Pilot Ladders (or Hoists), however, emerged. The distance from the surface of the sea to the deck of a very large crude carrier (VLCC) when ballasted, made it impossible for the present equipment to be enlarged proportionally. Pilot Hoists were considered too high to climb (even under ideal conditions) and the slightest movement of a very large ship might result in throwing the suspended Pilot at a dangerous angle away from the protection of the ship's hull. Such a situation might also cause the twisting of the Pilot Ladder to such an extent that the Pilot would be unable to climb it and the ship's crew would also be unable to assist.

In rough sea weather pilot boat often hits the ship itself frequently along high tides of rough sea and it is not out of possibility that the stepped pilot on ladder may get a press fracture.

As a consequence of accidents (some fatal), IMCO decided to pass various regulations regarding Pilot Ladders, which came into force on 20th November, 1973.

2.6.9.10 Staging

In this use a safety line and harness should always be worn as falls usually result in serious injury. The only exception to this rule is where staging is atleast 0.5 metre wide and fenced to a height of at least one meter. Check gantlines and make sure that the gantlines are not allowed to chafe, caused by running over sharp edges whilst in use. A canvas bag or a tool frog (a type of tool bag worn around the waist) should be used to hold tools, etc., to prevent them falling.

ALWAYS :

- *Wear a safety line and harness.*
- *Examine staging and gantlines before use.*
- *Assemble staging in the correct manner.*
- *Use good and suitable materials for staging.*
- *Use a container for holding tools, etc.*

2.6.9.11 The Bosun's Chair

- The Bosun's Chair is a useful method of getting aloft.
- The gantline must be tested to four or five times the load it will be required to carry.
- The chair itself must also be similarly tested. It should also be examined and tested atleast once per day whilst in use.

2.6.9.12 Towing

Towing operations may result in excessive loads being applied to ropes, fairleads, bitts and connections. A sudden failure of any element in the towing arrangement may cause death or serious injury to persons in the vicinity. The consequences of the failure of any element of the towing arrangements should be carefully considered and effective safety precautions be taken.

The equipment used for the towing operation should be adequately maintained and inspected before use to ensure that it is suitable for the proposed towing operation.

The rope used for the tow should be of adequate strength and free of defects and excessive wear.

Nonessential persons should keep well clear of the towing area. Persons involved in a towing operation should be adequately briefed in their duties and the safety precautions to be taken.

Persons involved in a towing operation should wear suitable protective clothing. Hard hats should be worn to reduce the risk of head injury from heaving lines and other ropes.

Lift Accidents

There have been a number of serious accidents to personnel who have entered lift trunks for inspection or maintenance of the installation. These have included crushing injuries and one fatality caused by the unexpected movement of the lift car and there is need for clear procedures and instructions for work on lifts, particularly when entering a lift trunk. Those responsible are reminded that in order to minimise risks, proper safety procedures should be in place and the lift and its safety apparatus should be maintained in good condition. It is recommended that the arrangements on each ship are reviewed periodically.

Ships lifts should be constructed, installed, tested and maintained in accordance with the "IEE Regulations (The Institution of Electrical Engineers - Regulations for the electrical and electronic equipment of ships with recommended practice for their implementation). and the British Standards (British Standard 2655 - Specification for lifts, escalators, passenger conveyors and paternosters. British Standard 5655 - Lifts and service lifts) current at the time the ship is built, or to equivalent National or International standards.

Safe Working Practices for Merchant Seamen (1991). {(Marine Safety Agency) Accidents Involving Personnel Lifts MARINE GUIDANCE NOTE MGN 56 (M+F)}.

Ship lighting

Proper lighting of a ship contribute to safe working, on vessel, which also aids in reducing errors by human element, help to increases the output working capacity of crew and support in prevention of accidents.

An adequate illumination is necessary for visual acuity, speedy seeing and also preventing the eye from excessive strain and fatigue. High level of illumination except direct viewing of sun do not produces any harmful effect on human eye. For a working desk important consideration is how much amount of light reaches eye after reflection and not the light falling over the desk only. When a reflection factor is reduced as in works on dark colour or when contrasts in colour between the object and its background are reduced, higher level of illuminations is necessary for good visual acuity and speedy vision. Higher levels are required for continuous eye work and for fine work or when the size of the object is very small.

Although eye can adopt very high level of brightness but it can not tolerate a great contrast in brightness between the central field of vision and the surrounding area which may produce a sense of uncomfortable feeling but also impair the vision. In viewing an object against its surrounding area, the visual acuity is greater when surrounding area has the same bright as the central field of vision. The brightness of this central field should never be less than that of surroundings. To avoid contrast in brightness, good general illumination rather than only local lighting on the work must be provide throughout the entire area. Local or supplement lighting, in addition to general lighting is needed when very high illumination is required.

When passing from an area of high illumination or brightly-lighted area to an area with low illumination, the visual acuity is markedly reduced until the eye is adapted to the dark.

The capacity to adjust to modifying luminance is called adaptation. The adaptation of human eye for light and dark may vary form person to person. Some adaptation occurs rapidly to dim light and it may take half an hour for a full adaptation to the dark to follow. It is always that dark adaptation follows slowly where as adaptation to light rapidly. It is why few minutes are needed for an adaptation to occur while passing from dim light spaces to the highly illuminated areas. Accidents can occur due to improper light because the capability of the eye is reduced to see clearly during the period of adjustment. A change in luminance between different portion of the vessel, as open deck, engine room, store room, ship galley, narrow passages, stairs, and enclosed spaces may endanger him if the adaptability is not synchronized with the proper lightening of the ship. Accidents has been noticed many times in the engine room and a fall of crew down in an open hatch in the dark with a not fully closed hatch cover while working in the night. The condition becomes worse if the sea weather become uneven and rough. The adaptation zone are mostly created by the ship designing technology at the entrance to the bridge, necessarily adjusted to the room illumination level of the bridge.

2.7 Fatigue in Seafaring

Fatigue can be described as process that result in physiological, psychological, and mechanical alterations that if carried to far will result in failure to maintain desired work performance (Basmajian and Deluca, Baltimore 1985).

There is no accepted definition of fatigue despite the fact it was acknowledged to be a common phenomenon which has been researched systemically for over 80 years. A distinction can be made between physical and mental fatigue, though the two clearly interact. Fatigue is a common symptom in the community. Most patients with excessive fatigue blamed psychosocial factors for their symptoms There has been a tendency over the last few decades for jobs to become more mentally rather than physically demanding.

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Similarly acute and chronic aspects of the fatigue can be mentioned encompassing tiredness, depression, sleepiness, stress, low quality of sleep, disturbed circadian rhythm and boredom even an person appear to be performing normal task. Acute phase of fatigue can occur due to excessive mental and physical activity within a matters of hours and is relieved easily by a period of rest and adequate sleep. Chronic phase of fatigue on the other hand is reached when a normal period of sleep proves insufficient to restore the working performance to its usual level. It is insidious and usually happens over a period of time and as a result levels of alertness and the ability to respond to some operation problems will deteriorate with the passage of time.

Fatigue and psychological morbidity were related and the association increased in those with prolonged or severe fatigue or with other symptoms such as muscle pain The process of fatigue can be local occurring in the effected tissue i.e., muscle, tendon or ligament or whole-body occurring when multiple muscles repeatedly contract and relax in conjugation with the performance of task.

As the muscle goes from a resting state to a state of maximum work the demand for blood can increase and if this demand is not met local muscle fatigue will eventually occur.

As the level of physical work increases, so does the level of stress placed on the heart and lungs. Work that involves the use of many large muscles to move the body and / or external loads (e.g., walking briskly, pushing a heavy load, shoveling, etc.) can result in a condition of whole body fatigue. Whole body fatigue occurs when the metabolic demand of working muscles throughout the body exceeds the capacity of the cardiovascular and pulmonary system to deliver oxygen and glucose to working muscle and to remove products of metabolism. Common symptoms includes shortness of breath and a feeling of general weakness. These symptoms increase with the intensity and duration of work activity.

Muscular work can be divided into two categories:

(a) Dynamic work, and
(b) static work.

In dynamic work the working muscle remains in rhythmic contraction and relaxation, where as in static work muscle remains for a prolonged period in a contracted state. An occupational task is frequently a combination of both dynamic and static work. For example a person pulling a rope in towing operation is performing dynamic work with his legs and static works with his arms. Generally, static work performed by the local muscle is more fatigue causing task than the dynamic one.

During static work the blood supply to local task muscle is impaired according to the demand and supply because (a) when the muscle contracts, the blood vessel within it is also compressed, (b)the demand for glucose and oxygen rapidly exceed the supply if the muscle is not allowed to rest, (c) the flow of the blood is insufficient to remove the waste products of metabolism created in the task. If there is no sufficient rest and these conditions persist, a state of acute pain occur, and muscle loses its tension for a desired task resulting in fatigue.

Moreover tremors may also be present and may interfere with a persons ability to perform precise manual task. If static muscular work is performed it is unlikely that permanent disorder will develop. On the other hand, if job demands place static stress on the same muscles on a daily basis over a long period of time, deterioration can takes place in the joints, tendons, and ligaments adjacent to the muscle. Because the postures needed to perform some jobs require prolonged static work on a daily basis, occupational postural stasis can contribute to the development of permanent

musculoskeletal disorders. In addition to being a factor in the development of musculoskeletal disorders, static work increase the total peripheral resistance of the circulatory system. Significant increase in the heart rate and mean arterial blood pressure have been reported for short duration static effects equal to 50% of a person's maximum strength.

In general, the dynamic work performed by local muscle is less stressful than static work because the rhythmic contraction and relaxation of the working muscle facilitate circulation. If, however, the frequency or intensity of the contractions is excessive, a variety of disorders involving the musculoskeletal or peripheral nervous system may result which may be called "cumulative trauma disorders."

Study has shown that there are significant psychological and behavioral patterns relating to work load regulation and an individual performance. Research further suggests that the work load management has effects on performance, and the physiological and affective states of individuals. In short term it is possible to manage heavy workloads but in the long term, errors are likely to occur in performance. Physiological factors such as anxiety and depression increase during high workload shift but individual more actively engaged in task demand (Farmer (et al) 1991; Tattersal and Farmer, 1995). A study of doctors showed different patterns of affective state depend upon high and low levels of work load. Changes in anxiety and endocrine activity have also been associated with aspects of performance following extended work shifts, (hockey & wiethoss, 1990). This was consistent with a later study which demonstrated changes catacholamines and cortisol excretion associated with increased work demands(Franaenhaeuser 1979; 1986).

The ILO sees fatigue as not only an issue which affects the safety of ships, but also a problem which affects the safety and health of seafarers. It is linked to the issue of personal safety on board and to accident prevention on board ship. As there is no comprehensive technical definition of fatigue accepted universally, it was agreed by the Assembly in 1993 that all parties involved in ship operations should be alert to the factors which can contribute to fatigue in addition to the resolution A.772(18), which deal with the fatigue factors in manning and safety.

Obtaining a better understanding of how human factors contribute to marine casualties is a key to improving marine safety. Fatigue is of special concern. This report documents research which was successful at improving the U.S. Coast Guard's methods for investigating an reporting the incidence of fatigue in marine accidents.

Two hundred and seventy-nine marine casualties (vessel casualties and personnel injuries) were investigated and analyzed using the new procedures. Analysis of potential indicators of fatigue identified three factors that could be combined to calculate a Fatigue Index score for casualty cases:

(1) the number of fatigue symptoms reported by the mariner;
(2) the number of hours worked in the 24 hour prior to the casualty; and
(3) the number of hours slept in the 24 hours prior to the casualty.

Application of the Fatigue Index score showed that fatigue was a contributing factor in 16% of critical vessel casualties and 33% of personnel injuries, making fatigue a significant causal factor in marine casualties.
Further analysis of the fatigue data identified a number of operational conditions which appear to distinguish fatigue-related casualties from casualties caused by other factors. Application of these investigation procedures to a larger sample of casualties is recommended in order to identify reliably what operational factors and what industry arrangements appear to be related to higher rates of fatigue-related casualties.

Abstract: As part of its mission to improve the safety of maritime operations, the U.S. Coast Guard (USCG) has undertaken a multi-year research program to establish a technical basis for maritime operational practice and regulatory guidance inwork-rest scheduling and work hour limitations. Numerous studies across various modes of transportation show fatigue to be an underlying factor in a significant percentage of accidents; further, many of the accidents appear to be a result of sleep disruption based on work schedule
requirements. The current phase of the program is concerned with the following: (1) identify the nature and extent of sleep disruption-induced fatigue in the commercial maritime industry, and (2) identify the impact of watch duration on personnel fatigue.

One hundred forty-one mariners from eight commercial ships (6 tankers and 2 freighters) provided data regarding their work and sleep patterns, as well as a variety of other data pertinent to fatigue. The results show that there is a fatigue

problem in the U.S. maritime industry, and by implication, internationally. The incidence of critical fatigue indicators such as severely restricted sleep duration per 24-hour period, very rapid sleep onset times, and critically low alertness levels suggest that fatigue regularly occurs.

The results pint to sleep disruption, reduced time between watches, fragmented sleep, and long workdays as principal contributors to the problem. Several courses of action for fatigue reduction are discussed: (1) work and rest period guidelines and policy, (2) government-industry educational programs, and (3) design and evaluation of alternative work-rest schedules.

Occupational Biomechanics

Biomechanics is the subdiscipline of ergonomics concerned with the mechanical properties of human tissue, particularly the resistance of tissue to mechanical stresses. Many mechanical stresses in the environment can cause overt injuries (e.g., a concussion when a worker is struck in the head by a dropped object). In most cases, overt injury hazards are readily recognized and can be controlled through safety engineering techniques such as machine guarding and personal protective equipment. Other stresses in the environment are more subtle and can cause cumulative trauma disorders. These stresses may be external (e.g., a vibrating tool that causes white finger syndrome) or internal (e.g., tension in a tendon when the attached muscle contracts). Hazards that cause cumulative trauma disorders are frequently difficult to recognize because the health effects are not temporally correlated to exposure. Although, cumulative trauma disorders occur in all parts of the body, the back and the upper extremities are the most commonly affected areas.

