

WORLD MARITIME UNIVERSITY

MALMÖ, SWEDEN

PROPOSAL FOR IMPROVEMENTS IN

THE INVESTIGATION OF MARINE CASUALTIES IN CHILE

by

FELIPE SILVA TOMASONI

CHILE

A dissertation submitted to the World Maritime University in
partial fulfilment of the requirements for the award of the

DEGREE OF MASTER OF SCIENCE

in

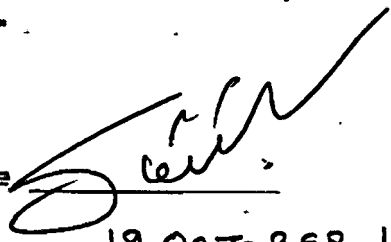
MARITIME EDUCATION AND TRAINING (NAUTICAL).

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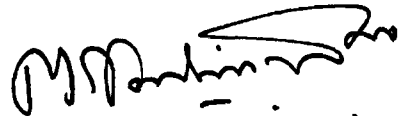
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Signature 

Date 19 OCTOBER 1992

Supervised and assessed by:

Professor - Dr/Capt. P S Vanchiswar
Course Professor
World Maritime University



Co-assessed by:

Captain Arne Ulstrup
Ex-Lecturer, WMU &
Principal Nautical Surveyor
The Danish Maritime Authority



ACKNOWLEDGEMENTS

I am very grateful to my Organization for providing me the opportunity to study in the World Maritime University in Malmö for this fruitful two-year period.

I would like to express my special gratitude to my friend and former colleague José Miguel Torres, for giving me the idea of writing the present project about this important subject and for his permanent and helpful guidance.

I would also like to express my gratitude to Prof. P.S. Vanchiswar, to Captain Arne Ulstrup and to Prof. Clive Cole, who read my scripts and suggested valuable ammendments where necessary.

I would also like to thank all resident professors, lecturers and visiting professors of the University from whom I acquired very useful knowledge and support.

To finalize, I would also like to thank my wife María Isabel, my daugther Isabel Carolina, and my sons Felipe Julián and Ignacio Javier for their patience, understanding and support during the preparation of this project.

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INTRODUCTION.

It is well known, all over the world, how important Marine Casualty Investigations are in order to obtain information about the causes of these casualties. Based on this information appropriate corrective measures, regulations, qualifications and standards of crew education, standards of safety, and many other related subjects may be developed to prevent the occurrence of similar casualties in the future.

The Chilean Maritime Administration, which is engaged in a wide variety of inherent duties, is by law the sole organization in charge of the investigation of marine casualties in Chile.

The author of this Project, after having worked for more than five years in the Headquarters of the above-mentioned organization, and despite the fact of never being involved directly in Marine Casualty Investigation Processes, realized that the current situation deserves to be improved.

When sent to study to the World Maritime University the author brought this thought with him and during the time at the University learnt the way through which other countries, especially developed ones, carry out such functions.

After analyzing all the aforesaid information and based on his knowledge and previous experience, mainly in the field of Electronic and Maritime Administration Engineering, the author has written some proposals for improvements in the Investigation of Marine Casualties in Chile, which he hopes will be useful to the Chilean Maritime Administration.

CHAPTER I

THE IMPORTANCE OF THE MARINE CASUALTY INVESTIGATION.

1.1

INTRODUCTION.

It is already known that nearly every day a Marine Casualty happens somewhere at sea. Some of them are more important or more spectacular than others, but all of them, however, are unwanted. The Human Factor is almost always present and plays an important role in many cases.

Many people, organizations and specifically the International Maritime Organization (hereinafter in this Project referred to as the "IMO"), know that, within the Shipping Society, there are a number of actions which might be taken to reduce marine casualties. Shipping is, undoubtedly, a complicated business which requires much more attention than other businesses.

There are many ways to reduce accidents at sea. One of the most important ones is the result of a Marine Casualty Investigation. If it were used properly, it would be possible to prevent the occurrence of similar casualties. It is not sufficient to know only how a casualty occurred; it must also be clear why it happened. Based on this information, appropriate corrective measures, regulations, and standards of safety may be developed and instituted, and amendments to legislation for marine safety may be recommended, if needed.

The Marine Casualty Investigation will be referred to, hereinafter in this Project, as MCI.

1.2

THE NEED FOR INVESTIGATION.

MCI is a methodical way of collecting information and interpreting facts regarding Marine Casualties. It is, as well, an important part of the Maritime Safety Administration. In a few sentences, and following the Casualty Investigation Process illustrated in Figure 1-1, we could say that the Investigation is always trying to establish the facts (what, who, where and when). Once the facts are clear, they are analyzed to be understood (how and why), considering the existing standards. From the analysis of the facts, the report is done and published, including conclusions and causes, but at the same time, from the same analysis the solutions are developed (recommendations), in order to improve the current standards. These optimal solutions are affected by practical, economical and social considerations.

Some advantages of carrying out detailed investigations are to :

- * Prevent further casualties and consequent loss of human life and property.
- * Respond to management needs.
- * Reduce environmental damage.
- * Satisfy company rules and define operating errors.
- * Satisfy insurance requirements.
- * Educate management and staff.
- * Isolate design deficiencies.
- * Satisfy news media and research purposes.

The order of this list does not follow any specific rule.

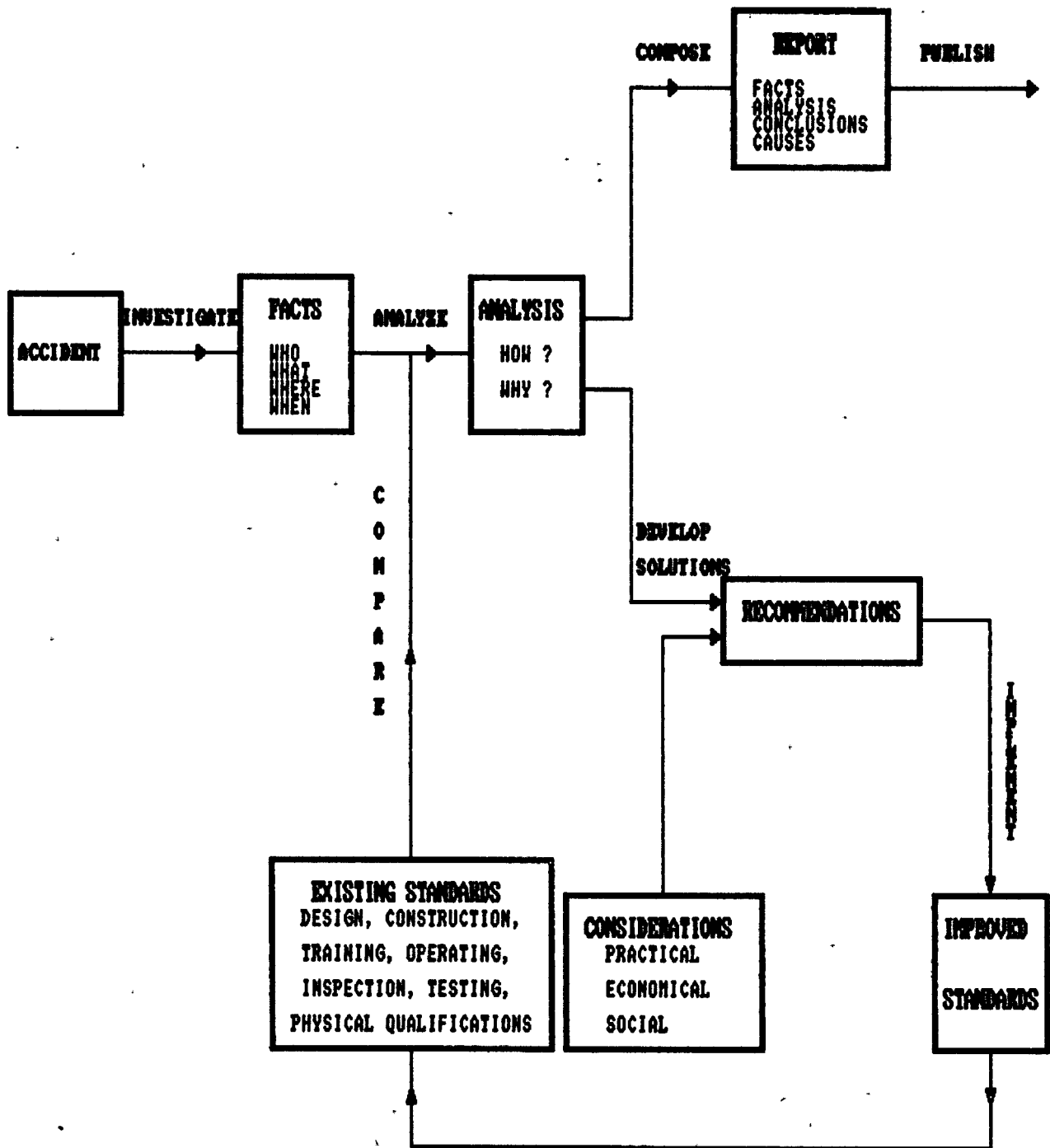


FIGURE 1-1 CASUALTY INVESTIGATION PROCESS.

1.3

WHAT IS A MARINE CASUALTY ?

We usually think of a casualty as an unexpected event, of course unwanted, with different unpleasant outcomes. A true casualty or accident is, almost by definition, something which is unpredictable and uncontrollable. According to this, we cannot usually consider the failure of a light-bulb as a casualty, because it is predictable that some day in the near future it is going to fail. On the other hand, it cannot be said the same for the behaviour of human beings, mainly because of the nature of the human element which is not always known in advance with absolute certainty. Many systems are characterized by their uncertainties, and many people have tried to develop techniques for predicting their performances, some of them with success.

Technology may change for the better, but uncertainties regarding the actual effect of the intended improvements will always last as long as human operators are involved.

The United States Coast Guard (in future referred to as USCG), in the Code of Federal Regulations, Volume 46 (Shipping), has defined the term "marine casualty" or "accident" as:

* Any casualty or accident involving any vessel other than public vessels if such casualty or accident occurs upon the navigable waters of the United States, its territories or possessions, or

* Any casualty or accident wherever such casualty or accident may occur involving any United States' vessel which is not a public vessel, or

* Any accidental grounding, or any occurrence involving a vessel which results in damage by or to the vessel, its apparel, gear, or cargo, or injury or loss of life of any person; and includes among other things, collisions, strandings, groundings, founderings, heavy weather damage, fires, explosions, failure of gear and equipment and any other damage which might affect or impair the seaworthiness of the vessel, or

* It also includes occurrences of loss of life or injury to any person while diving from a vessel and using underwater breathing apparatus.

The aforesaid form of definition for the marine casualty or accident, is commonly used by most of the national maritime legislations in many countries.

1.4 CLASSIFICATION OF MARINE CASUALTIES.

Some organizations, in order to make the administrative process of MCI's easier and faster, have classified them into different groups, mainly according to their gravity or seriousness. The organization considered in this regard is the USCG.

1.4.1 MAJOR MARINE CASUALTY.

The USCG has defined it as the marine casualty or recreational boating accident involving a vessel, other than a public one, which results in one of the following situations:

- * The loss of six or more lives;
- * The loss of a mechanically-propelled vessel of 100 or more GRT;
- * Property damage initially estimated at US\$ 500,000 or more;
- * Serious threat to life, property, or the marine environment by hazardous materials.

1.4.2 PUBLIC / NONPUBLIC VESSEL CASUALTY.

Under the United States regulations, the USCG must notify the National Transportation Safety Board of all casualties that involve a public and a nonpublic vessel and at least one fatality or US\$ 75,000 in property damage.

1.4.3 SIGNIFICANT MARINE CASUALTY.

Significant marine casualty is the casualty that involves important safety issues or causes substantial media interest. This kind of casualty generally involves the following:

- * Multiple deaths or a single death caused by unusual circumstances;
- * Hazard to life, property, or the marine environment;
- * Loss of any inspected vessel.

1.5 CATEGORIES OF MARINE CASUALTIES.

Considering that most of the statistical information which is going to be analyzed later in this chapter comes from Lloyd's Register of Shipping, I will mention the definitions given by this same prestigious source.

1.5.1 FOUNDERED.

This category includes ships which sank as a result of heavy weather, springing of leaks, breaking in two, etc., but not as a consequence of categories listed below.

1.5.2 MISSING.

In this category are included all ships which after a reasonable period of time, no news has been received from her, therefore its fate is undetermined. Thus, the ship is posted as "Missing" at the Corporation of Lloyd's and is included in the Missing category on the data base together with similar cases reported by other reliable sources. In peacetime, missing ships are considered as losses occasioned to ships by marine perils.

1.5.3 FIRE / EXPLOSION.

It includes ships lost as a result of fire and/or explosion where it is the first event reported. It therefore follows that casualties involving fires and/or explosions after collisions, strandings, etc., would be categorized under "Collision", "Stranding".

1.5.4 COLLISION.

It includes ships lost as a result of striking or being struck by another ship, regardless of whether under way, anchored or moored. This category does not include striking underwater wrecks.

1.5.5 CONTACT.

This category includes ships lost as a result of striking an external substance, but not another ship or the sea bottom. It also includes striking drilling rigs/platforms, regardless of whether in fixed position or in tow.

1.5.6 WRECKED / STRANDED.

It includes ships lost as a result of touching the sea bottom, sandbanks or seashore, etc., as well as entanglement on underwater wrecks.

1.5.7 LOST.

This category includes the following cases:

- * War loss, which encompasses loss occasioned to ships by hostile acts.
- * Hull or Machinery Damage, which includes ships lost as a result of hull/machinery damage or failure which is not attributable to any other category.
- * Miscellaneous, which includes ships which have been lost and for the lack of information or other reasons, cannot be classified.

1.6 ANALYSIS OF WORLD TOTAL LOSSES DURING RECENT YEARS.

1.6.1 INTRODUCTION.

The idea in this section is to present statistical information, under different point of views, concerning the total loss of ships of 500 GRT and above, from 1985 to 1990.

As was mentioned earlier, the statistical information is mainly based on Lloyd's Statistical Reports, the Institute of London Underwriters and the Institute of Shipping Economics and Logistics of Bremen.

There could be a great number of reasons which explain casualty occurrences. Many people think that the human factor is always present (negligence, carelessness, inaccuracy, lack of information or experience, bad manning or management, etc.), but it is also true that failures might, as well, be caused by the malfunctioning of equipment.

Regardless of all the above-mentioned, the reality is that every year many casualties happen with disastrous results and consequences, not only for human life but also for the environment.

1.6.2 WORLD TOTAL LOSSES ACCORDING TO THEIR CATEGORIES.

The world total losses, according to their categories, during the period 1985-1990, for ships above 500 GRT, are illustrated in Figures 1-2 and 1-3 in two different ways. Whilst the first gives us certain numerical information, the second graphically shows us the comparative number of each of these categories within the world total occurrences.

NATURE OF CASUALTY	1985		1986		1987		1988		1989		1990		AVERAGE 85-90	
	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT
WEATHER	33	117.8	40	458.2	46	408.4	49	260.9	54	353.8	-	-	37	266.5
FOUND. & AB.	35	156.1	32	113.5	19	66.1	29	65.7	20	77.2	72	305.8	35	144.1
STRANDING	37	314.0	23	166.5	19	245.5	17	150.2	18	121.3	44	262.7	26	210.0
COLLISION	13	120.9	7	25.3	16	113.2	8	25.4	19	85.4	21	33.8	14	67.0
CONTACT	2	4.9	2	3.8	1	27.3	1	1.6	5	7.0	9	71.9	3	19.4
FIRE/EXPL.	50	423.7	38	339.5	28	246.9	34	233.9	29	333.3	32	162.7	35	290.0
MISSING	1	28.4	2	2.2	5	51.9	1	9.9	3	28.8	6	186.1	3	51.2
MACH. DAMAGE	7	69.8	9	88.6	2	1.5	8	28.3	8	71.3	2	11.1	6	45.1
OTHER CASUAL.	10	46.1	3	9.9	3	18.1	-	-	-	-	2	12.0	3	14.4
TOTAL	188	1281.8	156	1207.4	139	1178.9	147	775.9	156	1078.1	188	1126.1	162	1108.0
WORLD TONNAGE	406697.6		395463.7		394018.8		393799.0		400697.5		401612.0		398714.8	
LOSS RATIO %	0.32		0.31		0.30		0.20		0.27		0.30		0.27	

* ALL GT DIVIDED BY 1,000

FIGURE 1-2 WORLD TOTAL LOSSES ACCORDING THEIR CATEGORIES.

WORLD TOTAL LOSSES (1985-1990)

Number of ships (Average)

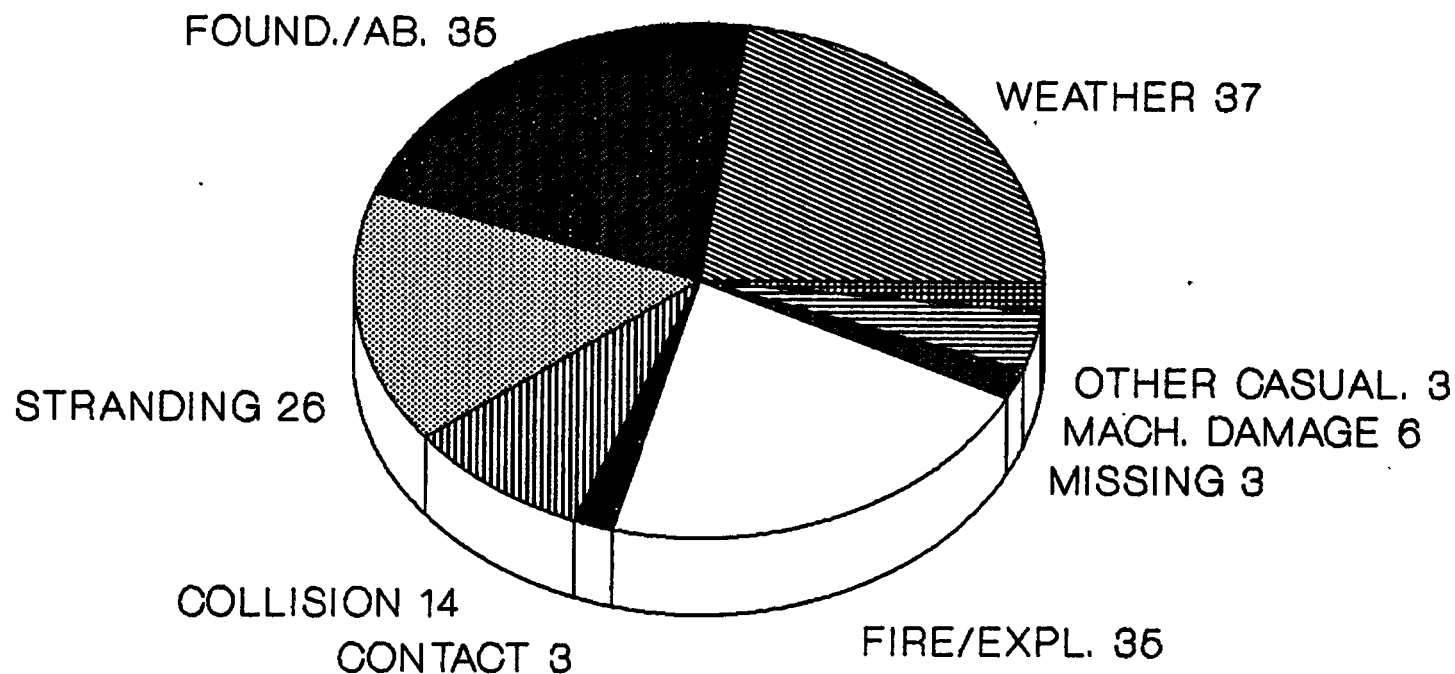


FIGURE 1-3 WORLD TOTAL LOSSES.

