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Establishing of fire fighting centre : Coast Guard Institute, Saudi Arabia

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" Establishing of Fire Fighting Centre Coast Guard Institute, Saudi Arabia"

BY

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(DECLARATION)

I certify that all material in this dissertation which is not my own work has been identified and that no material is included for which a degree has been previously conferred upon me.

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

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IN THE NAME OF ALLAH

THE BENEFICENT, THE MERCIFUL

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and

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who always encouraged me

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ABSTRACT

Fire has proved to be worst and very old enemy of persons and property on board ships and to understand and be prepared to combat this monster successfully - if an occasion arises - need of Fire Fighting Centres have been realized by all nations, from very early times.

The aim of this paper is to explore the possibilities and provide the basic and initial guidelines for establishing a modern Fire Fighting Centre under the supervision of Saudi Arabia Coast Guard, to train the necessary personnel in the field of fire fighting.

The paper begins by outlining the geography and history of Saudi Arabia in the first chapter.

Chapter two emphasizes the need and importance of such fire fighting centre in the country. In chapter three and four, the requirements - such as the equipment, qualification and number of instructors and trainees is discussed. Also mentioned is fire and its nature and hazards are given to prepare and understand the means and ways of fighting the fire.

Chapter five deals with the duration and control of the courses - ie Basic and Advanced Courses in line with IMO,s suggested Model Courses.

The final chapter is devoted to conclusions and proposals considered important for such a Fire Fighting Centre.

CHAPTER-1

INTRODUCTION

1.1- The Objectives of the Dissertation

Establishing a modern Fire Fighting Center to train the necessary personnel in the field of fire fighting is imperative for any Maritime Nation - and infact that is the objective of the Dissertation.

Throughout history and still nowadays fire is the worst enemy of the crew, cargo, vessels and the industry as a whole.

The primary objective of this Dissertation is to provide a comprehensive study and a guideline to the concerned Authority in Saudi Arabia for the day it undertakes to establish a Coast Guard Fire Fighting Centre.

In this work I shall mainly attempt to define and outline the detailed Syllabuses and Training Schemes for the Theoretical and Practical Training dealing with fire prevention, fire fighting and fire safety.

Furthermore I have also provided recommendations and description of the training facilities together with the necessary equipment and materials to carry out the various fire fighting exercises.

However, the financial aspect and cost involved for the establishment of such a Centre is outside the scope of this study.

The reason for embarking on this topic is to enhance the standard of maritime training in Saudi Arabia compliance with IMO, STCW Convention, and to promote the safety on board ships.

It is also believed that this work may constitute a useful tool and provide valuable information and guide-lines for any person in charge of setting up a Fire Fighting Programme in his own country.

The sources of my findings are based mainly on the experience I gained during my Naval education and training at the Pakistan Naval Academy and on board different vessels; and also fire fighting Courses attended in the World Maritime University. These are complemented by information collected from several Maritime Institutions of some advanced Maritime countries I visited during my two years stay period in the World Maritime University; Malmo Sweden and also from various Manuals dealing with Fire Fighting in general.

1-2- The Geography of Saudi Arabia

The Kingdom of Saudi Arabia (Al-Mamlakah Al-Arabiyah as - Saudiyah) has an estimated area of 865,000 square miles (2,240,000 Square Kilometers), occupying about four-fifths of the Arabian Peninsula. It is bordered by Jordan, Iraq and Kuwait on the north; by the Arabian Gulf, Qatar, the United Arab Emirates and Oman on the east; by a portion of Oman on the southeast; by Yemen on the south and southwest; and by the Red Sea and the Gulf of Aqba on the west.

The Arabian Peninsula is dominated by a plateau that rises abruptly from the Red Sea and dips gently towards the Arabian Gulf. In the north the western highlands are upward of 5000 feet (1500 metres) above sea level, decreasing slightly to 4000 feet in the vicinity of Medina and increasing southeastward to more than 10,000 feet. The watershed of the peninsula is only 25 miles (40 kilometres) from the Red Sea in the north, receding to 80 miles near the Yemen (San'a) border. The coastal plain, known as Tihamah is virtually nonexistent in the north, except for occasional Wadi deltas, and it widens slightly towards the south. Wadis flowing to the Red Sea are short and steep, though one unusually long extension is made by Wadi-al-Hamd, which rises near Madina and flows inland to the northwest for 100 miles before turning west ward.

The Interior of the Arabian Peninsula contains extensive sand surfaces, among them is the world's largest sand area, Rubál-Khali (The Empty Quarter), which dominates the southern part of the country and covers more than 250,000 square miles. A smaller sand area of about 22,000 square miles, called an-Nafud in the north central part of the country. A great arc of sand ad-Dahna, almost

900 miles long also joins an-Nafud with Rub'al-Khali. The most prominent of the ridges are the Tuwayq Mountains (Jabal Tuwayq) which rises to some 3500 feet above sea level, south west of Riyadh.

The Gulf Coast line is irregular, and the coastal waters are very shallow.

Riyadh is a capital and political and administrative city which Mecca and Medina are religious cities, and Jeddah is commercial and diplomatic city. Jeddah, Jizan and Yanbu are important ports of Saudi Arabia on the Red Sea, while Damman and Al-Jubayal are on the Arabian Gulf.

The Map of the Kingdom of Saudi Arabia.

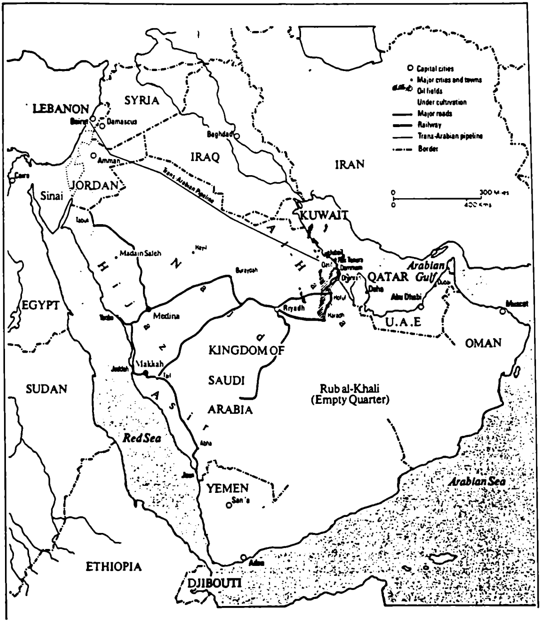


Figure The map of the Kingdom of Saudi Arabia

1.3- History of Saudi Arabia Coast Guard

The Coast Guard is a security sector and comes under the Ministry of Interior. According to the regulations specified in the decree no: 26/M dated 1974, the Coast Guard of the Kingdom is to perform the required duties with a great efficiency.

The Coast Guard of the Kingdom of Saudi Arabia was established in 1930 by the order of King Abdul Aziz Al Saud and ever since it has been involved in various security matters including the safety of the borders of the country.

Some of the important duties Coast Guard has to perform are:

(a) Supervision and control of frontiers along the coast line and at sea from smuggling and other unpermitted activities.

(b) To provide assistance in rescue operations around the coasts of the kingdom. And to provide cooperation and coordination in such matters to the Naval Units also.

(c) To do constant monitoring and checking and pass on warning immediately if any illicit and doubtful activity is noticed.

(d) Give help and assistance to people who require guidance in finding the way around the border line and territorial waters.

(e) Control of the movement and national transport in the boundaries according to the regulations.

(f) Coordinating with other Ministries according to the regulations.

With the great progress and activities in the country, the Coast Guard has to depend on developed Naval Units for the performance of the duties. The organization provides many technical jobs including the administration, and also to carry out the well being of its units.

1.3.1- An overview of the Coast Guard Institute:

In accordance with developing plans of the Marine Units in the Coast Guard along the coastal areas of Saudi Arabia, the establishment of the Coast Guard Naval Institute originated in 1973.

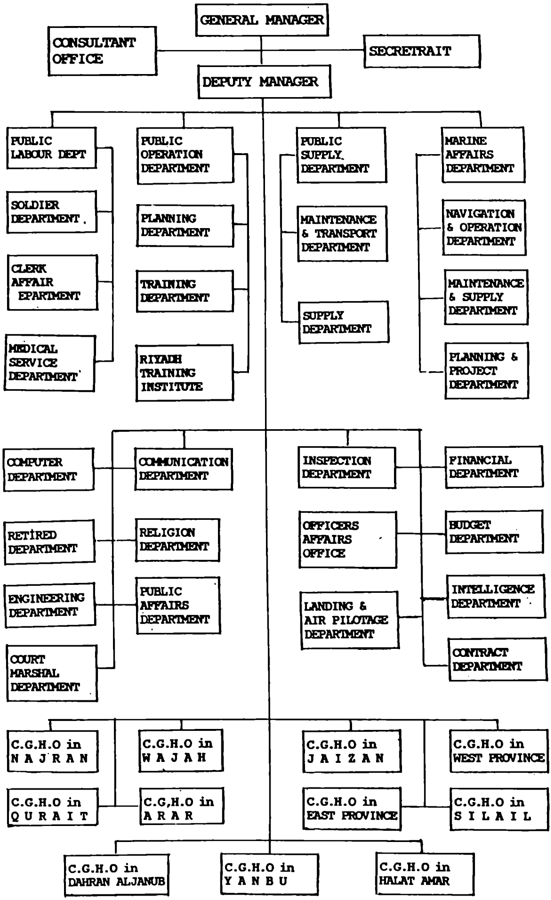
At the early years of the Institute, it was required to carry out on job training for Coast Guard officers, as an approach to gain more proficiency. This idea was further developed at later stage, specifically in 1981, to enable the institute to enhance greater qualities among the new officers, and to withstand the progressive requirements of the country. The first group of students joined the institute was in 1982.

The qualification process is under continuation, and up to now the institute has achieved the following:

(i) 183 officers passed the border security courses.
(ii) 39 officers passed the watch keeping courses.
(iii) 830 sailors qualified in different technical and marine sectors of the coast guard.
(iv) 1710 various cadres carried out studies/training to satisfy most of Coast Guard requirements.

The institute's infrastructure has been supported and enhanced by different expertise.

THE STRUCTURE OF THE COAST GUARD ORGANIZATION



CHAPTER-2

FIRE FIGHTING CENTRE IN SAUDI ARABIA

2.1- The Need of Fire Fighting Centre in Saudi Arabian Coast Guard Naval Institute

The Coast Guard Naval Institute of the Kingdom of Saudi Arabia is one of the prestigious institutes of the country which trains officers to protect the borders and coastal territories of the Kingdom from the illicit activities such as smuggling etc and to safeguard its nationals and provide safety and security.

Believing in the saying that prevention is better than cure the Kingdom maintains the high standards of prevention and safety in all matters - including cargo handling in ports and running the ships. And there has hardly occurred an incident of destruction of cargo or crew due to fire during last two three decades.

If we see the world records, fire on board is one of the major hazards which causes loss of human life and loss of property and productivity. Compared to persons ashore who have available the immediate assistance of well-trained fire fighting professionals, mariners are alone aboard ship. So when a fire occurs at sea, assistance is far away and the crew must cope with the problem.

These efforts, often because of lack of knowledge, training and experience, have often produced less than satisfactory results and at times have resulted in tragedy.

As a result of more advanced technology being employed on ships these days, mariners must acquire more knowledge in many special areas including fire prevention, control and extinguishing.

That is the main reason why the maritime nations small or large train their seafarers - officers as well as the seamen for facing such incidents - if they occur inspite of the utmost prevention. Some countries, even developing ones - such as Malaysia, Singapore, India, Pakistan have opened their own such centers to train concerned people of ports and ships at home instead of sending them abroad which costs not only great amount of foreign exchange but also precious time.

For the training of the nationals of the country there is a need of such Fire Fighting Centre in the Saudi Arabian Coast Guard Institute - which has various facilities of training in different fields of maritime nature.

By starting the Fire Fighting Centre in the Coast Guard Naval Institute great number of Saudi nationals can be trained in important fire fighting courses such as (a) Basic Fire Fighting Course and (b) The Advanced Fire Fighting Course - both approved and suggested by an International Maritime Organization IMO.

As mentioned above Saudi Arabian ports and shipping are considered highly safe from such incidents like fire. However, inspite of changes effected and regulations promulgated over the years by the government agencies such as Coast Guard/Maritime Administration, which have greatly reduced the ever-present danger of fire aboard vessels, fire tragedies can continue to occur.

Therefore, it must be the seafarer's responsibility to be as well-trained as possible and to understand the causes of fire through Basic and Advanced Fire Fighting Courses so as best to prevent them, and eventually to extinguish a fire if it occurs. Training of Seafarers is the most effective way to decrease the number of incidents due to fire on board and to increase safety.

2.2- The Importance of Fire Fighting Centre

The story of Noah's Ark is well-known and the design and construction well documented (from a numerical description rather than a set of scale drawings), being built to ensure continuity of man's existence at a time when the world was engulfed by flood. Since that time there has been much progress in ship design and construction methods.

As long as men go down to the sea there will always remain the possibility of dangers unseen and unknown; such a possibility has always been accepted by the seafarer.

The sinking of Danish vessel "Norway" in 1904 due to shipwreck, in which 629 people died due to inadequate life saving equipment or due to fire on Scandinavian Star in 1990 in which 158 people died. Or sinking of other many ships due to faulty navigation or substandard machinery, lack of fire fighting equipment or lack of knowledge & training of using it - caused great miseries & tragedies in many homes in the past. There was nothing to blame the owners, but there was practically no legislation in those days as to safety on board.

Seafaring has always been a hazardous occupation and accepted as such by all who choose to face the challenge. Life at sea in earlier times, particularly in sailing ships, created a very tough breed of seamen capable of withstanding extreme conditions. The seafarers of today are not called upon to suffer the same degree of hardship, and shipboard conditions are much improved, although it is still evident that 'living with the sea' brings out many indefinable qualities.

Safety is purely relative & in every walk of life there is an element of risk. It is still true that 'only fools do not fear the fire'. Anyone who goes to sea is exposed to a degree of risk.

Today, the International Maritime Organization, a specialized agency of the United Nations with its Headquarters in London, is concerned solely with maritime affairs, in particular the promotion of safety of life at sea.

The International Convention for the Safety of Life at Sea, known as the SOLAS Convention (SOLAS 1974 being the current legislation), sets out minimum safety standards to be met on ships on an international voyages and belonging to Member States.

Enforcement of these standards depends upon the Government of member Parties whose duty is to ensure that a ship shall not sail until it can proceed to sea without danger to passengers or crew. Member States write their own rules based on the SOLAS Convention, which means they meet the minimum standards; in many cases the national regulations achieve an even higher safety standards[1].

It must always be remembered that safety grows with knowledge and understanding and the highest standards will be possible only through raising crew training standards on a global level, which is the aim of IMO's International Convention of Standards of Training & Certification which came in force in April 1984.

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[1] Domestic regulations do not necessarily follow SOLAS, and do not necessarily require a higher Safety Standard than SOLAS. In many maritime countries, the Domestic Maritime Safety Standards are much older than SOLAS. In the USA, for example, some of the domestic maritime safety Standards date back to the 1920's and 1930's

Each year fires cost a huge amount not only in death and personal injury but also in property losses, insurance premiums and loss of productivity.

In the shipping industry fires & explosions on board constitute the major part of marine casualties which on the whole cause the highest rate of death compared to other industries.

Throughout the history mariners have gone to sea in all types of water craft & more often with very limited protection against the threat of shipboard fires.

In the event of fire persons ashore often have available immediate assistance of well-trained fire fighting professionals. Mariners are alone on board ship and when fires occur at sea they must remain on board and cope with these incidents to the best of their own abilities and facilities available.

These efforts, often because of shortage of equipment and mainly because of the lack of knowledge, training and experience, have produced less than satisfactory results. At times even tragedy.

The technological advancement in ship design, construction & operation, together with the various new specialized vessels and the transport of the increasing amount of hazardous materials of all types, make it imperative for today's mariner to possess much more knowledge than his predecessors, in many special areas - fire prevention, control and extinguishment.