Ergonomics is the study of humans at work and estimation of the stress that occur in the working environment and the ability of workers to cope with this stress. The main task of ergonomics is to device facilities, equipment, tool, seating places, and job demands to be compatible with human dimensions, skill, and expectations and thus alleviate stress. Human factor engineering, also called engineering psychology, is a discipline of ergonomics concerned with the information requirement of work.

Anthropometrics is a subdiscipline concerned with designing facilities, equipment tools, seating places and protective devices to cope with the physical dimensions of the worker.

This definition clearly links the question of fatigue to that of health.

Factors causing Fatigue

The ship board environment is rapidly changing with the introduction of new technology, reduced crew size and increasing diversity of cultures as recruitment extends overseas. As a result, significant changes have developed in the occupational structure of the ship which has highlighted a need for research into potential hazards and consequences of fatigue among crews. Seafarers counted as a group most vulnerable to fatigue because of their nature of duty, 24 hour shipboard life style, constant fear of sea, continue to challenge current effort at fatigue and stress management. The causes of fatigue are multi-dimensional but prolonged period of physical and mental activity, inadequate rest, interruption of sleep, adverse environmental factors, poor interpersonal relationships, working out of state with circadian rythm, taking responsibilities while off duty, lake of stimulation and motivation, and other physical and psychological factors are important fatigue causing element in maritime industry. There is no parameter to measure the density of fatigue and it is not necessary that fatigued person would have performance deficit but it should not be underestimated that judgment of a fatigued person can be impaired to a point of collapse producing its effects on not only on efficiency of work but in a catastrophe.

The organizational setup in maritime industry can mitigate the affect of fatigue when a person can recognize the symptoms of a fatigue which need a high standard of education, competency of the crew, proper training and adequacy of rest period. The lists factors that can cause fatigue, grouped under the following headings:

(a) Fatigue Management Aboard ship and responsibilities of Administration

It has been concluded that on the ship environment improved job satisfaction alleviates fatigue, indeed, planned maintenance and related activities have increased crew satisfaction. The maritime industry is a 24 hour society and

functions with a 7 day working week. The effects of this permanent working environment is different for the various people working onboard ships. Since the work organization is usually hierarchical, ultimate responsibility rests with the three top positions. The Master has overall responsibility for the operation of the whole ship, the Chief Engineer is responsible for the engine operations including maintenance, and the Chief Officer is responsible for the deck department and catering, maintenance of the ship and cargo operations. It was agreed that these three persons are always aware that they are in charge and this may affect quality of rest and sleep. With a more even spread of responsibility onboard ship, such as 2 Chief Officers, each Officer would be able to relieve one another. Educating crew to higher standards would also enable more sharing of responsibility thus allowing the opportunity for genuine rest periods. It was also agreed that the Master or Safety Officer would need to be trained to recognize the various symptoms of fatigue in order to identify the capability of individuals to continue working. Different people show stress and fatigue in different ways, e.g. levels of alcohol consumption. The Safety Officer should also have the authority to remove the fatigued crew member from the vessel or watch. Comments from engineers highlighted concerned over the broken sleep periods; being called out unexpectedly, and resulting cumulative fatigue over the swing duration of monitoring unmanned machinery space.
The strain become more progressive not due to the actual time spent in bed, but through indirect effects possibly associated with apprehension. In some cases the relationship at sea were strained by the lack of commitment and poor attitudes of some employees (Australian Maritime Safety Authority).

Clearly action should be taken earlier to prevent fatigue from building up to the point at which it is observable. This would include the monitoring of hours of work, hours of rest, pattern of work over a period of days, the quality of sleep, quality of rest, etc. Removing the causes of fatigue was considered more important than monitoring and alleviating the symptoms.

For a comprehensive fatigue management system onboard it is more crucial to have a better understanding, training and knowhow about fatigue by master safety officers and managers and to order fatigued person to stop working and to get sleep. A process called “Crew Resource Management” developed by the airline industry, is currently being introduced on some ships in order to increase awareness of factors which may lead to fatigue by educating Officers in time management and stress.

The Masters should, and in some companies do, have the authority to hold the ship in port if they feel that the crew is over tired, or order individuals to have compulsory rest and cap overtime; in spite of pressures to increase this while onboard. It is also necessary to consider not just the working time of seafarers but their free-time onboard, and to analyze the ship in terms of individual activities over 24 hours.

First Meeting of Joint IMO/ILO Working Group on the Seafarers’ Hours of Work and the

Manning of Ships Convention, 1996 (No 180): 19-23 January 1998 formulated Standard model developed for recording hours of work and rest.

The Joint Working Group developed guidelines and a standardized format for recording and monitoring seafarers’ hours of work and rest, in order to harmonize implementation of similar requirements in the International Labour Organization (ILO) Convention 180 and IMO’s International Convention on Standards of Training, Certification and Watchkeeping for Seafarers

(STCW).

The monitoring of seafarers’ hours of work and rest is seen as an important element in reducing seafarers’ fatigue, thereby contributing to the promotion of maritime safety and also seafarers’ health.

The Joint Working Group agreed that IMO and ILO should publish the agreed texts of:

- Guidelines for the development of tables of seafarers’ shipboard working arrangements and formats of records of seafarers’ hours of work or hours of rest;

- model format for a table of shipboard working arrangements; and
- model format for record of hours of work or hours of rest of seafarers.

PART II. SEAFARERS' HOURS OF WORK AND HOURS OF REST

Article 3

Within the limits set out in Article 5, there shall be fixed either a maximum number of hours of work which shall not be exceeded in a given period of time, or a minimum number of hours of rest which shall be provided in a given period of time.

Article 4

A Member which ratifies this Convention acknowledges that the normal working hours' standard for seafarers, like that for other workers, shall be based on an eight-hour day with one day of rest per week and rest on public holidays. However, this shall not prevent the Member from having procedures to authorize or register a collective agreement which determines seafarers' normal working hours on a basis no less favourable than this standard.

Article 5

1. The limits on hours of work or rest shall be as follows:

(a) maximum hours of work shall not exceed:

(i) 14 hours in any 24-hour period; and
(ii) 72 hours in any seven-day period;

or

(b) minimum hours of rest shall not be less than:

(i) ten hours in any 24-hour period; and
(ii) 77 hours in any seven-day period.

2. Hours of rest may be divided into no more than two periods, one of which shall be at least six hours in length, and the interval between consecutive periods of rest shall not exceed 14 hours.

3. Musters, fire-fighting and lifeboat drills, and drills prescribed by national laws and regulations and by international instruments shall be conducted in a manner that minimizes the disturbance of rest periods and does not induce fatigue.

4. In respect of situations when a seafarer is on call, such as when a machinery space is unattended, the seafarer shall have an adequate compensatory rest period if the normal period of rest is disturbed by call-outs to work.

5. If no collective agreement or arbitration award exists or if the competent authority determines that the provisions in the agreement or award in respect of paragraph 3 or

4. are inadequate, the competent authority shall determine such provisions to ensure the seafarers concerned have sufficient rest.

6. Nothing in paragraphs 1 and 2 shall prevent the Member from having national laws or regulations or a procedure for the competent authority to authorize or register collective agreements permitting exceptions to the limits set out. Such exceptions shall, as far as possible, follow the standards set out but may take account of more frequent or longer leave periods or the granting of compensatory leave for watchkeeping seafarers or seafarers working on board ships on short voyages.

7. The Member shall require the posting, in an easily accessible place, of a table with the shipboard working arrangements, which shall contain for every position at least:

(a) the schedule of service at sea and service in port; and
(b) the maximum hours of work or the minimum hours of rest required by the laws,

regulations or collective agreements in force in the flag State.

8. The table referred to in paragraph 7 shall be established in a standardized format in the working language or languages of the ship and in English.

Article 6

No seafarer under 18 years of age shall work at night. For the purpose of this Article, night means a period of at least nine consecutive hours, including the interval from midnight to five a.m. This provision need not be applied when the effective training of young seafarers between the ages of 16 and 18 in accordance with established programmes and schedules would be impaired.

Article 7

1. Nothing in this Convention shall be deemed to impair the right of the master of a ship to require a seafarer to perform any hours of work necessary for the immediate safety of the ship, persons on board or cargo, or for the purpose of giving assistance to other ships or persons in distress at sea.

2. In accordance with paragraph 1, the master may suspend the schedule of hours of work or hours of rest and require a seafarer to perform any hours of work necessary until the normal situation has been restored.

3. As soon as practicable after the normal situation has been restored, the master shall ensure that any seafarers who have performed work in a scheduled rest period are provided with an adequate period of rest.

Article 8

1. The Member shall require that records of seafarers' daily hours of work or of their daily hours of rest be maintained to allow monitoring of compliance with the provisions

set out in Article 5. The seafarer shall receive a copy of the records pertaining to him or her which shall be endorsed by the master, or a person authorized by the master, and by the seafarer.

2. The competent authority shall determine the procedures for keeping such records on board, including the intervals at which the information shall be recorded. The competent authority shall establish the format of the records of the seafarers' hours of work or of their hours of rest taking into account any available International Labour Organization guidelines or shall use any standard format prepared by the

Organization. The format shall be established in the language or languages provided by Article 5, paragraph 8.

3. A copy of the relevant provisions of the national legislation pertaining to this Convention and the relevant collective agreements shall be kept on board and easily accessible to the crew.

Article 9

The competent authority shall examine and endorse the records referred to in Article 8, at appropriate intervals, to monitor compliance with the provisions governing hours of work or hours of rest that give effect to this Convention.

Article 10

If the records or other evidence indicate infringement of provisions governing hours of work or hours of rest, the competent authority shall require that measures, including if necessary the revision of the manning of the ship, are taken so as to avoid future infringements.

Model format for table of shipboard working arrangements [1]

Name of ship---------- Flag of ship ----------IMO number if any ---------- latest update of table---------- ( ) of ( )

The maximum hour of work and minimum hours of rest are applicable in accordance with ----------(national law and regulation) issued in conformity with ILO's Seafarers Hours of Work and Manning of Ships Convention 1996 (180) and with any applicable collective agreement registered or authorized in accordance with that Convention and with the International Convention [2]

Maximum hours of work or minimum hours of rest[3]:----------

Other Requirements: ----------

Position/Rank[4]	Schedule daily work hours at Sea		Schedule daily work hours in port		Comments	Total daily work/rest[3] hours	
	Watchkeeping (from - to)	Non-Watchkeeping duties (from - to)[5]	Watchkeeping (from-to)	Non-watchkeeping duties (from - to)[5]		At sea	In port

Signature of Master ----------

1. The term in this module table are to appear in working language or language of the ship and in English.
2. See overleaf for selected extracts from ILO convention 180 and the STCW Convention.
3. Delete as applicable
4. For those positions/ ranks that are also listed in the ship's safe manning document, the terminology used should be the same as in that document.
5. For watchkeeping personnel, the comment section may be used to indicate the anticipated number of hours to be devoted to unscheduled work and any such hour should be included in the appropriate total daily work hours column.

(b) Ship specific factors;

There are other aspects of life onboard a ship which may potentially contribute to fatigue and consequently to accidents. Crews of vessels involved in short-sea movements in particular, often find it difficult to sleep well because of the inconsistency of noise levels through the constant starting up and shutting down of machinery, the banging of doors, and the general disturbance on the ship when in port. The crew accommodation is not always as soundproof as it could be and some cabins are situated in working alleyways where air intakes and temperature controls are insufficient. Fumes may also enter the accommodation and it is possible for watch keepers to feel the effects of engine exhaust and cargo fumes even on the bridge. Whole body vibration transmitted usually through vibrating seat or platform is one of the factor which can cause backache and fatigue.

(c) crew specific factors;

Person Physical Work Capacity and Rest Period

The metabolic demands of a job can be expressed in terms of rate of energy expenditure (common unit include Kilocalories per minute or British thermal unit (BTUs) per minute). Person physical work capacity (PWC) can be determined during a graded exercise test in clinic and measured in Kcals or BTUs per minute. PWC is thus an important factor in evaluating stress which depend upon the age, sex, body weight, heredity and level of physical fitness. PWC can be different for different peoples and a job for a person with high PWC level is relatively easy but can be fatiguing for a person with low PWC. Thus for a given weight the relative work load for a weak subject is greater than that for a strong subject. There is substantial variability in the aerobic capacity of the working population. The U.N. National Institute of Occupational Safety & Health (NIOSH) concluded that a person can work at intensity equal to his PWC for only a short period of time(4 minutes or less) without becoming unduly fatigued. As the duration of the work period increases, the intensity must be adjusted downward. If a task is to be performed continuously for a period of 1 hour, the average energy expenditure rate should not exceed 50% of PWC. The NIOSH recommended that the energy expenditure rate should not exceed 6.5 Kcals/minute for occasional short-duration lifting tasks (1 hour or less). For a job which is performed over an 8-hour shift, the average rate should not exceed 33% of PWC. For continuous, 8-hour work of lifting activities, the rate should not exceed 3.5 kcal/min.

One method for preventing whole body fatigue is to provide rest allowances on jobs that require high rates of energy expenditure (greater than 5.2 kcal / min). A formula for computing rest allowances has been developed by Spitzer:

$$R = \left[\frac{(E - 1.2)}{4} - 1\right] \times 100$$

were R is the required rest time (expressed as a percentage of work time) and E is the energy expenditure rate (in kcal / min).

For example, suppose that a job has an energy expenditure rate of 6 kcal/min. Substituting into the above equation, R is found to be 20 percent. For an 8-hour work shift (480 minutes), the actual work time should not exceed 400 minutes and 80 minutes must be provided for rest. Spitzer's formula assumes that the average aerobic capacity of the work force is 16 kcal/min. If the aerobic capacity of an individual is considerably less than 16 kcal/min, additional rest is required.
In order to design the appropriate work-rest cycle for a given job, it is necessary to estimate the energy expenditure rate. This is usually done in one of three ways: indirect calorimetry, table look-up, or modeling.
The benefit of rest period lies chiefly in the reanimation of interest. In addition, the change in posture or occupation involved permits the blood to circulate more freely to those parts of the body which were not receiving their proper supply in a cramped position at the machine. The mental and nervous reactions of workers to their environment as causes of fatigue and so of accidents will increase in accordance with the passage of time. No matter how well working conditions may be controlled in modern shipping the psychological make-up of the individual worker will remain and become increasingly more important.