The 188 ships reported lost during 1990 is one of the largest amounts during the last 5 years, whereas the loss GT of 1126.1 is within the average of this same period.

The largest totally lost (missing) ship and the largest stranded ship during 1990, were reported within the Chilean maritime jurisdiction. The first case happened when an ore/oil carrier- the seventeen-year old Liberian flagged Algarrobo- (89,178 GT), with a crew of 32 men aboard, disappeared whilst it was sailing from Chile to Japan. The second case happened when the eighteen-year old Norwegian ore/oil carrier Combi Star (84,348 GT), stranded at Huasco (Chilean port) while laden with a cargo of iron ore.

1.6.3 WORLD TOTAL LOSSES BY FLAG.

The world total losses by flag are illustrated in Figure 1-4 which includes statistical information from 1984 to 1989 concerning ships of 500 GT and above.

As can be easily realized, the flags with the largest percentage of total losses (Cyprus, Panama, Bahamas), having together more than 50% of the total amount in 1989, are developing countries which have adopted " Open Registration " (flag of convenience) whereby the beneficial owners are foreigners.

This situation appears to have resulted in a lack of a genuine link between the ships and their respective Administrations. Thus it is a situation which needs to be improved. The statistics show the actual facts and something must clearly be done in order to diminish these occurrences.

F L A G S	1 9 8 4		1 9 8 5		1 9 8 6		1 9 8 7		1 9 8 8		1 9 8 9		GT & SHARE OF TOTAL 1989
	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT	
CYPRUS	10	43.2	11	42.3	15	104.9	17	75.4	10	89.5	13	342.1	31.7
PANAMA	48	248.8	42	333.7	34	222.1	19	169.4	35	209.0	26	143.0	13.3
BAHAMAS	3	24.2	1	0.8	2	21.6	1	1.6	1	9.8	7	119.1	11.0
BRAZIL	2	6.5	3	9.6	1	11.4	1	4.9	1	2.0	2	38.3	3.6
GREECE	30	349.6	11	177.3	15	198.0	6	126.4	6	81.6	7	35.2	3.3
YUGOSLAVIA	3	19.4	2	9.3	1	12.2	1	1.5	1	1.6	3	31.0	2.9
LIBERIA	9	186.8	8	155.1	1	11.0	6	89.0	2	70.7	3	28.7	2.7
REP. OF KOREA	9	22.4	15	86.6	11	134.4	12	150.8	8	19.0	5	27.2	2.5
NETHERLANDS	1	1.7	-	-	1	4.0	-	-	2	3.2	1	24.8	2.3
ST. VINCENT	-	-	-	-	-	-	2	20.7	4	11.5	3	22.7	2.1
GIBRALTAR	-	-	2	23.9	1	1.2	-	-	-	-	1	22.6	2.1
USA	7	63.1	1	0.5	4	3.6	3	104.2	1	17.2	5	21.9	2.0
TURKEY	2	2.0	2	4.5	-	-	3	53.3	2	3.5	5	16.7	1.5
INDIA	-	-	5	54.8	1	24.6	5	82.8	1	13.4	2	16.5	1.5
THAILAND	3	7.2	1	1.3	3	6.4	3	7.1	1	3.4	4	16.3	1.5
MOROCCO	-	-	-	-	-	-	1	1.6	-	-	1	13.5	1.3
NIGERIA	-	-	-	-	-	-	-	-	1	3.0	1	13.2	1.2
PAKISTAN	-	-	1	12.0	-	-	1	9.7	-	-	1	11.9	1.1
PHILIPPINES	10	14.0	8	13.2	8	8.5	9	78.3	10	77.3	1	11.5	1.1
CUBA	-	-	3	20.2	1	11.1	-	-	-	-	3	10.8	1.0
JAPAN	3	1.9	5	6.6	1	1.5	3	5.4	2	1.9	5	10.5	1.0
SINGAPORE	4	16.3	1	3.3	3	5.8	3	9.1	2	6.6	4	10.5	1.0
ROMANIA	-	-	1	4.0	-	-	-	-	-	-	3	9.7	0.9
MEXICO	2	8.0	6	174.4	-	-	2	9.5	4	4.7	4	9.4	0.9
VENEZUELA	1	3.5	3	7.3	4	16.4	1	2.2	5	10.9	2	8.4	0.8
NORWAY	1	0.6	-	-	-	-	1	0.6	1	2.2	7	6.5	0.6
VANUATU	-	-	-	-	-	-	-	-	-	-	1	6.4	0.6
ARGENTINA	1	12.4	1	2.1	1	3.2	-	-	1	4.7	1	5.3	0.5
GERMANY	2	2.3	2	4.6	-	-	1	1.0	-	-	2	5.1	0.5
SPAIN	7	7.3	5	15.1	8	112.3	1	0.7	-	-	3	4.0	0.4
MALTA	2	10.6	3	7.2	1	0.6	3	7.8	6	17.8	2	3.7	0.3
CHINA	2	15.3	-	-	1	4.0	-	-	-	-	1	3.7	0.3
UAE	-	-	-	-	-	-	2	3.5	2	2.1	2	3.4	0.3
IRISH REP.	-	-	-	-	-	-	-	-	-	-	1	2.9	0.3
HONDURAS	2	5.1	5	9.0	1	1.7	3	3.5	3	12.2	2	2.8	0.3
SRI LANKA	-	-	1	3.4	-	-	-	-	1	2.0	1	2.6	0.2
TAIWAN	4	14.4	-	-	3	19.9	3	8.5	6	11.7	3	2.2	0.2
PERU	2	8.1	-	-	1	7.1	1	2.5	-	-	1	2.1	0.2
INDONESIA	2	4.7	-	-	1	1.6	1	3.7	3	7.7	2	2.0	0.2
DOMINICAN REP.	-	-	-	-	-	-	-	-	-	-	1	1.6	0.1
USSR	4	24.2	2	11.7	2	37.4	2	13.2	2	7.5	1	1.5	0.1
NETH. ANTILL.	-	-	-	-	1	1.3	-	-	1	5.4	1	1.4	0.1
FRANCE	1	4.2	-	-	2	3.2	1	3.7	1	0.6	1	1.2	0.1
CHILE	1	0.7	1	0.7	1	58.2	1	10.4	-	-	1	1.1	0.1
FIJI	-	-	-	-	-	-	-	-	-	-	1	1.0	0.1
OTHERS	36	118.4	36	87.4	26	158.1	20	117.2	21	62.3	3	2.2	0.2
T O T A L	214	1283.0	188	1281.8	156	1207.4	139	1179.0	147	775.9	156	1078.1	100.0

* ALL GT DIVIDED BY 1,000.

FIGURE 1-4 WORLD TOTAL LOSSES BY FLAGS.

As shown in the previous Figure 1-4, from the average world total losses of ships of 500 GRT and above, Chile contributed with 0.1%, which is too much considering the reduced size of its fleet.

1.6.4 WORLD TOTAL LOSSES BY AGE AT TIME OF LOSS.

Figure 1-5 illustrates the world total losses by age at time of loss during the period 1980-1989, divided into three groups, namely Tankers, Bulk & Combined Carriers and Other Ships. It can clearly be noticed that despite the huge differences in number of ships lost between the "Other Ships" group and the other two groups, the differences in the amount of GT lost is not too large. This can be easily understood since the "Other Ships" group includes fishing vessels and other small units.

1.6.5 WORLD TOTAL LOSSES VIS-A-VIS LATIN-AMERICAN TOTAL LOSSES.

In order to have an idea of the influence that Latin-American losses have on the World Total Losses during the period between 1980 and 1989, Figure 1-6 provides this information. It can be seen that Latin-American losses represent around 10% of the world total number of lost ships, whereas in the case of the world total tonnage of ships, it represents 15%. Unfortunately, despite the information shown in Figures 1-5 and 1-6 coming from the same source (Lloyd's Register of Shipping), they are not coincidental, neither in the number of ships nor in the tonnage of ships.

YEAR	0-4 YEARS		5-9 YEARS		10-14 YEARS		15-19 YEARS		20-24 YEARS		> 25 YEARS		T O T A L	
	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT
T A N K E R S														
1980	2	232.6	2	133.2	5	244.4	2	85.5	4	51.1	3	18.8	18	765.7
1981	-	-	1	59.1	3	26.3	4	87.4	10	141.6	4	48.2	22	362.5
1982	1	88.3	2	46.7	6	78.6	7	182.5	8	111.1	6	41.3	30	548.6
1983	-	-	4	298.3	3	4.1	6	115.0	3	34.5	3	21.0	19	473.0
1984	-	-	-	-	5	187.1	4	114.7	5	78.3	4	41.1	18	421.2
1985	2	30.0	1	4.5	5	41.9	5	202.8	3	87.9	3	21.8	19	389.0
1986	-	-	1	18.5	1	1.5	5	12.6	3	34.1	3	16.9	13	83.6
1987	1	1.4	1	0.6	1	37.8	3	7.0	1	9.1	2	75.7	9	131.6
1988	-	-	1	41.4	3	20.5	4	73.8	3	5.8	2	2.9	13	144.4
1989	2	4.6	3	48.8	1	13.5	2	115.6	5	130.9	-	-	13	313.5
B U L K A N D C O M B I N E D C A R R I E R S														
1980	2	95.9	2	30.4	4	124.6	2	30.6	3	35.3	4	36.3	17	353.0
1981	2	86.7	3	52.1	6	127.6	10	224.6	7	83.0	-	-	28	574.1
1982	-	-	-	-	5	144.8	2	34.3	8	82.7	1	8.0	16	269.8
1983	1	16.4	1	13.8	2	24.2	9	173.8	7	86.3	3	29.1	23	343.6
1984	-	-	2	30.5	2	32.3	6	86.5	5	52.2	2	16.9	17	218.4
1985	1	17.0	2	32.4	1	22.1	10	247.3	5	76.4	2	170.1	21	565.3
1986	1	4.0	2	117.1	10	348.4	7	179.5	4	52.5	1	4.2	25	705.6
1987	2	132.3	1	15.6	7	210.0	9	166.7	5	115.3	-	-	24	639.8
1988	1	18.6	-	-	1	16.2	-	-	5	89.4	1	9.3	8	133.7
1989	-	-	2	39.2	1	65.5	6	89.6	6	109.8	1	2.3	16	306.3
O T H E R S H I P S														
1980	7	20.8	17	56.8	30	91.4	39	101.3	50	246.0	49	147.9	192	664.1
1981	6	29.0	17	44.8	37	105.8	34	106.7	54	217.7	50	173.6	198	677.6
1982	8	21.6	15	24.4	30	101.2	45	139.8	43	204.3	49	150.5	190	641.9
1983	7	11.6	13	35.6	31	104.5	39	140.6	29	118.8	48	123.9	167	534.9
1984	9	17.4	19	71.1	28	117.0	31	122.0	46	206.8	46	109.0	179	634.4
1985	8	27.6	9	44.1	22	69.7	36	115.5	33	91.6	38	93.7	146	442.2
1986	3	4.1	9	32.6	22	102.3	40	137.3	25	87.6	21	60.0	120	423.9
1987	4	7.1	8	55.2	26	110.1	36	150.1	16	58.0	16	26.9	106	407.4
1988	5	85.7	13	34.3	22	91.5	39	157.8	21	58.1	26	70.4	126	497.8
1989	6	8.5	15	81.4	24	93.3	31	135.9	22	62.9	29	76.2	127	458.3

* ALL GT DIVIDED BY 1,000.

FIGURE 1-5 WORLD TOTAL LOSSES BY AGE AT TIME OF LOSS.

YEAR	LATIN - AMERICA		WORLD		L-A AS WORLD'S %	
	SHIPS	DWT	SHIPS	DWT	SHIPS	DWT
1980	66	182,206	387	1,804,027	17.05	10.10
1981	79	224,491	359	1,238,250	22.00	18.13
1982	86	341,990	402	1,631,930	21.39	20.96
1983	78	361,004	340	1,472,611	22.94	24.51
1984	70	389,111	327	2,353,941	21.41	16.53
1985	70	383,978	307	1,651,210	22.80	16.53
1986	56	262,338	265	2,608,735	21.13	10.01
1987	37	166,413	219	1,284,161	10.39	12.96
1988	49	191,300	231	864,670	21.21	22.12
1989	46	186,002	211	667,294	21.80	27.87

* L-A = LATIN-AMERICA

FIGURE 1-6 WORLD TOTAL LOSSES VIS-A-VIS L-A TOTAL LOSSES.

1980 - 1989.

CHAPTER II

THE CURRENT SITUATION IN CHILE.

2.1

CHILE, A MARITIME COUNTRY.

Chile is situated on the southwest coast of South America, and is bordered by Peru to the north, Bolivia and Argentina to the east, the Pacific Ocean to the west, and, to the south, the South Pole.

Chile, is a long, narrow strip of land with an area of 2,066,626.3 km², taking into account its Antarctic Regions, with a coast line of 12,175 km. in length, which gives it a Territorial Sea and Economic Exclusive Zone (EEZ), with its continental shelf of 5,800,000 km².

Chile has an excentric geographical situation compared with the American Continent, and in general with the rest of the continents, facing also the largest Ocean - the Pacific. This geographical position directs Chile towards the sea. If we consider the geopolitical theories of the German Karl Haushofer, who stated that the geopolitical axis of the world is going to be moved to the Pacific, this gives Chile a privileged position in being a governing force in the south eastern sector. One should not forget the fact that Chile controls the only natural passages between the Atlantic and Pacific Oceans, key points in maritime negotiations. Looking at its geographical configuration, Chile is made up of three "territorial blocks", with well defined characteristics in each one of them.

The northern block or zone, which embraces the desert regions and is rich in minerals; the central block with its temperate climate and soil characteristics making farming one of the most important activities, and lastly the southern block, with its innumerable channels and islands full of unexploited riches, whose potential is difficult to measure. The way to unite all these blocks is by sea. Maritime activity moves more than 90% of the products that Chile produces and/or imports.

But it is not all geographic, missing is the human element that should utilize the resources with a maritime mentality for the interchange and communication across the sea. The past is full of examples that show us how the Chilean National Flag has ploughed the waves of the world, especially the Pacific, where it has carried its products making the Chilean Peso (national currency) a common currency in Oceania during the 19th century.

Chile possesses an international maritime policy which was shown in an historical manifestation in the Presidential Address of 1947, which established for the first time in the world a 200-mile maritime zone. This initiative later permitted an agreement with the South American coastal countries of Colombia, Ecuador and Peru to get together an efficient system of cooperation designed to conserve and to better use the 200-mile zone. The Permanent Commission of the South Pacific, created in 1952, by these countries, constitutes a subregional maritime organization for the interests of these communities. In reality, as it was first done in Latin America, there exists a universal understanding on the 200-mile zone under the name of "The Exclusive Economic Zone" (EEZ).

2.2 THE CHILEAN NATIONAL ADMINISTRATION.

2.2.1 INTRODUCTION.

The Directorate General of the Maritime Territory and Merchant Marine (hereinafter in this project referred to as the "Directorate") is a high level organization responsible for the maritime administration of the coast, national waters, technical and professional control of the merchant marine and the rest of the national maritime activities.

The Directorate is also responsible for watching over the safety of life at sea, rivers and lakes, the protection of the marine environment, the administration of state property in the areas under its jurisdiction and looking after the maritime interests of the country, in order to contribute to the development of the maritime strength of the REPUBLIC OF CHILE.

2.2.2 MAIN FUNCTIONS OF THE DIRECTORATE.

2.2.2.1 SAFETY OF LIFE AT SEA AND SAFETY OF NAVIGATION.

The Directorate covers the following aspects, among others:

- * Maintains an efficient and dynamic maritime signalling system.
- * Attends to maritime telecommunications using a modern system comprising of 56 coastal stations installed along the coastline, capable of keeping in contact with ships all over the world and lending its services to the international maritime community anytime they need them.
- * Controls navigation in the waters under national jurisdiction.

- * Lends port and channel pilotage services to foreign and national shipping.
- * Controls compliance with national and international provisions, ratified by CHILE, which are related to safety of navigation, and safety of life at sea (SOLAS).
- * Maintains a permanent search and rescue (SAR) service in different parts of the country.
- * Gives certifications, registries, permits and embarkation documents in agreement with the law, and maintains a high standard of training for national crews, for which the "Maritime Instruction Center" (current Chilean branch of the World Maritime University) was created.
- * Conducts investigations into accidents involving ships and people in the waters under national jurisdiction including channels, lakes and rivers, with the objective of finding out the causes and persons responsible. They also have the responsibility for Chilean ships that are involved in accidents or are shipwrecked in open sea or in foreign waters, unless the responsibility is shared with the country in which the accident took place.

2.2.2.2 MARINE ENVIRONMENT PROTECTION.

To oversee, carry out and control all the present and future regulations, national or international, regarding the preservation of the marine environment and all sea life, 5 pollution fighting centers have been set up along the coast line of the country, with highly skilled personnel and technology.

2.2.2.3 SHIP REGISTRATION.

- * To keep a record of registrations, mortgages, mortgage payments and interest payments on ships of more than 50 GRT.

2.2.2.4 REPRESENTATION OF THE CHILEAN STATE.

- * To represent the Chilean State in bilateral, regional or international conferences regarding technical and professional maritime matters.