Even though Government Agencies and Maritime Administrations have over the years effected changes and promulgated Regulations that have greatly reduced the ever-present danger of fire aboard vessels, fire tragedies have continued to occur. It therefore must be mariner's responsibility to be as much well trained as possible and to understand the causes of fires so as best to prevent this from the outset. Furthermore, mariners must have a good working knowledge of the approaches that will best restrict the spread of fire and eventually to extinguish them.

And keeping all these things in mind, the importance of training and hence of Fire Fighting Centre in a country can not be denied.

2.3- The STCW 1978 Convention Requirement

Among the various areas of knowledge required for the certification of any deck/engine officer is the fire safety on board.

The Convection states that every candidate should have adequate experience or undergone appropriate training in the field of fire prevention and fire fighting appliances. This includes:

- the ability to organize fire drills
- the knowledge of classes and chemistry of fire
- the knowledge of fire fighting systems
- attendance of an approved fire fighting course.

It also states that every rating forming part of a navigational watch on a sea-going vessel should be familiar with the basic principles of fire fighting. These fire fighting courses are necessary to instill an appreciation of the danger of fire in ships - the main cause of such fires, the measure to be taken for the prevention of fire and the means which may be employed in fire fighting and fire extinguishing.

The value of this courses has been recognized by IMO and the courses will become compulsory for all countries under the STCW Convention which entered into force on 28th April 1984.

Due consideration given to the above, IMO assembly adopted the resolution A:437 (xi) on "Training of crews in fire fighting" on 13th November 1979. It recommends that each member government should aim at training all its seafarers in fire prevention and fire fighting to an extent appropriate to their functions on board ship and to this end the following:

(a) All seafarers should be instructed in the danger of fire in ships and the ways in which fires are caused.
(b) Training in the prevention and extinction of fires should be given as soon as possible in the career of every seafarer preferably in pre-sea courses.
(c) Masters, officers and as far as practicable other key personnel who may also have to control fire fighting operations should have advanced training in techniques for fighting fire with particular emphasis on organization, tactics and command.
(d) Specialized additional training in fire fighting should be provided to masters, officers and ratings of oil, chemical and liquefied gas tankers in accordance with resolution 10, 11 and 12 of STCW.
(e) Where training in fire fighting is not included in the qualifications for other certificates, consideration should be given to the issue of specialized certificates indicating that the holder has attended a specified course on training in fire fighting.
(f) In drawing up the syllabus for the different courses competent authorities should take into account the theoretical and practical elements described in the annexes of the resolution.

Some countries have understood earlier the importance of such training and therefore have gained long experience and obtained noticeable results in the reduction of fire casualties.

In conclusion it is firmly believed that the most effective way of increasing safety in general is to devote more of the available resources to crew education and training. This can be achieved by giving due consideration to the high standards of Fire Fighting Centre where the theoretical as well as practical knowledge regarding fire and of fighting it can be imparted in a most proper way. And it is understood that the Government of Saudi Arabia appreciates the necessity to establish adequate training facilities in order to provide its seafarers with an approved and complete fire fighting course.

2.4- Statistics of Ships' Casualties with particular emphasis on those caused by Fires[2]

It is impossible to formulate statistical tables which do not combine the two subjects of fire and explosion under a single heading.

So, from the statistical records of total losses due to fire and explosion recorded during the period of 1974 to 1984 shown in figure 1, there appears to be a cruel continuation of such incidents over many years.

In table I, "World total losses caused by fires and explosions" one can notice that over 11 years from 1960 to 1970 losses due to fire and explosion reached 35% in 1961 and 1969 and an average of 23% for the whole period.

Over the 11-year period from 1974 to 1984 the losses caused by fires and explosions reached 45% in 1977 and 1980, 47% in 1983 and averaged 36% for the whole period.

Table II, "Reports of fires and explosions; total and partial losses", indicates a number of 402 casualties in 1974 which had steadily decreased to 260 by 1984 over the intervening years.

It also shows a reduction in the number of outbreaks of fire known to be due to welding, collision and oil residue for the period from 1974 to 1984. However, there has been a substantial increase in the number of fires in machinery spaces.

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[2] Fires in Ships 1974-1984
Paper presented by K.S.Harvey, Dec:4, 1985,
The Institute of Marine Engineers.

Year	Loss ratio %	Fire loss/ Total loss %
1974	0.099 / 0.34	29.51
1975	0.060 / 0.31	19.49
1976	0.097 / 0.32	29.52
1977	0.140 / 0.31	45.14
1978	0.100 / 0.35	28.91
1979	0.174 / 0.56	31.20
1980	0.195 / 0.43	44.95
1981	0.163 / 0.39	41.74
1982	0.161 / 0.35	46.04
1983	0.154 / 0.33	47.16
1984	0.096 / 0.32	30.66

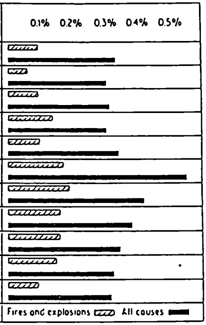

FIG. : World total losses by fires and explosions and all causes

Table I: World total losses caused by fires and explosions

Year	Loss (‰)	Year	Loss (%)
1960	12	1974	30
1961	35	1975	20
1962	12	1976	30
1963	17	1977	45
1964	23	1978	29
1965	21	1979	31
1966	30	1980	45
1967	25	1981	42
1968	23	1982	46
1969	35	1983	47
1970	25	1984	31
Average over 11 years	23		36

In Table III, "Total losses caused by fire and explosion relative to size", it appears that vessels below 6,000 gross tons show the highest number of losses.

Table IV, "Age of total losses posted as caused by fire or explosion; 500 gross tons and upwards", indicates that the greatest number of losses were recorded for vessels built between 1956 and 1965.

Table V and VI, "World total losses; 500 gross tons and upwards", provide further direct comparisons for the two periods 1960-1970 and also record the large increase in the gross tonnage lost during recent years.

In view of these statistics one can conclude, regarding Table IV, that there was a very large number of vessels built between 1956 and 1965 and maybe the material of construction at that time was a significant factor in the casualty rate.

But, generally speaking, in spite of the extensive advances made in ship design, materials, safety equipment and procedures, one can notice that total loss records due to fire and explosion are still very high.

Table VII, "Summary of lives lost by year and category of casualty" shows that from the statistical point of view, the total of 67 lives lost in 1988 was the highest for the last 8 years. Of these, 29 were lost when a ship sustained a fire and explosion and broke in two, 27 were lost when a ship broke in two and caught fire and 6 were lost due to a fire and explosion when the ship was under repair.

Table II: Reports of fires and explosions (total and partial losses)

		1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
World gross tonnage (in millions)		303.9	334.4	364.0	385.5	397.7	404.3	410.8	411.6	415.3	413.0	409.2
Total losses due to fire or explosions	No.	54	48	57	65	71	63	56	69	72	66	56
	Gross tonnage	302 677	202 673	356 160	541 858	398 939	704 632	401 446	673 717	672 310	637 340	296 855
Outbreaks discovered at sea		166	132	132	148	140	139	130	144	162	134	127
Outbreaks discovered in port:												
(i) under repair		16	18	12	14	16	24	22	22	15	20	23
(ii) not under repair		220	216	205	198	191	180	162	188	152	132	110
Totals		402	366	249	360	347	343	314	254	329	286	260
Outbreaks known to be due to	Welding	5	4	4	4	8	4	5	12	3	8	9
	Collision	7	6	1	7	—	15	6	—	1	—	—
	Oil residue	3	3	2	2	3	1	1	—	4	3	1
Locations of outbreaks include:												
Acommodation		59	44	27	23	31	25	24	30	47	25	25
Cargo spaces		64	94	85	82	72	65	62	99	58	46	52
Electrical installation		16	8	2	2	7	11	13	9	7	5	11
Funnels and uptakes		1	—	—	3	—	—	—	1	—	—	2
Galleys		5	2	3	5	6	3	4	3	1	—	3
Machinery spaces		97	103	99	125	109	118	113	108	103	112	99
Oil-burning stokeholds		18	17	8	13	13	11	5	9	8	3	1
Oil tanks		2	4	1	—	1	5	2	3	1	—	1
Stores		5	1	4	2	—	4	5	—	—	—	1
Cargoes affected include:												
Chemicals		13	11	11	9	7	10	4	6	5	5	8
Coal and coke		4	6	3	2	2	4	10	24	4	3	5
Copra		2	2	2	3	3	2	1	1	4	2	—
Cotton		24	19	10	16	8	12	8	9	5	10	3
Fishmeal		1	2	1	3	3	—	1	2	1	1	1
General		18	19	21	4	24	13	13	20	9	19	16
Grain and meal		10	7	7	4	7	2	9	15	11	12	6
Jute		7	4	8	4	3	3	3	1	—	—	—
Kernels		1	2	—	—	1	1	2	—	—	—	—
Metal and scrap		7	2	3	—	5	6	3	5	9	6	5
Oils		5	7	12	10	7	9	16	9	16	19	7
Paper		1	—	2	2	—	2	3	4	4	2	4
Seed expellers and oilcakes		1	—	5	3	—	—	2	2	3	2	1
Sisal		1	1	1	2	—	3	—	2	—	—	—
Sulphur		3	1	—	—	1	3	—	—	1	1	2
Timber		5	8	5	6	8	5	6	3	—	1	2
Wool		—	2	—	3	—	—	—	3	—	—	—

Table III: Total losses caused by fire and explosion relative to size

Tonnage	1974 No.	1974 Gross tons	1975 No.	1975 Gross tons	1976 No.	1976 Gross tons	1977 No.	1977 Gross tons	1978 No.	1978 Gross tons
500–1000	14	10 291	8	5868	10	8349	5	3894	14	10 046
1001–2000	9	12 408	12	17 254	9	13 787	10	15 543	19	25 840
2001–4000	13	40 814	10	30 224	12	35 707	15	40 557	11	34 396
4001–6000	4	18 697	5	24 165	6	28 681	8	40 339	7	35 688
6001–7000	2	12 657	2	12 366	3	18 965	3	18 881	2	13 639
7001–8000	3	22 769	3	22 780	2	14 693	3	22 779	3	22 581
8001–10 000	1	8886	3	26 997	4	33 850	5	42 460	6	54 718
10 001–15 000	5	64 000	4	47 021	7	85 009	11	128 816	2	25 504
15 001–30 000	2	39 861	1	15 998	2	39 978	1	26 650	5	105 193
30 001–50 000	—	—	—	—	2	77 141	2	80 282	2	71 334
50 001–75 000	1	72 294	—	—	—	—	2	121 657	—	—
75 001–100 000	—	—	—	—	—	—	—	—	—	—
over 100 000	—	—	—	—	—	—	—	—	—	—
Total	54	302 677	48	202 673	57	356 160	65	541 858	71	398 939

Tonnage	1979 No.	1979 Gross tons	1980 No.	1980 Gross tons	1981 No.	1981 Gross tons	1982 No.	1982 Gross tons	1983 No.	1983 Gross tons	1984 No.	1984 Gross tons
500–1000	4	3234	7	5230	8	6290	6	4911	8	6626	11	8556
1001–2000	13	19 364	10	15 266	16	25 080	11	16 872	11	15 481	11	14 888
2001–4000	20	57 414	12	36 877	9	28 009	15	46 860	9	26 506	10	29 537
4001–6000	—	—	3	14 528	5	22 814	8	39 493	6	28 482	3	14 377
6001–7000	1	6065	4	26 661	1	6139	1	6053	3	19 658	2	13 336
7001–8000	5	36 833	1	7028	2	15 009	4	30 229	2	15 547	1	7607
8001–10 000	7	61 322	4	35 212	8	72 478	10	89 832	12	110 293	4	35 850
10 001–15 000	3	35 275	5	59 828	11	136 313	9	108 542	10	118 231	8	89 479
15 001–30 000	5	104 134	4	78 288	4	103 602	3	59 965	—	—	4	82 250
30 001–50 000	2	73 782	1	33 340	3	115 468	3	121 310	4	157 694	1	33 555
50 001–75 000	1	61 766	1	50 904	2	142 515	1	59 958	—	—	1	67 420
75 001–100 000	1	91 963	1	96 228	—	—	1	88 285	—	—	—	—
over 100 000	1	153 480	3	342 056	—	—	—	—	1	138 822	—	—
Total	63	704 632	56	801 446	69	673 717	72	672 310	66	637 340	56	396 855

Table IV: Age of total losses posted as caused by fire or explosion (500 gross tons and upwards)

	1941–1945 and earlier	1946–1950	1951–1955	1956–1960	1961–1965	1966–1970	1971–1975	1976–1980	1981–1984	Total
1974	7	11	9	13	10	1	3			54
1975	3	5	13	14	5	8				48
1976	6	9	13	15	6	7	1			57
1977	4	6	20	23	9	3				65
1978	7	8	13	14	11	9	8	1		71
1979	2	7	12	20	7	11	3	1		63
1980	1	5	6	14	15	7	6	2		56
1981	1	2	8	23	16	12	6	1		69
1982	4		5	21	20	16	3	3		72
1983	3	1	2	12	25	15	4	4		66
1984	2	1	5	5	20	13	9	1		*56

Table V: World total losses (500 gross tons and upwards)

Nature of casualty	1959 No.	1959 Gross tons	1960 No.	1960 Gross tons	1961 No.	1961 Gross tons	1962 No.	1962 Gross tons
Weather damage			2	12 312			4	30 118
Founderings and abandonments	22	32 685	17	30 559	15	27 343	17	38 910
Strandings	41	135 008	61	211 422	32	162 565	68	280 732
Collisions	15	83 019	12	66 703	7	15 218	14	60 843
Contact damage	5	18 698	4	17 501	2	1345	4	23 559
Fires and explosions	13	65 503	8	50 192	20	127 300	13	60 319
Missing	2	1157	3	4670	1	535	2	9657
Damage to machinery, shafts and props	2	2000	2	21 115			2	3392
Other casualties			5	3721	1	1056		
Totals	100	338 070	114	418 195	78	355 362	124	507 530
World tonnage		121 463 414		126 246 158		132 143 280		136 030 729
Loss ratio (‰)		0.28		0.33		0.27		0.37

Nature of casualty	1963 No.	1963 Gross tons	1964 No.	1964 Gross tons	1965 No.	1965 Gross tons	1966 No.	1966 Gross tons
Weather damage	1	685	6	23 912	8	22 046	14	61 207
Founderings and abandonments	18	35 732	17	50 499	14	42 557	20	76 077
Strandings	71	266 767	47	215 302	69	312 824	52	281 362
Collisions	21	66 963	18	78 958	14	32 331	19	102 993
Contact damage	8	37 389	5	15 176	9	68 767	7	29 521
Fires and explosions	23	86 202	15	56 196	22	144 744	38	247 147
Missing	4	15 113	3	9201	3	9696		
Damage to machinery, shafts and props	1	7607	1	1645	5	21 864	1	2959
Other casualties	1	609	5	26 119	10	36 889	8	35 393
Totals	148	517 067	117	477 208	154	691 718	159	836 659
World tonnage		141 744 567		148 635 526		155 873 302		166 465 849
Loss ratio (‰)		0.36		0.32		0.44		0.50

Nature of casualty	1967 No.	1967 Gross tons	1968 No.	1968 Gross tons	1969 No.	1969 Gross tons	1970 No.	1970 Gross tons
Weather damage	8	24 470	15	59 817	12	98 222	21	138 867
Founderings and abandonments	17	39 060	9	32 327	19	72 650	23	81 208
Strandings	64	341 068	61	282 305	49	200 600	45	195 187
Collisions	16	63 997	10	54 271	21	124 365	12	39 270
Contact damage	8	9465	5	18 065	3	13 097	7	14 456
Fires and explosions	32	185 018	33	152 035	33	289 069	30	164 538
Missing	6	21 522	5	10 448			1	10 009
Damage to machinery, shafts and props			2	10 850	2	4636	2	13 423
Other casualties	12	62 234	17	54 936	8	17 101	10	51 877
Totals	163	746 834	157	675 054	147	819 740	151	708 855
World tonnage		177 249 686		188 730 467		205 781 443		221 322 771
Loss ratio (‰)		0.42		0.36		0.40		0.32