Prolonged work

Prolonged period of mental or physical activity causes fatigue. A study carried out recently by the British merchant navy officers union Numast showed that 62% of its members work more than 76 hours a week and 22% average 13 hours a day (only 23% of the United Kingdom population works more than 48 hours a week). The survey showed that the problem is worst on short-sea ferries. Attempts to regulate the hours worked by seafarers have not always been successful. Convention 109, adopted by the International Labour Organization in 1928, was intended to introduce restrictions, but it has never received sufficient acceptances to enter into force. Sometimes, however, the seafarers themselves are to blame. One speaker at the University of Wales workshop referred to earlier said; "We find in the short-sea ferry sector that when seafarers are given the choice they would prefer to work more hours on board the ship to obtain maximum time off. We pay our crews for a 12-hour day but even at the end of this period some crews want overtime. They were working 12 hours and claiming 4 hours overtime. I don't think working over 12 hours is safe, yet staff are willing to work it."

Strategies aimed at resolving the working difficulties of British doctors in training have been concerned primarily with the long, often excessive, hours worked. Following tough central directives and hard work by local task forces, many doctors now work fewer hours than five years ago.

The terminology of fatigue and boredom is interrelated where fatigue is a function of the task being performed where as boredom is a function of individual motivation i.e., something not interesting as in deep sea operation rather than short ferry operation.

For watch keeping it was accepted that watch off might be better than a full day rest because it can develop boredom and consequently build-up of chronic fatigue.

Prolonged sitting

Epidemiological and clinical studies have concluded that prolonged sitting is associated with increase rate of back pain (Kelsey JL 1975, Magora 1972) and thus causing fatigue. A suggested cause of an increased incidence of back pain is that when a person moves from standing to sitting position, the pelvis rotates backward, flattening the normal lordotic curve of the lower spine (forward convexity) and this flattening process compresses anterior portion of disc resulting in increased intradiscal pressure and places tension on the exterior portion of the disc, on the apophysial(bone tuberosity) joint ligaments, and on the erector spinae muscles. These stresses affect the supply of nutrients to the disc and surrounding tissue and may be related to the development of back disorders.

In vivo experiments have shown that intradiscal pressures when standing are only 35 percent of those when sitting (Anderson GBJ, Ortengren R, Nachemson A, Elfstrom G 1974). Spinal stresses that result from sitting can be decreased by properly designing the dimension and place of work seat. The most important design consideration is the inclination of the backrest(i.e., the angle of the backrest relative to the seat pan). By increasing the inclination angle from 90 to 110 degree, disc pressure can be reduced by as much as 50 percent (Chaffin DB, Anderson GBJ 1984). Anderson recommend that the backrest include a lumber support that also reduces the intradiscal pressure. Adding armrest to the work seat reduces the intradiscal pressure even further. If possible the seat and the associated work station should be designed to avoid prolonged static posture.

In addition to the angle between backrest and seatpan height and shape of the seatpan is also of prime concern. Dangling of the feet will cause pressure on the underside of the thigh if the height of the seat is high enough this can cause interference in circulation of blood and thus produce swelling in the feet and lower limbs. On the other hand if, the seatpan is too low the thigh do not make a sufficient contact with the seatpan and excessive amount of the body weight will be borne on the ischial tuberosities and the surrounding muscles. Moreover there will also be a considerable discomfort if seat is not provided with padding particularly if a person is sitting for a long period.

In order to accommodate the range of the body size an adjustable seat should be recommended if the chair is to be used by more than one person and particularly if the same work station is used by day-shift and night-shift. In order to avoid prolonged sitting another way is to modify the job description to include occasional tasks that must be performed away from the primary work station. This will manage to allow the worker to periodically change posture, stand up and walk during the performance of shift duty.

Human Natural Motoric Behaviour at Ship Control Station (Work Place)

Mission monitoring, surveillance and control activities aboard modern ships are mainly performed at a console work place. The natural motoric behaviour of the operator has, however, not been considered sufficiently. The movements of the operators at their workplaces at the engineering control station were studied by means of video recordings by B.Greiner and S.Queisser (Germany). Weather and sea-state conditions, navigational information, data from the vessel's deck log as well as data from the control station have been recorded during the entire cruise. The camera was firmly positioned onto a cabinet in the left-hand corner of the engineering control station (see Fig:2.13, in book page 112).

In general, three engineering control station consoles are manned during an entire voyage. The operators get information about incoming commands and malfunctions. Audible signals are used. The individual workplaces of the engineering control stations are equipped with functional seats. They offer a wide range of options to the operator. For example, individual adjustment of seating distance from the console, seat pitch and adaptation to the user's body weight is possible. There is ample space; air and lighting conditions make work comfortable.

Classification in posture groups was the next, consequently followed by a transformation to 48 definite groups. In order to make analyzing easier, the 48 groups were portrayed in drawing formats (an example, see in book Fig 2.14 a & b page 115-116).

For each of the classified 48 postures the duration of the posture presented was reckoned out. Differentiation of the postures was made in accordance to the position of upper body, arms and legs.

In accordance with the visual line, the 48 standard postures were classified into 4 basic postures (See Fig 2.15).

Type A shows the subject in orientation towards the desk.

Type B, C and D show a general orientation off the deck. It is called "communicative" posture due to the typical situation looking conversation. The upper part of the drawing shows the differentiation in relation to the total time, separated in day and night time. The left column here labeled with a capital "T" marks daytime. The central column shows the postures during night, and the right one shows the total alterations of the few basic postures during the 6-weeks cruise, respectively. It is remarkable to see the "communicative" forms, postures B, C and D, covering 54% of the total time. The total number of alterations during a three and a two watch systems the average of the registered alterations per hour were counted to 20.

Preliminary Results

The preliminary results show

- a certain variety of non job related postures,
- a high incidence of alternating postures with an average rate of 20 per hour,
- a high rate of communication attitudes,
- neglection of technical adjustment features of the seat and
- typical circadian modulation of the motoric pattern and dependence on watch cycles.

The finding of certain dynamic motion patterns led us to perform a control study aboard workplaces.

Preliminary Conclusions:

- subjective aspects have to be included into workplace design methods in terms of using human beings instead of dummies,
- workplace design has to consider non task related motoric behaviour,
- workplace design based on static anthropometric knowledge should be expanded by using the standard dynamic motion patterns.

The findings of certain non job related individual motion patterns combined with high intensity of motion where task doesn't require physical work leads to the following question:

".....is it called workplace but in the language of physics no work is said to be done as no physical force is applied against gravity and workplace is kept only for looking and watchkeeping?" Some factors will be more manageable than others as grouped follow:

1. Managing factors

- scheduling of work period
- assignment of duties
- shore-ship support
- voyage planning
- standardization of work procedures
- administrative duties

2. Ship - specific factors

- level of automation
- reliability of equipment
- motion characteristics
- vibration and noise levels
- quality of working and living environment
- cargo requirements

3. Crew - specific factors

- thoroughness of training
- experience
- crew cohesiveness.

It has been noted that during hand over procedure in watchkeeping shift the information is transferred from departing to incoming watch, evidences has shown that incoming watches are not vulnerable to accidents during early hours, this may be due to that they are more alert or involved in the task since they are attempting to gather information and the idea of the situation. The role of the sleep, rest and work, prior to the shift are liable to exert a substantial influence, while such factors are often inadequately measured.

Circadian Rythm and shift work

Circadia comes from two latin words Circa:about, and dia:day. It refer to the bodily rythms that vary throught the 24 hour period of the day in a periodic fashion. In maritime industry it is inevitable that ship personal will work unusual and unsocial hours due to the nature of the shipping industry, The question of whether certain types of people have the physiological and psychological constitution to cope better with working at night than others was considered. Some people easily adjust to night work and personality type tests have been used to identify differences in individuals, but it was felt that these may not be reliable. To effectively measure an individual's ability to adjust to night work their performance would need to be monitored over a period of time as it takes two or more weeks to adjust to night work. It was noted that in order for an individual's body to adjust fully to night work, a stable shift would need to be maintained throughout the time that a vessel was at sea and in port. In deep-sea operations, this would be possible and would improve safety measures and perhaps offer a solution to the current 24 hour manning problems of the shipping industry. Shift work peoples have incidence of peptic ulcer disease eight times than that of normal population. Cardiovascular mortality has also been noted to be increased among shift workers.

Psychosocial factors

Shipping has many characteristics that make it different from other jobs. Seafarers, because of absence from families, can also be affected by worries of a non-work category, varying from delays in being relieved after a period of service, to financial problems. They remain away from home for weeks or months on end. The Australian Maritime Safety Authority identified the main problems of away from home and family is one of the overwhelming factors which increases stress on the worker, The stress level is increased when family member were ill and having difficulty in getting telephonic contact. On interview form various seafarers, the stress start building after they pass one moth on vessel. Where as on vessel their rest periods and days off have to be spent at their workplace and they are forced to socialize with people they work with rather than friends of their own choosing. If they are ill, it may be days before they can reach a doctor and bad weather may make it impossible to rest when they are tired.
The causes of stress are clearly more complex than this focus on hours implies. Research in other workers suggests that loss of sleep rather than long hours of work is the problem, causing decrements in mood and performance and this has also been confirmed in doctors. The quality of sleep is also important, and evidence shows that this is inferior in those on call, expecting to be waken, who show greater sleepiness the following day. The nature of life at sea can create medical, social and psychological problems, but one of the greatest is fatigue.

Low Back Pain

Low back pain is one of the common problem in seafaring, causing fatigue, disability and abstinence from work. This ailment most commonly occur due to forceful exertions: lifting, pulling, and pushing heavy loads, and associated materials-handling tasks. The U.S. National Institute for Occupational Safety and Health (NIOSH) has proposed various procedures for evaluating and classifying manual tasks to keep metabolic and L5/S1 disk compressive loads within acceptable limits in a technical report entitled “Work Practices Guide for Manual Lifting.” Institute’s motive is that if engineering changes do not bring the job within the acceptable zone, administrative control should be implemented.

Awkward Positions

Sometimes workers complain of musculoskeletal pain causing fatigue due to awkward trunk postures: Axial twisting, lateral bending, flexion and sitting for a long time, required by their job. These problems often arise when work station design is improperly matched to the size of the worker or the task he is required to perform.

It is recommended to locate all items that must be touched or grasped within the reach limits and adjustability should be incorporated in to the work station according to the size of the worker rather than to adopt an awkward position.

Chronic fatigue syndrome

Chronic fatigue syndrome, or CFS, is a debilitating disorder characterized by profound tiredness or fatigue. Patients with CFS may become exhausted with only light physical exertion. They often must function at a level of activity substantially lower than their capacity before the onset of illness. In addition to these key defining characteristics, patients generally report various nonspecific symptoms, including weakness, muscle aches and pains, excessive sleep, malaise, fever, sore throat, tender lymph nodes, impaired memory and/or mental concentration, insomnia, and depression. CFS can persist for years. The cause of CFS has not been identified and no specific diagnostic tests are available. Moreover, incapacitating fatigue can be associated with a wide range of well defined illnesses, such as cancer, depression, autoimmune diseases, hormonal disorders, and subacute infections. Since many of these disorders are treatable, other causes of fatigue must be ruled out before a diagnosis of CFS can be made. Although it can be diagnosed only through this process of elimination, CFS is a genuine clinical condition whose cause and treatment are the focus of intense research. Without knowing the cause of CFS, it is difficult to identify effective treatments. Medications prescribed for CFS usually are intended to provide symptomatic relief and not a cure.

Medical Fitness and Fatigue

Another issue related to the health of seafarers and currently receiving attention from the ILO is that of fatigue. The eighth session of the Joint IMO/ILO committee on Training (September 1990) discussed fatigue as a factor in the manning and safety of ships. The STCW Convention, whilst providing that every candidate for certification in certain

board disciplines should satisfy the administration as to medical fitness, particularly regarding eyesight and hearing, provides also for fitness for duty ("The navigational and engineering watch system shall be such that the efficiency of the watch i.e., watchkeeping officers and watchkeeping ratings is not impaired by fatigue...").

The Joint Committee, more closely concerned by the manning and safety of ships, recommended that in view of the health implications which should be considered, the WHO should be invited to participate in the work of a group of experts which would 'draw up a uniform framework of procedures for the investigation of maritime accidents which would identify whether and if so to what extent, fatigue was a contributory factor to such accidents.'

The Joint Committee also recognized that medical fitness was important as a factor contributing to fatigue and that crew joining a ship need to be adequately rested before resuming on board duties.

(d) adverse environmental factors

Poor design, poor maintenance, noisy atmosphere, poor lighting, poor workplace design, instability of the work platform, discomfort caused by excessive cold or heat, humid atmosphere and inclement weather.

Fatigue Causing Accidents

Epidemiologist studies consistently show, that according to characteristics distribution of time, place and persons accidents are not random and uncontrollable but are quiet predictable. All involve harm resulting from one of five types of physical energy: kinetic, chemical, thermal, electrical, and radiation. The pre-injury or pre-accident phase exposure of the individual to the energy sources, usually while using these sources. The task of using energy sources may vary. As long as the performance level of exceeds the demands of particular task the energy sources remain under control, The moment the demand exceed performance, the energy source is no longer under control. The moment is commonly called an accident. Under this condition person should not seem to be grossly incompetent or fatigued.

In accident control strategy the effect of fatigue on the ability of the ship's staff to perform their duties are of major concern. In a recent report published by International Transport Worker's Federation (ITF) - the following incidents are recorded and are considered to be a direct result of long hours of work or fatigue:

- Failure to appreciate a developing collisions situation, failure to count for all cargo during stability calculation, and an inability to make decisions during an emergency;
- A helsman who turned hard to port instead of hard to star board;
- Pumping blast into a cargo hold loaded with news print
- Failure to correctly close hatches
- Numerous incidents of overfilled tanks, spillage of oil, chemicals and flammable materials, loading and blasting errors.