2.2.3 ORGANIZATION OF THE DIRECTORATE.

The Headquarters of the Directorate is situated in Valparaíso, which is the Chilean main port. The Director General of the organization is a Vice-Admiral who belongs to the Chilean Navy. Therefore, as might be guessed, the Directorate is within the Navy too.

A block diagram of the Headquarters organization is illustrated in Figures 2-1 and 2-2.

The organization along the coast considers Maritime Governors and Port Captains. The first ones are in charge of a zone, with many Port Captains under their control, whereas the Port Captains are the Maritime Authority in each port. There are also Delegates for minor ports or coves.

There are currently 16 Maritime Governors, who are distributed as shown in Figure 2-3. As was mentioned above, there are many Port Captains under the control of each of these Maritime Governors, but for reasons of clarity only some of them are included.

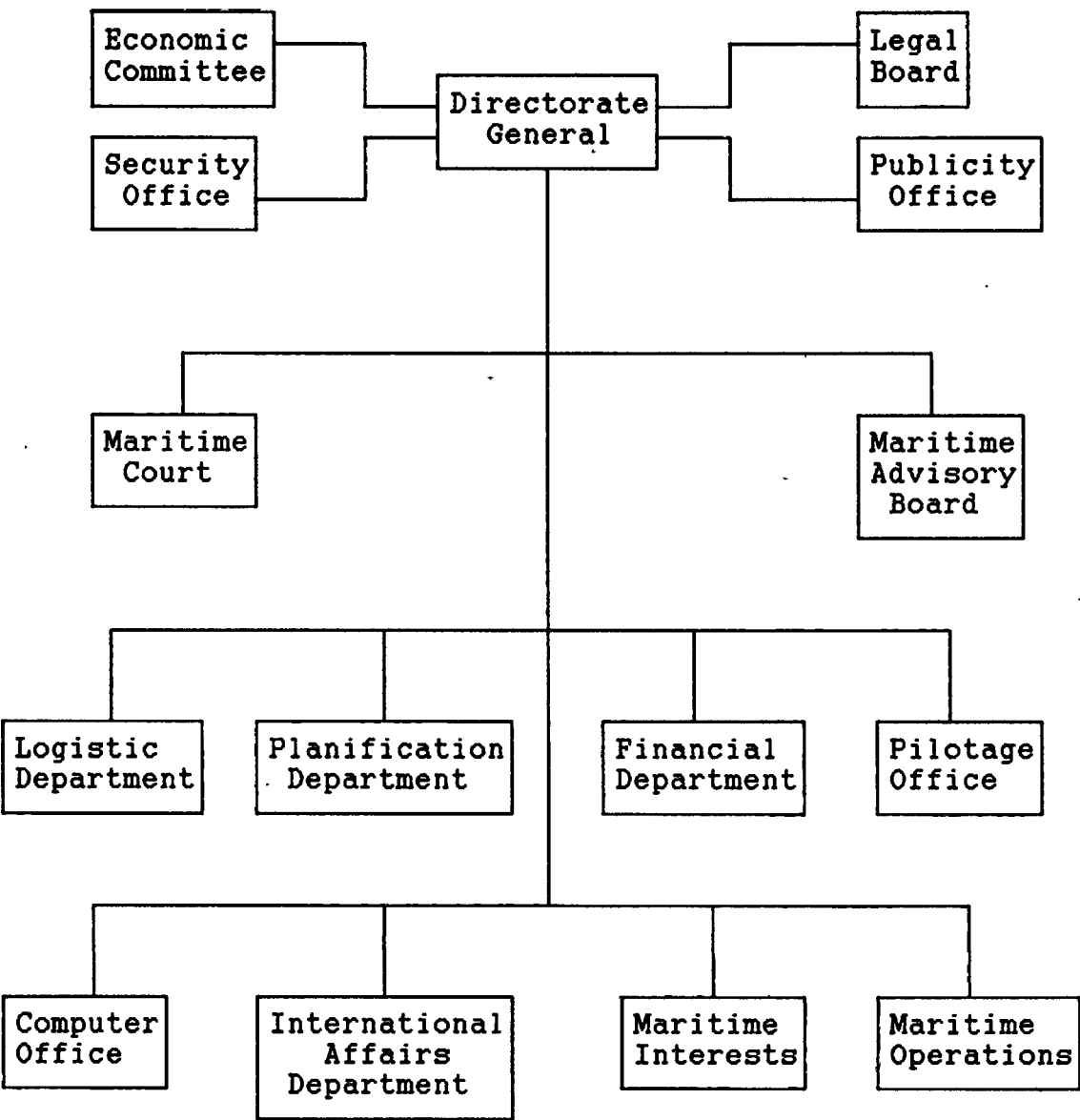


FIGURE 2-1 ADMINISTRATIVE ORGANIZATION OF THE DIRECTORATE.

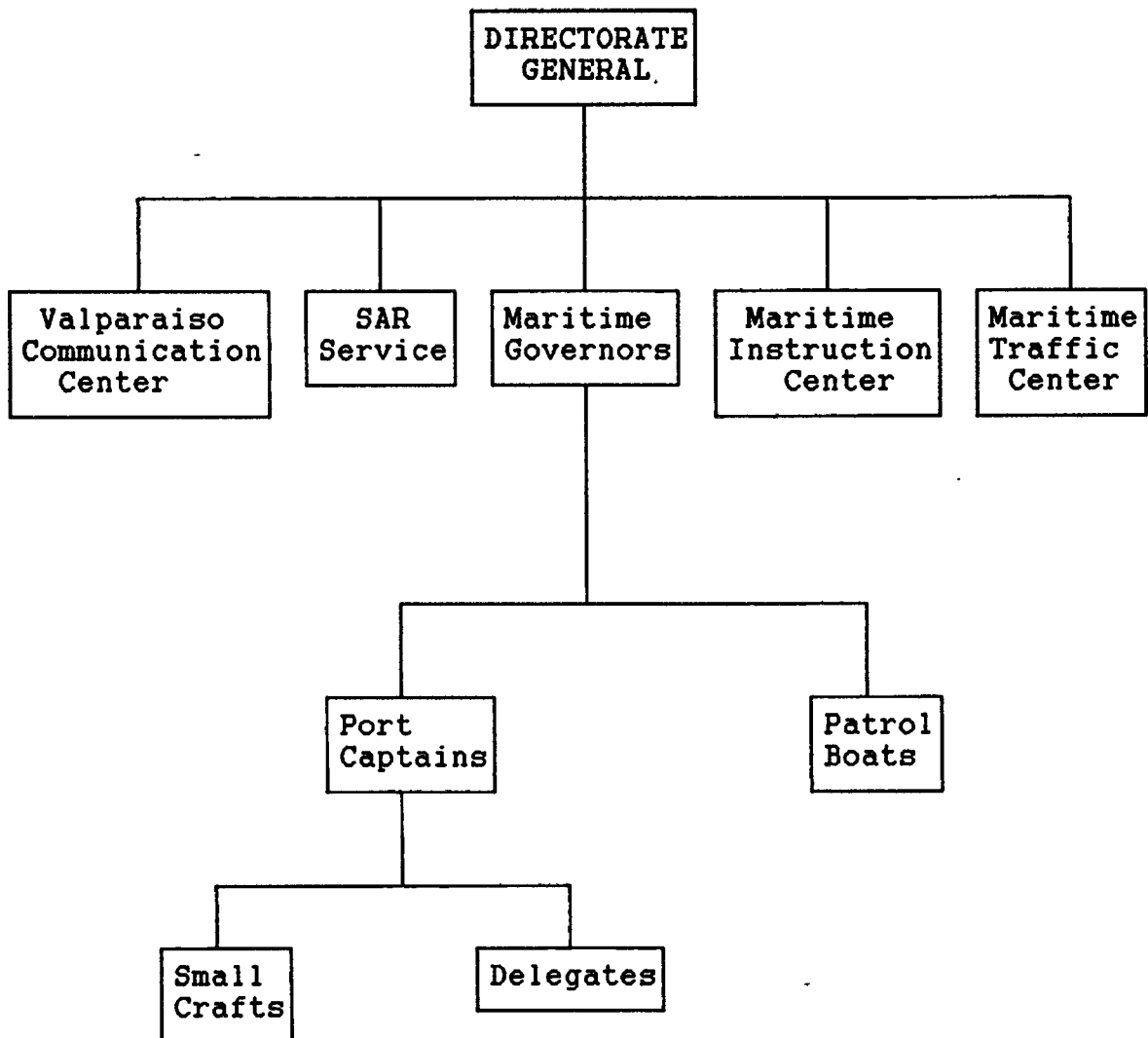


FIGURE 2-2 OPERATIVE ORGANIZATION OF THE DIRECTORATE.

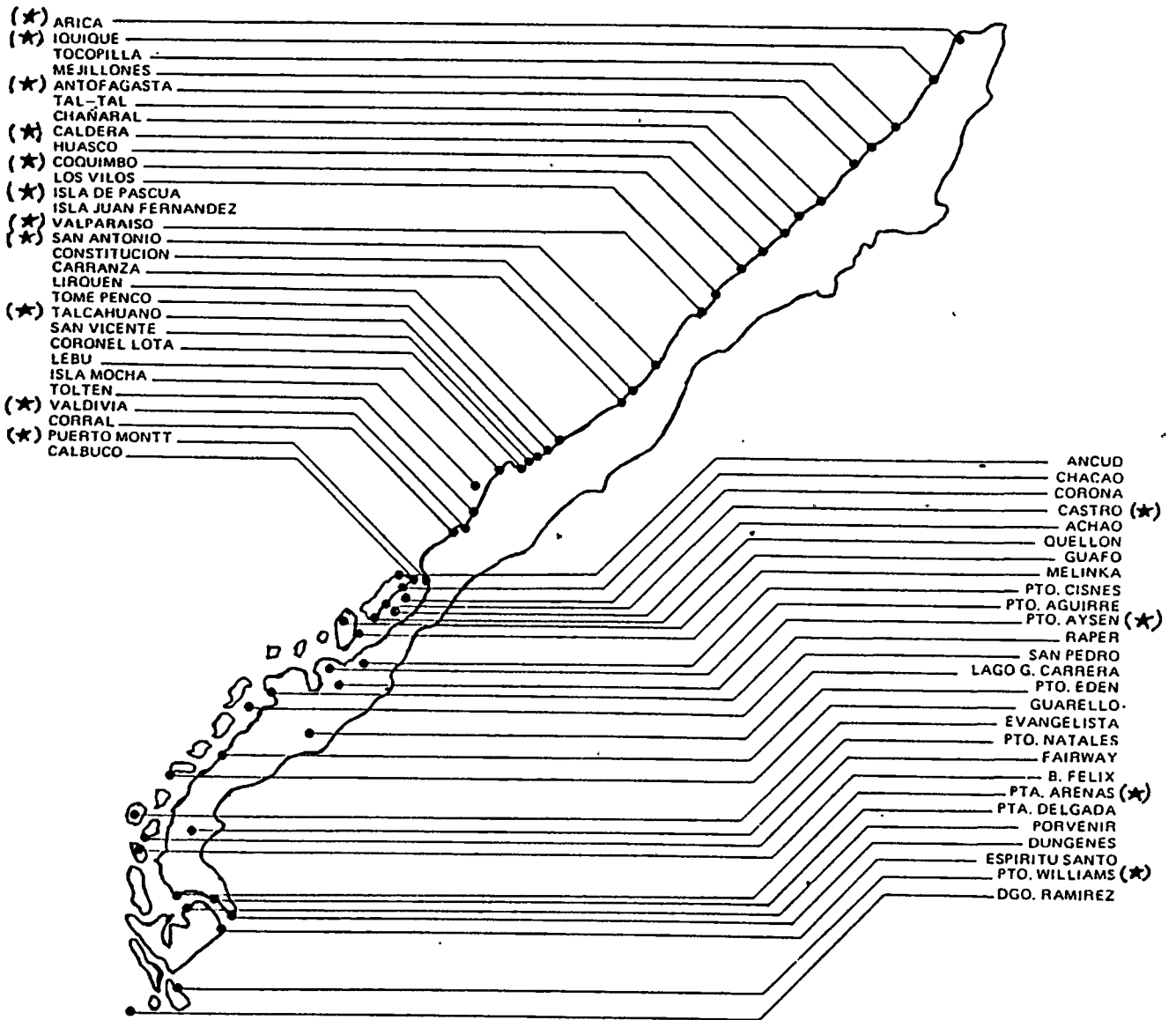


FIGURE 2-3 PRESENCE OF THE MARITIME ADMINISTRATION.
MARITIME GOVERNORS (*).

From Figure 2-1 it can be noticed that, mainly, there are 2 different blocks related with MCI's. One of them is the Legal Board and the other is the Maritime Court.

2.2.3.1 THE LEGAL BOARD.

The Legal Board is a permanent board which is responsible for advising the Director General in all legal matters within the scope of the Directorate. Likewise, if it is requested, it will advise the Maritime Governors and Port Captains. Among other things, it will keep the Director General informed about every change or development concerning important MCI's. It will also propose the constitution of the Maritime Court according to the gravity of the situation and for that purpose it will appoint experts (normally Pilots) when necessary.

2.2.3.2 THE MARITIME COURT.

The Maritime Court is an occasional summoning body which operates when the Director General considers it necessary. Its main purpose is not only to find out the causes and professional responsibilities which affect crew members of a ship or other persons who are connected or involved in a grave accident that has occurred in waters under the national jurisdiction, but also those which affect Chilean ships in high seas or abroad.

2.2.4 MODUS OPERANDI IN MCI's IN THE DIRECTORATE.

Upon receiving the information that a marine casualty has occurred, the Maritime Authority starts investigating.

The main reason to do this is to verify what really happened. Normally, the preliminary inquiries are carried out by the Port Captain in charge of the jurisdiction where the accident happened. At the same time the flow of information from this Port Captain to the Directorate starts. The procedure which is going to be followed is chosen depending on the gravity of the incident. The smaller ones will be kept under the control of the Port Captains, whereas the others will be taken under the control of the Maritime Governors or under the control of the Directorate's Headquarters (Legal Board). As was mentioned before, if the maritime casualty is extremely serious then the Maritime Court will be summoned.

2.3 LAWS AND REGULATIONS IN CHILE REGARDING MCI's.

The most important law in Chile regarding the MCI is the Merchant Shipping Act, which was decreed in 1978 by the Former Chilean President Augusto Pinochet. Within this law, under Title 8 (Navigational risks), the whole of Paragraph 3 is devoted to marine casualties. This paragraph includes 20 Articles which yield strong power to the Directorate in matters pertaining to MCI's, many of which were mentioned in the previous paragraph of this Project.

The most important regulation concerning the MCI is the Regulation for Incidents Investigation within the Armed Forces, which was decreed by the same Former President in 1974. Within this regulation, under Chapter 3 (Special case investigations), the whole of Paragraph E is devoted to the Directorate.

This paragraph only states, in a few lines, that all investigations pertaining to Marine Casualties shall be carried out by the Directorate, according to these and other regulations, without specifying clearly which ones.

Undoubtedly, as will be mentioned later, these are somewhat unclear, and, at the same time, weak regulations that need to be improved in the future.

Besides these national laws and regulations, there are many international conventions, resolutions, recommendations, etc, most coming from IMO, which were ratified or accepted by Chile. Therefore, they are, or they will be compulsory once in force internationally. Among these provisions might be mentioned the following :

- * The International Convention on Load Lines, 1966, Art.23, - Casualties - which directs each Administration to conduct an investigation of any casualty to any ship for which it is responsible and which is subject to this Convention when such an investigation may assist in improving the Convention. It also establishes that the findings of such investigations shall be furnished to IMO without disclosing the identity or nationality of the ship and without disclosing the responsibility of any ship or person.

- * The International Convention for the Safety of Life at Sea, (SOLAS) 1974, Chapter I, Regulation 21, - Casualties - which also directs each Administration to conduct an investigation of any casualty when it judges that such an investigation may assist in determining what changes in this regulations might be desirable.

It also states that each Contracting Government undertakes to supply the IMO with pertinent information concerning the findings of such investigations and that IMO reports or recommendations based upon such information shall not disclose the identity or nationality of the ships concerned.

* The International Convention for the Prevention of Pollution from Ships, (MARPOL), 1973, Article 12, which establishes that each Administration will conduct an investigation of any casualty to one of its ships subject to the regulations if there is a major deleterious effect upon the marine environment. It also states that each Party to the Convention will supply the organization with the findings when such information may assist in making desired changes in the Convention.

* The United Nations Convention on Law of the Sea, 1982, Part VIII, Section 1, Article 94(7) and Part XII, Section 5, Article 223, which require each state to hold an inquiry into every marine casualty on the high seas that involves a ship of its flag or that causes loss of life or serious injury to nationals of another state, or causes serious damage to ships or installations of another state, or to the marine environment.

Besides the aforesaid, this Convention requires that states conducting the inquiries should facilitate witnesses and evidence provided by other states or international organization and should facilitate the attendance of official representatives of any state affected by the pollution due to any violation.

* Resolution A. 322 (November 12, 1975), which draws attention to the obligations of Contracting Governments to investigate casualties as stated in the SOLAS and LL Conventions.

At the same time, it draws attention to supply IMO with information about the lessons to be learned and the conclusions.

* Resolution A. 440 (November 15, 1979) which urges Governments to cooperate in investigation into marine casualties and to exchange information freely for the purpose of a full appraisal of such casualties.

2.4 STATISTICAL INFORMATION FROM THE DIRECTORATE.

The Directorate distributes among users, at the end of every year, the annual statistical information concerning maritime activities in Chile; for instance, there is information about merchant marine activities, imports and exports through national ports, cabotage, cargo movements, containers, vessel traffic, marine casualties, fishing activities, etc.

From this statistical information we are going to see, first of all, some interesting charts and graphs, which shall give a rough idea about the size of the current Chilean Merchant Fleet and the Chilean Industrial and Artisanal Fishing Fleets. After that, the statistics shall focus on Marine Casualties, including certain SAR information and some pollution incidents.

2.4.1 THE CHILEAN MERCHANT FLEET.

Figure 2-4 illustrates the summary of the Chilean Merchant Fleet (registered in Chile and with Chilean Flag).

The information included in this figure was updated on the 31st December 1990.