Table VI: World total losses (500 gross tons and upwards)

Nature of casualty	1973 No.	1973 Gross tons	1974 No.	1974 Gross tons	1975 No.	1975 Gross tons	1976 No.	1976 Gross tons
Weather damage	35	119 496	26	123 860	31	190 193	36	283 040
Founderings and abandonments	15	71 761	23	55 295	23	55 599	18	35 016
Strandings	36	286 744	48	279 618	53	310 009	44	268 232
Collisions	20	68 383	19	153 637	13	102 384	25	73 694
Contact damage	5	23 098	8	48 070	3	47 258	8	91 796
Fires and explosions	50	404 862	54	302 677	48	202 673	57	356 160
Missing	3	27 683	4	13 223	3	20 729	4	37 516
Damage to machinery, shafts and props	3	3892	3	31 398	2	28 486	1	1585
Other casualties	12	72 604	10	17 714	16	82 332	15	59 232
Totals	179	1 078 523	195	1 025 492	192	1 039 663	208	1 206 271
World tonnage		282 789 525		303 896 126		334 424 470		364 066 852
Loss ratio (%)		0.38		0.34		0.31		0.33

Nature of casualty	1977 No.	1977 Gross tons	1978 No.	1978 Gross tons	1979 No.	1979 Gross tons	1980 No.	1980 Gross tons
Weather damage	37	243 184	41	294 275	58	398 425	53	281 963
Founderings and abandonments	25	61 052	29	54 452	37	95 115	36	142 587
Strandings	41	188 526	52	372 799	50	254 090	35	143 902
Collisions	18	57 223	28	113 763	33	508 384	10	39 460
Contact damage	2	9720	8	23 990	5	37 214	6	25 993
Fires and explosions	65	541 858	71	398 939	63	704 632	56	801 446
Missing	2	26 047	2	10 401	3	19 471	6	168 966
Damage to machinery, shafts and props	2	6536	7	28 936	7	48 308	4	6962
Other casualties	11	66 172	22	82 140	22	192 582	22	172 564
Totals	203	1 200 318	260	1 379 695	278	2 258 221	228	1 783 843
World tonnage		385 540 268		397 738 061		404 312 794		410 792 576
Loss ratio (%)		0.31		0.35		0.56		0.43

Nature of casualty	1981 No.	1981 Gross tons	1982 No.	1982 Gross tons	1983 No.	1983 Gross tons	1984 No.	1984 Gross tons
Weather damage	50	393 329	40	247 180	43	178 014	54	256 261
Founderings and abandonments	24	92 072	22	60 761	29	100 167	32	104 249
Strandings	38	178 216	40	177 418	34	294 253	37	290 273
Collisions	30	144 695	20	59 374	11	36 773	12	61 965
Contact damage	11	33 273	7	25 033	7	29 751	7	38 214
Fires and explosions	69	673 717	72	672 310	66	637 340	56	396 855
Missing	5	10 235	1	19 505	—	—	2	16 337
Damage to machinery, shafts and props	5	39 710	8	67 139	1	12 921	8	118 629
Other casualties	16	48 952	26	131 492	18	62 291	7	11 754
Totals	248	1 614 199	236	1 460 212	209	1 351 510	215	1 294 537
World tonnage		411 635 184		415 336 602		413 050 362		409 176 177
Loss ratio (%)		0.39		0.35		0.33		0.32

Of the total of 1,029 lives lost, 829 were due to fires and explosions. Of these, 167 were lost due to fire and explosion on ships under repair, including 83 in a single casualty in 1978.

In Table VIII, in comparison with oil/chemical tankers, combination carriers and gas carriers, it appears that over the 15-year period, the casualty rates for cargo and other fire and explosion accidents in combination carriers are considerably higher than for oil/chemical tankers and gas carriers.[3]

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[3] Casualty Statistics;
International Maritime Organization (IMO),
Maritime Safety Committee 58th session,
Agenda item 15.1

TABLE VII

8 SUPPLEMENTARY ANALYSES RELATED TO SERIOUS CASUALTIES TO OIL/CHEMICAL TANKES, COMBINATION CARRIERS AND GAS CARRIERS, 1974 - 1988

8.1 Summary of lives lost by year and category of casualty

					FIRE/EXPLOSION								
YEAR	FD	WS	CT	CN	CARGO	MCHY	PUMP	OTHER	MG	HULL	MCHY	OTHER	TOTAL
1974	0	0	0	8	58	18	0	0	0	0	0	0	84
1975	1	9	6	28	78	1	0	1	0	0	0	0	124
1976	25	1	0	2	11	2	0	3	74	0	0	0	118
1977	3	0	1	2	31	33	1	0	0	0	0	0	71
1978	0	0	0	0	14	88	0	57	0	0	0	0	159
1979	11	0	0	100	74	4	2	46	0	4	0	3	244
1980	8	0	0	0	48	3	0	9	0	0	2	0	70
1981	0	0	0	0	47	9	3	2	0	0	0	0	61
1982	15	0	0	0	17	12	0	12	0	0	1	0	57
1983	0	0	0	0	18	0	0	0	0	0	0	0	18
1984	28	0	0	0	28	3	9	0	0	0	0	0	66
1985	0	0	0	3	13	2	0	13	0	0	0	0	31
1986	0	0	0	0	5	5	4	5	0	2	0	0	21
1987	0	0	0	6	3	1	1	7	0	0	0	0	18
1988	0	0	0	0	35	4	0	28	0	0	0	0	67
TOTAL	89	10	7	149	480	185	20	183	74	6	3	3	1,209

TABLE VIII

ALL YEARS (1974-1988)

OIL & CHEMICAL TANKERS	AT RISK	FD	WS	CT	CH	FIRE/EXPLOSION (FX) CARGO	MCHY	PMP	OTHER	MG	HD	MD	OTHER	TOTAL	RATE
6,000 - 14,999 (10,000 - 24,999 DWT)	11,379	5	42	17	39	16	42	1	7	0	16	47	3	235	2.07
15,000 - 29,999 (25,000 - 44,999 DWT)	14,362	6	78	33	54	25	32	4	9	2	18	74	0	335	2.33
30,000 - 79,999 (45,000 - 149,999 DWT)	12,843	1	67	31	54	31	43	5	19	0	40	66	2	359	2.80
80,000 & + (150,000 DWT & +)	7,797	1	24	8	14	16	13	1	3	0	20	45	4	149	1.91
TOTALS	46,381	13	211	89	161	88	130	11	38	2	94	232	9	1078	2.32
RATE %		0.03	0.45	0.19	0.35	0.19	0.28	0.02	0.08	0.00	0.20	0.50	0.02	2.32	

COMBINATION CARRIERS	AT RISK	FD	WS	CT	CH	FIRE/EXPLOSION (FX) CARGO	MCHY	PMP	OTHER	MG	HD	MD	OTHER	TOTAL	RATE
6,000 - 14,999 (10,000 - 24,999 DWT)	110	0	0	0	0	0	0	0	1	0	0	0	0	1	0.91
15,000 - 29,999 (25,000 - 44,999 DWT)	377	0	1	1	1	0	2	0	2	0	0	3	0	10	2.65
30,000 - 79,999 (45,000 - 149,999 DWT)	3,853	0	10	3	7	16	9	0	6	0	10	17	3	81	2.10
80,000 & + (150,000 DWT & +)	1,213	0	0	4	2	3	3	0	1	0	1	2	0	16	1.32
TOTALS	5,553	0	11	8	10	19	14	0	10	0	11	22	3	108	1.94
RATE %		0.00	0.20	0.14	0.18	0.34	0.25	0.00	0.18	0.00	0.20	0.40	0.05	1.94	

GAS CARRIERS	AT RISK	FD	WS	CT	CH	FIRE/EXPLOSION (FX) CARGO	MCHY	PMP	OTHER	MG	HD	MD	OTHER	TOTAL	RATE
6,000 - 14,999 (10,000 - 24,999 DWT)	952	0	5	0	4	0	0	0	0	0	1	4	0	14	1.64
15,000 - 29,999 (25,000 - 44,999 DWT)	457	0	0	0	0	1	1	0	1	0	1	1	0	5	1.10
30,000 - 79,999 (45,000 - 149,999 DWT)	1,092	0	3	2	2	0	1	0	0	0	0	2	0	10	0.92
80,000 & + (150,000 DWT & +)	211	0	1	0	0	0	0	0	0	0	0	1	0	2	0.95
TOTALS	2,608	0	9	2	6	1	2	0	1	0	2	8	0	31	1.19
RATE %		0.00	0.35	0.08	0.23	0.04	0.08	0.00	0.04	0.00	0.08	0.31	0.00	1.19	

CHAPTER-3

TRAINEES, TEACHING & THE SUBJECT (FIRE)

3.1- The Trainees

The primary objective of fire fighting facility is to provide a thorough training for every seafarer, rating and mainly officers in shipping, fishing and offshore industries, as required by IMO's STCW Convention. It also concerns the candidates for deck engine officers' certificates and seamen currently pursuing their training in respective institutions and for those serving already on board vessels but requiring an approved fire fighting course.

However this programme may extend and expose the Fire Department and the marine community to the same training. This will greatly increase their ability to work together on the problems of fire areas and as a result their chances of success of fires in ports would be enhanced. It is known that most of ship fires occur in port itself.

This training may also suit the land air transport personnel since the nature of their duties present some similar characteristics to those of the maritime field.

Last but not least it would be considerable interest and value to personnel of other industries and private enterprises.

A trainee successfully completing the Basic Fire Fighting Course will enable him to react in a correct manner in the event of an outbreak of fire, to take appropriate measures for the safety of personnel and of the ship, and to use the fire appliances correctly. He will also be able to state and demonstrate that he has acquired knowledge and skills which, in some instances, will enable him to identify and correct the defects and thus prevent fire from occurring.

The Fire Fighting courses may be made open to prospective seafarers and should preferably be given prior to their being employed on a sea-going ship. There are no particular education requirements. All trainees must be certified by a doctor to be in good health.

Provided that the course has been approved by the Administration, a trainee who successfully completes the Basic Fire Fighting Course may be issued with a certificate attesting that he has completed a course based on Annex 1 of resolution A.437 (XI): Training of crews in fire fighting.

The number of trainees should not exceed 16 and, subject to adequate supervision, the practical training should be undertaken in small groups of not more than four.

3.2- Teaching Facilities

Ordinary classroom facilities and an overhead projector are needed for the theoretical part of the course. When audiovisual materials such as video programs, slides and taped recordings are used, the appropriate equipment must be available. In addition, a demonstration table measuring 3m x 1m would be an advantage.

For the practical part of the course, it would be advantageous if the training facilities of a local or port fire brigades could be used. Alternatively, the following structure and equipment are required:

- (i) Building for smoke and fire drills, or a similar facility
- (ii) Facilities for recharging compressed-air bottles with spare parts for maintenance
- (iii) Room with work-bench area for inspection and maintenance
- (iv) 2 steel fire trays approximately 1mx1mx0.3m
- (v) 2 three-sided brick fire trays
- (vi) 2 fire hydrants with 2 outlets each, or similar water supply from open water and a fire pump
- (vii) A large supply of carbonaceous and hydrocarbon fuels (wood, diesel and lubricating oils, etc) for the fire tray
- (viii) 6 dummies for search and rescue procedures
- (ix) 6 fire hoses (70-mm diameter)
- (x) 3 fire hoses (45-mm diameter)
- (xi) 3 branch pipes
- (xii) 6 fire nozzles (2 standard, 2 diffuse and 2 jetspray)
- (xiii) 2 mechanical foam branches
- (xiv) 1 high-expansion foam generator and foam compound
- (xv) 2 standpipes, keys and bars to operate hydrant supply
- (xvi) 6 9-litre water extinguishers
- (xvii) 6 9-litre foam extinguishers
- (xviii) 6 5-litre kilogramme carbon-dioxide extinguishers
- (xix) 4 2.5-kilogramme halon-1211 extinguishers
- (xx) 10 10-kilogramme dry powder extinguishers
- (xxi) Refills for all types of extinguishers

(xxii) 30 sets of protective clothing, overalls, gloves, fire-boots, helmets and rainproof clothing

(xxiii) 25 sets of self-contained breathing apparatus, complete with spare cylinders, spare parts and maintenance tools (including sets for use by instructors only)

(xxiv) 25 distress signal units (DSVs) for attachment to breathing apparatus sets

(xxv) Smoke generator

(xxvi) Smoke helmets with air pump

(xxvii) A shower at the site

(xxviii) 1 stretcher

(xxix) 1 first aid kit

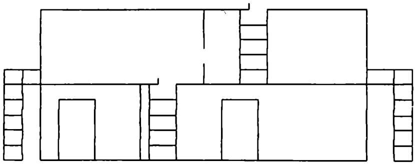
(xxx) 1 resuscitation kit with oxygen/suction unit

(xxxi) 2 sets of fire-protective clothing

(xxxii) 2 helmets with visor and neck protector

(xxxiii) 2 fire axes

(xxxiv) 2 36-metre safety lines with snap hooks



The figure shows the building for smoke and fire drill

The building can easily be constructed by placing two steel containers one on top of the other, arranged as shown in the illustration above. Each container should measure approximately 7m x 3m x 2m. The different rooms should be designed as follows:

1 a cabin
2 corridor/open room
3 electric board room
4 engine room with grating floor

Every room in the building must be readily accessible from the outside as a safety precaution. In addition, there should be access between rooms 1 and 2 by manhole, between 2 and 4 by manhole & vertical ladder, and between 3 and 4

The location of this building and the area for fire-fighting drills should preferably be adjacent to the lecture room, toilet and shower facilities. There should be no restrictions concerning smoke emissions in the area.

3.3- Teaching Aids/Equipment

(i) Instructor's Manual
(ii) Cross-section or cross-sectional drawings of different types of fire extinguishers and nozzles
(iii) International ship-to-shore fire-hose connection
(iv) Demonstration set or drawing of self-contained breathing apparatus
(v) Optional Audiovisual Aids
Cassettes or films. Some of the films recommended
- Fire Below
- Fire Prevention

- Basic Fire Fighting
- Command and Control, Part I
- Command and Control, Part II

Available from: Videotel Marine International Ltd.
Ramilies House
1/2 Ramilies House
London W1V 1DF.

Textbooks

T1 Bo, Olav. Basic Safety Course: Fire Safety. Oslo: Norwegian University Press, 1987. (ISBN 82 00 43093 6.)

B1 Rushbrook, F. Fire Aboard. Glasgow: Brown, Son and Ferguson Ltd., 1979. (ISBN 0 85174 331 5.)

3.4- Safety precautions

Throughout the course, safe working practices are to be clearly defined and emphasized with reference to current international requirements and regulations.

It is expected that the national institution implementing the course will insert references to national requirements and regulations as necessary.

Safety precautions during drills are a major component in the organization of this course. Course trainees must be protected from danger at all times while the course is in progress.

Instructors and their assistants must supervise strictly and act as safety guards. When necessary, the staff should wear complete breathing apparatus and carry portable fire extinguishers so that they can assist trainees when required. Other safety precautions include an extra fire hose nozzle, a shower near to the site, first aid equipment and an oxygen unit and resuscitation kit.

3.5- Importance of Fire Fighting Training[1]

From early times up to the 19th Century, the design of ships, their safety and that of the cargo and crew were matters entirely in the hands of the owners.

With the volume of trade growing and with increased emigration, the demand for bigger and faster ships grew and it was not surprising that in this race, cargo carrying capacity took precedence over the safety of both ship and crew.

By the early 19th Century, World shipping was in a desperate state, the number of ships and men being lost reaching unprecedented proportions. The Navigation Laws, under whose protectionist policy the British and its colonies, merchant fleet had operated, were also repealed in 1849 and it was becoming obvious that Government intervention in some form was necessary if the country was to retain its position as one of the great seafaring nations.

It was against this background that the Mercantile Marine Act of 1850 was introduced which established a

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[1] G.Victory and T.H.Owe - Fire Fighting Equipment and its use in ships.