These incidents have been selected because they have particular relevance to port operation and preparing the ship for sea.
From these incidents it can be clearly seen that the effect of fatigue have the potential to create significant effects on the overall success of the voyage. It is particularly so at the beginning of the voyage and , in many instances, it is not unknown that the master will take the first sea watch to allow the appropriate capital to gain sufficient rest after particularly long hours during a port stay.

On a number of ships, it as not unusual to have been "on the go" for in excess of 24 hour when the ship finally left port.

Many times it has been observed that fatigue contributed to accidents on board but due to the blame culture people do not report to an incident because the feel that they will be blamed for causing it (Captain Trever J Bailey FNI. Seaways Apr. 1999).

All too often shipowners and managers have acted as though their responsibility for the ship and its crew ended once it left port, an attitude that has sometimes been reinforced by the fatalistic belief that accidents are inevitable (and therefore not worth trying to prevent). Yet great improvements can be made, as the oil company shell has proved. After

a series of accidents and incidents involving crew safety in 1981-1982, the company carried out a major review of its procedures and introduced an Enhanced Safety Management Programme. Over the next 15 years, safety improved by thirty times and the time lost through injuries was cut by nearly 90%.

The role of human elements in maritime casualties has become a regular item on the agenda of the MSC, and all technical bodies within IMO now take the human element into account when preparing new instruments or standards. Fatigue is such an important factor in accident that IMO has been paying special attention to this subject for many years. In 1990 the Joint IMO/ILO committee on Training devoted its eight session to the subject and identified a number of factors which can contribute to fatigue at sea. A Joint Working Group on Fatigue was established and its work enabled the MSC to issue guidelines for the investigation of accidents where fatigue may have been a contributing factor. It list factors to be covered by investigators and give questions which can be asked in carrying out an investigation. The first of these is Does the company have a written safety policy? In view of the development of the International Safety Management (ISM) Code, which developed from guidelines adopted by IMO assembly in 1991, this can be regarded as significant, because it recognizes the crucial responsibility of management in preventing fatigue.

A strong and profitable maritime industry demand talented, healthy, and competent workforce. Fatigue present a safety risk in all mode of transportation. There is need of professionals comprising with subject matters expertise in areas including ergonomics, occupational medicine, environmental health sciences, industrial hygiene, public health, epidemiology, safety sciences, marine transportation and human factors to formulate a step to fight against fatigue to combat accidents. Decrement in workers physical and mental health affect human performance thus impacting the ability of industry to optimize. It is the best interest of individual, the industry, and the nation to have a healthy maritime work force and an important contributor to a health workforce is a safe work environment free of undue health hazard. The fatigue issue is of significant value now a days when industry has undergone rapid structural adjustment in term of manning, technical changes and operational requirement. The number of crew becoming smaller and more multicultural and some of them have been of uncertain quality, poor level of education and training exerting more burden to senior officers in performing a delicate task as they are unsure of their competency and thus putting more stress and fatigue for them.

Workers exposed only occasionally to these disadvantages often fail to appreciate their effects. The adverse effects of constantly rotating shift is a major source of stress, in fact its the single most important reason given for premature attrition from the field. The problems in watch keeping rotating shifts stem mainly from working in opposition to the body's normal circadian rhythms. The main circadian rhythm involved is the sleep/wake cycle. Social isolation to those who must work while other sleep is also a major problem. Shift work on ships other than physical problems include chronic fatigue, excessive sleepiness, and difficulty in falling a sleep with higher rates of substances abuse and depression. The job feel more stressful and accidents are increased as a result of shift work.

IMO has also encouraged further research into the human element and Australia has announced an ambitious six-stage study into Fatigue, stress and Occupational Health (FASTOH) which began in 1995.

A Joint IMO/ILO Working Group of Investigation of Human Factors in Maritime casualties held its first session in January 1997, following the successful contribution made by the Joint Working Group on Fatigue. One of its main task will be to develop guide lines on the investigations of human factors in maritime casualties.

A list of problems which might effects how seafarers work - and there by contribute to accident - includes:

- alcohol abuse,
- inadequate technical knowledge,
- language skill,
- fatigue,
- low morale,
- injury,
- staffing level,
- work environment

A study carried out by the United States Coast Guard and reported to the Maritime Safety Committee at its 68th session in May-June 1997 indicates the scale of the problem. The study involved 279 incidents using a new technique that enabled the creation of a Fatigue Index. The coast Guard reported to IMO that the study "uncovered information that fatigue is a more significant factor in marine casualties that previously thought." It showed that fatigue played a part in 16% of vessel casualties and 33% of personnel injury casualties compared to figure of just 1.2% and 1.3% found in a previous study.

Once a high-risk jobs are identified, the second step is to recognize specific risk factors to be considered for possible intervention.

The U.S. Coast Guard found that factors contributing to fatigue included the number of consecutive days worked prior to the incident, hours on duty prior to the incident and absence of a company or union policy on work hours. The report quotes Japanese research suggesting that fatigue and lack of alertness is responsible for more than 50% of groundings and standings and 38% of collisions.

Accordingly, one of the factors considered was the level of productivity in relation to accident risk which emphasizes that the greater the workload, the more potential there is for accidents. It is possible that if carefully adapted, methods of dealing with fatigue used by other modes of transport and safety industries, in particular where the human factor plays an essential role, may be transferable to the maritime industry. Using evidence compiled from studies of various transport workers, such as bus and train drivers, it was observed that a peak in accident prevalence occurred between 2 and 4 hours into the operator's shift. Notwithstanding this, it was also evident that the patterns of accident occurrence increased dramatically, even exponentially, towards the end of shifts of very long duration of 12 hours or more.

Fatigue has contributed to ship accidents and to accidents onboard, but there are difficulties in measuring the former and under-reporting exists for the latter. In the inquiries into accidents there is still a 'to blame culture'. As well as accident data there are additional requirements for information on the mental and other illnesses of seafarers and potentially on post-retirement mortality, as the facts emerging are extremely disturbing and possibly related to the long-term effects of fatigue.

There is still need to find or modify jobs to incorporate any limitations which can arise from manmade management or Green House effect.

Low quality sleep and its deprivation in seafaring

The issue of quality and quantity of sleep is a very important component of ship board life style to restore the working performance to its usual level. There are two modes of life in every living individual, i.e., sleep and wakefulness. If we go without sleep or drastically reduce it, the desire or need to sleep become more important than life itself. Sleep is so preemptive, that we can not stay awake even to avoid death. The secret of sleep...why we sleep, how we sleep, and what we do during sleep is still mysterious. Thus the train crews that died in the head-on collision near Thompson Point, Pennsylvania, at 5.30 a.m. on Jan 14, 1988, or in Colorado at 3.00. a.m., in 1994, died because they fell asleep. Captain of Torrey Canyon was under considerable commercial pressure to anchor the vessel and he was suffering with considerable fatigue. He had been on board his ship for a year without any leave to avail. He left the bridge at 2.30 a.m. Due to interruption of sleep, interpretation of his brain for recalling input sensing, decision making and motor action, was not correct and he took a wrong decision, regarding conveying navigational advise and as a result the ship met a disaster. Same occurred in Herald of Free Enterprize tragedy, where sailing was ordered with an open bow door, because a man who should have issued a warning had fallen sleep, although a member of the crew was instructed to check, it was assumed that door was closed.
There have been many instances where an accident happened because somebody had fallen asleep. It is a simple matter to put all the blame on that one individual.

A cargo vessel grounded in the early hours of the morning. The vessel had been proceeding along a buoyed channel which was flanked on one side by shallow mud banks. The cause of the grounding was that the Officer had fallen asleep. The bridge was equipped with a comfortable chair at

*the conning position. It was also fitted with a watch alarm that was set to18 minutes. The estimated time from the vessel leaving the channel to grounding was less than 15 minutes. The consequences of this incident highlight the need for watch keepers to stay alert and prevent the onset of drowsiness by standing up and moving about. It also underlines the need for watch alarm systems to be set to an interval appropriate to the circumstance (*Seaways*: The International Journal of Nautical Institute London).*

But we should also ask as to why that person fell asleep? Was it stress - or fatigue? And if it was fatigue, what caused it? And why was he asked to perform such a delicate task under those conditions risking the safety of the ship and its crew?

An earlier paper from the United States showed that seafarers have a significant risk of fatigue. As a group they average 6.8 hours of sleep at sea compared with 7.9 hours at home and, on a long voyage, that difference can accumulate. A study carried out by the National Commission on Sleep Disorders in 1993 showed that "sleep debt is cumulative over successive nights and that fatigue and job performance effectiveness worsen as sleep debt accumulates". The paper (which was submitted to the MSC"s 67th session in 1996) concluded that "the problem of fatigue is directly and primarily related to the continuity, duration and quality of sleep.... an individual who is not provided (or does not use) an opportunity for an extended and continuous period of sleep run the rise, over time, of suffering from symptoms which are associated with critical states of fatigue." The importance of sleep is the subject of a book called "Sleep Thieves," written by Professor Stanley Coren of the University of British Columbia. He holds up the invention of the coiled tungsten light bulb in 1913 for particular censure, because "it was this light bulb that made it possible for working people to free themselves from the darkness of night." It also reduced the average sleeping time from 9 hours in 1910 to around 7 ½ hours today. One chapter in the book is devoted to the link between fatigue and poor health. The author refers to a survey carried out in Finland which lasted six years and involved more that 10,000 people. It revealed that men who were poor sleepers were 2½ times as likely to die during the lest period as good sleepers. A test carried out a few years later in the town of Tampere showed that poor sleepers were 6 ½ times more likely to report poor health than good sleepers. In a chapter dealing with road traffic accidents, Professor Coren shows that the peak time is not during the morning and evening rush hours, but in the early hours of the morning and afternoon. Between 1 a.m. and 4 a.m. the daily rhythm of peaks and troughs known as the circadian cycle is at its lowest and the accident rate reaches its highest point, while a smaller peak comes between 1 p.m. and 4 p.m. A French researcher, using data from the United States, prepared a report in 1994 which showed that sleepiness accounted for 41.6% of motor vehicle accidents - a total of 769.689 disabling injuries and 17,689 deaths during the year. It is scarcely surprising, therefore, that the Numast study indicates that there is a peak of accidents two or three hours into a watch, with the main danger area being between midnight and 6 a.m.

Results: Of all vehicle accidents to which the police were summoned, sleep related vehicle accidents comprised 16% on major roads in southwest England, and over 20% on midland motorways. During the 24 hour period there were three major peaks: at around 0200, 0600, and 1600. About half these drivers were men under 30 years; few such accidents involved women. {BMJ}

Sleep is a vital constituent of our physical and mental health and occupies two third of our existence but still we are lacking the exact definition of sleep. Sleep and fatigue are two important inter-related component of our daily life activity which have no precise meaning in the dictionary.
The secret of sleep....why we sleep? how we sleep? what do we do during sleep? is still not known. It is still mystery as to what happen to us when we sleep, how does sleep alleviates fatigue, and revitalize and refresh us to work again. The moment we go sleep we are disengaged from the real world, our most of sensory input is blocked or modified to such an extent that result in perceptional blindness and deafness, and the same kinds of signals are being transmitted through brain net circle in the world of dreams.

What do we know about sleep?
It is a biological state in which discharges from specific neurons in certain part of brain are actively generated. The sleep consists of two phases:

- rapid-eye movement (REM) sleep,
- non-rapid eye movement (NREM) sleep.

In REM sleep there is rapid synchronous movements of both the eyes under the lids with twitches, where as NREM

sleep it lacks the visible movements of the eyes. Both REM and NREM sleep have different electroencephalogram (EEG).
During sleep phase at night the NREM and REM cycles alternate with each other, beginning with NREM sleep lasting for a period of 80 minutes followed by REM sleep lasting for a period of 10 minutes.
Onset of sleep process begins with a pattern of involuntary, slow and rolling eye movements in the state of drowsy wakefulness, proceeding to NREM phase of the sleep. Throughout night this 90 (80 + 10) minutes cycle is repeated nearly about 3-6 times where as the REM sleep increases progressively in the subsequent cycles. Non-REM sleep has four stages; during stages 3 and 4, the deepest of the stages, it is difficult to arouse a person.
During REM sleep, muscle atonia occurs, voluntary motor functions diminish, suppression of various somatic reflexes occurs and the activity of the autonomic nervous system is irregular and accelerated. Heart and respiration rate and blood pressure are much more variable during when subjects pass from NREM to REM sleep. During NREM sleep, breathing is automatic and very regular under the feed back control where as in REM sleep breathing is quite irregular and relatively free of chemical feed back control. Sleep related hypoxemia can occur in some individuals. Most adults need the traditional seven or eight hours of sleep a night, but some adults are “short sleepers” and function well on only three or four hours.

The definition of sleep that brain is resting to recover is not accepted as during REM sleep brain is more active than in wakefulness and may represent the hallucinated dream scene.

It has been estimated that heights of activities of our various physiological system vary systematically with the time of day. Brain temperature and cerebral blood flow increases during REM sleep. The core body temperature of human body is not fixed to 98.6 ºF, but it is actively maintained near 100 ºF at mid-afternoon and nearly 96 ºF in the early morning hours before awaking and synonymous fluctuation has been observed in plasma level of hormones, such as cortisol, growth hormones, prolactin and same pattern is observed with the heart rate, blood pressure and as well as in production of urine.

The sleep/wake cycle of circadian rhythm is regulated by, endogenous components by an internal biological circadian clock in brain and the exogenous components which reflects the changing in external environments such as various time clues called zeitgebers. Light/dark cycle is one of the most powerful zeitgeber.