OWNERS	NUMBER OF SHIPS	T O N N A G E S		%	CHILEAN	
		GT	DWT		OFFIC	RAT
EMPRESA MARITIMA DEL ESTADO	4	98.040	180.781	22.02	37	55
SOCIEDAD NAVIERA ULTRAGAS LTDA.	6	80.754	133.652	16.28	54	78
SOCIEDAD ANONIMA DE NAVEGACION PETROLERA	2	62.063	127.806	15.57	22	43
COMPANIA CHILENA DE NAVEGACION INTEROCEANICA	4	49.992	88.335	10.76	40	68
COMPANIA SUDAMERICANA DE VAPORES S.A.	7	68.722	88.284	10.75	82	114
EMPRESA NAVIERA CHILENA DEL PACIFICO S.A.	3	37.507	66.039	8.04	33	51
NAVIERA INTEROCEANICAS S.A.	5	38.528	59.811	7.29	46	63
SOCIEDAD NACIONAL DE OLEODUCTOS LTDA.	2	12.813	24.531	2.99	20	26
TRANSMARES NAVIERA CHILENA LTDA.	2	17.037	22.193	2.70	22	34
NAVIERA DEL SUR S.A.	1	7.040	11.570	1.41	7	20
NAVIERA PASCHOLD LTDA.	1	3.334	4.928	0.60	6	6
KENRICK Y CIA. TRANSPORTES S.A.	1	1.991	3.341	0.41	8	10
MARITIMA INSULAR TRANSPORTE Y TURISMO	1	2.517	1.395	0.17	8	10
EMPRESAR SUR S.A.	4	1.320	1.393	0.17	20	28
TRANSBORDADORA AUSTRAL BROOM LTDA.	5	1.349	1.350	0.16	32	38
TRANSPORTES MARITIMOS CHILOE, AISEN LTDA.	6	1.442	1.218	0.15	32	38
SOCIEDAD NAVIERA COMERCIAL ALVAYAY LTDA.	1	395	670	0.08	4	6
SOCIEDAD MARITIMA Y COMERCIAL SOMARCO S.A.	2	718	660	0.08	10	8
FISCO CHILE-DIRECCION DE VIALIDAD	2	502	562	0.07	13	12
NAVIERA ANTARTICA LTDA.	1	295	380	0.05	2	5
CONSTANTINO KOCHIPAS CARCANO	2	571	364	0.04	7	12
EMPRESA MINERA AISEN	3	288	325	0.04	6	6
NAVIERA Y TURISMO SKORPIOS	1	1.263	286	0.03	4	6
SOC.COMER.DE TURISMO MARIT.AEREO Y TERR.VERA Y MARTINEZ	1	313	250	0.03	4	4
NAVIERA CRUZ DEL SUR LTDA.	1	168	236	0.03	4	10
AGRICOLA, FORESTAL Y GANADERA KOCHIPAS HERMANOS Y CIA.	1	126	200	0.02	2	4
EMPRESA NACIONAL DE PETROLEO	1	322	180	0.02	4	4
ILUSTRE MUNICIPALIDAD DE VALDIVIA	1	75	120	0.01	2	3
EDULIO NAVARRO MANCILLA	1	73	60	0.01	2	2
SOCIEDAD TURISMO ALTA MAR LTDA.	1	82	45	0.01	2	3
T O T A L	73	489.640	820.965	100.00	535	767

FIGURE 2-4 SUMMARY OF THE CHILEAN MERCHANT FLEET.

As shown in the previous Figure, the current national fleet could be seen as a rather small one considering the size of the country and its EEZ.

Figure 2-5 shows the continuous fluctuating performance of the Dead Weight Tonnage (DWT) of the Chilean Merchant Fleet throughout the last 10 years.

Figure 2-6 illustrates the continuous fluctuation of the number of ships composing the Chilean Merchant Fleet during the same period of time.

2.4.2 CHILEAN INDUSTRIAL FISHING FLEET (> 50 GT).

As can be easily noticed in Figure 2-7, in this case, conversely to the former one, the Chilean Industrial Fishing Fleet has experienced steady growth during the last 10 years. The current number of fishing vessels is more than twice the number of 10 years ago. This issue, as shall be discussed later, has a tremendous influence on the MCI system, mainly because this fleet, together with the artisanal one, is almost daily involved in maritime casualties or incidents.

2.4.3 CHILEAN ARTISANAL FISHING FLEET (< 50 GT).

Figure 2-8 illustrates how the Artisanal Fishing Fleet, the Tugboats and the Industrial Fishing Fleet are distributed along the different Chilean ports. There are many artisanal fishing boats in the northern part of the country, but at the same time there are many in the central and southern part too. It is not difficult to guess that this fleet is the poorest of all, and, therefore, it is the source of many casualties, accidents, etc.

DWT OF THE CHILEAN MERCHANT FLEET 1980-1990

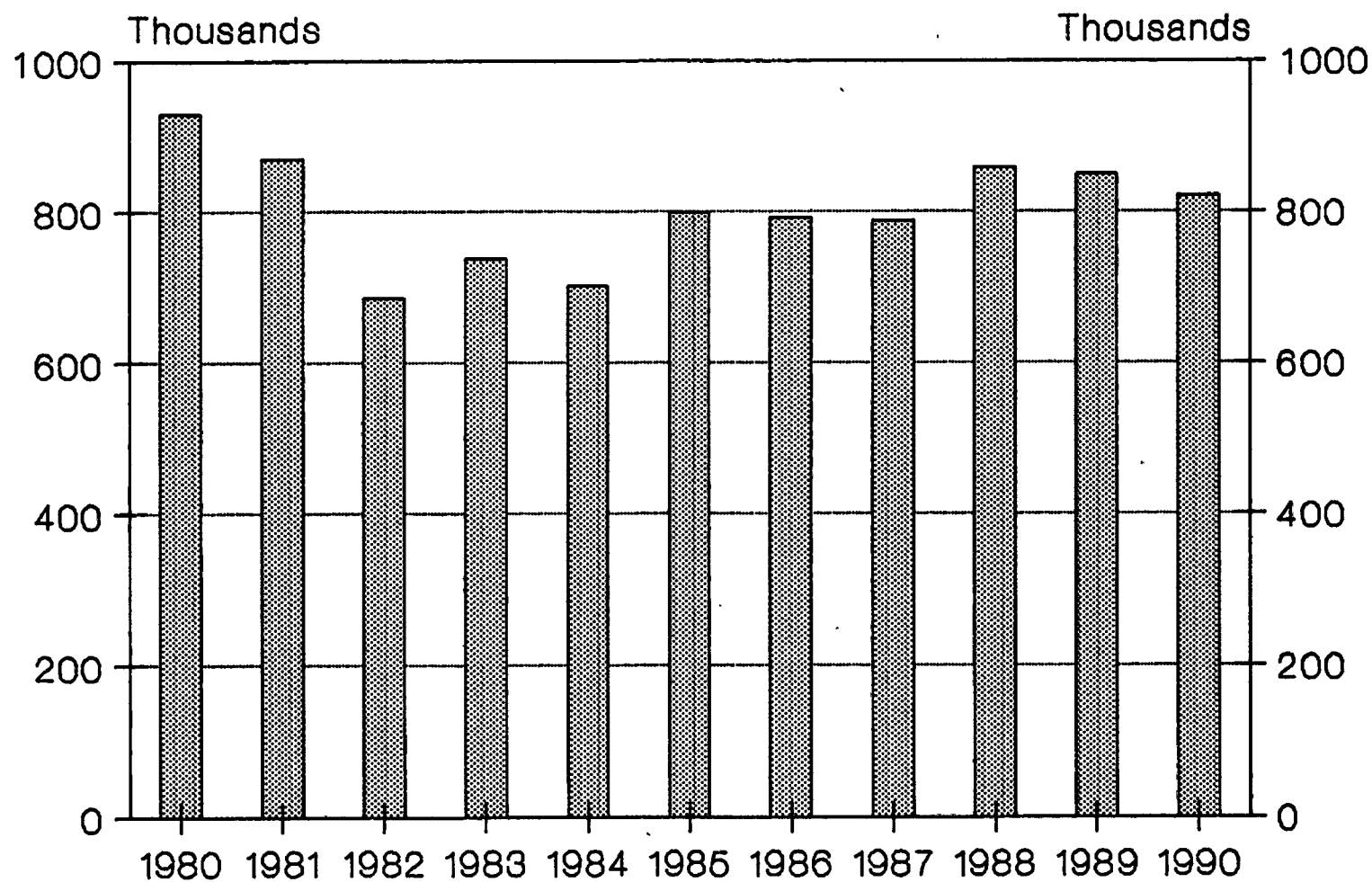


FIGURE 2-5 CHILEAN MERCHANT FLEET (DWT)

CHILEAN MERCHANT FLEET

NUMBER OF SHIPS

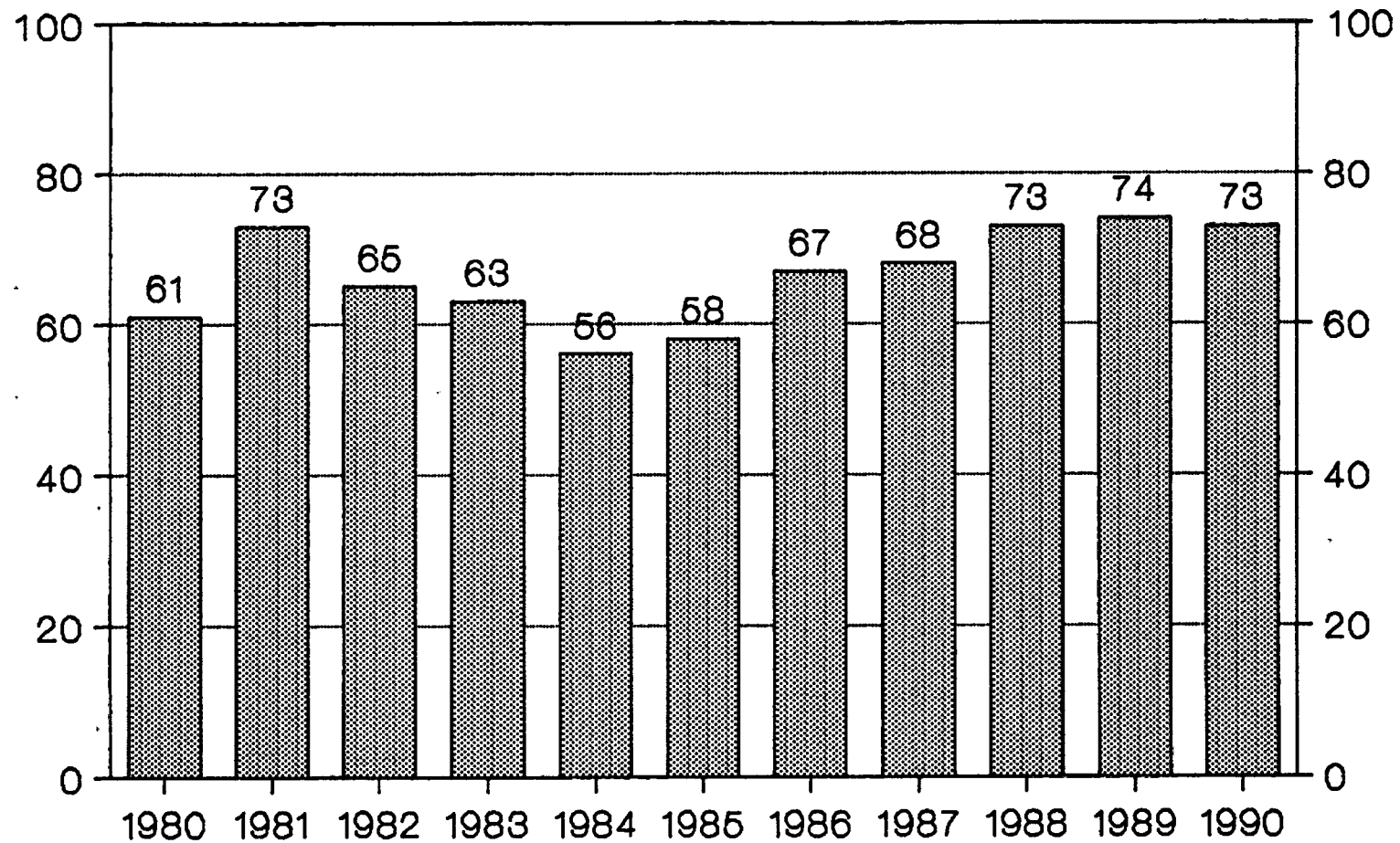


FIGURE 2-6 CHILEAN MERCHANT FLEET

CHILEAN INDUSTRIAL FISHING FLEET (> 50 GT)

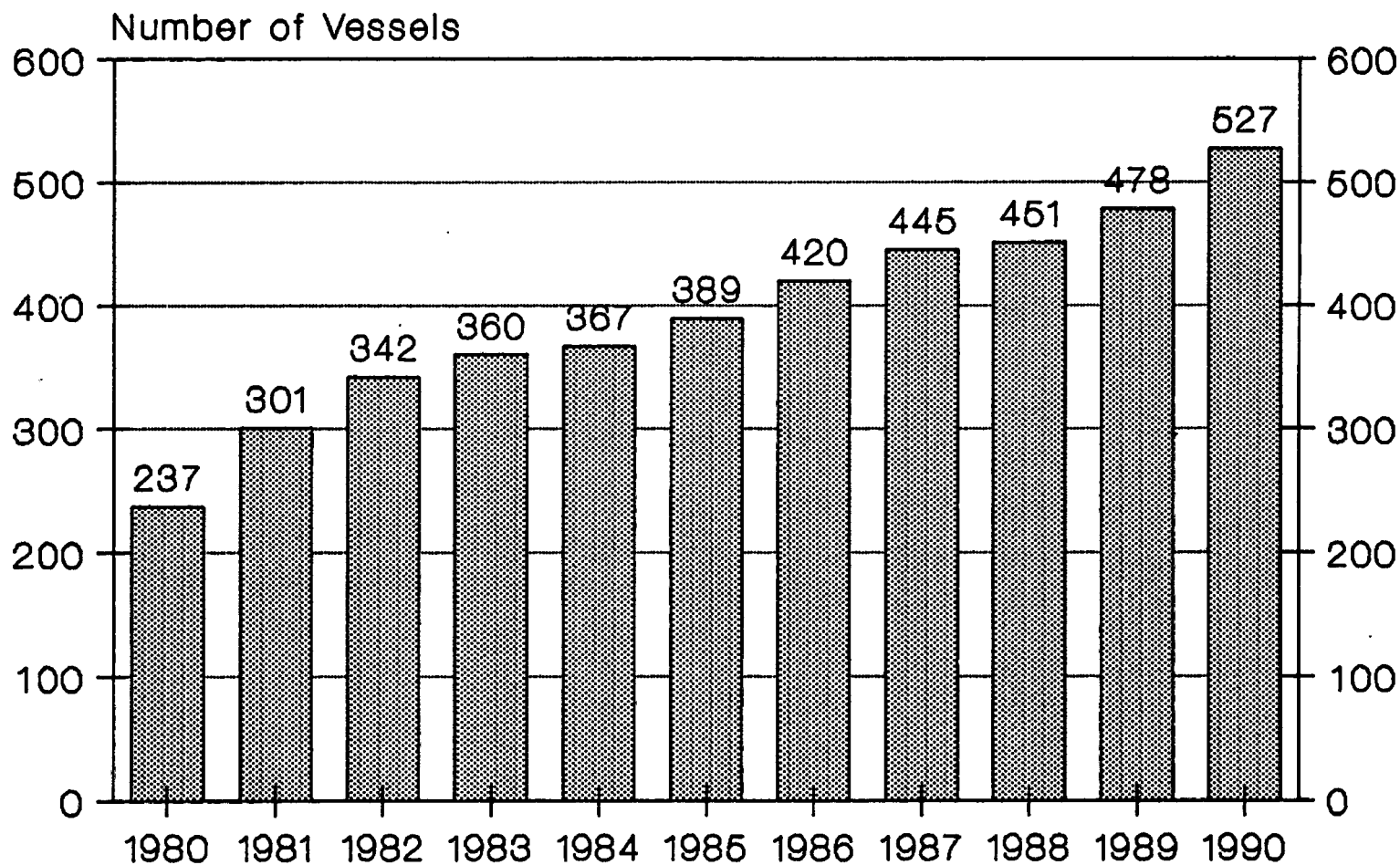


FIGURE 2-7 CHILEAN FISHING FLEET

PORTS	< 50 GT	> 50 GT	TUGS
ARICA	405	57	3
IQUIQUE	825	105	3
TOCOPILLA	408	17	1
MEJILLONES	196	14	-
ANTOFAGASTA	609	5	3
TALTAL	238	-	-
CHANARAL	218	-	1
CALDERA	359	18	0
HUASCO	214	-	1
COQUIMBO	1,889	32	1
LOS VILOS	798	-	-
ISLA DE PASCUA	54	-	-
ISLA JUAN FERNANDEZ	75	-	-
QUINTERO	797	10	0
VALPARAISO	1,512	18	8
RAPEL	397	-	-
SAN ANTONIO	920	24	4
CONSTITUCION	572	-	-
LIRQUEN	1,091	3	-
TALCAHUANO	577	55	10
SAN VICENTE	110	50	3
CORONEL/LOTA	181	27	1
LEBU	275	-	-
LAGO VILLARRICA	1,312	-	-
CORRAL	1,232	-	-
VALDIVIA	3,011	-	3
PUERTO VARAS	519	-	-
PUERTO MONTT	2,257	19	6
CALBUCO	2,371	2	-
MAULLIN	2,890	-	-
ANCUD	3,666	-	-
CASTRO	1,611	1	-
ACHAO	1,350	-	-
QUELLON	906	3	-
CHAITEN	617	-	-
CHONCHI	299	3	-
MELINKA	388	-	-
PUERTO AGUIRRE	506	-	-
PUERTO CISNES	678	-	-
AYSEN	618	-	-
CHACABUCO	450	16	1
LAGO GENERAL CARRERA	50	-	-
PUERTO NATALES	534	-	-
PUERTO EDEN	95	-	-
PUNTA ARENAS	1,032	37	19
TIERRA DEL FUEGO	183	-	-
PUERTO WILLIAMS	42	-	-
FACTORY VESSELS	-	-	-
TOTAL	39,337	527	68

FIGURE 2-8 CHILEAN FISHING VESSEL FLEET AND TUGS.

Like the Industrial Fishing Fleet, the Artisanal Fishing Fleet has experienced huge developments, increasing its number of boats from 6,080 units in 1980 to 39,337 in 1990. This is illustrated in Figure 2-9.