Marine Department at the Board of Trade. In the following year, the Steam Navigation Act of 1851 was enacted, this marking the beginning of Government involvement in the safety and seaworthiness of ships. The monumental Shipping Act of 1894, still on the statute book and known in shipping circles as the Principal Act, was a milestone in maritime legislation and from it all present legislation stems. In 1949 the Safety Convention Act gave the Government powers to prepare rules in respect of, inter alia, fire appliances and resulted in the promulgation of the Merchant Shipping (Fire Appliances) Rules 1952. As a result of the international conference on Safety of Life at Sea held under the auspices of the Intergovernmental Maritime Consultative Organization in 1960, usually referred to as IMCO, these rules were superseded in due course by the Merchant Shipping (Fire Appliances) Rules 1965. These last named rules detail the arrangements and equipment necessary for fire detection, prevention and extinction, which must, by law, be provided on ships today; any ambitious marine engineer is advised to be aware of their existence, if not of their detailed contents.

3.6- Some important topics of teaching

3.6.1- The character of fire

Fire is an external sign of chemical action, usually the combination of carbon and hydrogen with oxygen, resulting in the release of heat energy. Only gas can be ignited. To start the action it is necessary either to apply a flame or a spark having a certain minimum energy value to a substance which has been raised to a temperature sufficient to release flammable vapours conducive to the continuation of the action; or else the raise the substance to its auto-ignition temperature or temperature, where spontaneous combustion of the liberated gases occurs. Once started, the heat energy released is available to raise a greater amount of the substance to the temperature of combustion, so the amount of gases liberated and of burning material increases and the fire spreads ever more rapidly. If the temperature is near that of self-ignition, little energy is required to cause combustion, and fires will appear to break out at points some distance from the main fire at a bewildering speed. Given a good start and plenty of combustible material, most fires are eventually limited only by the rate at which air can get to the burning material. There are limits to the air/fuel ratio at which different substances will burn, and limitation of air will cause long tongues of flame to reach out searching for the air required. Incomplete combustion can result in the formation of pockets of gas which may explode if sufficient air becomes available, whilst heated hydrocarbons, if lacking air, will decompose and form the sooty and tarry particles characteristic of thick, black smoke.

There are three requirements covering the propagation of practically all fires:

1) a combustible material;
2) a supply of oxygen usually in the form of air;
3) a source of heat or ignition.

Similarly, there are three basic ways of fighting a fire:

1) by removing the combustible material;
2) by preventing the supply of oxygen;
3) by using a cooling medium to reduce the temperature

of the material to a point where combustion ceases.

Most successful fire fighting techniques use a combination of two or all of these methods, though any one will subdue a fire.

The combustible materials commonly found on ships fall into two groups:

a) solid materials such as wood, paper, coal and cloth;

b) liquid materials, mainly fuel and lubricating oil.

For fires involving solid materials, water jet cooling or inert gas smothering are usually applied with the emphasis on cooling, whilst for fires involving liquid fuels cooling by water spray and smothering by either inert gas or a foam blanket are all possibilities.

The techniques in fighting fires involving explosives and the multiplicity of dangerous goods and chemicals now being transported by sea in bulk as well as in packages, is too specialized a subject to be dealt with here.[2]

3.6.2- Fighting Fires - Basic Steps

a)- Detection and Speed

Early detection of a fire is of prime importance if successful fire fighting is to be accomplished. If a fire is detected while still in the incipient state and if the

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[2]Further information may be found in the publication "Recommended Code for the Construction and Equipment of Ships Carrying Dangerous Liquid Chemicals in Bulk", issued by the Marine Division of the Department of Trade and Industry and in the "Carriage of Dangerous Goods in Ships", second edition 1971, as amended September 1972, issued by H.M. Stationery Office.

fire can be quickly reached with the proper fire-fighting agent and equipment, there would be little trouble in its extinguishment. Serious fires are often the result of small fires which have not been detected or acted upon quickly and which, reaching dangerous proportions, overpower and overtax the ability of personnel and available equipment.

'Speed' is essence of fire and likewise the all important requisite of fire fighting. With an understanding of information previously presented in this manual explaining what fire is and describing fire fighting agents and equipment, the fire fighter is prepared to review the methods and techniques for its actual control and extinguishment. With little or no experience in fire fighting, he knows in a general way what his task is and he is familiar with the tools and what he can accomplish with them. It remains then for him to apply his knowledge to problems confronting him on shipboard.

The basic steps in successful fire fighting are:

1. Locate fire and give alarm.
2. Get fire under control.
3. Extinguish fire.

After sounding the alarm, the fire fighter must quickly determine the following:

1. Where the fire is.
2. What is burning.
3. What is the extent of the fire.
4. What combustibles are in the immediate vicinity- in all surrounding spaces and in the compartments above and below.
5. What vents and other channels are present that would facilitate the spread of the fire.

6. What method of extinguishment is indicated.
7. What is the best technique to prevent the spread of the fire and to extinguish it.

b)- Line of Action

Having learned where the fire is, the fire fighter determines what is burning and how extensive the fire is. In small or incipient fires he would proceed to extinguish without taking extensive measures to keep the fire from spreading, as such measures probably would not be necessary. For the purpose of this chapter, the supposition will be that the fire fighter has to deal with fires that have progressed beyond the incipient stage.

Upon learning where the fire is, what is burning, and the extent of the fire, a fire area is established. Within those boundaries, tanks, hatches and ports are closed. Ullage hole covers, Butterworth plates, tank tops, ventilation ducts, and all other vents not already closed are closed and secured throughout the vessel. Electrical circuits in the vicinity of the fire should be de-energized.

If handling cargo, bunkers or ballast, or if tank cleaning, all operations shall be terminated, valves closed and hose disconnected.

Insofar as practicable fires should be attacked from the windward side. By so doing, wind will carry flames with smoke and fumes away from the fire fighter and at the same time carry the extinguishing agent into the fire. This practice can be of immeasurable assistance, as fires are very likely to get out of control unless the fire fighter can get close enough to use the agents and equipment properly.

3.6.3- Extinguishing fires

a)-Getting Fire Under Control

Getting the fire under control means limiting its size and intensity, as by successfully confining it to a single compartment or group of compartments. Control is often accomplished by removing or wetting down adjacent combustibles to prevent their involvement. The fire fighter has all but conquered a fire at the moment he has confined it within the boundaries of an area he can take care of with the means available and has stopped its further devèlopment.

While the work of preventing the spread of fire is underway, the work of extinguishing is not neglected. The two are undertaken simultaneously and they are equally important. The experienced fire fighter would probably say that confining a fire within bounds is the more important of the two. He would consider that a fire so confined is definitely under control. His main problem would then be to put the fire out. The selection of the method of extinguishment is by far the most important decision which must be made by the fire fighter using his knowledge and experience as well as the devices available to him for shipboard fire fighting.

b)-Fighting "Class A" Fires

"Class A" fires in bedding, clothing, wood, canvas, rope, paper, etc., are dealt with by cooling the fire to below its ignition temperature. All "class A" fires leave embers which are likely to rekindle when air finds its way under them. Hence the entire mass must be cooled thoroughly. For this purpose, water is the most effective extinguishing agent. If this were not done and the burning embers below the surface of the combustibles were left uncooled, the smoldering fire would raise the temperature of the matter to the ignition point and the fire would break out again. Smothering with steam, CO_2 or dry chemical is not effective in completely extinguishing "class A" fires, except in tightly sealed spaces, such as cargo holds, protected by fixed systems. However, in an emergency when any of these agents are more readily available than water, any one or more may be used to smother the surface and retard the propagation of the flame.

High and/or low velocity water fog may be used in the initial stages of the fire to get it under control. The fog will also serve a useful purpose in shielding the fire fighter from the heat, and to a limited extent in dispersing fumes and smoke. The solid water stream should always be used for final extinguishment and, if of sufficient pressure, will assist in pulling the burning or smoldering combustibles apart. In all "class A" fires it is essential that the combustibles be pulled apart to make certain that the extinguishing agent, water, can penetrate and thoroughly saturate all parts of the materials, even though the fire is apparently extinguished.

"Class A" fires are most often attacked from within a compartment. In this situation, if the fire fighter has to enter a hatch or has to advance more than a few paces within a compartment, he should be equipped with a life line, and self-contained breathing apparatus. His purpose would be to locate the fire and get close enough to direct the steam and to insure thorough wetting of the burning materials.

On the modern oil tanker the greatest hazard presented by a "class A" fires is the possibility of its spreading to the vessel's cargo or, if in ballast and not gas free, to the explosive vapors in the tanks. Therefore, in putting hose lines into action against the fire, the fighter considers first the direction in which the greatest exposure or hazard lies. If he can do so, he begins operations between the fire and this hazard. From this point first and then from others, water is directed on the fire. When the fire has been extinguished, the fire fighter should stand by to watch for rekindling.

c)-Fighting "Class B" Fires

"Class B" fires are those in flammable liquids such as alcohol, paint, turpentine, grease and all petroleum products where a smothering or blanketing method of extinguishment is essential to cut off the supply of air (oxygen). The extinguishing agents recommended are water, fog, steam, foam, carbon dioxide and dry chemicals. The particular agent or combination of agents will depend in each case on the nature and location of the fire.

When it is said that "class B" fires are those in combustibles that do not leave embers, it should not be concluded that these fires cannot be rekindled. When burning petroleum or other liquid has been extinguished, it may rekindle because of heat radiated from the vessel's structure or other object or from fire in the vicinity. To avoid rekindling under these conditions, a barrier such as foam, steam or water fog must be maintained between the liquid surfaces and the radiating heat.

"Class B" combustibles release vapors on the surface and, as in the case of all fires, it is the vapor air mixture that burns when the temperature of an object is raised to its "ignition temperature". The fire then is all on the surface an when the supply of air is cut off, the fire goes out. It may be that while fire is burning over the surface, only a shallow layer of the combustible is heated to its ignition temperature. In fact, the rate of heat penetration in fuel oil is slow. Fuel oil burning for 10 to 12 minutes may have only an inch deep layer of oil heated to its ignition temperature. The longer a fire burns, the deeper the heated layer of oil will be, with corresponding increased intensity of fire. The problem of extinguishing a fire of this type is aggravated to a considerable degree the longer it burns. The answer is control and extinguishment in the early stage of the fire.

3.6.4- Fires at various places

i)-Fire in Cargo or Bunker Tank

To extinguish a fire in a cargo or bunker tank, an attempt should first be made to completely shut off the supply of air (oxygen). This may be accomplished by closing the tank tops, ullage hole covers, Butterworth plates and any other tank opening. In the case of a ruptured tank, thoroughly wetted canvas, bedding or similar material should be used to plug the opening if it is not too large. If this can be done, the foam system (or, in the case of vessels so equipped, the fixed carbon dioxide (CO_2) or steam smothering systems) should be used. If steam smothering is used, valves on branch lines leading to pump rooms, cofferdams or tanks not on fire and which are not adjacent to such tanks, which are on fire, should then be closed. Water in the form of a solid stream or high and/or low-velocity water fog should then be used to cool the surrounding decks, bulkheads and other structural members. All "class A" combustibles (wood, bedding, stores, rope, etc.) and "class B" combustibles (paint, turpentine, grease and petroleum products) in containers in the vicinity should be removed to a safe distance if possible or, if not possible, thoroughly wet down and shielded from the fire.

If the supply of air cannot be shut off from the fire by closing tank openings, or if the tank is ruptured, foam (special foam must be used for alcohol or other products that mix with water) should be directed into the tank. For this purpose, either the "pick-up" unit or fixed foam system may be used to blanket the burning surface.

Foam supplied on "class B" fires forms a stout smothering blanket, the thickness of which is determined by the character and the temperature of the oil beneath it. Oil burning for some time may be heated throughout. When this stage is reached, the foam has a greater tendency to break down and a larger quantity of foam must be applied. In this case, water fog may first be applied sparingly to cool the liquid and when the surface is cooled sufficiently, foam may be applied.

Foam serves exclusively as an extinguishing agent. It affords little protection to the fire fighter against the heat and fumes of the fire and it is not effective for cooling the hot structure of the vessel even after the fire has been extinguished. High-or low-velocity water fog should be used for these purposes.

High-or low-velocity water fog is effective for extinguishing high flash point oils by cooling them below their flash point or causing the quick formation of steam, which will drive the oxygen away from the combustion area. On low flash point oils, water fog must completely cover the burning surface and dilute the vapor-air-mixture sufficiently to extinguish the fire. In both cases, water fog will slow combustion and absorb radiant heat.

On "class B" fires, steam acts in a manner similar to those of water fog but with very much less cooling effect; also, if injected in an open or ruptured tank, it may escape through the opening(s) to such an extent that it interferes with the fire fighters. It will, however, act as a smothering agent by displacing the oxygen of the air that is required for combustion.

It is accordingly recommended that as a first choice, water fog, or as a second choice, steam, be used in conduction with foam whenever practicable. Water fog, however, should not be applied simultaneously with or on the foam, particularly if working at close range, as it will tend to dilute and disintegrate the foam blanket.

ii)-Fire in Pump-room

In view of the fact that most fires in the pump-room occur in the bilges or at pump level, it is difficult for fire fighters to approach the fire. if the fire is small or in its incipient stage, the portable foam, dry chemical or carbon dioxide (CO_2) extinguishers can be used effectively. Fires in the lower pump-room may also be extinguished by lowering from the main deck level one (1) or more hose fitted with "all-purpose" nozzles and high-velocity fog tips. When available, "fog-foam" nozzles with "foam shaper" or "screen assembly" attached, used in conduction with a fixed foam system, may be used in the same manner. If, however, the intensity of the fire prevents close approach, the pump-room should be sealed by tightly closing all openings and shutting down the mechanical ventilation system. On ships fitted only with steam smothering, the system should be turned on and the valves on branch lines leading to cofferdams or tanks not on fire and that are not adjacent to the pump-room should then be closed.

On ships so fitted, the fixed carbon dioxide, water fog or foam system should be discharged. Steam, if available, should discharged in adjacent tanks and cofferdams.

Regardless of the extinguishing agent used, all tank openings throughout the vessel should be closed as quickly as possible and high and/or low-velocity water fog (or monitors if fitted) should be used to cool the surrounding decks, bulkheads, and other structural members.

iii)-Fire on Deck

Such fires may result from cargo overflow, bursting hose or leaking pipeline. The first action should be to shut off the supply of fuel if possible. Foam, if available, should then be applied, using preferably the deck foam system or the "pick-up" unit if no deck foam system is installed. In such fires it is extremely important that the foam stream be played against a nearby vertical structure of the vessel: this will cause the foam to run down the structure and spread evenly over the fire. Foam can also be "bounced" off the deck ahead of the flowing fuel to splash gently over the fire. A foam stream played directly on the burning oil would cause it to scatter over the deck or dock, thus spreading the fire.

Foam is not effective on flowing liquids as the movement of the liquid prevents its forming a blanket. Therefore, if the supply of the fuel cannot be shut off and it is burning at its source, some other extinguishing agent must be used to extinguish the burning stream. For this purpose, portable carbon dioxide (CO_2) or dry chemical extinguishers or water fog are effective when applied directly on the burning fuel as it emerges from the opening. Foam should be sprayed ahead of the flowing fuel to form a dam and thereby prevent the spreading of the fire.

High-and/or low-velocity water fog should be used to augment the foam and to cool the surrounding structure of the vessel and to protect the fire fighters using the foam, thereby permitting them to approach closer to the fire. However, the water fog should be used in such a manner so as not to affect the firmness of the foam blanket or dam.

All tank openings throughout the vessel and the pump rooms should be closed as quickly as possible.

iv)-Fire in Machinery Spaces

To extinguish a fire of this type, an attempt should first be made to extinguish it by means of the portable foam, dry chemicals, or carbon dioxide (CO_2) extinguishers or form 'pick-up' unit (or fixed foam system) or water fog, depending on the location and type of fire. The fixed carbon dioxide system should be used only as a last recourse when all other means of extinguishment have failed.