A circadian rhythm is also maintained by a release of hormone from the pineal gland ‘melotanin’ in response to the darkness. The release of melotanin is influenced by light and not by sleep. The receptors for melotanin release have been localized to the suprachiasmatic nucleus (a group of the nerve cell in brain) of the hypothalamus. The nocturnal release of melotanin occur during night is inhabited by light. Scientists have recently concluded that melotanin has a minor effect on human sleep and not involved in deep sleep process only it has sedative action and produces drowsiness. Several studies of jet lag have shown significance improvement with melotanin and studies are still underway on the use of melotanin for shift workers. We feel sleepy and calm after taking high carbohydrate and fat meal in afternoon, which may stimulate the secretion of melotanin.

Circadian rhythm refers to the bodily rhythm that vary through the day in a periodic fashion. Sleep results from the complex interaction of circadian and non-circadian influences. The amount of sleep and wakefulness does not significantly change when circadian clock in the brain is destroyed as per experiments on rodents but the normal 24-hour rhythm of sleep and wakefulness is no longer present.

Same type of experiments were carried out with humans, where a subject have lived for a period of 6 months in a special apartments without, telephone, windows, television, radio, and any contact with the outside contact that might provide a clue as to the time of day. Under these conditions diurnal rhythms regulated by circadian clock of sleep, activity, body temperature, hormones secretion and a range of other variables persist, but they no longer exhibit a period length of 24 hours. In the case of the typical human subject, “free running period” of the circadian system is greater than 24 hours i.e., 25 hours, so the internal clock of the individual has a natural rhythm of exactly 25 hours. In this free running phase the body temperature was noted. The body temperature rhythm changed its phase relationship to sleep-wakefulness. The lower point temperature which was towards the end of the sleep occurred at the beginning of the sleep period. This change in the phase relationship between sleep and body temperature suggests that these two processes have distinct timing mechanisms.

Most humans, as we have indicated, have a natural periodicity of approximately 25 hours, which is easily entrained to the 24-hour day. However, in insomniacs and other sleep-disordered patients, something may be wrong with either the entrainment mechanism or the innate oscillation so that their bodies cannot oscillate in synchrony with their environment.
The first is the infamous "jet lag" which is a circadian disorder that results from changing time zones (and zeitgeber orientation) faster than the internal circadian clock can adjust.

The second common circadian disorder has been termed the "Monday Morning Blues" An individual who sleeps late on Saturday morning misses the normal early morning zeitgeber signal and as a consequence the 25-hour internal clock drifts approximately one hour later. The process is repeated on Sunday morning so that when the alarm clock rings at 6 a.m. on Monday morning, the body's clock is 2 hours behind and one has to struggle to get out of bed because it is 4 a.m. according to the body's internal clock.

Neither the basal condition nor the free-running condition establish that the circadian clock is directly controlling sleep and wakefulness. An alternative, and equally plausible hypothesis, is that the circadian clock controls a homeostatic mechanism in which sleepiness increases in proportion to the time awake and eventually results in sleep onset. The reverse homeostatic mechanism, in which alertness increases with the amount of time spent asleep, could account for the timing of the onset of wakefulness. Determination of the relative contribution of each mechanism to the timing of sleep requires dissection of their normally coincident influences. In one experiment in which this was done, subjects were put in bed and allowed to sleep for only one hour out of every 3 hours. This cycle of one hour in bed and two hours awake was maintained for several days around the clock. Thus, a total of 8 hours were spent in bed per day, but the hours were evenly distributed throughout each 24 hour period. Despite severe sleep deprivation accumulating over several days, subjects were still unable to sleep during the hour periods in the afternoon and evening that coincided with the peak of the circadian cycle when they would "normally" be awake.

Nonetheless, homeostatic influences on the timing of sleep are also important. After lesions of the suprachiasmatic nuclei have been made in animals, sleep and wakefulness are no longer rhythmic; alternating episodes of sleep and wakefulness which vary in length occur randomly throughout the day and night. However, if the animal is kept awake for a significant length of time, and then is allowed to fall asleep, the duration of this " recovery" sleep is increased above the normal baseline duration, thus supporting a role for homeostatic regulation of sleep and wakefulness.

The complex interaction between homeostatic and circadian influences in the timing of sleep is thought to explain the phenomenon of internal desynchronization" seen in humans during the free-running conditioning (i.e., what happens in the absence of zeitgebers). After varying lengths of
exposure to free-running conditions, subjects will spontaneously exhibit long or short sleep-wake cycles with periods of 30-40 or 5-20 hours. The circadian clock maintains its normal near-24 hour period as evidenced by persistent rhythms in such parameters as body temperature. The mechanism of this breakdown in synchrony between sleep-waking and other circadian rhythms is unclear. It has been suggested that the long sleep-wake rhythm is the manifestation of a second internal clock with a longer and more variable period length. Under normal conditions the two oscillators are synchronized, but in internal desynchrony the sleep-wake oscillator breaks free. The anatomical location of this proposed second clock is not known.

The strength of fatigue was noted in a subject who remained awake for a period of 72 hours, and fatigue was rated every three hours, on a scale in comparison with the fatigue of a normal individual. The fatigue was highest in the early hours of morning and lower in the afternoon period and these periods are counted peak period for accidents.

Common Sleep Disorders

In humans entrainment to the 24 hours environmental cycle result from daily resetting in response to the zeigeber signals. For example, an individual with an intrinsic period length of 25 hours need a correction of one hour per day to

be entrained to the 24-hour day. Entrainment involves synchronizing the period of the circadian rhythm to the period of zeitgeber and the rhythm. In insomnia and other sleep disorders patients, some thing may be wrong with either entrainment mechanism or the innate oscillation so that their bodies cannot oscillate in synchrony with their environment. A jet lag which is circadian disorder that result from changing time zone (zeitgeber orientation) faster than the internal circadian clock can adjust.

Many occupations that are associated with the loss of sleep and the development of excessive sleepiness, which in turn impair the quality of life, impair function, and create enormous hazards. Such performance failure can lead to catastrophes and various sleep loss impaired decisions. Many people overestimate the amount of sleep they need and underestimate the amount they actually get during a restless night. Generally, there is no need for concern, even if an unbroken night's sleep is rare. However, if loss of sleep impairs a person's ability to function well during the day, it might indicate a problem. Sleep affects and in turn is affected by almost every physiological and psychological process.

Insomnia

Insomniac patients have perception of inadequate non-restorative or poor quality of sleep because of one of the following:

difficulty in falling a sleep, more than 30-40 minutes (initial insomnia);

frequent waking during night and difficulty returning to sleep, or wakening up too early in the morning.
Insomnia may be for short term (transient) lasting from a single night to a few weeks, on and off (intermittent) and constant that last more than one-month (chronic) insomnia.

Transient and intermittent insomnia may be caused by:

- Stress,
- environmental noise,
- extreme temperatures,
- shift work,
- use of the sedative,
- sleep/wake schedule problems, medication side effects.

Chronic insomnia result from combination of factors:

Advanced age (more than 60),

- Psychiatric disorders, especially depression,
- Chronic medical illness,
- respiratory disorders such as asthma and chronic obstructive lung disease,
- Pain: duodenal ulcer pain (which is related to increase gastric condition which awaken the individual during night which in turn occurs during REM sleep),
- arthritis and other rheumatic pain,
- burning foot pain and other neuropathies of diabetes,
- frequent urination.
- Primary sleep disorders such as sleep apnea and narcolepsy. Circadian rhythm disorders,Periodic leg movements in sleep and restless leg syndrome, Shift work,
- long term use of central nervous system depressant sedatives, (Paradoxically, insomnia may result from the use of a sedative prescribed to relieve it. Some people, especially the elderly, develop an inverted sleep rhythm: drowsiness in the morning, sleep during the day, and wakefulness at night).

- other causes may include low socioeconomic status, poor education, recent life stress, big change in daily routine, expecting to have difficulty sleeping and worrying about it.
- Excessive napping in the afternoon or evening.
- Behavioral causes may be misuse of the alcohol, watching exciting programs on television late at

night, smoking cigarettes before bedtime.

- Use of the stimulants such as:

-Caffeine: caffeine contains one of a group stimulant called methylxanthine or xanthine that occurs in some natural plants available in beverages and coffee.
-Chocolate: chocolate contains small amount of caffeine, cocoa derived from the seeds of "Theobroma cocoa plant" used to make chocolate milk, and large amount of theobromine, another alkaloid in xanthine family.
-Cocacola: made from Kola nuts.
- Tea: An average 5 ounce cup of tea can contain 20-110 mg, of caffeine and other stimulant theophylline.
-Chinese Salt: Chinese salt contains monosodium glutamate (MSG) a seasoning used in Chinese cooking also act as a stimulant.

Symptoms

The daytime symptoms includes fatigue, sleepiness, impaired daytime function, irritability, difficulty in concentrating upon a task, depression, anxiety, and other mood changes which are often attributed by the patients to their poor sleep.

The nearly 30 million people in the United States who suffer with insomnia are more likely to suffer an automobile accident, get hurt on the job, develop dependence on alcohol or other drugs, or develop mood disorders like depression, the researchers say. Elderly people suffering from Long-acting anxiety, or on Insomnia drugs have been shown to suffer from more car crashes.

"Chronic insomnia is serious," says Dr. Reynolds, professor of psychiatry and neurology, "yet there is far too little attention paid to it as a symptom of either hidden psychiatric or medical illness. Physicians, especially family doctors, need to learn more about how to diagnose and treat it."

HOW IS IT DIAGNOSED?

Patients with insomnia are some times difficult to diagnose and are often underestimated but with the help of a medical and sleep history a diagnosis can be reached. The sleep history may be obtained from a sleep diary filled in by the patient or by an interview with the patient's bed partner concerning the quantity and quality of the patient's sleep. Specialized sleep studies may be recommended, but only if there is suspicion that the patient may has a primary sleep disorder such as sleep apnea or narcolepsy.

physician must carefully evaluate a patient's complaint of insomnia before starting any treatment. A doctor should learn all possible causes, which could include medical conditions such as sleep-disordered breathing or nocturnal myoclonus (restlessness of the legs at the beginning of sleep); use of substances such as alcohol, caffeine or nicotine; or mood disorders like acute or chronic stress or depression; or disordered circadian rhythms brought on by shift work or jet lag. "Chronic insomnia is a symptom of a deeper problem not a disorder itself," explains Dr. Kupfer, Thomas Detre Professor and chairman, department of psychiatry. "There are often many causes underlying a person's inability to get a good night's sleep. If a physician fails to recognize or treat those underlying causes, someone suffering from chronic insomnia can face more serious problems later.

"These results suggest that sex and sleep are significant problems for Canadians," said Dr. Pierre Assalian, executive director of the Canadian Sex Research Forum and the director of the Human Sexuality Unit at Montreal General Hospital. "Some of the most disturbing findings relate to sex and sleep problems experienced by a key audience targeted in the study - Canadians taking antidepressants."

Canadians taking antidepressants are also four times more likely than the general public to experience sleep problems every night (30 percent versus eight percent). It also found people taking antidepressants are four times more likely than the general public (60 percent versus 15 percent) to take sleep medications in addition to their antidepressants.

HOW IS IT TREATED?

Transient and intermittent insomnia may not require treatment since episodes last only a few days at a time. For example, if insomnia is due to a temporary change in the sleep/wake schedule, as with change due to shift work, the person's biological clock will often get back to normal on its own. However, for some people who experience daytime sleepiness and impaired performance as a result of transient insomnia, the use of short-acting sleeping pills may improve sleep and next-day alertness. As with all drugs, there are potential side effects. The use of over-the-counter sleep medicines is not usually recommended for the treatment of insomnia. Treatment for chronic insomnia consists of:

- First, diagnosing and treating underlying medical or psychological problems.
- Identifying behaviors that may worsen insomnia and stopping (or reducing) them.

Use of sleeping pills: although the long-term use of sleeping pills for chronic insomnia is controversial. A patient taking any sleeping pill should be under the supervision of a physician to closely evaluate effectiveness and minimize side effects. In general, these drugs are prescribed at the lowest dose possible and for the shortest duration needed to relieve the up-related symptoms. For some of these medicines, the dose must be gradually lowered as the medicine is discontinued because, if stopped abruptly, it can cause insomnia to occur again for a night or two.

"Most cases of chronic insomnia can be treated with either one or a combination of education, behavioral intervention or medication. The basic aim of education or behavioral intervention is to re-establish the link between the bedroom and sleep. Patients learn what activities help or inhibit sleep," explains Dr. Kupfer.

"Chronic insomnia defies easy diagnosis or treatment," acknowledges Dr. Kupfer. "Even so, the bottom line is that once the underlying problems are identified and worked through, a successful treatment plan can be implemented."

Elderly people taking a certain type of drug for anxiety or insomnia are at increased risk for motor vehicle crashes, according to an article this week's issue of The Journal of the American Medical Association (JAMA). Brenda Hemmelgarn, M.N., Samy Suissa, Ph.D., and colleagues from McGill University and Royal Victoria Hospital, Montreal, Quebec, studied 224,734 drivers, aged 67 to 84 years, to determine if benzodiazepines were associated with car crashes in elderly drivers. The researchers found a 45 percent increased rate of motor vehicle crashes involving injuries for elderly patients during the first seven days of taking long-acting sedatives.

Narcolepsy

Narcolepsy is a chronic, neurological, lifelong sleep disorder that generally begins in young adulthood. The most common symptom is excessive daytime sleepiness, which is characterized by uncontrollable sleep attacks. These attacks hamper a person's ability to perform basic daily activities. As a result, narcolepsy significantly impacts a person's quality of life and its working.

Sleep Apnea

Sleep apnea a serious potentially life-threatening condition, is a disorder of breathing during sleep occupied by loud snoring. It occurs in about four percent of middle-aged men. Obstructive sleep apnea, the more common and severe form of the disease, occurs when air cannot flow in or out of the person's mouth or nose although efforts to breath continue. Sleep apnea can also be characterized by choking sensations as a person does not get sufficient oxygen. Person may wake up several times to breath without memory of these brief awakenings.