2.4.4 MARINE CASUALTIES, SAR AND POLLUTIONS.

As earlier stated in this chapter, there are many more MCI's involving fishing vessels than any other type of ships in Chile. This is mainly due to the size of the fishing fleet but also due to other reasons, inter alia, the social and cultural level of fishermen, the economical situation of fishermen, difficulties of field control of their activities by the Maritime Authority, etc. This situation is illustrated in Figure 2-10.

Considering now the statistics concerning the SAR organization and looking at Figure 2-11, it is easy to realize that the number of SAR operations has steadily increased during the last seven years, from 60 operations in 1984 to 285 operations in 1990. All these SAR operations are related to marine casualties. From Figure 2-12 it is possible to realize that as a consequence of the casualty increase, the number of dead and missing people has also increased but following a fluctuating pattern. To finalize the SAR situation, it is much more important to notice that, because of the extraordinary development that the Chilean SAR Organization has undergone during the last 10 years, the number of survivors from marine casualties has dramatically increased from 70 survivors in 1981 to 1,980 survivors in 1990. This is shown in Figure 2-13.

CHILEAN ARTISANAL FISHING FLEET (< 50 GT)

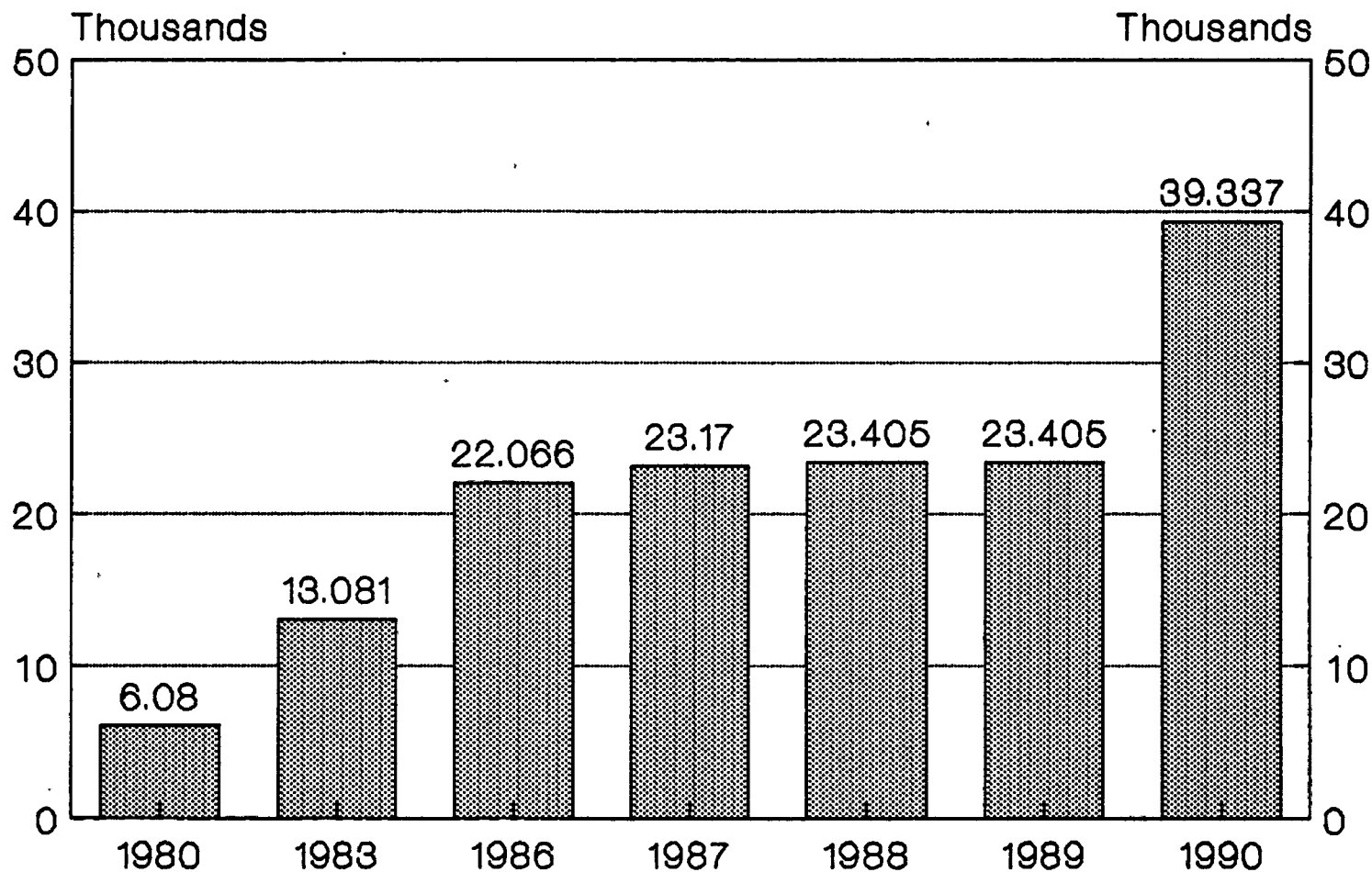


FIGURE 2-9 ARTISANAL FISHING FLEET

MARINE CASUALTY OCCURRENCES	TOTAL	P E R S O N S			
	ACCID	DEADS	MISS.	CASUAL	SURVIV.
MERCHANT SHIPS					
GROUNDING	2	-	-	-	29
COLLISION	3	-	-	-	63
MACHINERY DAMAGE	3	-	-	-	81
STRUCTURAL DAMAGE	2	-	-	-	47
STABILITY	1	-	-	-	29
ALARM ACTIVATED BY ERROR	1	-	-	-	-
ACCIDENT VICTIM ABOARD	2	1	-	1	-
SUBTOTAL	14	1	-	1	249
FISHING VESSELS (> 50 GT)					
SHIPWRECK	7	19	-	12	156
GROUNDING	11	-	-	-	206
MACHINERY DAMAGE	19	-	-	-	309
ENTANGLED PROPELLER	4	-	-	-	62
FIRE	5	-	-	2	-
FLOODING (HULL DAMAGE)	1	-	-	-	25
RUDDER/PROPELLER DAMAGE	1	-	-	-	18
CREW OVERBOARD	2	-	1	1	-
ACCIDENT VICTIM ABOARD	20	-	-	20	-
OTHER MARINE CASUALTIES	2	-	2	-	16
SUBTOTAL	72	19	3	35	820
FISHING VESSELS (< 50 GT)					
VESSELS LOST	5	-	6	-	4
SHIPWRECK	24	9	19	1	70
CAPSIZE	17	8	17	6	22
GROUNDING	12	1	1	1	51
ENTANGLED PROPELLER	5	-	-	2	26
MACHINERY DAMAGE	62	-	-	-	358
FLOODING	5	-	-	-	28
COLLISION	2	-	-	-	6
FIRE	4	-	-	-	18
ELECTRIC FAILURE	13	-	-	-	80
LACK OF GASOLINE	1	-	-	-	3
HULL DAMAGE	1	-	-	-	2
ARRIVAL DELAY	24	-	-	-	84
CREW OVERBOARD	4	-	3	-	13
RUDDER FAILURE	8	-	-	-	53
OTHER MARINE CASUALTIES	12	5	-	2	45
SUBTOTAL	198	18	46	12	863
TOTAL CASUALTIES	285	43	49	48	1,932

FIGURE 2-10 MARITIME CASUALTIES OCCURRED IN CHILE DURING 1990

SEARCH AND RESCUE SERVICE NUMBER OF OPERATIONS

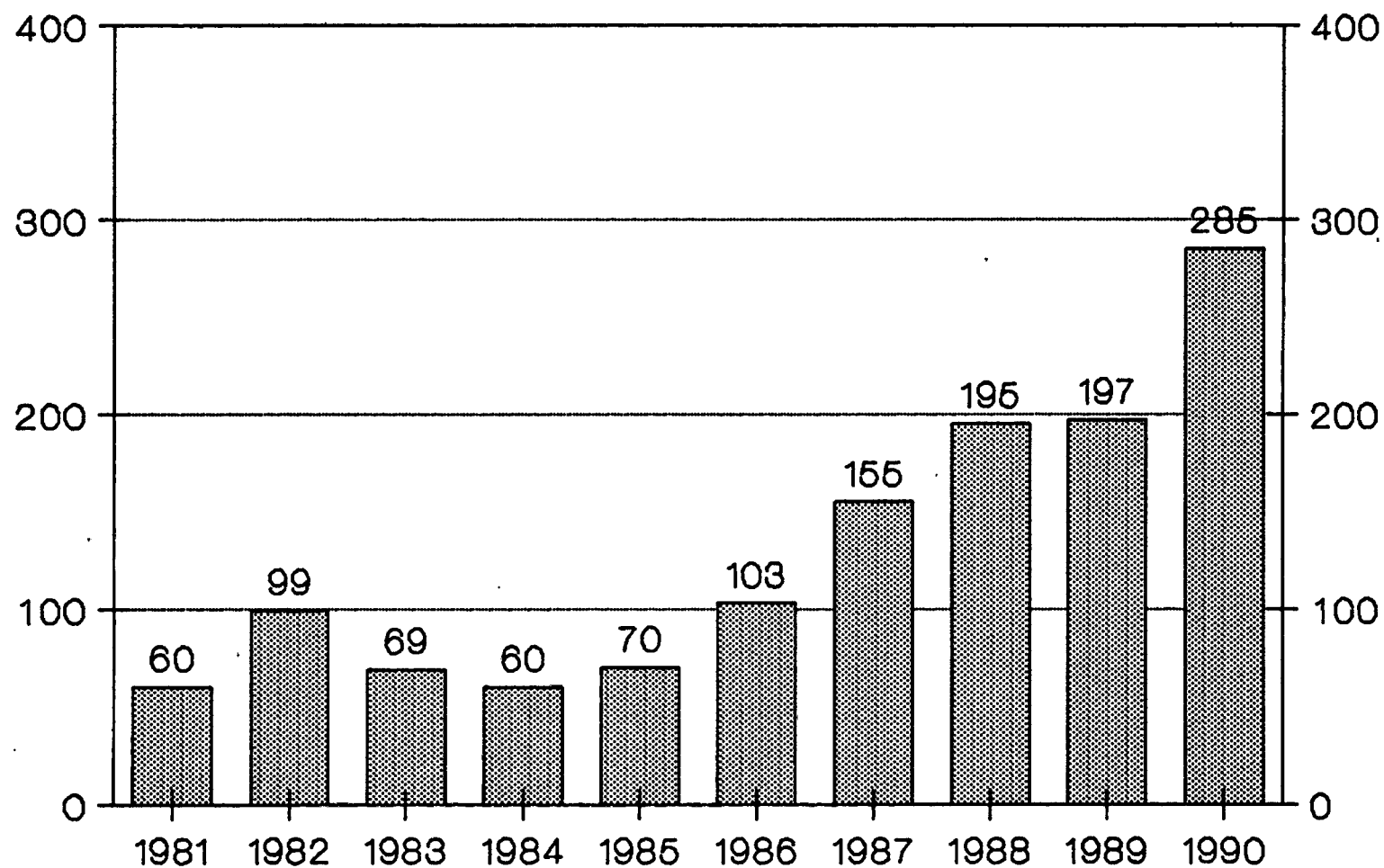


FIGURE 2-11 NUMBER OF SAR OPERATIONS

SEARCH AND RESCUE SERVICE NUMBER DEAD AND MISSING

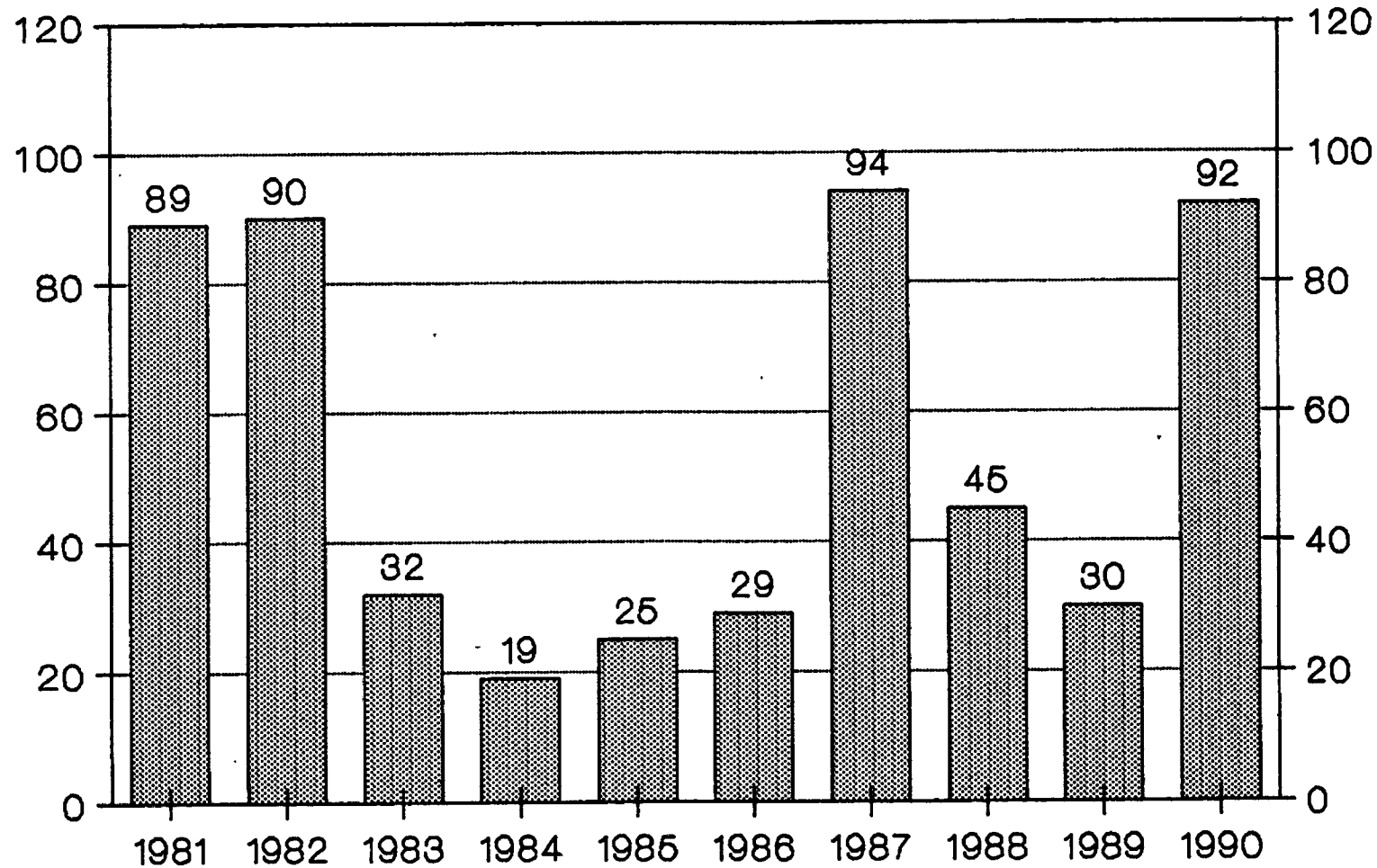


FIGURE 2-12 SAR OPS.(DEAD & MISSING)

SEARCH AND RESCUE SERVICE NUMBER OF SURVIVORS

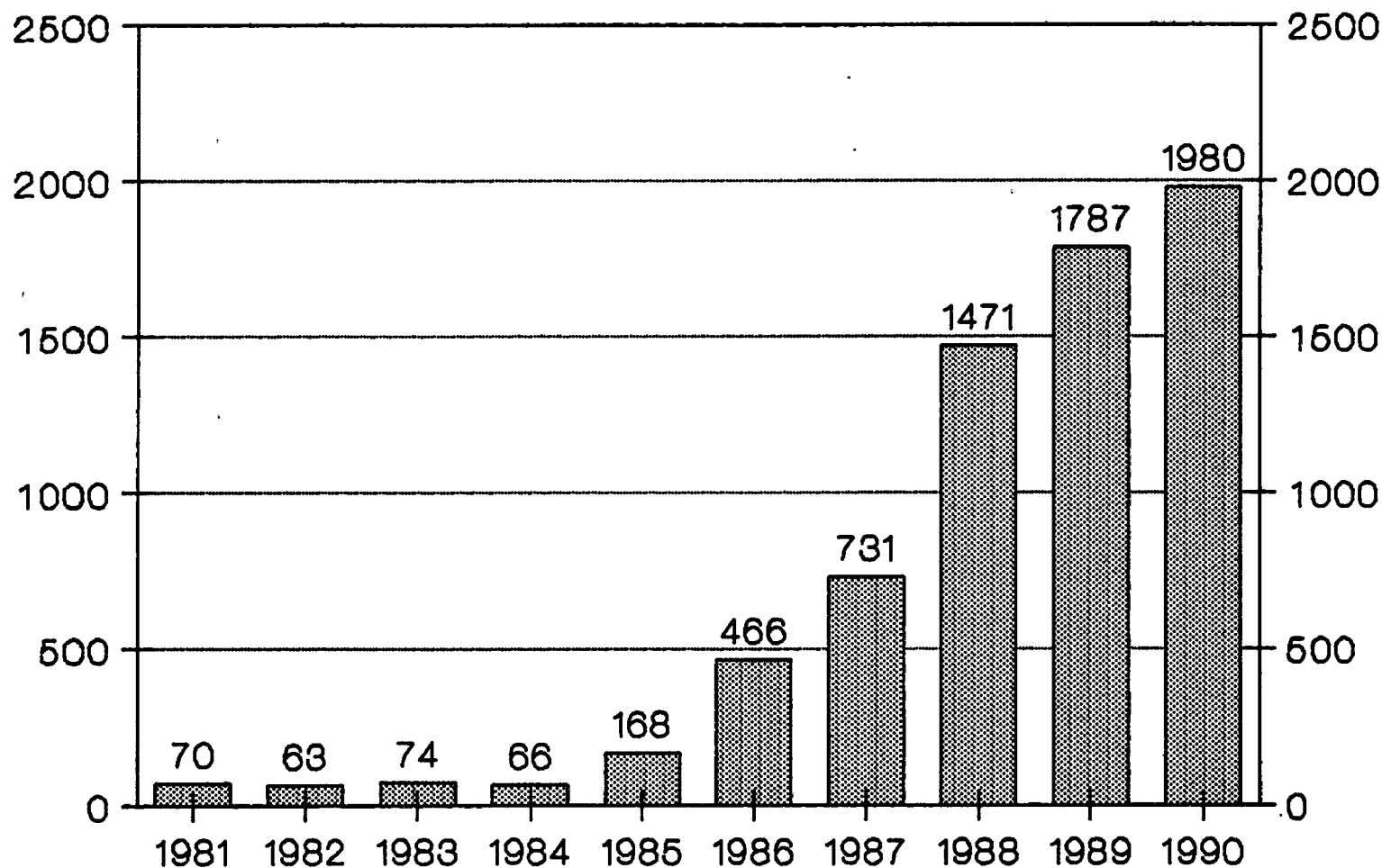


FIGURE 2-13 SURVIVORS IN SAR OPERATIONS

Besides the investigations related to the occurrences of typical marine casualties (foundering, stranding, collision, etc), the Directorate is also bound to carry out an investigation because significant marine pollution has happened. It might be pollution with or without injured or dead people. To give an idea of the main characteristics of pollution in Chile, Figure 2-14 shows a list of the main marine pollution incidents that have occurred in Chile during 1990.