As carbon dioxide will support neither life nor combustion, before operating the fixed system, all personnel must leave spaces to which the system is connected; the boiler fires must be extinguished and the auxiliaries stopped. Also, to prevent the loss of the carbon dioxide, the ventilation system should be shut down and all openings into the spaces closed. Except in an emergency, spaces that have been flooded with carbon dioxide should not be opened for at least 10 minutes (preferably much longer) after flooding. This a precautionary measure to allow burning substances time to cool down below their ignition temperatures and thereby prevent their re-ignition upon the admission of fresh air (oxygen).

Regardless of the type of extinguishing agent or equipment employed, water fog should be used when necessary to protect the fire fighters and to cool the hot structure of the vessel.

v)-Bilge Fires

Since it is difficult to gain access to this type of fire, low-velocity water fog should be used with an applicator in conduction with foam applied as described under Fire on Deck.

vi)-Spill Fires on Floor Plates

As this type of fire is usually due to a ruptured fuel line or leaking connection to burner, the source of the supply should first be shut off. The fire can then usually be extinguished with a portable foam, dry chemical, or carbon dioxide (CO_2) extinguisher or, if necessary, water fog. In this case, low-velocity is more effective and is recommended over high-velocity fog.

Small or incipient fires in the fire room can often be extinguished with a portable extinguisher or sand, if available, spread with the scoop provided.

vii)-Burning Oil on Water Surrounding Vessel

The most effective manner of fighting a fire of this type is to apply foam as described under Fire on Deck. If possible, the foam stream should be directed against or as close as possible to the side of the vessel. This will cause the foam to flow outboard over the surface of the burning oil in an even blanket.

In the event sufficient foam is not available, solid streams of water should be directed at the edges of the burning oil, thus setting up a surface current which may carry the oil clear of the vessel.

When applying foam and/or water as described above, wind and current conditions must be taken into account. If the wind is blowing in the same direction as the current is flowing, the application should be to windward and above the oil. If, however, the wind is blowing opposite to the flow of the current, the application will depend on which is the stronger. The object is to apply the foam and/or water so that it flows down on the oil carrying it away from the vessel.

Preparations should be made to get underway; if advisable, the vessel should steam clear of the burning oil.

d)-Fighting "Class C" Fires

"Class C" fires are those in electrical equipment that may be caused by short circuits, over-heating, or the spreading of "class A" or "class B" fires. When equipment so involved cannot be de-energized, the danger of electrical shock and short circuiting must be guarded against. Pure distilled water is not a conductor of electricity; fresh water usually is because it contains minerals. The conductivity of sea water is many times greater than that of fresh water.

In view of the above, a solid stream of water must never be used to extinguish fires in electrical equipment that is energized. The hazard is reduced, but not entirely removed, when water is applied with the high-velocity fog tip on the "all purpose" nozzle and further reduced when applied with the low velocity fog head on the "applicator." Therefore, in so far as practicable, electrical circuits should be de-energized before any extinguishing agent is applied.

The portable carbon dioxide (CO_2) extinguisher is usually the most readily available extinguishing agent and is recommended as first choice as it is a nonconductor of electricity, offers protection to the fire fighter against electric shock and is less likely to damage equipment.

The 50-, 75-, or 100-pound carbon dioxide (CO_2) cylinders connected to semi-portable extinguishers, where installed should be used when required. However, the fixed system protecting the machinery spaces should only be used as a last recourse, when all other means of extinguishment have failed.

Dry chemical, if available, is an excellent extinguishing agent. However, it may have more adverse after effects than carbon dioxide as it leaves a residue.

On "class C" fires (electrical apparatus) when the equipment is de-energized and when neither carbon dioxide nor dry chemical is available, water fog or foam may be used.

However, fires of escaping liquefied flammable gas should generally be extinguished only by stopping the flow of gas. At the same time water spray should be used to cool surrounding material while shut off efforts are underway. Extinguishing a large LPG or LNG fire and permitting the gas to continue flowing can be dangerous in that a flammable mixture may be formed in the air - the ignition of which may cause far greater damage than if the original fire had been allowed to burn.

Flames from small leaks may be extinguished by utilizing carbon dioxide or dry chemical extinguishers, provided so doing permits closing valves to stop the flow of gas. Newer vessels are outfitted with semi-portable dry chemical extinguishers of 500 or 1000 pounds capacity which are effective in dealing with fires of moderate size.

If fire is adjacent to an LPG container, but no gas is escaping, immediate steps should be taken to keep the container cool, thus diminishing the possibility of a buildup of pressure, or the container should be removed immediately from the fire area if this is possible.

CHAPTER-4

REQUIREMENT FOR THE IMPLEMENTATION

For the course to run smoothly and to be effective, considerable attention must be paid to the availability and use of:

- properly qualified instructors;
- support staff;
- rooms and other spaces;
- equipment;
- text books, technical papers; and
- other reference material.

Besides the above things which are discussed here in various chapters under different headings, one of the most important thing worth mentioning here is the "Fire Center".

The marine environment is the most dangerous arena for a fire. More often than not external help for such fires is difficult if not impossible to get. The normal mode of fighting fire ashore does not apply easily to the marine fire. This is because of stability problems that are due to water accumulation (free surface). Add to this the unique accessibility problems found aboard and the difficulty encountered when retreating to a save haven. Due to self sufficiency in power supply and at times the cargo being carried, liquid fuels are in abundance aboard, increasing the fire risk and making water which is in abundance in the marine field unusable for the fighting of this kind of fire.

Special training is therefore required to equip the mariner to deal with fires without external help. He must also be trained not to compound a fire problem with a stability one. This training can be effectively undertaken in a well set-out fire training center in the maritime training facility. One should not rule out the possibility of utilizing the national or local fire training facility if it is in close proximity to the maritime training facility. Modification (mostly additions) will of course be needed to make the alternative meet the maritime's special needs.

In the maritime training facility, the fire center should be situated where there are no restrictions on emissions (especially of smoke and gases). A minimum of two hundred metres is recommended to separate this cluster from any of the other clusters. The wind direction should be given due consideration to prevent carrying the combustion products to other parts of this learning institution. The fire center cluster will preferably be near the water, sea, lake, river or lagoon to enable the center to have access to a copious supply of water. Fresh water supply is rather advisable unless special care will be taken of the steel equipment to prevent rusting and salt water corrosion.

The fire cluster should consist of two blocks. The first is the main block containing the lecture room, office and equipment cluster. The second block is the "ship" which would be used for most of the smoke and fire exercises. Thirty to forty metres should separate these two blocks. In-between and around these two blocks, some of the fire training equipment which need not be indoors may be sited.

The main block will house a classroom which should seat at least largest class in the institution (say twenty-five). Student stations should have chairs and tables as in the normal lecture rooms in the lecture room cluster. Overhead, slide and movie projectors should also be provided together with video recorder/player and a television set. The instructor's table must have at least two square metres of top area to accommodate realia which is being shown or demonstrated with. Samples of devices should be on display in the lecture room. These samples will preferably be sectioned, and include sensors, sprinkler heads, international shore connection, portable extinguishers, gas detection metres and a demonstration set for low and high explosive limits.

A changing room with lockers is essential. The changing room should be about two-thirds the size of the high and large enough to seat the class. A shower room should adjoin the changing room. There should be one shower per six students in a class i.e. four showers for a class of twenty-five and one for the instructors. Where arrangements are such that trainees can go for showers in their hostel without inconvenience, the showers may be dispensed with. For toilet facilities, three sets of w.c. bowls should be installed.

The main block may also house a demonstration room. This demonstration room should contain the "ship" model to a twentieth scale. It should be sectioned and have the possibility for removing stacks deck by deck. This will aid briefing, planning and debriefing of an exercise in the "ship". Different gases and liquids with their matching measuring instruments should be stored here and used for calibration exercises. A zero point nine metre (0.9m) high table should be provided for this. The table should have enough top space for half of the class at zero point five square metres (0.5m) per student.

Extinguishing chemical mixing, testing and reactions could be demonstrated here. A sink with taps should be installed.

Carbon dioxide engine room flooding systems are scarcely operated on board except during the two yearly inspections or when there is fire. When it comes to operating them in an emergency (where there is a big fire, which in itself is rare), problems arise despite the detailed posted instructions. A one metre by one metre and zero point seven metre high (1m * 1m * 0.7m) engine room model with doors and sky lights, carbon dioxide piping and bottles can be arranged in this room to give students a miniature hands on experience. This engine room flooding system will contain pilot and main cylinders, isolating valves with all the accompanying wires and pulleys as found on board. All equipment in this model should be sized to match and real fires (not simulated) can be set in it just as real fires will be used in all exercises in the fire center.

The various detection systems should have working models in the center. Thermal, smoke (optical and ionization), flame and fragile bulbs should all be installed. Fire fighting media such as the halons, foam and dry powder should also have samples here. This room can also be used for re-charging exercises of the foam, dry powder and water portable extinguishers. Measuring jars, weighing scales and sinks should then be installed.

Another room of special interest is the equipment room. This will be a sort of store house. Lockers should be provided for cotton gloves, gauntlets, firemen's coats, helmets, oil skins, hoods and boots. Complete sets of breathing apparatus (at least each of one thousand two hundred litre capacity free air or the most widely used capacity in the local maritime field) and low air level alarms should also be stored here. An oil-free air compressor for refilling air bottles is a must. The location of this compressor must take air purity into consideration together with filtering devices. There should be enough breathing apparatus sets with at least twenty-five percent spare. Air bottles should have over fifty percent spare. Air bottles should have over fifty percent spare in addition to the air compressor to enable changing bottles whilst exercises are in progress.

Fire proof life lines (at least thirty-six metres each), safety harnesses, axes and safety flash lights should all be stored here. This equipment room should be at least twice the size of a lecture room but it must have a very high ceiling (at least five metres inside height) for air circulation.

Spaces for storing portable extinguishers should also be provided here. Nine litre water and foam extinguishers, five kilogramme carbon dioxide, two to three kilogramme halon 1211, ten kilogramme dry powder extinguishers, smoke generators, seventy and forty-five millimetre diameter hoses and their nozzles may all be stored here for the various exercises.

The "ship" block will very likely be constructed of steel. Where steel is too expensive, fire resistant bricks may be used. There should be enough doors on this block to allow immediate evacuation of all persons in an emergency. These emergency doors should not be more than five metres apart on each floor. Windows should also abound so that smoke can also be evacuated in the shortest some doors and windows will be designated "unmovable" parts of the bulkheads.

There should be a minimum of five decks in the "ship" structure. The first deck (ground floor) should have a total floor area not less than twenty metres by thirteen metres. This deck will comprise an engine room with a workshop area containing engine dummies, a dummy tunnel with shaft and a door with closing possibility. A manhole in an engine room bulkhead should lead into the ′tween deck of a hatch. A fuel tank also with a manhole should be located here. Portable extinguishers befitting the fire expected in the locality should be sited all over the engine room or as an exercise might demand.

On the second deck, the engine room trunking should house a dummy electrical switch board, a dummy boiler and some gratings in the deck. Two sets of stairs should lead from the engine room first deck to this second deck.

Tanks and trays for setting fires should be provided. A door from the engine trunking should lead to eight or so cabins also on this deck. Half of the cabins in this ship structure should have a bed, settee and wardrobe each. The others should be equipped with a table and a chair each. A bathroom and lavatory should also be provided on this deck.

The third deck should still have an engine trunking, office, dining saloon, pantry, galley and three or four more cabins. Each space must be furnished (in steel) as appropriate e.g. range in galley, tables and chairs in dining saloon.

The fourth deck is going to have the hatch covers, limiting the enclosed structure to about twelve by ten metres. In the open air on this deck may be mounted dummy winches and windlasses. On the engine room casing may be sited a fan room. On the fore end of this deck telegraph, chart table and possibly air sampling (with carbon dioxide flooding) dummies will all be found. A radio room should adjoin the wheel house by a communicating door.

The fifth deck should just be about six metres by seven metres (on top of the wheel house) with a funnel sticking out.

All decks should be connected with two sets of stairs on the outside. These are to be staggered just as found on board ship. There should also be an internal flight of stairs. The shaft tunnel should have a vertical escape tunnel and ladder which may terminate on the third deck. The whole ship structure should not be less than ten metres high. Apart from the first deck, all decks should have scuppers equipped with plugs. A ten centimetre high coaming should then be provided on these decks to draw trainees' attention to the fact that water should be drained off during fire fighting to prevent instability.

The accommodation in the "ship" should be fitted with a working sprinkler system with different temperature bulbs for demonstration. No electrical wiring should be installed in the "ship" for safety reasons. If any are fitted, there should be no means for making them live. This will safeguard against electrocution. There should be at least two fire hydrants on each of the first three decks and one each on the other decks. They will be advantageously located at the entrances to the spaces which they are to protect. Each hydrant should have a valve for turning on and off the water, a hose and a nozzle. It will be advantageous to have nozzles that can give a spray of up to four and a half metre diameter at a distance of two metres from the nozzle end to form a shield. They should also embody regulating/shutoff valves and be capable of throwing a jet of twelve metres minimum when the flow rate is twenty-six tonnes of water per hour. A pump (or water main) capable of delivering at least three and a half kilogramme per centimetre squared pressure at two hydrants (fitted with nineteen millimetre bore nozzles) should be installed. Isolation valves and an international shore connection may be fitted for practice. Where pump is installed in addition to the water supply mains from outside the fire center, the pump facility may be used as the emergency fire pump. Each hose should be at least sixteen metres in length which will give trainees the feel of real sizes and orientation.

Breathing apparatus exercises will be needed by the trainees to give them the feel of climbing from the lowest hold or engine room deck to the bridge of a modern vessel or offshore structure. A hill of at least thirty metre height nearby should be adequate for this breathing apparatus exercises. In lieu of this, a flight of stairs with landing every three metres height should be constructed to about thirty metres high. Where intensive exercises are being undertaken (which is not very likely), a belt of lead weights may be provided to be worn on the waist to simulate tiredness or a load being carried.

At least six dummies (of human beings) will be needed for smoke rescue exercises. These should have weights commensurate with humans - forty to eighty kilogrammes each will do. Two stretchers, a first aid kit (including burns treatment materials) and a resuscitation kit with oxygen/suction unit should be provided for the first aid post in the fire center.

In the open air, outside the two blocks mentioned above, should be provided a gas network of twenty-five millimetre diameter pipes in two branches, each having a length of three metres. The pipes should be perforated in different places and at angles to give a blaze of gas fire for practicing gas fire fighting. A nine metre diameter concrete platform with a maximum holding depth of ten expansion foam set. This will mean a high expansion foam generator, two mechanical foam branches and foam compound.

Steel trays, each fifty centimetres off the ground should be provided for halon, foam and carbon dioxide portable extinguisher training. Two of the trays may be two metre diameter each and the third a metre square. They should each have a zero point three metres of depth. Three sets of brick fire "trays" should also be built in the open air. They should be adjacent to each other and closed on three sides. These brick trays may be a metre by two each with the walls rising a metre and a half high. Theses trays will be used for "metallic/electrical" fire practice.

Fire hydrants located near these out of doors equipment will help trainees combine water spray shielding with approaching conflagrations.

This setup should hopefully meet the marine fire training demand of the maritime training facility. It is of utmost importance to stress that the planning and the execution of the fire training programme should be meticulously undertaken if the full import of the training is to be gained.

4.1- THE REQUIRED EQUIPMENT

4.1.1-Equipment and Protection of Personnel

A- Elementary Working Outfit - (20 sets):

- Under-wear, cotton or woolen socks
- Linen overall
- Non-skid shoes, or
- Pair of rubber boots
- Helmet

B- Fireman's Outfit - (20 sets):

- The above-mentioned outfit generally used against classical hazards (fire, water, etc) must be completed by the following:
- A set of jacket, pants, impermeable to water, permeable to air and not ignitable
- Plastic hard helmet (electrically insulated up to 440V) with a mining fitting
- Anti-flash plastic goggles withstanding temperature up to 100 degrees C
- A pair of PVC gloves with internal lining (electrically insulated up to 440V)
- Cotton or woolen gloves
- Fireman's belt
- White cotton hood for face protection
- Lifeline for investigation and intervention
- Mining lamp (watertight and explosion proof)
- Flash light (watertight and explosion proof)
- Hose connection spanner
- Breathing apparatus (Fancy type with an autonomy of 1 hour whatever the physical constitution of the bearer).