Apnea may be:

Obstructive sleep apnoea: it is most common and occur due to obstruction in the throat during sleep or other part of upper respiratory narrowing due to inherent physical characteristics, excessive consumption of alcohol before sleep, or obesity. Central sleep apnoea: caused by delay in discharge of signals from brain centers to breath.
It contributes to excessive daytime sleepiness, which has been established as a risk factor for motor vehicle accidents and delicate task. Early recognition and treatment are also important because the condition may be associated with irregular heartbeat, high blood pressure, heart attack and stroke. It is more common in Asians.
The clinical importance of sleep apnea arises from the fact that it is one of the leading cause of excessive day time sleepiness. The most common manifestations are neuropsychiatric and behavioral disturbances that are though to

arise from the fragmentation of sleep and loss of slow wave sleep induced by recurrent arousal responses. Apart from the affecting daily activities can become disabling and dangerous for carrying delicate safety -related task if the disorder progress. Further more several epidemiological studies has come to the conclusion that it may be a risk factor for the development of hypertension, heart attack and premature death. (Elliot A Phillipson Harrison's Principles of Medicine 14th edition sleep apnea p.1480-1491). Effective method of weight reduction, improvement of nasal patency, avoidance of alcohol, and sleeping in supine position may be beneficial for its prevention and treatment.

Microsleep

Between the boundaries of consciousness and alertness was seen an intermediate area where persons would appear to be awake but would make no reactionary movements. This was defined as microsleep, with those concerned, often totally unaware of the phenomena, and denying its existence or effect. The Japanese however, were seen to have already acknowledged its existence terming it 'dozing' (JAMRI, 1993) and attributing it to several ship collisions.
It was also noted that mean behaviour immediately following microsleep did not alter, but it increases as with the age of forty.

Shift work Syndrome

It is not actually a disease which occurs in persons who work fully in the night, part time in the night or part of a rotating work schedule? Mostly the individuals possess a normal circadian timing system.
Shift-work syndrome is not really a disease, in that most patients who complain of this problem probably possess perfectly normal circadian timing systems. Night work presents obvious problems for the circadian clock, given that the available zeitgeber signals continue to enforce a daytime orientation.
Many shiftworkers do not adapt, and the conflict between their work schedule and circadian orientation produces insomnia during the day when they try to sleep and excessive sleepiness at night when they are trying to work. Over time the resultant chronic sleep deprivation produces general stress and a host of secondary medical disorders. Research on the importance of light to entrainment of human circadian clocks may well help resolve this problem.

Entrainment failure is the persistence of a "free-running" sleep-wake rhythm despite the presence of adequate zeitgeber signals in the environment. This produces a complaint of cyclical insomnia in which patients report that they sleep fine when the circadian system is in synchrony with the external world. But as the clock drifts out of phase it prevents sleep during normal nocturnal hours, resulting in insomnia lasting for several days until the clock drifts back into a normal orientation and the cycle starts all over again.

Delayed Sleep Phase syndrome

In this case circadian system is shifted to a position that is later than normal and occurs usually in adults. The sleep trend is shifted, so that the patient is unable to fall asleep before 3 or 4 a.m., and similarly cannot wake up before noon with other than an outstanding try. There is an evident failure in circadian entrainment mechanism, which prevents normal corrective shift to the early hours, thus preventing stable entrainment to 24-hour cycle. The individual is unable to work in a diurnal world and his functioning is interrupted into a permanent jet-lag. Artificial bright light therapies may sometimes be used for zeitgebers orientations and shifting the phase progressively later rounds the clock.

Advanced sleep phase syndrome

In this case sleep-wake cycle is advanced to the early hours and individual complaints of excessive sleepiness at 7 or 8 p.m. which enables him to remain awake, where as a person wake up at 3 to 4 a.m., and is unable to sleep again. Elderly are mostly affected. There is one hypothesis that neurons in the brain CNS are degenerated. In this case "free running" period is reduced with shifting of phase in early hours and the amplitude of circadian variation is decreased.

Periodic leg movements in sleep (RLMS) and Restless Legs Syndrome (RLS)

PLMS is a syndrome that consists of periodic movements of the legs, feet, and/or toes during sleep. People with

PLMS are often not aware of these movements, and often complain of several symptoms, including, insomnia, excessive daytime sleepiness, and frequent awakenings from sleep, or unrefreshing sleep.
RLS or Periodic leg movements in sleep are frequently associated with a waking disorder. RLS is a disorder of the central nervous system that is characterized by unusual sensations in the legs and an overwhelming urge to move the legs while resting or attempting to fall asleep. Not all patients with PLMS also have RLS; however, most patients with RLS have PLMS. RLS most commonly occurs in cases associated with, anemia, or diabetes. Symptoms includes, creeping or crawling sensations in the legs, and an irresistible urge to move the affected extremity where as the walking relieves the symptoms, rest aggravates the condition, particularly during evening and afternoon hours.

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2.7.6 Just Go To Sleep And Forget About It

Mick Winter's methods for sleep (with permission)

Ah, well. We need a better way, don't we? So we've collected a variety of methods for getting you to sleep, including some we're quite sure you've never seen before.

They're all designed to help you deal with tension, stress and anxiety, and to get a good night's sleep. Not every one of these techniques alone will get you to sleep, but a few of them at least should prove successful. Needless to say, there's no guarantee, and no attempt to provide medical advice.

With that caveat out of the way, we can only wish you good luck. And a good night's sleep.

Techniques you've probably already tried
but are still worth trying again.

- See a Doctor
- Take a Warm Bath
- Get a Massage
- Listen to Music
- Drink Warm Milk
- Drink Herb Tea
- Eat a Bedtime Snack
- Avoid Caffeine, Alcohol and Tobacco
- Sleep in a Well-Ventilated Room
- Sleep on a Good Firm Bed
- Sleep on Your Back
- Get Some Physical Exercise During the Day
- Keep Regular Bedtime Hours
- If You Can't Sleep, Get Up
- Don't Sleep In
- Get Up Earlier in the Morning
- Keep Your Bed a Place for Sleep
- Avoid Naps
- Avoid Illuminated Bedroom Clocks

Of course there's the standard technique
that everyone knows (although it never
worked for us)

- Counting Sheep

And some techniques you probably
haven't seen before

- Sleep With Your Head Facing North
- Don't Watch TV or Read Before Going to Bed
- Toe Wiggling
- Stomach Rub
- Progressive Relaxation
- Deep Breathing
- Visualize Something Peaceful
- Visualize Something Boring
- Imagine It's Time to Get Up
- Quiet Ears

Good luck! Have a pleasant sleep!
Oh, and one more thing... Musical Massage Sound Therapy

Musical Massage Sound Therapy is a CD (or audiotape) of pure sounds, which relax and soothe. We use it and find it extremely relaxing. (The extract has been quoted with the permission)

mick@well.com

Counting Sheep

We finally figured out why it never worked for us. The old wives' cure for insomnia is to count bouncy little sheep leaping over a fence. No wonder it doesn't work. Bouncy sheep are hyperactive and wide-awake. They're the last things you need to dwell on when you want to go to sleep.

So try the variation that worked for us. Count sleeping sheep.
Imagine a beautiful green meadow stretching to infinity. Every ten feet or so, right in a row, lies a peaceful, sleeping sheep. Imagine that you're just gliding by, almost floating. And that you pass by a sheep every 3 or 4 seconds (experiment to find which time interval works best for you -- it varies from person to person).
Count the sheep and glide on to the next, and the next, and so on.

Take it from us. Sleeping sheep are much more effective.

Take a Warm Bath

It's a great way to relax your body. Don't overdo it, however. You merely want to relax your body, not exhaust it. Too long in hot water and your body is drained of vitality.

Use bath salts, or throw in Epsom salts and baking soda -- one cup of each. These will relax you and also help remove toxins from your body.

Sleep in a Well-Ventilated Room

Fresh air (we know - it's hard in the wintertime) and a room temperature between 60-65 degrees will give you the best sleeping conditions. Any warmer and you'll toss and turn from the discomfort of being too warm. Keep the thermostat down and do your temperature adjusting inside the bed -- with more or fewer blankets.

Avoid Caffeine, Alcohol and Tobacco

It should be obvious, but some people forget that coffee is not the only drink containing caffeine. Tea (black, not herbal), chocolate and cola drinks are also high in caffeine.

Alcohol may feel like it's soothing you, but all it's doing is stupefying you. Research has shown that alcohol upsets sleep, preventing a deep rest. Same with tobacco. Avoid them all.

Eat a Bedtime Snack

A small, low protein, high carbohydrate bedtime snack, such as juice and cookies, eaten about an hour before bedtime can help you fall asleep sooner. (Pizza does not qualify.)

On the other hand:

Studies indicate that foods with large amounts of the amino acid L-tryptophan help us sleep better. These include warm or hot milk (but not cold milk), eggs, cottage cheese, chicken, turkey and cashews.

Try both food theories, and see which works best for you.

Drink Herb Tea

If you don't like milk - or are avoiding dairy products - try a cup of hot camomile, catnip, anise or fennel tea. All contain natural ingredients, which will help you, sleep. Most health food stores will also have special blends of herb tea designed to soothe you and help you get to sleep.

Drink Warm Milk

A glass of warm milk 15 minutes before going to bed will soothe your nervous system. Milk contains calcium, which works directly on jagged nerves to make them (and you) relax.

Listen to Music

Play some soft, soothing music that will lull you to sleep. There are even cassettes and records designed for that very purpose. Some are especially composed music, others simply have sounds of waves rhythmically breaking, or the steady pattern of a heartbeat. Another that we know of simply plays long notes, but it's extremely effective on the psyche and the body.

Of course if you don't have a record, cassette or CD player that will automatically turn off, we don't suggest this. If you have to get up and turn it off at the end, you've obviously lost its effect.

Quiet Ears

This technique is an ancient Eastern meditation as well as a great way to fall asleep.

- Lie on your back with your hands behind your head, fingers interlocked, and your palms cupping the back of your head. Get as relaxed as possible (This position make take a little while to get used to).
- Place your thumbs in your ears so that you are pressing the outer flap of your ear and blocking the entrance to the ear canal.
- Lie quietly and listen for a high-pitched sound that you will gradually hear inside your head.

- Lie there for 10 to 15 minutes and concentrate on that sound. Then put your arms to your sides and go to sleep. (Don't worry about all the stories of people who have ringing in their ears. This is different -- and natural.)

Imagine It's Time to Get Up

This is a neat one too. Kind of a variation on the previous technique. Imagine that you're not allowed to go to sleep. Imagine that your morning alarm has gone off and it's time to get up and go to work. You know how delicious that feeling is in the morning when it's time to get up but you're so tired and your eyes are very heavy and you shouldn't do it but you just want to fall right back to sleep for a few minutes more?

Well, we find you can often bring that about just by imagining as fully and realistically as possible that it's morning, that you have to get up, put your feet on a cold floor, stagger around the house,, take a cold shower, and do whatever unpleasant things you associate with getting up in the morning.. The more unpleasantly you can imagine it, the more you won't want to do it. And the more you'll just want to stay in bed and sleep. Try it. You'll be surprised how tired and sleepy your mind Can make your body..

Get a Massage

Have your spouse (or whoever) give you a massage just before going to sleep. If you can convince them to give you a full body massage, great. If not, even a short backrub and/or a face and scalp massage can be a big help. Have them make the massage strokes slow, gentle, yet firm, to work the tension out of your muscles and soothe you to sleep.

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1.Sleep on a Good Firm Bed

A firm bed will give your entire body the support it needs to really relax. It's better for your spine, too.

2. Sleep on Your Back

It's the best position for relaxing, and allows all your internal organs to rest properly. If you must sleep on your side, do it on your right side, not your left. Sleeping on the left side causes your lungs, stomach and liver to press against your heart, causing stress on an organ that most of us find quite useful.

Never -- ever -- sleep on your stomach. It causes pressure on all your internal organs -- including your lungs, which results in shallow breathing. It can also, as you've no doubt discovered, cause Al stiff neck and upper back problems..

3.Get Some Physical Exercise During the Day

People with "mental" jobs, like office workers, have far more trouble with insomnia than do people who work physically hard all day. Even 15 minutes a day of exercise (at least half an hour before going to bed so your body will have a chance to slow down) will give your body the activity and oxygen it needs to help you relax more and sleep better.

4.Keep Regular Bedtime Hours

Your body likes regular routines, whether you do or not. It likes to know that it's going to get up at the same time each day, eat at the same times, and go to bed at the same time. Not very exciting, maybe, but comfortable. So pick a reasonable and regular time to go to bed each night. And stick to it. Even if you don't think you're tired when the time comes. Your body will appreciate it. And after a while when it feels it can rely on the routine, it will begin to repay the favor by letting you get to sleep when you want.

5. If You Can't Sleep, Get Up

Don't like awake trying to get to sleep any longer than 30 minutes. If it goes that long, get up. Do something quiet and non-stimulating. When you feel tired again, go back to bed.

6. Don't Sleep In

Get up at the same time every day, even on weekends and holidays. Once you've awakened, get up. Don't lie in bed awake, thinking about getting up. Just do it.

7. Get Up Earlier in the Morning

At least try this when you're trying to set up your new regular bedtime routine. As much as you may hate getting up one-half hour earlier (or even more) than you really have to, you'll be that much more tired at night and more apt to get to sleep. Once you and your body have the confidence that you can get to sleep when you want at night, you can go back to your preferred wake-up-in-the-morning time.

8. Keep Your Bed a Place for Sleep

Okay, and maybe for one other thing. But not for working, reading, watching television, doing crossword puzzles, or whatever else occupies you in the evening. Let your mind and body identify bed with sleeping.

9. Avoid Naps

Sure, they're nice to do during the day, and if you couldn't sleep at night, you're grateful for any chance to sleep. But if you're really having trouble sleeping at night--and you're not a senior citizen who sleeps for small periods of time, skip naps. You'll be more tired at bedtime and more able to fall asleep.

10. Avoid Illuminated Bedroom Clocks

Try to keep your bedroom as dark as possible. An illuminated bedroom clock is a source of light that can be extremely annoying if you're having a hard time getting to sleep. If you can't replace the clock, at least block its light with something.