2.5 REMARKS FROM IMO ABOUT MCI IN LATIN-AMERICA.

In September 1990 IMO produced a report about the priorities concerning technical cooperation in Latin-America. In this report, under the title of MCI, they stated that despite the importance of carrying out a good analysis after every casualty, this is not properly done in many countries of the region. Thus, IMO suggested to take due care of it. It has been proved, IMO stated, that most casualty reports which were sent to IMO from countries of that area of the world did not include all the necessary information to make them valuable.

Figure 2-15 illustrates some statistical information coming from IMO about marine casualties in Latin-America. Considering that during the period 1980-1989 the Chilean average losses were 1.13 %, whereas the regional average losses were only 0.54 %, it clearly can be noticed that Chile is one of the countries with most losses. According to IMO, 1986 was a critical year for Chile due to the fact that losses were more than 10 % of its total fleet.

DATE	PLACE	SHIP CLASS.	SHIP'S NAME	FLAG	SPILLAGE CAUSE	POLLUTANT	AMOUNT
01 JAN	PUERTO MONTT	RO-RO	TIERRA DEL FUEGO	CHILE	(*)	FUEL OIL	(*)
13 JAN	QUINTERO	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	CRUDE OIL	1.0 M3
23 FEB	HUASCO	BULK CARRIER	COMBI STAR	NORWAY	GROUNDING	DIESEL OIL	1.0 M3
24 FEB	SAN VICENTE	FISHING VESS.	TAMARUGAL	CHILE	(*)	FUEL OIL	(*)
01 APR	TOCOPILLA	TANKER	OCEAN SPIRIT	LIBERIA	PIPE BREAK.	FUEL OIL	1.7 M3
08 APR	TALCAHUANO	FISHING VESS.	GUAMBLIN	CHILE	PIPE BREAK.	FUEL OIL	0.3 M3
08 MAY	TALCAHUANO	FISHING VESS.	SAN MIGUEL	CHILE	(*)	FUEL OIL	(*)
12 MAY	TOCOPILLA	BULK CARRIER	STANLEY SPRAY	CHILE	PIPE BREAK.	SULF. ACID.	2500 LT
20 MAY	CAL. TOTORAL	FISHING VESS.	NICOMAR II	CHILE	GROUNDING	FUEL OIL	(*)
21 JUN	TALCAHUANO	FISHING VESS.	V. SIMONOK	USSR	HULL DAMAGE	CRUDE OIL	6.0 M3
30 JUN	SAN VICENTE	TANKER	ALPACA	CHILE	PIPE BREAK.	DIESEL OIL	0.3 M3
03 JUL	CALDERA	FISHING VESS.	ATACAMA II	CHILE	PIPE BREAK.	FUEL OIL	(*)
09 JUL	I. DARWIN	FISHING VESS.	MAR AZUL XV	CHILE	GROUNDING	OIL	(*)
11 JUL	PTA. ARENAS	FISHING VESS.	ISLA SOFIA	CHILE	GROUNDING	DIESEL OIL	4.0 M3
28 DEC	TALCAHUANO	FISHING VESS.	SAN MIGUEL	CHILE	(*)	OIL	(*)
28 DEC	TALCAHUANO	FISHING VESS.	IQUIQUE	CHILE	(*)	OIL	(*)

(*) = INFORMATION UNKNOWN SO FAR. THE INVESTIGATION IS STILL IN PROCESS.

FIGURE 2-14 MAIN MARITIME POLLUTIONS OCCURRING DURING 1990.

	1985		1986		1987		1988		1989	
	FLEET (GT)	% LOSS	FLEET (GT)	% LOSS	FLEET (GT)	% LOSS	FLEET (GT)	% LOSS	FLEET (GT)	% LOSS
ARG	2,457,377	0.09	2,117,017	0.01	1,901,026	-	1,876,673	-	1,832,518	0.29
BOL	14,913	-	14,913	-	13,824	-	9,610	-	9,610	-
BRA	6,057,364	0.14	6,212,287	0.18	6,324,059	-	6,122,836	-	6,078,150	0.69
CHI	454,484	-	566,881	10.33	546,745	-	603,557	0.06	589,669	0.20
COL	365,638	0.03	380,074	-	423,631	-	412,321	-	378,916	-
COS	19,936	-	13,325	-	14,781	-	15,080	-	12,976	-
CUB	965,077	1.31	958,613	0.31	966,288	-	912,002	-	900,252	-
DOM	46,676	-	42,241	-	43,560	-	48,306	0.90	43,715	3.99
ECU	443,893	0.44	437,682	0.38	421,361	-	428,066	0.09	401,809	-
ELS	3,501	-	3,819	-	3,819	-	3,819	-	3,819	-
GUA	16,046	-	9,432	-	4,694	-	4,694	-	4,993	-
HAI	2,688	-	2,688	-	512	-	512	-	711	-
HON	356,610	2.64	555,202	0.76	506,374	2.41	582,170	0.87	691,465	1.04
MEX	1,467,191	3.20	1,520,246	-	1,532,485	0.62	1,448,335	0.34	1,388,157	0.53
NIC	17,956	-	22,930	-	12,739	-	13,658	6.73	4,620	-
PAN	40,674,201	0.73	41,305,009	0.43	43,254,716	0.33	44,604,071	0.39	47,365,362	0.21
PAR	42,851	-	43,298	-	41,670	-	38,567	-	38,761	-
PER	818,103	0.04	745,179	0.1	788,171	0.11	674,952	0.08	638,467	1.63
URU	173,423	-	149,811	-	144,394	-	169,939	-	101,481	-
VEN	984,881	0.62	998,296	0.44	999,195	0.22	982,117	0.57	1,091,674	0.01

ARG = ARGENTINA
 BOL = BOLIVIA
 BRA = BRAZIL
 CHI = CHILE

COL = COLOMBIA
 COS = COSTA RICA
 CUB = CUBA
 DOM = DOMINICAN REP.

ECU = ECUADOR
 ELS = EL SALVADOR
 GUA = GUATEMALA
 HAI = HAITI

HON = HONDURAS
 MEX = MEXICO
 NIC = NICARAGUA
 PAN = PANAMA

PAR = PARAGUAY
 PER = PERU
 URU = URUGUAY
 VEN = VENEZUELA

CHILEAN AVERAGE LOSSES (1980-1989) = 1.13 %
 REGIONAL AVERAGE LOSSES (1980-1989) = 0.54 %

FIGURE 2-15 MARINE CASUALTIES IN LATIN-AMERICA (1985-1989).

CHAPTER III

OTHER COUNTRIES-SITUATION AND PROCEDURES.

3.1 INTRODUCTION.

The main idea behind this Chapter is to develop and show a global picture on how other countries, especially developed ones, are organized to face the investigation of marine casualties.

It is not the aim to go deeper into every specific case but to give a general understanding of their organizations, their procedures, their objectives, etc.

The countries to be described are:

- * France
- * The Netherlands
- * The UK
- * The USA
- * Two Scandinavian countries (Sweden and Denmark)
- * Greece

3.2 THE CURRENT SITUATION IN FRANCE.

The French MCI system is penal in nature rather than oriented towards finding the cause.

The current "Disciplinary and Penal Code of the Merchant Marine" was enacted in 1926, and although there have been numerous amendments since then, it is still the principal law relating to casualties.

In view of the strict secrecy procedures provided by this Code, the possibility of using the process for improving safety is very limited.

The investigations are carried out in all cases by employees of the Department of Transport. According to the Law, casualties to French ships anywhere and casualties to foreign ships in French territorial waters must be reported to a Maritime Affairs Administrator and an investigation is carried out.

The main purpose of regular investigations is to impose penalties. For instance, if a mariner is found guilty, according to the gravity of his fault, he is subject to have his certificate suspended or revoked, to be fined with up to 500,000 francs or to be imprisoned for up to five years. In the case of pleasure craft, they must be registered in France if they are more than two tons. Casualties to pleasure craft are dealt with in the same manner as those to other ships. As seen above, the principal inquiry system in France is not oriented towards safety recommendations except in special cases. This is, however, the main role of the commissions created in 1981, after the Amoco Cadiz disaster. Indeed, they were created to permit the conduct of technical and administrative inquiries, in order to determine causes and the lessons which can be drawn from them for marine safety.

3.3 THE CURRENT SITUATION IN THE NETHERLANDS.

The Netherlands has investigated casualties since 1856, but the present system was established by the enactment of the Merchant Shipping Act of 1909, which is still in effect although it has been amended several times. This Act applies to all seagoing vessels, including all seagoing fishing vessels, except open fishing vessels; it excludes pleasure boats unless they carry paying passengers. There are, however, other provisions relating to the inland fleet, which is considerably large.

The Netherlands has a Casualty Investigation Department which is a division of the Ministry of Transport and Public Works. This Department relies on the shipping inspection directors in the three areas of maritime transport, who in turn are assisted by more than 40 deputy inspectors or surveyors who are the ones carrying out the field investigations.

Not all casualties are investigated. A decision is taken in each case by the Head of the Casualty Investigation Department.

The criteria for investigating are the seriousness of the casualty or, sometimes, the knowledge that safety lessons can be learnt from an investigation.

Pleasure craft are not subject to casualty investigations, unless they carry, as it was mentioned, paying passengers or they are seagoing craft.

In inland waterways the majority of accidents are minor and are handled by the local police.

3.4

THE CURRENT SITUATION IN THE UK.

The UK probably has the longest history of casualty investigations dating back to two centuries ago or more. The Maritime Accident Investigation Branch (MAIB) has been, since its establishment in 1989, the governmental agency in charge of MCI's. It is an independent arm of the Department of Transport, reporting directly to the Secretary of State for Transport. The MAIB's role is to investigate:

- * Accidents at sea and on board ships, and
- * Dangerous occurrences at sea.

For the MAIB, the main purpose of carrying out investigations is to determine what is the cause of an accident in order to prevent it from happening again. Reports on casualties or accidents are published and include recommendations and lessons to be learnt. This is an important contribution to improving safety at sea.

The professional staff and the Inspectors of the MAIB, come from the three marine disciplines -nautical,engineering and naval architecture. The Inspectors are available to travel at instant notice to wherever a ship has been involved in an accident. To respond quickly to an accident, the MAIB phone is manned 24 hours a day. Upon receiving casualty information, the duty Inspector will be contacted and the decision will be taken whether to send or not, an Inspector or Inspectors to the scene of the accident.

Depending upon the evidence obtained by the Inspector, the Chief Inspector decides whether the accident will be the subject of a limited investigation or whether a full investigation is to be carried out.

The Inspectors are kept fully up-to-date with the operational practice in ships of all types, often visiting ships other than in the course of investigations, and making short voyages. The Inspectors also lecture on the aspects of accident investigation.

In the case of pleasure craft accidents, these are not normally investigated unless the craft was carrying paying passengers. Boating is neither regulated nor subject to compulsory registration. It is felt that the government should keep out of pleasure activities.

3.5

THE CURRENT SITUATION IN THE USA.

The USA marine casualty investigations are carried out under a dual system whereby the USCG carries out almost all the investigations and the National Transportation Safety Board (NTSB) either carries out an independent investigation or acts as a participant in the investigation by the USCG in some of the major accidents. Discussions have taken place over the years about the possibility of the NTSB taking care of everything but this has not occurred, although working arrangements have been concluded from time to time between the two organizations. It is difficult to determine, whether or not the present situation is to be permanent.

The main roles of these two organizations are described below.

3.5.1

THE USCG.

The USCG is responsible for a broad range of maritime activities affecting both commercial and non commercial matters.

In particular, it is responsible for vessel inspection and certification, licensing and certification of personnel, federal pilotage, vessel traffic management, regulations and enforcement. It is also responsible for SAR.

The Commandant is in full charge of the Coast Guard but he is not directly involved in investigations. Under him there are various offices, one of which is the Merchant Marine Safety Office, which is headed by a Rear Admiral. This office has five divisions namely Inspection, Licensing, Documentation, Investigation and Marine Technical and Hazardous Materials.

At the field level, there is a District Commander who is a Rear Admiral; under him there is the Marine Safety Division, and under that there are Officers in Charge of Marine Inspection (OCMI); under the OCMI there is the investigation section.

There are 11 districts. In major field offices there are Senior Investigating Officers plus others, whereas in some smaller offices there might be only one Investigating Officer.

A Senior Investigating Officer is one who has had one or more years of experience.

All investigators report to the OCMI and all such reports eventually go to headquarters; some of them may go through the district office first.

The Coast Guard still has full jurisdiction to investigate all casualties. The NTSB has concurrent jurisdiction to investigate "major marine casualties" involving loss of six or more lives, loss of self-propelled vessels over 100 GRT, damage exceeding \$500,000 (American dollars) or serious threat to life, property or the environment by hazardous materials. In such cases, the NTSB participates in the investigation, which is then carried out by the Coast Guard according to its own rules. On the other hand, the NTSB investigates exclusively all collisions between a Coast Guard vessel and a non-public vessel involving at least one fatality or \$75,000 (American dollars) in property damage.

This last arrangement results from a Memorandum of Understanding signed between the USCG and the NTSB in September 1981. If a "major marine casualty" occurs, the Coast Guard informs NTSB; there is then consultation as to the participation of the latter in the investigation or, eventually, in a public inquiry.

3.5.2

THE NTSB.

The NTSB was established by statute in 1966 (Public Law 89-670) as an independent Government Agency located within the Department of Transportation in order to perform some important tasks pertaining to accident investigations.

Its main duty is to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations.

Regarding marine casualties, the NTSB shall investigate major marine casualties, but without in any way diminishing the responsibilities of the USCG. The Board is composed of five full-time members, one of them is the Chairman and another the Vice-Chairman.

There are 5 accident investigation divisions namely Aviation, Railroad, Highway, Marine and Hazardous Materials-Pipelines.

The Board also has 10 field operations offices, a Bureau of Technology, a Bureau of Safety Programs and a Bureau of Administration.

The Board's activities are more prominent in aviation accident investigations than in marine accident investigations. Approximately 4000 aviation investigations are carried out per year, many of which are minor ones. The Board gets involved only in approximately 60 to 65 marine casualties per year, most of which are major, and in over 90% of the cases, the investigations are carried out by the Coast Guard, with NTSB acting as a participant. Only two or three investigations per year are currently carried out directly by the NTSB, in cases involving Coast Guard or other public vessels. In all marine cases, however, the NTSB issues its own report and recommendations, and the USCG does the same. It is felt by many people that having two distinct reports issued on a single casualty is a rather unsatisfactory system.

The NTSB investigation and hearing processes exclude all disciplinary involvement.

Unlike the Coast Guard, the NTSB does not include any recommendation as to the conduct of individuals or companies in its reports.

3.6 THE CURRENT SITUATION IN TWO SCANDINAVIAN COUNTRIES.

(SWEDEN AND DENMARK).

These two Scandinavian countries have established a compatible casualty investigation system in their respective legislations to such an extent that where, for instance, Sweden does not have a foreign service in a specific foreign port it will allow the proceedings to be held before a Danish representative in that port if that does not interfere the objectivity, confidence and other important factors clearly established in the current regulations, among which the IMO Resolution A 637 (16) - 1989 is one of the most important.

The process is called Maritime Declaration and its main purpose is to obtain the fullest possible information concerning the casualty or incident, particularly the information concerning the circumstances which are of importance for judging the seaworthiness and safety at sea, and concerning facts which may give rise to penal liability or other liability for the shipowner, shipmaster, crew member or others.

There are mandatory declarations, such as when there has been loss of life, serious injury, a collision, a grounding, an abandonment at sea, appreciable damage or significant fire/explosion in the cargo.

Other accidents of any significance may be subject to a declaration at the request of the Government Casualty Investigation Board, of the maritime investigator or of the owner or master of the ship.

Generally the request for a maritime declaration must be made by the shipmaster not later than the second day after arriving in port. This request is made to the nearest court. Minor occurrences are not subject to maritime declarations and they are handled only by the maritime investigators properly appointed by the aforementioned Casualty Board.

The courts hearing maritime declarations have no jurisdiction to deal with discipline, which goes through a separate process.

Many marine offences are subject to criminal laws and are dealt with by penal courts. The maritime declaration system is totally open and parties or insurers can use it for their own purposes but, in practice, the hearing is not very long.

Investigators can go on board and can seize or copy logbooks, but they have no power to compel testimony. However, in practice, evidence is rarely refused.

The real purpose of maritime declarations is to obtain evidence. The evidence and all the information about the facts are sent to the Casualty Board.

Accidents to pleasure craft are investigated in the same way as those to commercial or fishing vessels.

3.7

THE CURRENT SITUATION IN GREECE.

In this country, a preliminary investigation is carried out by the port authority or the consular authority under whose jurisdiction the casualty took place or within which the damaged ship approached or disembarked her crew.

The findings are submitted to the District Attorney and to the Ministry of Mercantile Marine. Such findings are then referred to a MCI Board, which holds a public hearing in which involved parties, insurers and cargo owners can participate.

The report of this Board determines the causes and the degree of guilt of the parties. Upon receipt of the report the Disciplinary Board of Merchant Marine may suspend or revoke certificates or licences.

It is interesting to note that the definition of a "shipping casualty" is limited to total loss of the vessel, abandonment of the ship, loss or damage to the cargo to the extent of more than 25%, loss of life or serious injury.

3.8

COMMENTS.

As was explained earlier in this chapter, the MCI systems in these countries vary, to a lesser or greater degree, from one country to the other.

Each of these systems has advantages over the others, but at the same time they have their respective weaknesses.

The investigation processes, as well as the reports and their use, are directly affected by the nature of the objectives pursued, depending on whether strictly safety purposes or disciplinary or civil considerations are taken into account.