C- Approach or Proximity Suit

A Proximity Suit consists of:

- Jumper-type pants that cover the legs and upper part of the body including the arms
- A hood (with a transparent heat-reflecting vision shield) that covers the entire head, shoulders and upper part of the body
- Heavy gloves with sleeves not less than 15 cm in length
- Special covering for the feet.

The outer surface of the suit is covered with a highly reflective material (the suit reflects as much as 90% of the radiant heat).

When properly donned the proximity suit encases the wearer in a heat-resistant envelope. It may be used to approach close to a fire but it is not designed to protect the wearer during direct contact with the flames. The suit must be completely in incombustible fabric and adjustable to fit all wearers. A self-contained breathing apparatus must be worn under the proximity suit, otherwise the intense heat near the fire can damage the wearer's respiratory tract.

D-Entry Suit - (2 sets):

The entry suit will protect the wearer from direct contact with flames up to a temperature of 815^0 C during at least 90 seconds.

It may be used to enter flames for rescue, to close a fuel valve and for similar emergency tasks. However the wearer cannot linger in the flames. He must move in, do what is necessary and move out rather quickly.

The suit will not provide unlimited protection against flames.

The entry suit consists of:

- Boots
- Trousers
- Coat
- Hood

Each of these is constructed of nine (9) layers of fiberglass insulating material separated by aluminized heat-reflecting glass fabric. The outermost layer is aluminized fiberglass. The vision shield is of a special heat reflecting material and is sealed into the hood. Drawstrings and snap buttons on the suit provide an airtight seal around the wearer. The hood is attached to the coat with straps when the suit is donned so that it cannot be accidentally removed. An air pack (demand type breathing apparatus is worn under the entry suit).

E- Underwater Investigation Equipment - (6 sets):

The personnel having the task of sub-sea work, or intervention in the water, should be protected by a suitable suit against hypothermia effects and accidental wounds. (Suits in Neoprene).

F- Miscellaneous Equipment - (5 sets):

- Electrical equipment handling:
  * 100000V electrically insulated gloves

* Insulated handle tools
* Individual insulated blanket.

Clearing operations: For the handling of hot metallic pieces, sharp and shredded:

Leather gloves with asbestos lining
Leather gloves with asbestos lining and re-enforced internally by a coat of mail.

G- Personal Protection of the Instructors:

The continuous contact of instructors with an atmosphere contaminated by smoke and toxic gases, and the deficiency in oxygen, necessitate special protection in order to avoid accidents.

During smoke diving fire fighters perform a strenuous exercise and are exposed to a substantial heat load. Due to the risk of over-exertion it has been suggested that fire fighters (instructors) should regularly pass a health check. In addition to this health check they are required to carry while exercising:

- Light mask in fabric sponge, easy to clean
- Anti-dust respirator protecting the mouth and nose.

They must consist of cartridges easy to clean or change.

H- Explosinmeters and Gas Indicators - (3 sets):

Flame Safety Lamp

The flame safety lamp is a device that is used to detect oxygen deficiencies in confined spaces. The lamp uses naphtha as fuel for its flame. Changes in the flame size and its brightness indicate the relative amount of oxygen in the atmosphere being tested.

This lamp will be used for the exercise of familiarization with fire without a breathing apparatus.

Oxygen Indicator

The oxygen indicator is an instrument that measures the amount of oxygen in the atmosphere of a confined space. The percentage of oxygen in the sample is indicated by the meter needle.

Explosimeter or Combustible Gas Indicator

The combustible gas indicator detects and registers concentrations of dangerous gases in the air in confined spaces and possible gas leakages. This device is similar in appearance to the oxygen indicator.

Hydrogen Sulphide and Carbon Dioxide Indicators

These indicators are used to detect toxic gases in the compartments before entry. The toxic gases are harmful to inhale or to the skin even at low ppm levels.

The permissible amount of toxic gas per cubic metre of air is indicated in ppm or mg/m^3. The alarm is set to react long before the gas content has reached the safety limit.

4.1.2 Necessary Equipment for the Centre

A- Equipment for the protection of the building and the Trainees:

- 2 portable fire pumps
- 5 hoses of 20 metres
- 2 Y-connections of 40 mm
- 5 hose connection spanners
- 5 nozzles (straight stream fog stream)
- 2 fog applicators (12 mm in diameter)
- 2 pike head fire axes
- 1 foam cannon with 5 cans of 25 litres.

B- Equipment for the Trainee

- 4 hoses of 20 metres
- 2 nozzles (straight and fog stream)
- 1 fog applicator (12 mm)
- 1 foam cannon with 4 cans of 25 litres

4.1.3 Necessary Equipment for Damage Control Compartment

A- Piping repairs

- Rubber, strings, steel or yellow brass wire
- Metallic collars with bolts
- Hooping apparatus
- Plastic material plaster and thersetting resin

B- Hull repairs

- Batardeaus: Wood
- Rapid hardening cement
- Slow setting cement
- Oxy-gas cutting (welding workshop)
- Arc and oxyacetylene welding

- Use of a gudgeon planting gun

C- Holes repairs
- Collision material
- Obturating plate (wood)
- Sealing plug with base plate (wood)
- Rivetted or bolted patches
- Double sealing plug (wood)
- Folding place (wood)
- Plate for cracks
- Wood for prop
- Hydraulic jacks for prop

D- Mobile Stripping Equipment
- 2 non-submersible electro-pumps
- 2 submersible electro-pumps
- 2 educators 30 m^3/h (SAJ type)
- 4 bend-pipes (type C.E.Ps) with connections (Accessories for Educators).

E- Diving Equipment
- 6 complete wet suits with air bottles
- 6 "Narghile" apparatus (air hose with sufficient length)
- 1 Air compressor for filling the bottles and the supply air for the air hoses

F- Necessary Equipment for the Open Field Facility

The open field will be protected by a fire-main identical to the one used in the enclosed structure.

Ten (10) hydrants will be required to carry out the different exercises with hose lines.

The appliances necessary for the training and the protection of the Trainees will consist of:

- 15 hoses of 20 metres with connections
- 15 nozzles
- 4 fog applicators
- 4 foam cannons and 40 cans of emulsion product
- 30 CO_2 extinguishers
- 30 fog stream water extinguishers
- 30 foam extinguishers
- 2 mobile foam extinguisher (136 litres)

G- Fire Detection Equipment

A contact with a specialised manufacturer is preferable, for the supply of the different components with the possibility of training personnel for maintenance and repairs.

4.2- THE QUALIFICATION AND NUMBER OF INSTRUCTORS.

The shortage of qualified instructors and teaching staff is one of the major difficulties faced by developing countries. However, if there are any, they generally either lack a consistent theoretical knowledge, or sufficient practical experience.

In my opinion it will be of great assistance for a new Training Centre to keep a close co-operation with the Fire Department (Fire Brigade) of the city. They can provide the Institution with valuable help by appointing qualified instructors to carry out the practical side of the training. They may also provide advice and recommendations concerning the technical aspect such as construction of the actual facilities, the acquisition of the necessary equipment and their maintenance.

As far as the theoretical courses are concerned they may be given by the Maritime Institute Teaching Staff. This may include teachers in Chemistry or Maritime Safety.

This solution may be continued until qualified instructors possessing both the theoretical and practical knowledge and experience are available or trained.

CHAPTER-5

DURATION AND CONTENTS OF THE COURSES:

Since its inception the International Maritime Organization has recognized the importance of human resources to the development of the maritime industry and has given the highest priority to assisting developing countries in enhancing their maritime training capabilities through the provision or improvement of maritime training facilities at national and regional levels. IMO has also responded to the needs of developing countries for postgraduate training for senior personnel in administration, ports, shipping companies and maritime training institutes by establishing the World Maritime University in Malmo, Sweden, in 1983. [1]

Following the earlier adoption of the International Conventions on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, a number of IMO Member Governments had suggested that IMO should develop model training courses to assist in the implementation of the Convention and in achieving a more rapid transfer of information and skills regarding new developments in maritime technology. IMO training advisers and consultants also subsequently determined from their visits to training establishments in developing countries that the provision of model courses could help instructors improve the quality of their existing courses and enhance their effectiveness in meeting the requirements of the

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[1] FOREWORD C.P.S RIVASTAVA

Convention and implementing the associated Conference and IMO Assembly resolutions.

In addition, it was appreciated that a comprehensive set of short model courses in various fields of maritime training would supplement the instruction provided by maritime academies and allow administrators and technical specialists already employed in maritime administrations, ports and shipping companies to improve their knowledge and skills in certain specialized fields. IMO has therefore developed the current series of model courses in response to these generally identified needs and with the generous assistance of Norway.

These model courses are used by the training institutions all over the world and the Organization is prepared to assist developing countries in implementing any course when the requisite financing is available.

5.1-Purpose & Use of Model Courses

The purpose of the IMO model courses is to assist maritime training institutes and their teaching staff in organizing and introducing new training courses, or in enhancing, updating or supplementing existing training material where the quality and effectiveness of the training courses may thereby be improved.

It is not the intention of the model course programme to present instructors with a rigid "teaching package" which they are expected to "follow blindly". Nor is the intention to substitute audiovisual or "programmed" material for the instructor's presence. As in all training endeavors, the knowledge, skills and dedication of the instructor are they key components in the transfer of knowledge and skills to those being trained through IMO course material.

Because educational systems and the cultural backgrounds of trainees in maritime subjects vary considerably from country to country, the model course material has been designed to identify the basic entry requirements and trainee target group for each course in universally applicable terms, and to specify clearly the technical content and levels of knowledge and skill necessary to meet the technical intent of IMO conventions and related recommendations.

To use the model course the instructor should review the course plan and detailed syllabus, taking into account the information provided under the entry standards specified in the course framework. The actual level of knowledge and skills and prior technical education of the trainees should be kept in mind during this review, and any areas within the detailed syllabus which may cause difficulties because of differences between the actual trainee entry level and that assumed by the course designer should be identified. To compensate for such differences, the instructor is expected to delete from the course, or reduce the emphasis on, items dealing with knowledge or skills already attained by the trainees. He should also identify any academic knowledge, skills or technical training which they may not have acquired.

By analysing the detailed syllabus and the academic knowledge required to allow training in the technical area to proceed, the instructor can design an appropriate pre-entry course or, alternatively, insert the elements of academic knowledge required to support the technical training elements concerned at appropriate points within the technical course.

5.2- Selection of Courses

The fire fighting training concerns the candidates for deck and engine officers' certificates and seamen as required by the "STCW" convention.

To meet the requirement it is necessary that the Fire Fighting Center should conduct the various courses to train the sea-farers and shore based personnels.

By using the basic information of IMO short courses jointly with the information acquired during studies as a WMU student, I would like to suggest the following main fire fighting courses:

1) Basic Fire Fighting course designed for first year cadets, first year port officers trainees, deck and engine ratings;

2) Advanced Fire Fighting upgrading course for senior officers.

These two courses namely: the basic fire fighting course and the advanced fire fighting upgrading course will be used also as refresher courses.

They should enable the trainees not only to renew their fire fighting certificates, but also they should provide them with the acquisition of new knowledge and skills, and as a result improve the safety standards and efficiency on the job.

5.3- Objectives of Courses

If the principal objective of the fire fighting courses is to provide a thorough training for every seafarer and particularly for officers aboard ships as required by the STCW Convention, two other kinds of objectives can be expected with the establishment of fire fighting center.

Regarding the basic fire fighting course designed for first year cadets, first year port officers trainees and ratings, the main objective will be to provide them with a comprehensive basic knowledge of fire prevention, detection and fighting and enough information that will allow them to realize the dangers caused by fires on board ships, to prevent and detect them and to handle the adequate fire fighting equipment in case of need.

Besides that the training facilities may be of such a nature that they can be capable of understanding and learning the theoretical and technical aspects of fire fighting and fire safety such as ship construction, fire chemistry and fire prevention.

This course will give essential principles to the trainees so that they should have no difficulty in applying them to any kind of fire.

Concerning the advanced fire fighting upgrading course it will provide the trainees with additional theoretical and practical background in fire fighting in order to help them to organise and direct fire operations and to be able to train the personnel aboard their ships.

My aim in establishing these courses at the proposed fire fighting center in my country is:

i) to allow the Government to spend less foreign exchange on training sea-farers abroad,

ii) to save valuable time of students seeking admissions in different countries,

iii) to make the training more uniform in nature and raise its standard according to national requirements and law.

Due to the advanced technology being employed on ships these days, seafarers on board are called upon to assume more responsible roles. As a result, again, this calls for extra training, ie refresher courses - which can be implemented accordingly.

5.1-Basic Fire Fighting Course

Day one:

1st period: Introduction, Safety and Principles,
Theory of Fire

2nd period: Theory of Fire (contd)
Fire Prevention

3rd period: Fire Prevention (contd)
Fire Detection

4th period: Fixed Fire-extinguishing Systems

Day Two:

1st period: Fixed Fire-extinguishing Systems
(cont)
Miscellaneous Fire-Fighting Equipment

2nd period: Miscellaneous Fires-Fighting Equipment
(contd)
Ship Fire-fighting Organization

3rd period: Fire-fighting Methods

4th period: Fire-fighting Drills

Day Three:

1st period: Fire-fighting Drills

2nd period: Fire-Fighting Drills
(contd)

3rd period: Review and Final Assessment

4th period: Review and Final Assessment
(contd).

Note: Each period of one and half hour, with 5 minutes break after half time.

5.4.1- Course outline

Subject Area

1. Introduction, Safety and Principles

2. Theory of Fire

    2.1 Conditions for fires
    2.2 Properties of flammable materials
    2.3 Fire hazard and spread of fire
    2.4 Classification of fires and appropriate extinguishing agents

3. Fire Prevention

    3.1 Fire prevention principles
    3.2 Ship construction arrangements
    3.3 Safe practices

4. Fire Detection

    4.1 Fire and smoke detection systems

4.2 Automatic fire alarm

5. Fixed Fire-extinguishing Systems

5.1 General
5.2 Smothering effect systems: carbon dioxide (CO2), foams
5.3 Inhibitor effect systems: halogenated hydrocarbons (halon) and powders
5.4 Cooling effect systems: sprinklers, pressure spray
5.5 Emergency fire pump (cargo ships)
5.6 Chemical powder applicants

6. Miscellaneous Fire-fighting Equipment

6.1 Fire hoses and nozzles
6.2 Mobile apparatus
6.3 Portable fire extinguishers
6.4 Fireman's outfit
6.5 Breathing apparatus
6.6 Resuscitation apparatus
6.7 Fire blankets

7. Ship Fire-fighting Organization

7.1 General emergency alarm
7.2 Fire control plans and muster list
7.3 Communications
7.4 Personnel safety procedures
7.5 Periodic shipboard drills
7.6 Patrol systems

8. Fire-fighting Methods

8.1 Knowledge of fire safety arrangements
8.2 Fire alarms and first actions
8.3 Fire fighting

9. Fire-fighting Drills

9.1 Small fires
9.2 Extensive fires
9.3 Drills in smoke-filled spaces

5.4.2- Evaluation

The effectiveness of any evaluation depends upon the accuracy of the description of what is to be measured.

The learning objectives used in the detailed syllabus will provide a sound base for the construction of suitable tests for evaluating trainee progress.

The methods chosen to carry out an evaluation depends upon what the trainee is expected to achieve in terms of knowing, comprehending and applying the course content.

The methods used can range from a simple question-and-answer discussion with the trainees (either individually or as a group), to prepared tests requiring the selection of correct or best responses from given alternatives, the correct matching of given items, the supply of short answers or the supply of more extensive written responses to prepared questions.

Where the course content is aimed at the acquisition of practical skills, the test would involve a practical demonstration by the trainee making use of appropriate equipment, tools, etc.

The responses demanded may therefore consist of:

(a) the recall of facts or information, by viva-voce or objective tests

(b) the practical demonstration of an attained skill

(c) the oral or written description of procedures or activities

(d) the identification and use of data from sketches, drawings, maps, charts, etc.