11. See a Doctor

Insomnia can be a symptom of physical disorders, although for most of us it's the result of tension, stress and anxiety -- and of course the more anxious we get about our insomnia, the worse it gets. If your doctor pronounces you a "healthy" insomniac, he might suggest some of the techniques provided here. Or she might prescribe drugs to help you get to sleep.

We suggest you try all these methods first, and use drugs only as a last resort. The decision, of course, is yours.

12. Sleep with Your Head Facing North

And, obviously -- unless you have a particularly unusual body -- your feet facing south. This aligns your body with the electromagnetic field of the planet, bringing your own energies into harmony with those of the Earth. Sound like a pretty bizarre theory? Try it. You'll see what a difference it makes.

13. Don't Watch TV or Read Before Going to Bed

Wait at least one-half hour (preferably longer) before going to bed after reading or watching television. We know; some people say that reading a detective story or some such escapist book helps put them to sleep. If it works for them, great. But it seldom worked for us. And it probably hasn't worked for you either.

The reason is that no matter how passively we watch television, or how innocuous the book wee read is, our minds are still being stimulated. And an overstimulated mind -- along with anxiety and stress -- is what keeps us awake. It's all those thoughts in our head we have to get rid of before wee can get to sleep. The last thing we need is more input into our heads from television or books..

14. Toe Wiggling

A relaxed body is essential for a sound sleep. This may sound like we're contradicting what we just said about our minds keeping us awake, but it's no contradiction. Eastern sciences (such as yoga) have known for thousands of years that the mind and body are connected (actually they're not just connected, they're one, but the idea that they're connected is sufficient for our purposes here.) So if the mind is not relaxed, the body is not relaxed. Conversely, the body has to be relaxed for the mind to be relaxed. It's a package deal.

So how do you relax your body? We've already mentioned milk, herbal teas, exercise, and avoiding caffeine. But there are techniques you can do directly with your body. Toe Wiggling is one of them. Lie on your back (where you should be in the first place) and wiggle your toes up and down 122 times, wiggling the toes of both feet at the same time. This will relax your entire body, inside and out..

How does it work? According to the science of Reflexology -- which has been around in other cultures for thousands of years -- your feet are a kind of master control panel for the rest of your body. "Meridians" in the body -- which are those channels of energy treated by acupuncture -- end up in the feet. So the ends of those meridians in your feet connect with every organ and every part of your entire body. When you wiggle your toes, you are stimulating -- and thus relaxing -- your entire body.

(Incidentally, this is a good place to mention that you can be energized and relaxed at the same time. It's a matter of the quality of that energy. If it flows freely and smoothly, you will be relaxed. If the energy flow in your body is restricted or blocked, you will be tense. And toe wiggling helps to bring about a relaxing, free-flowing energy.)

Note: This same exercise is also great first thing in the morning before getting out of bed in order to energize the body.

14. Stomach Rub

This soothes down the digestive system and helps to bring about a deeper relaxation. An extra benefit is that it will help you to lose weight by improving the functioning of the digestive system. Simply lie on your back and place your hand on your navel. Begin to make small circles in a clockwise direction as you gently glide your hand over your stomach. Let your circles gradually become bigger and bigger. When your circles reach the outside of your stomach, gradually reduce their size until you are back at your navel again. Then reverse the direction (to counter-clockwise)) and do the same thing again. Repeat this whole series with your other hand. Do this several times..

Note: Food material moves through the colon in a clockwise direction. If you have trouble with constipation, make all your circles clockwise. If troubled by diarrhea, make all your circles counter-clockwise. Clockwise circles will alleviate the blockage, counter-clockwise circles will help solidify faecal material.

15. Progressive Relaxation

This exercise is most effective when you tape record the instructions in advance, preferably in your own voice. This way you don't have to concentrate on remembering the instructions.

We'll give you the instructions here. You tape record them, with a short pause after each sentence to allow yourself time to actually do the sensing and relaxing.

Lie on your back, close your eyes, and begin to listen to the tape.
Feel your feet. Feel the weight of your feet.
Feel your feet relax and sink into the bed.
Feel your lower legs. Feel the weight of your lower legs.
Feel your lower legs relax and sink into the bed.
Feel your knees. Feel the weight of your knees. Feel your knees relax and sink into the bed.
Feel your upper legs. Feel the weight of your upper legs. Feel your upper legs relax and sink into the bed.
Feel your hands. Feel the weight of your hands. Feel your hands relax and sink into the bed.
Feel your lower arms. Feel the weight of your lower arms. Feel your lower arms relax and sink into the bed.
Feel your elbows. Feel the weight of your elbows. Feel your elbows relax and sink into the bed.
Feel your upper arms. Feel the weight of your upper arms. Feel your upper arms relax and sink into the bed.
Feel your buttocks. Feel the weight of your buttocks. Feel your buttocks relax and sink into the bed.
Feel your back. Feel the weight of your back. Feel your back relax and sink into the bed.
Feel your pelvic and belly area. Feel the weight of your pelvic and belly area.
Feel your pelvic and belly area relax and sink into the bed.
Feel your chest. Feel the weight of your chest. Feel your chest relax and sink into the bed.
Feel your shoulders. Feel the weight of your shoulders. Feel your shoulders relax and sink into the bed.
Feel your neck, both front and back. Feel the weight of your neck. Feel your neck relax and sink into the bed.
Feel your skull. Feel the weight of your skull. Feel your skull relax and sink into the bed.
Feel your mouth. Feel any tension in your mouth. Feel your mouth relax and any tension slide off into the bed.
Feel your eyes. Feel any tension in your eyes. Feel your eyes relax and any tension slide off into the bed.

Feel your entire face. Feel any tension in your face. Feel your face relax and let any tension slide off into the bed.
Mentally scan your body. If you find any place that's still tense, relax it and let it sink into the bed.

16. Deep Breathing

One of the main reasons many of us are tense is our breathing. Most people breathe very shallowly, using only the top part of their lungs. Deep Breathing allows us to use our entire lungs, providing more oxygen to our bodies, and energizing and rejuvenating every organ and cell in our bodies. It is probably the most effective and beneficial method of relaxation we've seen.

- Lie on your back.
- lowly relax your body, starting with your feet and moving through every part of your body until you have reached -- and relaxed -- your face and scalp.
- Do a quick check to see if you've missed any place. If so, relax it.
- Slowly begin to inhale, first filling your lower belly, then your stomach area, and then your chest and the top of your lungs almost up to your shoulders. Hold for a second or two, then begin to exhale. Empty the very bottom of your lungs first, then the middle, then finally the top.
- Continue this breathing for 4 or 5 minutes. Don't force your breathing; it's not a contest to see how much air you can take in. Just do it in a relaxed, peaceful manner.
- After a while, imagine that you are resting on a warm, gentle ocean. The sun is shining peacefully on your body. Imagine that you rise on the gentle swells of the water as you inhale, and that you slowly descend as you exhale.
- Continue this relaxing breathing as long as you wish (hopefully until you fall asleep).

Note: This is particularly effective when you do it after Progressive Relaxation -- if you haven't already fallen asleep!

17. Visualize Something Peaceful

Just lie there with your eyes closed and imagine you're in your very favorite, most peaceful place. It may be on a sunny beach, swinging in a hammock in the mountains or your back yard, or all alone in a cave in the Himalayas.

Wherever it is, imagine you are there. You can see your surroundings, hear the peaceful sounds, smell the fragrance of the flowers, and feel the warmth of the sun or whatever sensations are there. Just relax and enjoy it -- and drift off to sleep.

Once you've found a place that's especially peaceful and effective, you'll find that the more you use it, the more you can count on it to help you relax and get to sleep. Its comfort and familiarity will make it more and more effective.

18. Visualize Something Boring

We like this one in particular. The beauty of it is you can turn a negative into a positive. Just visualize that you are someplace that you have always found extremely boring. It could be listening to a particular teacher who was so boring that he or she almost always put you to sleep. Perhaps it's some friend or acquaintance whose incessant talk and theories put you to sleep. Maybe it's your work, maybe it's your commute each day.

Whatever it is, visualize it. And recapture that bored, tired, heavy, sleepy feeling that you always experience. Let that feeling spread through your mind and all through your body till you're filled with complete tiredness and sleepiness. It works.

2.8 Terror Attacks in Seafaring

A war whether on land or at sea occupy a stressful event, loss of human lives, destruction of ware houses, interruption of routine work and the tragic effects on the individual. A pilot study of ship's crew exposed to terror attacks during the Iran-Iraq war in the Gulf region was carried out by Lars Weisaeth and Terje Lie (Norway) who were the medical members of an Emergency Personnel Group organized by the Royal Min- istry of Foreign Affairs which, in case of attacks, evaluated and if necessary reinforced the health care services provided in the Gulf area and in the homeland for the affected sailors.

During the first six months of 1988, with the increase in number and severity of attacks on neutral merchant ships, from findings such as reported here, it became obvious that stress reactions were a real problem among the attacked crews. The missiles used for this purpose, including Exocet missiles, turned out to have a maximally destructive effect on the gas and oil tankers, their engineers and the cargo, while the risk to the crew was moderate. From 1986, however, for one reason or the other, the attacks were aimed directly at the crews in order to kill. This terror clearly aimed at creating fear and, like other victims of terrorism, the crews were threatened mainly as a way of exerting pressure upon a third party.

For the Norwegian crews the attacks during this period provided the strange experience of being 'neutral,' i.e., defense-less victims, while nearby naval ships from NATO allies could only watch and do nothing, before the attack was over and rescue work could begin.

Neutral ships are not allowed to carry any kind of armament; only protective equipment is permitted. The standard procedure, when attacked, was that the captain remained on the bridge with an assistant, seeking cover there, while trying to communicate to the crew assembled at a mustering station or in some kind of improvised 'safety room' during course and effects of the terror attack. In these attacks on neutral ships all types of modern naval weapons were used (missiles, artillery, mines, bombs, hand held weapons), with the exception of submarines.

Although, neutral ships quite often, accidentally or on purpose, are attacked during war, where exists no study of this type of war or terror stress exposure upon the crews. There has, however, been extensive research on Norwegian war sailor; i.e., the merchant seamen sailing in the Allied convoys during World War II. Although, their war experience can only in certain respects be compared to the sailors exposed to terror attacks in the Gulf from 1980-88, it seems justified to report some results from the main study: One-third of the Norwegian sailors who survived their service in the Merchant Marine during the Second World War were eventually disabled by the war experience. Many of the health problems surfaced as late as in the 1970's and 1980's. The symptoms of the 'war sailor syndrome' are very similar to the 'Concentration Camp Syndrome' and what is today labeled the "Post-traumatic Stress Disorder." The stress to which the sailors were exposed to during the five years war was characterized by a constant and unpredictable threat to their lives and frequent or even continuous interruption of sleep. The foremost dangers were represented by enemy submarines and attacking aero planes. The freight was highly explosive; gasoline, ammunition. During 1942-43. on average, one Norwegian ship was torpedoed every third day. In contrast to the cc-prisoners, the sailors experienced mainly psychological stress. That stress, however, was constant and consisted of a long-lasting confrontation with dangers they had no possibilities to escape from- nor could they fight back, a particularly vicious kind of restraint stress.

In addition to the physical threat, the sailors were separated from their families for several years and many of them lost brothers, a father or close friends on ships in the same convoy without having any chance to make rescue efforts. The recognition of the specific chronic post-traumatic syndromes described above produced important improvements in the laws governing disability and compensation claims. There is no doubt that the full understanding of the true nature of the disorders and the increased practical and social support given have made life somewhat less painful for these chronic sufferers of war traumatization. Needless to say, the frequent delayed/late effects of war sailor exposure has made Norwegian coastal communities extremely sensitive to this problem area; this is yet another reason to take a closer look at the Gulf sailors.

2.9 Global Maritime Distress and Safety System (GMDSS)

In order to extend radio communication technology and to adopt highest practice technical standards the research committee after INMARSAT Organization in 1979 was further expanded to include other international organizations, notably International Telecommunication Union (ITU), World Meteorological Organization (WMO) & International

Health Organization (IHO) to resolve complexity of global system in a more systematic and methodical manner before presenting it to shipping and establishing uniform principles and rules.

As a result of its deliberation and continuous assistance from International Radio Consultant Committee (CCIR), ITU, WMO, IHR and INMARSAT organization the IMO finally succeeded in developing an integrated system known as Global Maritime Distress and Safety system.

The basic concept of the GMDSS System is to alert search and rescue authorities ashore, as well as ships in the immediate vicinity of the ship in distress and respond rapidly to such distressed incident in a coordinated search and rescue operation. This system, in addition to general radio communications, will also provide for urgency and safety communications and dissemination of marine safety information including navigational and meteorological warnings.

It provides, among other things, for general radiocommunication which, inter alia, includes general medical advice and medical assistance for serious cases where life is clearly at risk. The person concerned is considered to be in "distress" and under the GMDSS, SAR co-ordination and on scene communications are involved to alert ships with a doctor on board who can assist or provide helicopter evacuation of the patient to the shore. Ship reporting systems such as AMVER (Automated Mutual Assistance Vessel Rescue System) are also used to identify nearby ships with a doctor on board who can provide medical assistance. It is expected that the GMDSS, which will employ the most technologically advanced radiocommunication techniques (both terrestrial and satellite), will prove to be extremely useful in all the communication aspects it is designed to serve, including medical aspects of life on board ships, giving the humanitarian nature of messages requesting medical advice and assistance. It has been decided that they should be free of charge to the originating ships.

This means every ship in the vicinity of distressed incident as well as Search & Rescue (SAR) authorities ashore will now be able to perform those communication functions considered essential for the safety of the ship itself and of other ships operating in the same area. By an estimation a total of 439 persons have been rescued by distress massages sent out via COSPAS - SARSAT system. According to an estimation 40,000 beacons, has been installed (IMO news number 2: 1993).

Hence, the major changes in the communication scenario is that all commercial vessels will now have a new equipment and qualified radio electronic officer for maintaining, listening and watches on specified frequencies, depending upon operating area or areas through which they will pass on their intended voyage and not as is the case, on the size of the vessel.