Most countries have two types of inquiries or investigations, namely preliminary inquiries and formal investigations. Some countries place emphasis on the former, and others on the latter, at least with respect to the number of investigations.

CHAPTER IV

WEAKNESSES OF THE CURRENT SITUATION IN CHILE.

4.1

INTRODUCTION.

Based on what has been explained in the previous chapters, especially Chapter II (The Current Situation in Chile), and considering the different systems analyzed in Chapter III, it is not difficult to realize that something could be done to improve the Chilean MCI system in many aspects. This does not in any way mean that the current system is not working well. It means that, according to the author's point of view, there are certain weaknesses in the system, some being more important than others, which impede and impair the better performance of it.

These aforementioned weaknesses are discussed in the following paragraphs.

4.2

ORGANIZATIONAL WEAKNESSES.

4.2.1

WEAKNESS No.1.

Firstly, are we right in our system to designate the task of MCI to the Directorate as part of its general role in the superintendence of shipping ? There are strong arguments for a different approach.

A separate body, an independent one, would develop a high degree of expertise and moreover, by its independence, ought to be free from any charge of conflict of interest should the actions of the Directorate or its staff be called into question, e.g. if the adequacy of survey procedures prior to the casualty are in doubt, or of SAR procedures after it. We have to remember that the Directorate is, by law, the regulator and the enforcer of maritime regulations. Based on these two realities, in these two capacities that it performs, it can be claimed that the Directorate is not an independent body, being seen as the investigator and the judge at the same time, as it currently is.

There can also be degrees of conflict of interests when the Directorate is having to investigate and report on a casualty resulting, in whole or in part, from a deficiency in the regulations or their enforcement.

Considering all the aforesaid arguments it is believed by the author that this situation needs to be rectified; some sort of solution should be found, in order to overcome this problem, but at the same time, allowing the Directorate to keep its participation in some legal way in the MCI's.

4.2.2

WEAKNESS No.2.

Another weakness of the current situation is that in Chile, like in many other countries, despite the fact that among the Air Force, the Directorate and other organizations there are some similar tasks which could be faced together (SAR, MCI, etc.), their roles in such tasks are not coordinated to the optimum extent.

A couple of years ago the author proposed, in one of his projects, the establishment of an independent body (under the responsibility of the Minister of Defence), in charge of the administrative process of SAR activities, allowing the Air Force and the Directorate to continue being in charge of the operational activities (on field) in their respective areas.

At that time, and because of the national organizational requirements from the Cospas-Sarsat system, within the GMDSS, the proposal was accepted but has not been completely implemented as yet.

As has been attempted in the SAR case, some sort of cooperation among all organizations involved in MCI should also be attempted.

4.3 OPERATIONAL WEAKNESSES.

4.3.1 WEAKNESS No.1.

In the current Chilean MCI procedures, discipline plays an important role. From the author's point of view, this appears to be a weakness, because sometimes during the investigations, too much time is devoted to solving disciplinary matters, rather than devoting the time to find out the facts. What is more important is to find out the causes of casualties and make appropriate recommendations to eliminate or reduce safety deficiencies and to prevent their repetition. A casualty investigation system with the dual purpose of advancing safety and exercising disciplinary sanctions must be carefully conducted to avoid these things from happening.

4.3.2

WEAKNESS No.2.

First of all, since the Directorate belongs to the Chilean Navy the confidentiality policies of the Directorate are at a high level. These policies seem to affect our present investigation system and tend to feed the feeling of conflict of interest held by many and thus represent another weakness of the present situation. The fact that a collision or stranding may result from human error is true for the vast majority of casualties and this is the main area where mariners can learn safety lessons.

In the author's view, the publication of investigation reports is very important not only when human error is the cause of the casualty, but also when operational deficiencies are involved; in order to prevent the same errors from occurring again, mariners will learn from the conclusions of the report and quickly improve their practices. This may well be the area where the greatest improvement in safety can be achieved.

After learning from a number of actual cases of fires or explosions caused by dirty bilges, fishing vessel skippers will surely improve their cleaning-up practices, probably more than if they are just told to do so by a notice or even by a code.

4.4

TRAINING WEAKNESSES.

4.4.1

WEAKNESS No.1.

Currently there are no adequate specialized Marine Casualty Investigating Officers within the Directorate.

Often, of course, the cause of the casualty is quite obvious, sometimes almost painful; but there are also many cases when the causes are complex and varied and the investigation is particularly difficult, especially in those tragic incidents where a ship is lost with all hands, and there is therefore no first hand evidence to help the investigator in his enquiries.

In such cases, we need to have efficient investigators and marine experts who know the technical, scientific and practical approaches to investigate and analyze marine casualties.

4.4.2

WEAKNESS No.2.

All Directorate Officers, upon graduating from the Naval Academy, have to comply with certain training and course requirements throughout their careers in order to obtain promotion. MCI courses or qualifications are not included in the current promotion requirements scheme.

Many of the Officers, sooner or later, will have to perform the job of Marine Casualty Investigator, whether as a permanent position or as an occasional one. Anyhow, the only requirement is that the task must be carried out properly.

In spite of the fact that the investigations are not always difficult, there is no system to enable these officers to be well prepared and acquainted with the procedures to be followed. There is no specific training system and many times, they have not even received lectures giving them the basic investigative knowledge to perform, in a good way, the role of a marine casualty investigator.

CHAPTER V

SUMMARY AND CONCLUSIONS WITH RECOMMENDATIONS.

5.1 SUMMARY AND CONCLUSIONS.

As it will have been noticed through the reading of this Project, the objectives of casualty investigation systems differ considerably from one country to another and vary from strictly penal systems to systems solely oriented towards safety, with many variations in between.

The investigation processes, as well as the reports and their use, are directly affected by the nature of the objectives pursued, depending on whether strictly safety purposes or whether disciplinary or civil considerations are taken into account.

Some countries place more emphasis on the preliminary inquiries than on the formal investigations, whereas others do it the other way.

In spite of IMO's effort, no success has been achieved in standardizing casualty investigations. This is in direct contrast with the International Civil Aviation Organization (ICAO) procedures, which are adhered to by many countries. The reason for this is probably that civil aviation came into existence more recently and that ICAO was not faced with long-standing traditions and practices as have existed in the marine world for many decades.

After thoroughly studying the current situation of MCI in Chile, it seems vital and, at the same time, of utmost importance to have efficient investigators and marine experts who know the technical, scientific and practical approaches to investigate and analyze marine casualties. In order to train and qualify the personnel concerned, a specialized course for such officers should be developed and implemented by the Directorate.

The mere acceptance by the maritime community, that the sea will continue taking its toll is totally unsatisfactory. A concerted effort by all concerned must be undertaken as a minimum requirement in reducing the loss of personnel and equipment. One important method in achieving this goal is to improve the investigative procedures pertaining to marine casualties.

Due to the valid claim that a conflict of interests exists between the Directorate's role as the investigating authority and its role in various other areas of marine activity in Chile, it is not advisable to keep the current situation any longer. Given the differences in the expertise required, there are arguments for having some form of distinction between a marine investigation authority and an aircraft investigation authority. However, if there were a convenient level of cooperation and data interchange, there may be advantages of common standards in investigation methodology, rules of evidence, record-keeping, determination of the significance of items under investigation and many other important topics.

5.2

RECOMMENDATIONS.

Some of the recommendations given in this Chapter have come from the knowledge and previous experience of the author, but others have been gathered from the experience of other MCI organizations. In making recommendations I have not attempted to reinvent the wheel; therefore I have used not only the experience of my country (Chile), but also the experience of other, more developed maritime countries.

The Basic Recommendations were made on the assumption that they can be implemented easily, i.e. modifying some Navy or Armed Forces Regulations, whereas the Subsequent Recommendations contain proposals which cannot be implemented without modifying certain National Laws, and therefore its implementation shall take longer.

5.2.1

BASIC RECOMMENDATIONS.

5.2.1.1 RECOMMENDATION No.1: A Course for Marine
Casualty Investigators should be
established.

This course was drafted as a course for Directorate Officers who are going to be specifically trained and qualified as investigators.

To develop the syllabus, the Author has mainly considered the Qualification Requirements for Marine Casualty Investigators prescribed by the USCG for its officers, and the Model Course for Marine Accident and Incident Investigation developed by IMO. The syllabus for this course is included in Appendix "A".

5.2.1.2 RECOMMENDATION No.2: A Brief Course for all Directorate Officers concerning MCI should be established.

This course has been drafted as a brief course for all Directorate Officers, since many of them could become Investigators during their careers, in order to give them the minimum investigative knowledge required to perform in a good way the role of OCMI. The topics covered in this course could also be included in the course plan of all merchant marine officers while studying at the Chilean Maritime Academy. The syllabus for this course is included in Appendix "B".

5.2.1.3 RECOMMENDATION No.3: The primary purpose of MCI should be the improvement of safety of lives and property in marine activities.

It is argued that since an important proportion of casualties is the result of human failure, investigations should also be used to remove incompetent seamen because they constitute major safety risks. The other aspect concerns civil liability considerations. The use of the investigative process to help resolve civil liability matters is seen by some as a necessary and useful part of the process. The casualty investigation system should, in principle, be independent of any disciplinary process, on the other hand, there could be the possibility of recommending that faults have been committed and that one or more separate inquiries should be carried out from the disciplinary point of view.

5.2.1.4 RECOMMENDATION No.4: All Casualties should be investigated to some degree, although in most cases further action may be unnecessary. Nevertheless there is the possibility of identifying trends.

As was shown in Figure 2-10, almost 300 marine casualties are currently being reported in Chile, and it would be extremely costly to investigate them all fully and deeply. However, despite the fact that in the great majority of cases no significant benefit would be derived therefrom, at least a limited investigation should be carried out.

5.2.1.5 RECOMMENDATION No.5: The Investigating Authority should establish, and periodically review, public guidelines indicating when full investigations should be carried out.

Duly publicized guidelines for carrying out investigations to the fullest extent possible should be established and reviewed periodically by the investigating authority, which should, however, have full discretion in their application. The exercise of that discretion should be supported by reasons in all cases.

The Chilean Casualty Investigation Authority, as the executive branch of the government, should nevertheless have the power to order that a particular marine occurrence be fully and deeply investigated.

5.2.1.6 RECOMMENDATION No.6: Most MCI Reports of the Investigating Authority should be made available to the public, subject to any restrictions required in the interest of National Security or specific cases evaluated for the Directorate.

When an investigation is carried out, a complete report should be written and most of the time published. The reports should, of course, include conclusions or findings as to the contributing factors and causes and any other findings which could lead to the improvement of safety, even those unrelated to the causes.

Whenever deemed appropriate the investigating authority should summarize its reports to facilitate the dissemination of its findings and recommendations.

5.2.1.7 RECOMMENDATION No.7: Reports on Serious Casualties, with the findings, should be furnished to the IMO.

The Investigating Authority should furnish the IMO with the findings or result of investigations into serious casualties, without disclosing identity, nationality or responsibility of any ship or person. This is an obligation under the LL, MARPOL and SOLAS Conventions which have already been ratified by Chile.

This fact stresses the need to perform marine casualty investigations in the best manner in order to properly inform the IMO on the conclusions and lessons to be learned.

5.2.2 SUBSEQUENT RECOMMENDATIONS.

5.2.2.1 RECOMMENDATION No.1: The MCI Authority should be an Independent Government Agency (CAMCI).

The establishment of this new independent agency would not affect the normal duties and obligations of the Directorate, regarding MCI. Comparing this case with the current situation in the USA, CAMCI would play a similar role to the NTSB, and the Directorate to the USCG. Moreover, all marine casualties shall be investigated by the Directorate, but only some of them (according to a future agreement between the Directorate and CAMCI) shall be investigated by the latter.

The main reason for creating this new agency is because the Directorate is, by law, the regulator and the enforcer of maritime regulations and as such, it would be in an untenable position when having to investigate and report on a casualty resulting in whole, or in part, from a deficiency in the regulations or their enforcement (e.g. an incomplete inspection). The Directorate is the supplier of a wide variety of services such as aids to navigation, vessel traffic system, SAR, etc., and where such services may be found at fault, the casualty investigator may hesitate to criticize his colleagues.

The Directorate could be the subject of damage claims as a result of casualties and the investigator might have difficulty in being totally objective and impartial where his employer is liable to be sued as a result of a casualty investigation report; he might also be tempted to supply more information to his employer than to the potential claimant.

As has been noticed, there are many reasons and explanations which totally justify, in practice, the creation of this independent body, without diminishing or affecting any of the current tasks performed by the Directorate.

5.2.2.2 RECOMMENDATION No.2: In all MCI's where Public Ships (Navy, Directorate, etc) are involved together with Commercial ones, CAMCI should be present.

If CAMCI comes into being, there should be, as was mentioned earlier, an agreement between CAMCI and the Directorate regarding " who is going to investigate what ". In this agreement it should, compulsorily, be established that in the event of any occurrence of a casualty involving both a public and a commercial ship, the investigation should be performed by both organizations working together.

5.2.2.3 RECOMMENDATION No.3: CAMCI should keep a convenient level of cooperation and data interchange with the Chilean Authority in Aviation Casualty Investigation (CAACI) in order to share some facilities e.g. laboratories, and interchange technical information pertaining to the MCI.

As previously mentioned at the end of paragraph 5.1, having a convenient level of cooperation between these two organizations would allow each to gain benefits from each other regarding data and knowledge.

LIST OF ACRONYMS.

BC.....Bulk Cargoes.
 CAACI.....Chilean Authority in Aviation Casualty Investigation.
 CAMCI.....Chilean Authority in Marine Casualty Investigation.
 CLC.....Civil Liability Convention.
 COLREG....Collision Regulations.
 DG.....Dangerous Goods.
 DWT.....Dead Weight Tonnage.
 EEZ.....Economic Exclusive Zone.
 GAP.....Group Activity Pre-planned.
 GRT.....Gross Registered Tonnage.
 GT.....Gross Tons.
 IBC Code..International Code for the Construction and Equipment
 of Ships carrying Dangerous Chemicals in Bulk.
 IGC Code..International Code for the Construction and Equipment
 of Ships carrying Liquefied Gases in Bulk.
 ICAO.....International Civil Aviation Organization.
 ILO.....International Labour Organization.
 IMDG.....International Maritime Dangerous Goods.
 IMO.....International Maritime Organization.
 IOPC.....International Oil Pollution Compensation.
 LL.....Load Lines.
 km.....Kilometers.
 MARPOL....Marine Pollution.
 MCI.....Maritime Casualty Investigation.
 OCMI.....Officer in Charge of Marine Investigation.

LIST OF ACRONYMS (Contd.)

P&I.....Protection and Indemnity.
RO-RO.....Roll on - Roll of.
SAR.....Search and Rescue.
SFV.....Safety for Fishing Vessels.
SOLAS.....Safety of Life at Sea.
STCW.....Standards of Training, Certificates and Watchkeeping
for Seafarers.
UAE.....United Arab Emirates.
UK.....United Kingdom.
UNCLOS....United Nations Convention on the Law of the Sea.
USA.....United States of America.
USCG.....United States Coast Guard.
US\$.....United States Dollars.
WMU.....World Maritime University.

BIBLIOGRAPHY.

1. Arvedson, S.
What lessons can be learnt from marine casualties for teaching marine personnel. Sweden, Malmö, 1984.
2. Deschenes, Bernard M.
Study on Marine Casualty Investigations in Canada. Canada, 1984.
3. Ferry, Ted S.
Modern accident investigation and analysis. Second edition. USA, California, 1988.
4. Harrold, A. F.
The investigation of marine casualties. UK, London, 1987.
5. Institut of Shipping Economics and Logistics.
Shipping Statistics, Yearbook 1990. Germany, Bremen, 1990.
6. International Maritime Organization.
Model Course for Marine Accident and Incident Investigation. UK, London, 1988.
7. Lloyd's Register of Shipping.
Casualty Return. UK, London, 1988 & 1989.

8. National Archives and Records Administration (USA).
The Code of Federal Regulations.
USA, Washington, 1989.
9. Sheeny, N. P.
The interview in accident investigation, methodological
pitfalls. UK, Wales, 1981.
10. The Department of Transport, MAIB.
Summary of Investigations No. 1/90, 2/90 and 3/90.
UK, Southampton, 1990.
11. The Institute of Marine Engineers.
Seminar on Marine Inquiries and Casualty Investigations.
UK, London, 1982.
12. Wayne Norman.
Marine Accident Investigation: Time for Change ?
Sweden, Malmö, 1988.

APPENDIX "A"

MARINE CASUALTY INVESTIGATION. QUALIFICATION COURSE.

A.1

Introduction.

During the last 20 years, i.e. since the beginning of the 1970s, huge developments have occurred in shipping activities. These developments not only have improved efficiency, but also influenced ship design, ship types, national and international laws and regulations, and many other related matters. As a result of that marine casualty investigations have become more and more complex and difficult to carry out.

Nowadays, investigators should be well prepared and trained Directorate Officers. The alternatives in getting such Officers are two:

- * Any Officer from the Directorate, once appointed as a new marine casualty investigator, must study by himself everything related thereto. (Current situation).
- * Any Officer from the Directorate, before being appointed as an Investigator, should be qualified as a Marine Casualty Investigator, i.e. he should have successfully completed the specialized course. (Proposed situation).

Undoubtedly, the second alternative is the best, because in this case the investigator would perform the duty for which he has been qualified to, i.e., the right man would be in the right position.

A.2

Scope of the Course.

This Course would provide the officers with a general understanding of the international and national obligations regarding the investigation of marine casualties and their administration. The organization and conduct of preliminary enquiries and formal investigations are also covered, as well as the follow-up actions to be taken regarding the findings and recommendations of an investigation. Case studies, as part of group activities, are also included, to develop investigative and analytical skills.

A.3

Objective of the Course.

The objective of the Course is to qualify Directorate Officers as Marine Casualty Investigators, in such a way that those Officers having successfully completed the Course would be qualified as "Marine Casualty Investigators" and would receive a document certifying this fact. This Qualification would enable them to be appointed as a Marine Casualty Investigator in any case, wherever this would happen.

The idea is that in a few years, all Directorate Officers, Pilots, Merchant Marine Officers, Naval Officers and, in general, other possible applicants, should be qualified as a Marine Casualty Investigator, as a prerequisite, to be appointed as an Investigator in any case.

If this objective were reached, it is the Author's opinion that a great step ahead would have been made.

A.4

Course Contents.

The contents of this course are divided into 14 main subjects, which in turn are divided in many different topics.