(e) carrying out calculations to solve numerical problems

(f) the writing of an essay or report

The evaluation must be based on clearly defined objectives, and it must truly represent what is to be measured. There must be a reasonable balance between the subject topics involved and also in the testing of trainees' KNOWLEDGE, COMPREHENSION and APPLICATION of concepts.

The time allocated for the trainee to provide a response is very important. Each question or task must be properly tested and validated before it is used to ensure that the test will provide a fair and valid evaluation.

To be reliable, an evaluation procedure should produce reasonably consistent results no matter which set of papers or version of the test involved is used.

Traditional methods of evaluation require the trainee to demonstrate what has been learned by stating or writing formal answers to questions.

Such evaluation is subjective in that it invariably depends upon the judgement of the evaluator. Different evaluators can produce quite different scores when marking the same paper or evaluating oral answers.

In simple scoring of objectives tests one mrk may be alloted to each correct response and zero for a wrong or nil response.

A more sophisticated scoring technique entails awarding one mark for a correct response, zero for a nil response and minus one for an incorrect response.

Where a multiple choice test involves four alternatives, this means that a totally uniformed guess involves 25% chance of gaining one mark and a 75% chance of losing one mark.

Scores can be weighted to reflect the relative importance of questions, or of sections of an evaluation.

5.5- Advanced Fire Fighting Course

This Course will extend more or less over the whole area of fire prevention, fire fighting and fire safety.

After completion of this Course the student will have sufficient theoretical and practical background in fire fighting and matters associated with it, enabling him to understand and combat the fire, organise and direct fire operations, train the personnel and bear responsiblilty.

1st Day

Introduction to Marine Fire Fighting
Class Room: Time Length: 00.30 hrs
Fire Chemistry
Class Room: Time Length: 02.00 hrs
Extinguishing Agents
Class Room: Time Length: 01.30
The student will be introduced to the handling, stowage and maintenance of these agents.
Fire Prevention
Class Room: Time Length: 0200

This session will be mainly directed towards the safety measures related to both personnel and equipment and the enforcement of the different Regulations and Guide lines with fire prevention.
Fire Fighting Equipment
Class Room: Time Length: 02.50

Heavy emphasis will be placed on proper maintenance and correct handling of equipment. This class will include detailed instruction on the selection and purchase, and confidence testing procedures of the equipment.

2nd Day

Introduction to Fire Tactics
Class Room: Time Length: 01.30
Introduction to Breathing Apparatus
Class Room: Time Length: 01.30
Case Histories
Class Room: Time Length: 02.00
The class will discuss real fire causes which occured on board Algerian ships and other well-known historical casualties which happened in the past. Analysis of wrong and correct actions will be made. Presentation of video films is strongly recommended.

Miscellaneous Fire Safety Equipment
The equipment discussed during this session is not used to detect or fight fire but rather to protect personnel in the event of fire. This type can be classified into three categories:

- Constructional Features
    - Bulkhead and decks
    - Doors & Fire dampers

- Portable devices
    - Fire safety lamp
    - Oxygen indicator
    - Portable conbustible gas indicator or combined with oxygen indicator
    - Fire axe
    - Key

- Personnel equipment
    - Fireman's outfit
    - Proximity suit
    - Entry suit, etc.

3rd DAY

Introduction to Practical Training
Training Site: Time Length: 00.30
Hose Lays Techniques
Training Site: Time Length: 01.00
Fire Fighting
Training Site: Time Length: 02.30
Practical Training with Breathing Apparatus
Training Site: Time Length: 02.00
Search and Rescue
Training Site: Time Length: 02.00

4th DAY

Marine Terminology
Class Room: Time Length: 01.00
Vessel Construction and Arrangements
Class Room: Time Length: 01.00
Reading Maring Drawings
Class Room: Time Length: 01.30
Types of Vessels
Class Room: Time Length: 02.00
The primary objective of this session is to familiarise the student with the different types of vessels he will be likely to serve on, or those calling into his port.

He will mainly discuss the particularity of each vessel as far as:-

- Design and construction
- Propulsion machinery
- Type of cargo
- Cargo handling

- Trading patterns

Marine Engineering Systems

Class Room: Time Length: 01.00

It is very desirable that a good fight fighter should be familiar with some Marine Engineering Systems which are commonly the sources of ship fires. This will be great help and understanding to him in carrying out both fire prevention and fighting successfully fires once they occur.

This will include:-

- Machinery propulsion systems
- Fuel oil piping
- Cargo pumps
- Electric motors
- Electric distribution panel
- Lighting
- Fans

Marine Fire Protection Systems

Class Room: Time Length: 03.00

This lesson will mainly stress upon the correct operation and proper maintenance of the monitoring, systems, fire detection systems and fixed fire extinguishing systems.

5th DAY

Ship Board Field Trip

Aboard Ship: Time Length: 03.00

The first session of the fifth day will be spent aboard a modern merchant vessel preferably one which incorporates several fire protection systems. This visit will strengthen the knowledge and experience of those students (seafarers) who are familiar with these systems, and will acquaint those who are not.

Emergency Mooring

Aboard Ship: Time Length: 01.00

During the shipboard field trip the instructor will take the opportunity to introduce the students to the various mooring and anchoring system components in use aboard this ship. The primary objective is to acquaint the student with emergency procedures to move a vessel under fire conditions.

Vessel Hazards

Class Room: Time Length: 01.30

This class will discuss the typical contents of each major compartment aboard a typical vessel and the hazards those contents may create during a fire. The primary purpose is to make the fire fighter aware of the hazards to be found aboard ship which are not encountered ashore.

These will include materials involving fires of different classes.

Although vessels are constructed of metal and may appear incombustible, there are many flammable products aboard, which may be located in the cargo holdsor on deck stowed in containers or in bulk stowage.

Some examples of such material:-

- The bridge contains wooden desks, charts, alamanacs and other such combustible objects
- Wood in many forms may be found in the carpenter shop
- Various types of cordage are stowed in the botswain's locker
- Emergency rockets and explosives for the line-throwing

gun on the bridge wing

- Lummer for dunnage
- Rubber and plastics are used extensively for the insulation on electrical wiring
- Flammable and combustible liquids in the form of fuel and diesel oil, lubricating oil in the engine room, etc
- Paints and varnishes
- Flammable gases
- Electrical equipment
- Specific metal such as aluminium, magnesium, titanium, etc.

IMDG CODE

Class Room: Time Length: 01.30

The amount of dangerous cargo transported by ships has increased tremendously and so has the hazard associated with them in case of fire. It is of primary importance for the people who handle these goods and particularly the seafarers to have an adequate familiarity with the Regulations under the International Maritime Dangerous Goods Code (IMDG), and a complete awareness of the hazards involved in case of fire.

They must be acquainted with the classification indentification, stowage and the use of the correct extinguishing agent, if a fire occurs.

6th DAY

Class Room: Time Length: 01.30

Introduction to Damage Control

Class Room: Time Length: 02.30

Damage Control Operations

Damage Control Basin

Time Length: 02.00
During this session the trainees will practice damage control operations by trying to stop leakages from hull openings of different shapes using several types of obturators found on board ships. Wearing diving equipment they also learn how to stop underwater leakages and perform rescue operations.

7th DAY

Accomodation Space Fires
Class Room: Time Length: 01.00
Marine Fire Tactics
Class Room: Time Length: 01.00
Engine Room Fires
Class Room: Time Length: 01.30
Cargo Hold Fires
Class Room: Time Length: 01.30
Container Hold Fires
Class Room: Time Length: 02.00

LNG Carrier Fires
Class Room: Time Length: 02.00
NOTE: During these sessions the student will be introducted to different fire-fighting tacts and procedures peculiar to some categories of ships with fires located in different places.

8th DAY

Pump Room Fires
Class Room: Time Length: 01.00
Tanker Deck and Tank Fires
Class Room: Time Length: 02.22

Instruments Operations

Class Room: Time Length: 01.00

Students will be trained in the operation of various instruments available to assist in the extinguishment of ship fires.

The course will discuss the operating features of various instruments and other limitations and capabilities.

Students will also be taught basic techniques to be used in obtaining readings and their interpretations, and thus they will be required to test for temperature, CO_2 and combustible gases during a laboratory session.

Bulk CO_2 Application

Class Room: Time Length: 01.00

This session will complement the session on instruments to prepare the students for the field application of CO_2 on board the drill operation. The class will discuss the procedures to follow when applying in CO_2 in bulk from the tanks, including safety measures, preparations, groundings, sealing, ventilation and test readings.

Bulk CO_2 Drill

Training Site: Time Length: 02.00

This session will constitute the field application portion of the previous segments on Instrument Operation and Bulk CO_2 Application.

The session will take place on the training vessel and involve the use of a Bulk CO_2 tank.

Students will be required to extinguish a simulated Class A Fire in the cargo hold by actually applying CO_2. Students will set up for application, apply the CO_2, obtain test readings, vent the CO_2, and assure the compartment is

safe for personnel.
Final testing will be conducted under the supervision of a certified Marine Chemist.

Foam Operations
The student will be introduced to the different Foam Systems:
- Mechanical foam
- Chemical foam
- Foam generators
- Deck foam systems (Tankers)

The student will learn the description of the different equipment, their operation and maintenance.

9th DAY

Indirect Fire Fighting Attack
Class Room: Time Length: 01.00
During this session the student will be introduced to the indirect attack techniques employed when it is impossible for fire fighters to reach the seat of the fire. Generally this is the case when the fire is in the lower portion of the vessel such as cargo holds and engine rooms.

Manifest Readings
Class Room: Time Length: 01.00
The success of any fire fighting operation depends greatly on the very good appreciation of knowledge of the cargo on board, its nature, amount and location.

This session will be dedicated to the interpretation and reading of the Cargo Manifest.

Command Post Operations

Class Room: Time Length: 01.00

Legal Considerations of Marine Fires

Class Room: Time Length: 01.00

Port Contingency Planning

Class Room: Time Length: 03.00

The purpose of this planning is to increase efficiency when an emergency arises. In achieving this goal the planning process must anticipate problems, their possible results and prepare solutions before the problems do occur.

The majority of fire incidents which will occur in a port are of a "routine" nature and are well within the capability of the local jurisdiction to handle. However when a majore fire occurs it can quickly exhaust the locally available resources. This is especially true if the proper planning has not been done ahead of time.
There are numerous examples of fire ground decisions being made as they based on inadequate information or data, which would have been adequate if only the proper planning had been done.

Therefore during this session the students will discuss the following points:-

- Who is responsible for developing the Plan
- Identification of the interested Agencies such as:
  - Fire Department
  - Coast Guards
  - Vessel Operators
  - Insurance Underwriters
  - Ship's Agent
  - Port Authorities

- Determination of responsibility and interest of these Agencies
- Identificaion of resources
- Large industrial complexes, i.e., nearby military bases, shipyards, commercial suppliers, local companies, which may be able to provide additional fire fighting supplies
- Availablilty of experts with identification of their skills and function:

  - Marine Chemist
  - Coast Guard personnel
  - Salvage expert
  - Insurance personnel
  - Shipyard personnel
  - Pollution Contractors
  - Marine Fire Protection System Contractors
  - Ship's Agent
  - State Department of Emergency Services
  - Port Authority personnel

- Development of procedures which is the final step in preparing a comprehensive Fire Plan for its implementation.

Logistics and Air Operations

Class Room: Time Length: 01.00

This class will discuss the problems of supply and transportation of equipment, and people to or from the place of fire.

10th DAY

Class Room: Time Length: 01.30

An important facet of Marine Fire Protection are the small ships - tugs, pushboats, dredgers, supply vessels, icebreakers and others which are given an auxiliary fire fighting role.

On the other hand the Fire Department units such as Tucker Pump Trailers, etc, may take part in ship fires. During this session the student will discuss the limitations and capabilities of such units and the co-ordination in actions of the different parts involved with the ship's crew.

Emergency Medical Care
Class Room: Time Length: 04.00

The medical emergencies that arise in fire fighting situations are not limited to burns. Inhaling smoke from the fire can poison the victim but all types of injuries normally associated with any accident situation can occur during fire fighting owing to the restricted work, space, the rolling of the vessel, poor footing in water-soaked compartments, and poor visibility due to smoke. In addition smoke may cause respiratory arrest and fire fighters under strain may have heart attacks. Both cases require immediate action on the part of the rescuer.
During this session the student will be informed on the necessary steps to follow and how to react effectively during the following situations:

- Treatment of shipboard injuries
- Determining the extent of injury or illness
- Evaluating the accident victim
- Triage
- Head, neck and spine injuries
- Respiration problems and resuscitation
- Cardiopulmonary resuscitation
- Bleeding
- Wounds

- Shock
- Burns
- Fractures and injuries to the bones and joints
- Environmental emergencies
- Techniques for rescue and short distance transport

Final Written Examinations
Class Room: Time Length: 02.00
The Examination will cover the whole material presented during the training.

The emphasis will be put on the most important points the trainee should keep and master during his career.

Clean Up
Class Room: Time Length: 01.00

CHAPTER-6

FIRE FIGHTING CENTRES IN SOME SELECTED COUNTRIES

6.1- In General

Nearly all the fire centres of international reputation cater Basic and Advanced Fire Fighting Courses on similar pattern in line to IMO model courses. They are recognised and are suitable for Nautical and Engineering sea-officers according STCW 78 requirement.

The International Maritime Organization (IMO) has been and is working in order to save life at sea and to improve the safety of international shipping by adopting conventions, codes, recommendations and other legal instruments.

One of the most important conventions of IMO since its inception in 1959 is the International Convention for Safety of Life at Sea (SOLAS).

It was the 1948 SOLAS convention which introduced the International Passenger Ship Safety Certificate which, i.a, dealt with requirements for structural fire protection, fire detection and extinction, and the Cargo Ship Equipment Certificate for cargo ships of 500 gross tons and above which, i.a, dealt with extinguishing arrangements.

The SOLAS 1960 Convention introduced the cargo ship safety construction certificate which, i.a, includes requirements for structural fire protection.

Casualties to passenger ships through fire in the early 1960s emphasized the need to improve the fire protection provision of the 1960 Convention, and in 1966 and 1967, amendments which particularly detailed fire safety provisions for tankers and combination carriers were adopted by the IMO Assembly.

However, in spite of the high safety standards in the ships built, fire accidents still occurred. So, IMO and the maritime nations have tried and are trying to elevate the seafarers standards through training.

As a result, at the conference convened by IMO on this subject in 1978, the International Convention on Standard of Training, Certification and Watchkeeping for Seafarers (STCW) was adopted. Its major aims are to establish:

.1 Global minimum standards of competence of seafarers (officers and key ratings).

.2 Global harmonization of standards of training and examination of seafarers.

.3 Global acceptance of certificates granted under the Convention.

.4 Globally safe and efficient manning of ships.

As far as fire safety on board is concerned, the convention states that every candidate should have adequate experiences or have undergone appropriate training in the field of fire prevention and fire fighting equipment, including:

a- the ability to organize fire drills,

b- the knowledge of classes and chemistry of fire,

c- attendance at an approved fire fighting course.

In addition to this, ratings forming part of a navigational watch on a sea-going vessel should be familiar with the basic principles of fire fighting. Therefore the fire fighting courses enable the trainee to appreciate the danger of fire aboard ships, to know the main causes of fires, the measures to be taken to prevent them and the means to fight such fire.[1]

These courses are part of IMO short courses delivered at the maritime academies of the countries which have ratified the STCW Convention. There are necessary since training of seafarers is the most effective way to decrease the number of incidents due to fire on board and to increase safety.

In every Fire Fighting Centre, atleast those author had a chance of visiting or had discussion with colleagues for some others; there is nearly same type of theoretical and practical training as well as mock fire drills which are conducted during the training.

In theory: Conditions for fire, properties of flammable materials, how fire is spread, classification of fires and appropriate extinguishing agents required, fire and smoke detection systems, automatic fire alarms, various fixed fire extinguishing installations, about fire fighting equipment (fire hoses, nozzles, fireman's outfit, fire blankets, breathing apparatus etc), fire fighting organization etc.

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[1] International Maritime Organization (IMO): International Conference on Training and Certification of Seafarers, 1978.