The Conference to the International Convention for the Safety of life at Sea, 1974 on the Global Maritime Distress and Safety System has adopted amendments to SOLAS-74 for the implementation of the communication arrangements known as amendments-88. These amendments will now be applicable to all ships to which the present regulations of chapter IV of the SOLAS-74 apply and to cargo ships of 300 tons gross tonnage and commenced from 1st February, 1992 with seven years transition period until 1st February, 1999.

In addition to the above, two other documents are also mentioned. The first consists of measures to prevent unlawful acts which threaten the safety of ships and the security of their passengers and crew. The measures were circulated to all IMO Member States by the Maritime Security Committee in September, 1986.

The second consists of guidelines for use by shipowners, seafarers and others closely involved with the operations of ships in preventing drug smuggling on ships engaged in international maritime traffic. They were circulated in 1987.

2.10 Accidents at Docks Jobs Involved and Workers Affected

The workers affected include ship's officers, crews and passengers; pilots and tugboat crews, harbour boatmen, sometimes called foy-boatmen, who perform the necessary work of handling ship's lines on or off bollards or buoys; riggers, who in many ports are engaged to remove or replace hatches and generally to prepare a cargo vessel for discharge, for loading or for sailing; the general body of registered dock workers, especially stevedores, controlled by the National Dock Labour Board and primarily engaged in loading or discharging cargo or in working goods in or out of sheds, ware-houses, wagons and open storage wharfingers; checkers, winchmen, hatchway men and capstanmen; crane drivers, locomotive drivers, firemen, shunters and tractor drivers; tillermen and lightermen; freshwater men

working hydrants and water-boats; dock pilots, known on the northeast coast as watermen; dock gatemen and hydraulic-machinery men; watchmen at the landward entrances and at special points; coal teamers, or hoistmen or boxmen; coal trimmers, whose work is inboard; all the engineers' maintenance people including tradesmen and their labourers of many categories as well as a body of general labourers; divers and their attendant labourers. All the crews who work at the dredgers, hoppers, launches and other harbour crafts; dock office and traffic staff; steamship agents and their clerks; policemen and fire-fighters belonging to the borough or the port authority or a special force; trades people and other persons authorized to visit ships; officers and servants of H.M. Customs, the port health authority and the immigration department of the Home Office; the principals, staff and workmen of firms occupying tenancies on the docks estate; visiting lorry drivers and their mates; staff and employees of contractors employed by the port authority; and members of the general public to a greater or lesser extent.

2.11 Occupational Hazards among Sea-pilots

Studies of sea-pilots have, among other things, shown high catecholamine excretion during pilot operations and an excess incidence of coronary heart disease. Irregular working hours and night work contributes to fatigue and high morbidity from gastritis and peptic ulcer. The sea-pilot work is considered hazardous, but we have not found any recent study of accidents and near accidents. In order to add to the picture of the sea-pilot, working conditions the Swedish sea-pilot Union in cooperation with the Division of Occupational Medicine in Gethenburg, 1990 have distributed a questionnaire to all 299 sea-pilot in Sweden. The response rate was 78 % the average age of the respondents 50 years and the average time working as sea-pilot 17 years.

Every fourth sea-pilot had a reported accident. Most frequent were a slippage, fall and press accidents. Accidents of less severe character and near-accidents were very common. The majority (85%) had slipped on oil spots, ice and the like. (79%) had an accident or near- accidents on pilot ladder. (76%) had been hit on the head while ascending or descending on ladders. While common injuries were broken ribs, broken or sprained ankles, legs, hands, back pain and wounds.

The probability of meeting with an accident increases with rising age. Half of the sea-pilots have a body mass index exceeding 25.5 (BMI = weight in kilograms divided by squared height in meters. "Normal body mass index" is considered to be 20-25). This subgroup had twice as many reported accidents as their slimmer colleagues. The body mass index does not correlate with age.

Embarking is a physically strenuous and hazardous operation. With increasing age the sea-pilots experience greater fatigue and their way of embarking is affected they become more slow and careful. In many operations the feeling of stress can be rather, high especially in bad weather.

Some kind of personal safety equipment, usually life jacket is used by approximately 80%. Almost all young sea-pilots are able to sleep after night-work (4.4 hours on an average). The 50% sleep sometimes, seldom or not at all after night-work.

The risk for accidents, the physical strain and the irregular working hours with the difficulties to sleep after night shifts endorses their opinion for reducing service period.

Common diseases and injuries among sea-pilots which have been determined are given below:

musculoskeletal disorders 39%
injuries .....27 %
cardiovascular diseases 14%
peptic ulcer and gastritis .....12%.

2.12 Icebreaker Ships

Before the introduction of the steam engine, trading under ice conditions was out of question. So, such navigation, other than ice-free periods of the year, became a reality in the Northern hemisphere only in the latter part of the nineteenth century.

All over in the world where shipping is hindered by ice formation, special icebreaker ships are used. Icebreaker vessel designed to make or keep open a navigable passage through ice. Icebreakers shatter the portion of the ice sheet directly ahead of them either by ramming the ice or by running up onto it and letting the weight of the ship break through the ice sheet; icebreakers are heavily built to withstand the shocks involved in these processes. Icebreakers are equipped with a heavy, usually overhanging bow, and armored sides. These ships also normally have both forward and aft propellers to provide greater maneuverability and to create suction under the ice to facilitate its breaking. Icebreakers have been used mainly to clear channels during the winter in bodies of water such as the Great Lakes and the Baltic Sea, but in recent years they have been increasingly used in exploration of the Arctic and Antarctica. The former Union of Soviet Socialist Republics employed nuclear power in at least one icebreaker used in Arctic waters. Besides localized operations, such as on Dutch canals, there are three major areas where icebreaking techniques have been specially developed, all of them situated in the northern hemisphere. In the southern hemisphere only Argentina engages in sea traffic in icy condition.

The three areas are Alaska and Canada in North America and the Russia , particularly the passage between Northern Europe and Eastern Asia, where ice can be broken only by super- icebreakers of around 7500 hp, mostly nuclear powered and finally the Baltic, bordered by Sweden, Finland and Russia.

The first ship intended for icebreaking was the 'City Ice Boat' a 51-metre long wooden paddle boat build for operations on the Delaware River in 1837.

In Europe, the steamer Pilot is regarded as the first icebreaker. She was converted in 1870 for the Russians, to secure the link between Kronstadt, Saint Petersburg (Leningrad) and the open sea.
SS *Manhattan* was converted into an icebreaker and became the first commercial ship to travel from the Atlantic Ocean to northern Alaska via the frozen Northwest Passage.

During the extremely severe winter of 1871, the Russian government ordered the first specially designed icebreaker. By the end of the nineteenth century, most of the major ports in far Northern Europe were provided with ice-breakers.

One of the largest, in 1898, was the Russian 8,800-ton SS Yermak (9500 IPK), which could break ice four metres thick. Another well-known one was the SS Krassin (10000 IPK), which rescued the crews of several wrecked ships and the airship Italia.

Russia (Soviet Union) has successfully built and put into operation a fleet of nuclear powered icebreakers, starting with the Lenin, commissioned in 1959. With her 44,000 SHP, the Lenin was superior to any conventionally powered icebreaker, for two main reasons. Firstly she would maintain a constant predetermined displacement, owing to the fact that the vessel would not have to carry large amounts of fuel oil, normally to be consumed with resulting reduced displacement and changing icebreaking properties.

Secondly, for all practical purposes, the nuclear powered icebreaker has an unlimited sailing independence. It has been claimed that Lenin could circumnavigate the world 7-10 times without refueling. Further, Lenin could proceed through ice of 2 metres thickness at a continuous speed of about 3 knots. The later Soviet nuclear icebreakers were larger and more powerful than Lenin, with displacements up to 23,500 tons and 75,000 SHP.

The first nuclear powered merchant ship, the United States Savannah, was launched on 21 July 1959 and put into service on 01 May 1962. The Federal Republic of Germany put their nuclear powered merchant ship Otto Hahn into operation in October 1968 and in November the same year, the keel of the first Japanese nuclear ship, the Mutsu, was laid at the Ishikawajima Harima Heavy Industries in Tokyo.

The purpose of reinforcing the ship against ice is not only to withstand ice during trading. All sailors harbour the fear of being jammed in the ice without an icebreaker nearby, especially when strong wind creates high pressure on the ice. Many ships have been seriously damaged in such situations and ice piling on to the main deck is quite common.

In fact, it is easy to understand why bulbous bows make ice navigation more difficult. The ice needs to be split vertically by the weight of the ship, so that the stem should have at least a 30-degree rake.

A special feature of traffic through ice in the Baltic is short towing. When the ice is very thick, or wind pressure closes the open channel immediately behind the icebreaker, the ship is attached to the icebreaker by a special winch. The bow of the ship is pulled inside a structure containing a wedge shaped opening, at the stem of the icebreaker. Ship strengthened against ice should be fitted with special short-tow bollards on the forecastle, so that the icebreaker and following ship can proceed as a single unit.

Another special feature of icegoing ships is the huge searchlight, used during the long winter nights, to find the way among the ice flows, when the ship is sailing alone.

A particular hazard at low temperatures and in heavy weather, on seas that are not ice covered, is the formation of ice on deck, caused by spray. Sometimes, the ship's stability can even be jeopardized and she may have to slow down.

When a ship is stuck in the ice and no icebreaker is available promptly, ice strengthening of her structure becomes a vital factor. Pressure can be so strong that the ice flows will push right on to the deck. Serious damage has been reported to steel plating and ships have even been lost in such situations.

R.Zomerdijk (1989), during the voyage through the ice, inspected several parts of the ship. The noise in the forward part was unbelievable, though ice strengthening meant that the ice caused no damage. In the aft part, the screw could be heard striking fragments of ice. Curiously enough, a controllable pitch screw suffers no more damage than a fixed blade propeller, perhaps even less.

Disorders Related with the Extreme-cold Weather:

Antarctica has no native population. Its residents are scientific and support staffs who usually stay no more than a year at a time. Antarctica is more than 95 percent ice covered and contains about 70 percent of the world's fresh water. Because of its thick ice cover, it is the highest of all continents.
Antarctica is the coldest continent. The lowest temperature ever recorded anywhere on earth, -89.2° C (-128.6° F), was on July 21, 1983, at Vostok Station. The continent is also buffeted by heavy winds. In the interior, winds as high as 320 km/h (200 mph) have been recorded. These winds flow downslope from the interior toward the coast and, combined with the low temperatures, create dangerous wind-chill conditions.

Three basic climatic regions can be distinguished in Antarctica. The interior is characterized by extreme cold and light snowfall; the coastal areas are characterized by somewhat milder temperatures and much higher precipitation rates; and the Antarctic Peninsula is characterized by a warmer and wetter climate, with above-freezing temperatures common.

Seafaring is a international activity and working of seafarer in the extreme-cold weather exposes him to harmful effects of temperature below freezing point, ultraviolet radiation by spending a great deal of time while working in snow:

1. Effects due to reflection of ultraviolet rays from bright snow causing like inflammation of the skin, conjunctivitis, keratitis.

2. Effects due to extreme cold weather with a temperature below freezing points causing dry skin, hypothermia, frostbite, sore throat, flu, pneumonia, asthma, joint pain.

According to Cruise report of United States Coast Guard Operation Deep Freeze, cold–weather-related disorders while working on Icebreakers at Antarctica were not so significant due to very thorough pre-deployment preparations both by the Coast Guard and embarked science parties, spirit of cooperation among crew, working relationship and safety briefing given to the crew (see table). For every voyages new order were placed for Ultraviolet protective sunglasses.

A bear watchstander spent extended period of time on the ice in bright conditions. During this times, he wore his own Ultraviolet protective sunglasses which turned out to be rated allergic conjunctivitis ,a condition the watch stander had

experienced before. Symptoms slowly became more intense over several days with three to five hours of light exposure to Ultraviolet light. A safety briefing given emphasized the most sever consequences of corneal and retinal damage from Ultraviolet light exposure.

Safety briefings for crewmen exposed to high Ultraviolet light conditions including describing the entire range from temporary blind spots to permanent blindness. The risk of injury is similar to solar skin injury, that is to say that total time exposed and intensity of light are directly correlated. Ultra violet protection extends the time of protection but does not fully eliminate the exposure.

An example briefing note:
If on a brightly lit day on the ice, an unprotected crew man could work for 5 minutes without significance injury; then he could work for 50 minutes wearing 90% Ultraviolet protective lenses. He could work for 100 minutes wearing 95% and 500 minutes wearing 99% Ultraviolet protective lenses.

Bright sun = 2 times the light of Cloudy Bright
= 4 times the light of Over cast
= 8 times the light of Dark Overcast

These correction factors would seem safe guidelines to estimate safe exposure times over the range of light conditions.

S. No.	Year	Name of Ship	ENT	Respiratory Disorders			Neuro-psychiatric disorders		
			Throat Infections	Mediastinal Emphysema	Pneumonia	Pleurisy	Fatigue	Adjustment Disorder	Depression/ Anxiety
1	1994	Polar Sea	2		2		1	1	
2	1984	Polar Sea							
3	1992	Polar Star							
4	1992	Polar Sea							
5	1996	Polar Star							
6	1997	Polar Sea							
7	1995	Polar Star							5
8	1995	Polar Sea	2						
9	1983	Westwind				1			
10	1988	Polar Star							
11	1986	Polar star							
12	1989	Polar Sea							
13	1993	Polar Sea	1	1					
14	1996	Polar Sea							
15	1993	Polar Star							
16	1991	Polar Sea							
		Total	5	1	2	1	1	1	5

S. No.	Year	Name of Ship	DVT	Jelly Fish Stings	Ha
1	1994	Polar Sea			
2	1984	Polar Sea			
3	1992	Polar Star			
4	1992	Polar Sea		8	
5	1996	Polar Star			
6	1997	Polar Sea			
7	1995	Polar Star	1		
8	1995	Polar Sea			
9	1983	Westwind			
10	1988	Polar Star			
11	1986	Polar star			
12	1989	Polar Sea			
13	1993	Polar Sea			
14	1996	Polar Sea			
15	1993	Polar Star			
16	1991	Polar Sea			
		Total	1	8	