On practical side: trainees are shown different equipment for extinguishing and help in fighting fire, such as Breathing Apparatus, Extinguishers etc. They are asked to work on it in order to familiarize themselves and better use can be achieved in case of emergency.

In mock drills trainees are given chance to extinguish small fires with various extinguishers such as foam, powder etc. Drills are conducted for extensive fires. Trainees are asked to extinguish such large fires (oil or/and wood fires) with water spray by reaching as near to fire as possible by forming water spray shield to avoid heat waves from the fire.

And finally drill in smoke filled compartment is conducted in all such fire fighting centres. The trainees enter the smoke filled room with fire suit, breathing apparatus to search dummy human bodies. In this exercise they get feeling very near to actual fires which take place in engine room, pump room, cargo spaces or in the accommodation areas. They can feel heat, darkness and difficulty of moving with breathing apparatus at the back. Also they get used to breathing through the breathing apparatus.

Everywhere the duration of Basic Course is also the same usually three to four days depending on working hours. Similarly the duration of Advanced Course is about ten days. The details of course/curriculum are given in chapter 5.

After the completion of this course the student get sufficient theoretical and practical background in fire fighting and matters associated with it, to enable him to understand and combat the fire, organize and direct fire operations, train the personnel and bear responsibility.

6.2- The International Fire & Safety Training School-Malta[2]

IFSTS - the International Fire and Safety Training School - Malta is owned and managed by a Maltese registered company based in Malta. The aim of school is to instruct and train students who come to Malta from any part of the world for any aspect of fire fighting and safety - not only for floating staff but for shore based personnel also.

Some of the courses offered concerning to fire fighting, are:

- Basic Fire Fighting and Safety
- Urban and Rural Fire Fighting
- Industrial and Petrochemical Fire Fighting
- Industrial and Petrochemical Supervisors Fire Fighting
- Breathing Apparatus
- Air Field Fire, Safety and Rescue
- Marine Fire, Safety and Rescue

The school accommodates students in self catering apartments. The school maintains close links with a number of hotels and owners of furnished flats, for those who want to stay on their choice.

There are various courses that can be conducted on site at the clients' premises also. IFSTS - Malta has the facility of conducting the Training programme in various languages, Arabic, French, Italian, German, and in English. This helps the candidate to grasp the

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[2] Reference taken from "The International Fire and Safety Training School Ltd" brochure 1992; Zurrieq, Malta.

basic/foundation material in his native language.

Central Office
Administration Buildings,
IFSTS Ltd, Hal-Far, Zurrieq, Malta
Tel: 684747, 680086, 681055
Telex: 522 FIRSAF MW, Fax: (0356) 235708.

6.3- The Swedish Maritime Fire Protection Committee

Fire fighting courses are arranged by SBK - Sjofartens Brandskydds Kommitte (The Swedish Maritime Fire Protection Committee) mainly at Helsingborg but also at Gothenburg, Kalmar and Stockholm. Training and education for seagoing personnel is covered by four courses.

a) Basic Fire Protection: Training to IMO Res A437 (Xi), a five day practical course offered monthly.

*b) Fire-Protection Course for Nautical College Students:*This is four day course at Swedish Nautical Colleges covers basic fire protection.

*c) Compulsory Fire-Protection Extension Course:*This five day course leads to a certificate, valid for five years for officers on tankers, gas carriers and chemical tankers and dry cargo ships. A two day revalidation course based on practical exercises is also offered.

d) Fire Protection for Fire Fighting Supervisors: This four day course intended for senior officers serving at sea and shipping company managers, but is also available for ratings with supervisory duties and is available twice a year.

Composition:[3]

- Fire Protection Association
- Fire Officers' Association
- Shipowners' Association
- Ship Officers' Association
- Engineer Officers' Association
- Seamen's Union Association
- Association of Marine Underwriters

Chairman

The Maritime Safety Director

Secretariat

Accommodated at the Swedish Fire Protection Association, Trgelvddsvagen 100, 11587 Stockholm.

Tel: no: 08-783 70 00

Various Tasks Conducted:

a- Arrange fire protection courses

b- Inform about international and national legislation

c- Inform about fires that occurred on board ships

d- Inform about new fire fighting equipment and systems

e- Offer technical advisory service on fire safety.

Primarily financed by course fees paid by the shipowners who send their seafarers to the courses.
Most of the courses conducted at the Fire Brigade in Helsingborg. The basic courses arranged in accordance with the IMO Resolution A.437 (XI).

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[3] From the lecture notes of Professor Per Erickson: WMU Handouts 1992.

6.3.1- Basic Training

Following syllabus covered during the basic training:[4]

- Elements of fire

Fire Tetrahedron (ie Fuel, Source of Ignition-Heat, Oxygen and Chemical Reaction).

Ignition Sources: Chemical, Biological, Physical.

Flammability : Flammability, Ignition Point, Burning Temp, Burning Speed, Thermal value, LFL/UFL, Flammable Range, Inerting, Static Electricity, Flash Point and Auto Ignition.

Fire Hazards and Spread of Fire: By Radiation, Convention and Conduction.

Reactivity: Classification of Fires, and Applicable Agents, and main Causes of Fire.

- Main Causes of Fire:

a- Oil Leakage in the Engine Room.
b- Smoking
c- Careless Handling of Fire
d- Overheating
e- Galley Apparatus
f- Spontaneous Ignition
g- Hot Work
h- Electric Apparatus
i- Reaction, Self Heating or Auto-Ignition
j- Careless Handling of Combustible Material
k- Static Electricity, Mechanical Work, etc

- Fire Prevention, Fire Detection and Fire Equipment
- Construction and Arrangements:

a) Escape Routes, b) Gas-Freeing, c) A.B.C Divisions etc

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[4] Course derived from IMO Res.A.437 (XI).

- Ship Fire-Fighting Organization: It includes a) Alarm System, b) Fire Control Plan, c) Muster Stations d) Communication e) Patrol Systems f) Drills etc.

- Resuscitation Methods
- Fire Fighting Methods
- Fire Fighting Agents

6.3.2- Practical Training

The Practical Training includes use of:

- Various types of Portable Extinguishers
- Self-Contained Breathing Apparatus including Smoke, Diving and Personal Protection Equipment.

6.4- U.S.Coast Guard Approved Fire Fighting Training Course:

U.S.A has always maintained its safety standards much higher than the basic requirement of IMO Conventions. There are a number of Fire Fighting Centres approved by U.S.Coast Guard around the country. The courses run and the duration of courses is almost the same which are already mentioned above but for further information, guidance and for attending courses for the candidates of developing countries mention of some of them is given below for reference.

ORGANIZATION	COURSES OFFERED
- Houston Marine Training Services, 1600; 20th Street, Kenner, LA 70062	Basic Only
- International Marine Safety Bureau P.O.Box 6325, Terra Linda, CA94903	Basic and Advanced
- Maritime Administration;Great Lake Region Fire Training Centre 2600 Eber Road, Swanton,OH 43558	Basic Only
- Pyrotech At Delgado Community College Fire School;13 Old Gentilly Road,New Orleans LA	Basic Only
- Sea School, 3770 16th Street North; St.Petersburg, FL 33704	Basic Only

(Note: Although most courses include only basic fire fighting, all courses are considered to satisfy the requirement for basic and advanced training. Anyone attending a 'classroom only' course must also complete field training (hands-on, practical) in order to satisfy training requirement in the licensing regulations.)

6.5- Fire Fighting Centre, Rotterdam - Netherlands.[5]

6.5.1- General

RISC Education & Training (RISC) is one of the world's leading fire-fighting training centres situated at the Maasvlakte - approximately 60 Km west of the town of Rotterdam provides safety and survival training for personnel working in the offshore and shipping industries; with cooperation of Maritime Training Centre (M.T.C) of Netherlands.

A wide range of Basic Safety Course as well as the complete range of preparedness training including STCW (IMO) Courses for Shipping Industry, are conducted here.

Courses are given in English and/or Dutch. For non-English or Dutch speaking participants interpreters are employed. The courses conducted by RISC Education & Training BV and M.T.C are approved and accepted by the Norwegian, British, Danish and Dutch authorties and/or operators associations.

6.5.2- Materials

All required material for the courses and trainings is available at the institute, such as:

- Self Contained Breathing Apparatus
- Fire Engines
- Protective Clothing

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[5] Information collected from RISC - Fire Fighting Centre, Rotterdam-Netherlands, and also from M.T.C - Maritime Training Centre, Netherlands.

- Extinguishing agents & extinguishers
- Hoses and nozzels, etc.

6.5.3- Target Groups

The target groups of RISC Education and Training are:
- Petrochemical Industry
- Chemical Industry
- Offshore
- Maritime Sector
- Ports and Trans-Shipment Insstallation, etc

6.5.4- Standard Courses - Industrial Fire Fightings

a) Basic Fire Fighting Course - 5 days
b) Advanced Fire Fighting Course - 5 days
c) Refresher Advanced Fire Fighting Course - 3 days
d) Leadership Fire Fighting Course - 5 days

The required number of Participants is twelve. The course price includes:
- Use of the school accomodation
- Use of training objects and facilities
- Use of protective clothing (Nomex)
- Use of breathing equipment (Drager PA-80)
- Use of Fire Fighting equipment
- Instructor
- Assistant Instructor
- Fuel and extinguishing agents
- Hand-outs
- Coffee, tea and lunches.

6.5.5- Information Address

RISC Education & Training B.V
Europaweg 930, 3199 LC Maasvlakete
Rotterdam Harbour no: 8301
The Netherlands
(Tel:no:31-1818 63155; Fax:31-1818-63935)

6.6- Fire Fighting Courses in some other Countries:[6]

6.6.1- Australian Maritime College:

The Advanced Fire Prevention and Control course is conducted three times a year. The course is of 4 days duration and is structured in compliance with the recommendation contained in Annex 2 of IMO Res A437(XI) and is a prerequisite of competency as ship's master and chief engineer. Emphasis is placed on developing organization, communicative and strategic command and control skills required to cope with emergencies aboard ship. Other topics covered include stability during fire fighting. A four day "Fire Prevention and Control" course is also offered for watchkeepers. It is conducted six times a year.

Besides above courses, a three day duration course namely "Elements of Shipboard Safety" course is also conducted three times a year. It meets requirements of Section 2, Schedule 3 of the Australian Uniform Shipping

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[6] LSM Guide to Maritime Training; "Safety and Technical Training".

Laws Code and includes practical instruction in the operation of survival equipment, fire prevention and fire fighting onboard small craft, first aid, safety and accident prevention on small craft.

6.6.2- Institute of Maritime du Quebec, Canada:

The institute offers five day duration course which includes basic and advanced fire fighting with practical training at the centre's own ship's mock-up. Courses run from September to July. Tuition languages are French and English. An additional five day course in "Fire Fighting and Damage Control" covers leadership in emergency situations, medical evacuation, dangerous cargoes and damage control and is offered monthly from September to July. In total 24 courses are conducted each year.

6.6.3- Hong Kong Fire Service Department & Vocational Training Council:

A 2 day duration basic course is offered four times a year by Hong Kong Fire Service Department at the training school at Pat Heung, New Territories. Tuition languages are English or Chinese. The advanced course of 4 days duration is also conducted four times a year.

A five day basic and advanced courses are available to IMO requirements and are approved by the Hong Kong Marine Administration for certificates of competency. 18 courses per year are conducted in languages Cantonese and English.

CHAPTER-7

CONCLUSION & RECOMMENDATIONS

The Kingdom of Saudi Arabia is a maritime developing nation situated in south-western Asia with an estimated area of 2,240,00 km^2, that is approximately one-sixth the size of Europe. The capital is Riyadh and the two main ports are at Jeddah and Dammam.

The estimated population of Saudi Arabia is about ten million and it has 2,314 kilometers of coast line divided into two separate East and West Coasts. The 537 kilometers of eastern coast face the Arabian Gulf - the region where most of the oil is produced, while the 1,777 kilometers of the western coast face the Red Sea. Dammam and Jubail are big and busy ports on the eastern coast while Jeddah, Yanbu and Gizan are the main ports on the western coast. Besides the main ports there are many small ports such as: Al-Khatif, Al-Khobar, Al-Aqur, Ras Tannura, Al-Johimah, Haql, Al-Khirba, Daba, Rabigh etc.

The development of the ports, shipping and other maritime activities has been the most spectacular growth area in the economy of the Kingdom in recent years. And to further raise and maintain the growth of shipping and cargo, the confidence of Shipowner and Shipper, Importer as well as Exporter is required to be boosted up. And this can only be cultivated by providing safety and security. For a cargo owner it matters a little whether his cargo is transported by a large ship or small ship, new ship or old ship but he is interested but what he is worried about that it should reach from port A to B safely and in time.

Among marine casualties, fire on board or in port is one of the major hazards which many times becomes the cause of damage of cargo or atleast it delays the schedule of ship. Fire annihilates life and property if it is not extinguished in time. And it is not only sufficient to keep fire-extinguishers or other extinguishing agents but to know how to fight with these weapons is also very important.

The best approach to avoid casualties is to give people in the maritime industry the best training available, and to encourage them to apply the knowledge so acquired to their trades. Everybody will agree that a fire extinguisher in untrained hands will be more of a liability than an asset when there is a fire. Is there any point in entrusting a multimillion dollar set of equipment to an untrained person? How can we entrust life to people who are not properly trained? It will be a pure economic suicide couple to social injustice to all parties involved.

To fight any enemy it is necessary to understand it and to study its various moves. The best thing is to avoid such a warfare ie we should try to create such an atmosphere that fire is not started as it is well known saying that 'Prevention is better than cure'. Anyhow in order to prevent fire from taking place or to fight it in case it breaks out, one must know its characteristics, and how it propagates. For the sake of practice one must carry out the mock drills so that he can face the real situation in a better way when and if it occurs on board or in port. And for all these things Fire Fighting Centres play an important role for the maritime safety in nation's economic and maritime growth.

There is therefore no doubt that the need for a "Fire Fighting Centre" facility is of paramount importance to every nation - and especially for a fast developing maritime nation like Saudi Arabia - which has shown remarkable progress in every sector of maritime affairs and achieved very high standards in every field.

Hence by starting Fire Fighting Centre as mentioned in this dissertation, on line with IMO Convention (SOLAS 78) and its suggested model course, for ship officers, ratings and other necessary personnels, will be a great boon for all parties concerned. And infact it is an urgent need of the hour.

- By establishing fire fighting centre and imparting training in the most effective way the number of fire incidents can be decreased and the standard of safety on board can be increased.

- By establishing such a centre in the country lot of Foreign Exchange flow to outside the country can be reduced.

- Highest standards of safety required by IMO and ILO can be maintained.

For establishing Fire Fighting Centre in the Kingdom of Saudi Arabia it is <u>recommended that:</u>

- Initially the Centre should provide basic course to about ten to fifteen trainees at a time. Later on advanced fire fighting course may be introduced.

- Well trained staff who have experience of teaching

Fire and conducting fire drill may be employed. In case of non availability of nationals, foreigners may be posted till locals are sufficiently trained to run the courses efficiently.

- As a result of more advanced technology being employed on ships these days, mariners must acquire more knowledge in many special areas including fire prevention, control, extinguishing.

However, in spite of changes effected and regulations promulgated over the years by Government agencies and Maritime Administrations that have greatly reduced the ever-present danger of fire aboard vessels, fire tragedies have continued to occur. Therefore, it must be the seafarer's responsibility to be as well-trained as possible and to understand the causes of fire through pre-sea courses, advanced training and refresher courses so as best to prevent them, and eventually to extinguish a fire if it occurs.

- For necessary help and guidance in establishing and initially running the centre, IMO can be approached in this matter.

- Saudi Graduates of this University - World Maritime University, Malmö-Sweden - specially MET or MSA Course can surely be a great privilege in sharing and exchanging knowledge on this subject as during their two years study at the University they get opportunity to visit and study in some of the Fire Fighting Centres of more advanced European Countries.

By setting up such a Fire Fighting Centre in the kingdom not only foreign exchange and time can be saved but it can be run with such a careful eye and high standard that the country can be proud of it.

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