The main subjects of the course are:

- * National Laws and Regulations.
- * International Regulations.
- * MCI in Other Countries.
- * SAR.
- * Dangerous Goods (DG).
- * Ship Stability.
- * Naval Architecture.
- * Liability and Compensation for Oil Pollution.
- * Marine Insurance.
- * Categories of Marine Casualties (Characteristics).
- * Investigative Purposes and Procedures.
- * Analysis of Evidence.
- * Inquiry Reports.
- * Administration of Investigations.
- * Findings and Recommendations.
- * Group Activities (Case Studies).

To develop the present course, the Model Course from IMO was mainly considered. Of course, some changes were made in order to make it suit the requirements of the Directorate. The Qualification Course from the USCG was also considered. Figures A-1 and A-2 illustrate the Course Outline.

SUBJECT AREA		TEACHING HOURS
1.	Course Introduction	1.0
2.	National Laws and Regulations	
2.1	The Merchant Shipping Act	1.0
2.2	The Regulation for Incidents Investigation	3.0
2.3	Directorate's Organizational Law	1.0
2.4	Discipline Code for Seafarers	3.0
3.	International Regulations	
3.1	Conventions and Protocols	0.5
3.2	Convention provisions regarding MCI	2.0
3.3	Resolutions and Circulars regarding MCI	0.5
4.	MCI Systems in other Countries	
4.1	MCI System in The USA	0.75
4.2	MCI System in The UK	0.75
4.3	MCI System in France	0.75
4.4	MCI System in Spain	0.75
5.	Search and Rescue	
5.1	SAR Convention	1.0
5.2	Chilean SAR Organization	0.5
5.3	Chilean SAR Procedures	1.5
6.	Dangerous Goods (DG)	
6.1	IMDG Code	6.0
6.2	International Instruments regarding DG	2.0
6.3	Physical, chemical and health properties & hazards	4.0
6.4	Handling, stowage and segregation of DG	6.0
6.5	Safety precautions and emergency procedures	6.0
7.	Ship Stability	
7.1	Basic knowledge	6.0
7.2	Practical stability	6.0
7.3	Case studies (capsizing, grounding, collision, etc).	6.0
8.	Naval Architecture	
8.1	Geometry of the ship	9.0
8.2	Forces acting on the ship	3.0
8.3	Calculations	12.0
9.	Liability and Compensation for Oil Pollution	
9.1	International Instruments related thereto	1.0
9.2	Voluntary Industry Schemes	1.0
9.3	Compensation principles	1.0
10.	Marine Insurance	
10.1	Hull and Machinery	1.0
10.2	Protection and Indemnity	1.0
10.3	Other Insurances	1.0

FIGURE A-1. COURSE OUTLINE.

11. Categories of Marine Casualties		
11.1 Characteristics of the different casualties		3.0
12. Investigative Purposes and Procedures		
12.1 Purposes and types of investigation		2.0
12.2 Initiation of investigation		2.5
12.3 Documentary evidence	*	1.5
12.4 Physical evidence		1.0
12.5 Examination of witnesses		1.5
12.6 Records of testimony	*	9.0
12.7 Liaison with other authorities		0.5
13. Analysis of Evidence		
13.1 General aspects		1.0
13.2 Technical aspects		3.0
13.3 Human aspects		3.0
13.4 Determination of causal factors	*	5.0
14. Inquiry Reports		
14.1 Content of reports		2.0
14.2 Attachment of documentary evidence	*	10.0
15. Administration of Investigations		
15.1 Enabling legislation		1.0
15.2 Appointment of investigators		1.0
15.3 Guidance to investigators		1.0
15.4 Informal inquiries		1.0
15.5 Preliminary inquiries	*	10.0
15.6 Formal hearings		3.0
15.7 Cooperation with other States		0.5
15.8 Costs of inquiries and hearings		0.5
16. Findings and Recommendations		
16.1 Recommendations on standards		1.0
16.2 Recommendations on research		0.5
16.3 Dissemination of information		0.5
16.4 Implications of investigation results		0.5
16.5 Submissions to IMO		0.5
17. Group Activity (case studies)		
17.1 Engine-room Fire		6.0
17.2 Capsizes		6.0
17.3 Grounding		6.0
17.4 Chilean Cases		8.0
* It includes group activities	SUBTOTAL:	182.0
		FIELD STUDIES: 18.0
		EXAMINATIONS: 8.0
		GRADUATION: 2.0
		TOTAL: 210.0

FIGURE A-2. COURSE OUTLINE (Contd.).

A.5 General Information about the Course.

A.5.1 Duration of the Course.

As shown in the previous Figures A-1 and A-2, the duration of the course would be 210 teaching hours. If we consider that:

- * 1 teaching hour = 45 minutes.
- * Daily teaching hours = 6 hours.
- * Number of working days per week = 5 days.
- * Total weekly teaching hours = 30 hours.

Thus, the duration of the course shall be equal to 7 weeks.

A.5.2 Facilities.

All the facilities of the Maritime Instruction Center and the Directorate Academy would be available for this course, i.a.

- * Radar simulator.
- * Arpa simulator.
- * Computer center.
- * Language laboratory.

Besides these facilities, all the educational and training establishments of the Navy would also be available, i.a.

- * Automatic Control Laboratory.
- * Fire Fighting Center.
- * Diving Training Center.
- * Ship Machinery Simulator.

A.6

Field Studies.

The Course considers spending 18 hours on field studies, i.e. 3 full days, which are intended for visiting, i.a., some of the following places:

- * Chilean Aviation Casualty Investigation Organization.
- * Chilean Police Casualty Investigation Service.
- * Chilean Port Authority.
- * Chilean Maritime Traffic Control Center.
- * Chilean Search and Rescue Organization.
- * Chilean Pollution Control Organization.

These field studies were considered in order to give the students the knowledge of how other parallel organizations (Air Force and Police) carry out the casualty investigations occurring in their respective jurisdictions, and at the same time, to give the students the opportunity to learn a little bit more about other organizations which are in some way related to and have expertise on marine casualty investigations.

A.7

Staff Requirements.

A number of instructors, drawn from various relevant disciplines (e.g. lawyers with maritime experience, people experienced in police and fire investigations, etc.), should be available. The aforesaid instructors should have had a minimum of some years of practical experience in casualty investigations.

A.8 Assessment and Examinations.

The students are subject to continuous assessment throughout the theoretical part of the course, but at least, with one short examination (1 hour) at the end of each week, and a final written examination (2 hours) at the end of the course.

A.9 Teaching Syllabus.

The Teaching Syllabus is illustrated in the following pages but before looking at it, it is important to realize that in this syllabus, like in the syllabus of the IMO's Model Course, the detailed teaching activities have been written in a "Learning Objectives" format, in which the objectives describe what the trainee must do to demonstrate that the specified knowledge has been transferred.

Most objectives are understood to be prefixed by the words "The expected learning outcome is that the trainee.....".

In order to assist the instructor, besides the instructor manual of the IMO's Model Course and the guidance for its implementation, at the end of this Appendix "A", a list of recommended reference material, both in Spanish and English, is given. Many other books and maritime publications could be used, either by the instructor or the trainee, in order to complement what is given in this Project, so that a more complete picture of this complex but important subject is achieved.

LEARNING OBJECTIVES.

1. COURSE INTRODUCTION (1 HOUR).

- .1 explains scope and objectives of the course.
- .2 explains relationship of this course with other IMO model courses.
- .3 explains the need to supplement what is learnt on the course with practical experience in organizing and conducting investigations, initially into simpler cases.
- .4 explains what is the reference material which is going to be used during the course.
- .5 explains that because of the wide variations in legal systems, the course cites the practices of several IMO Members States as examples of how investigations may be conducted and emphasizes the common fundamentals and principles.
- .6 describes the general aspects of marine accidents and incident investigations.

2. NATIONAL LAWS AND REGULATIONS (8 HOURS).

2.1 The Merchant Shipping Act (1 hour).

- .1 states the duties of the Master of a ship which is involved in a casualty.
- .2 explains the main subjects related with marine casualties under the provisions of Title No. 8, Paragraph 3rd.
- .3 explains the relationship between a "marine pollution" and a "marine casualty", regarding investigations, sanctions and fines, according what is mentioned in Title No. 9

2.2 The Regulation for Incidents Investigation (3 hours).

- .1 explains the concept of an Investigation (what is and when should be carried out ?).

- .2 states the organizational aspect of the investigations within the Armed Forces in Chile.
- .3 states the procedures used to carry out investigations within the Armed Forces in Chile.
- .4 explains the relationship between the present regulation and the Directorate, according to what is mentioned in Article 125.

2.3 Directorate's Organizational Law (1 hour).

- .1 explains the aims of the Directorate.
- .2 explains the general organization of the Directorate.
- .3 explains the organization of the Directorate regarding Marine Casualty Investigations.
- .4 explains the duties of the Legal Board and the Maritime Court.

2.4 Discipline Code for Seafarers (3 hours).

- .1 defines many terms related with MCI, i.a. casualty, serious casualty, etc.
- .2 explains, in detail, the procedures for the disciplinary aspects of Marine Casualty Investigations.

3. INTERNATIONAL REGULATIONS (3 HOURS).

3.1 Conventions and Protocols (0.5 hour).

- .1 explains that a convention, protocol or agreement is a treaty between States.
- .2 explains the steps that should be followed to ratify a convention.
- .3 states the steps which are necessary for a convention to enter into force.
- .4 explains the difference between explicit and tacit acceptance.
- .5 defines flag State, port State, coastal State, etc., and their respective role in enforcing conventions.

3.2 Convention provisions regarding MCI (2 hours).

- .1 explains the main requirements related to MCI under the United Nations Convention on the Law of the Sea (UNCLOS).
- .2 explains the main requirements related to MCI under the SOLAS Convention.
- .3 explains the main requirements related to MCI under the Load Lines Convention (LL)..
- .4 explains the main requirements related to MCI under the Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW).
- .5 explains the main requirements related to MCI under the Convention on Safety for Fishing Vessels (SFV).
- .6 explains the main requirements related to MCI under the Convention on Maritime Pollution (MARPOL).
- .7 states that the ILO Prevention of Accidents (Seafarers) Convention, requires occupational accidents to be reported and investigated.
- .8 states that the ILO Occupational Safety and Health (Dock Work) Convention, requires that measures shall be taken to ensure that occupational accidents and diseases are reported and, where necessary, investigated.

3.3 Resolutions and Circulars regarding MCI (0.5 hour).

- .1 explains the main requirements related to MCI under the following Resolutions and Circulars:
 - * IMO Resolution A.422
 - * IMO Resolution A.173 (ES.IV)
 - * IMO Resolution A.322 (IX)
 - * IMO Resolution A.440 (XI)
 - * IMO MSC/Circ.433
 - * IMO Resolution A.147 (ES.IV)
 - * IMO Resolution MEPC.30 (25)
 - * IMO MSC/Circ.360/Rev.1
 - * IMO Resolution A.598 (15)

4. MCI SYSTEMS IN OTHER COUNTRIES (3 HOURS).

4.1 MCI System in The USA (0.75 hour).

- .1 states a general overview of the MCI in The USA.
- .2 explains the investigation process in the The USA.
- .3 explains the pros and cons of this system.

4.2 MCI System in The UK (0.75 hour).

- .1 states a general overview of the MCI in The UK.
- .2 explains the investigation process in the The UK.
- .3 explains the pros and cons of this system.

4.3 MCI System in France (0.75 hour).

- .1 states a general overview of the MCI in France.
- .2 explains the investigation process in France.
- .3 explains the pros and cons of this system.

4.4 MCI System in Spain (0.75 hour).

- .1 states a general overview of the MCI in Spain.
- .2 explains the investigation process in Spain.
- .3 explains the pros and cons of this system.

5. SEARCH AND RESCUE (3 HOURS).

5.1 SAR Convention (1 hour).

- .1 states a general overview of the Convention.
- .2 explains the main connections between the Convention and the MCI activities.

5.2 Chilean SAR Organization (0.5 hour).

- .1 states a general overview of the Marine and Aviation SAR Organizations.
- .2 explains the pros and cons of the Chilean SAR Organization based on the knowledge gotten from the previous subject (SAR Convention).

5.3 Chilean SAR Procedures (1.5 hours).

- .1 explains the SAR Procedures used in Chile, i.e. search procedures, communication procedures, rescue procedures, etc.
- .2 explains the pros and cons of the Chilean SAR Procedures, based on the ideal situation shown in the SAR Convention.

6. DANGEROUS GOODS (24 HOURS).

6.1 IMDG Code (6 hours).

- .1 explains, in detail, the contents of the main chapters of this code.
- .2 be acquainted on how to get information, quickly, from this code.
- .3 be acquainted with the terminology used in this code.
- .4 under certain given parameters or conditions, the trainee should know the kind of information that could be obtained from this code.

6.2 International Instruments regarding DG (2 hours).

- .1 explains the main requirements related to DG under the following International Instruments:
 - * SOLAS Convention, Chapter VII
 - * MARPOL Convention, Annex III
 - * BC Code
 - * IBC Code
 - * IGC Code

6.3 Physical, chemical and health properties & hazards (4hrs).

- .1 explains the classification of DG.
- .2 explains the criteria on which the classification was done.
- .3 defines the following terms:
 - * Flashpoint
 - * Flammable Range
 - * Relative Density
 - * Water Solubility
 - * Vapour Density
- .4 explains the different chemical reactions to which the DG are subject to, i.e. reactions with oxygen, reactions with water, self reactions, etc.
- .5 explains the main hazards to human life that these substances can generate.

6.4 Handling, stowage and segregation of DG (6 hours).

- .1 explains the risks involved while handling DG.
- .2 explains the main reasons for segregation.
- .3 explains the different categories of stowage of DG.
- .4 be acquainted with the segregation tables and with all the terminology used therein.
- .5 be acquainted with the facilities that should be available in all Ports which handle DG.

6.5 Safety precautions and emergency procedures (6 hours)

- .1 explains what is the current situation on ships and in ports related with this subject.
- .2 be acquainted with the IMO procedures to follow in case of an emergency on a ship carrying DG.
- .3 defines some technical terminology commonly used in emergencies, i.e.:
 - * UN Number (United Nations Number)

- * EmS (Emergency Schedule)
- * MFAG (Medical First Aid Guide)
- .4 be acquainted with the procedures to follow in case of an emergency in Ports, involving DG.
- .5 explains the procedure used on ships for asking medical advice by radio.

7. SHIP STABILITY (18 HOURS).

7.1 Basic knowledge (6 hours).

- .1 explains some concepts related with stability, such as:
 - * gravitational stability.
 - * weight and center of buoyancy.
 - * displacement and center of buoyancy.
 - * interaction of weight and buoyancy.
 - * upsetting forces.
 - * submerged equilibrium.
 - * variation in position of center of gravity with loading of vessel.
 - * weight and location of center of gravity.

7.2 Practical Stability (6 hours).

- .1 explains the basic principles of the Inclining Experiment.
- .2 states the points which require attention prior to the Inclining Experiment.
- .3 explains the operations involved in conducting the Inclining Experiment.
- .4 explains the report that should be done after the Inclining Experiment.

NOTE: It is considered to carry out a practical Inclining Experiment aboard a small fishing ship.

7.3 Case studies (6 hours).

- .1 be acquainted with some marine disasters, preferentially occurrences happened in Chile, analyzed under the stability point of view. Among these disasters, at least, should be included one of each followings cases:

- * Fire/Explosion.
- * Capsizing due to heavy weather.
- * Capsizing due to fish catch force on purse seiner vessels.
- * Grounding.
- * Insufficient reserve of buoyancy.
- * Collision.

- .2 be acquainted with some great and well known disasters, such as the following ships :

- * Titanic.
- * Torrey Canyon.
- * Amoco Cadiz.
- * Exxon Valdes.
- * Herald of Free Enterprise.
- * Scandinavian Star.

8. NAVAL ARCHITECTURE (24 HOURS).

8.1 Geometry of the ship (9 hours).

- .1 explains the different categories of vessels according to their mode of support, e.g. aerostatic, hydrodynamic, hydrostatic, etc.
- .2 explains the different categories of vessels according to their mission, e.g. merchant ships, utility ships, fishing vessels, pleasure crafts, naval vessels, etc., and their respective subdivisions.
- .3 defines the principal dimensions of vessels, e.g. length, breadth, depth, draught, midship section, etc., and mentions the differences between the IMO and the Classification Societies definitions related thereto.

- .4 defines some technical words commonly used in Naval Architecture, such as:
 - * Freeboard deck.
 - * Tonnage deck.
 - * Bulkhead deck.
 - * Weather deck.
 - * Platform deck.
 - * Sheer.
 - .5 explains in detail, the different elements of the ship, i.e. the hull, the propeller, the steering gears, the outfittings aboard, the cargo handling devices and the navigation bridge.
- 8.2 Forces acting on the ship (3 hours).
- .1 explains, in detail, the static forces acting on the ship, e.g. the forces due to the water, the buoyancy force, the bending moment, etc.
 - .2 explains, in detail, the concept of resistance against advancement, the components of the resistance and the relationship between resistance and speed.
 - .3 explains, in detail, the forces acting due to maneuvering the ship, e.g. ships turning, forces acting on the rudder, etc.
 - .4 explains the forces due to waves.
 - .5 explains the ship motion in waves.
 - .6 explains the most effective devices to reduce motion.
- 8.3 Calculations (12 hours).
- .1 explains the general physical quantities for Naval Architecture, e.g. time, length, mass, density, force, specific gravity, moment and moment of inertia.
 - .2 defines some concepts about mechanic of fluids, e.g. fluid pressure, center of buoyancy, etc.
 - .3 be acquainted with some mathematics for calculations, i.a. area by calculus, volumes by numerical methods.

- .4 describes a ship's hull form through the use of ship's lines drawings (half breadth plan, body plan, etc.), tables of offsets, coefficients of forms, and dimensional ratios (water plane coefficient, block coefficient, etc).
- .5 makes calculations of areas and volumes.
- .6 makes calculations of moment, center of area, center of volume and second moments.
- .7 explains the use of Curves of Form and Bonjean Curves.

9. LIABILITY AND COMPENSATION FOR OIL POLLUTION (3 HOURS).

9.1 International Instruments related thereto (1 hour).

- .1 explains the main requirements related to Oil Pollution Compensation under the International Convention on Civil Liability for Oil Pollution Damage (CLC).
- .2 explains the main requirements related to Oil Pollution Compensation under the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund Convention).
- .3 explains the aims of the International Oil Pollution Compensation Fund (IOPC Fund).

9.2 Voluntary Industry Schemes (1 hour).

- .1 explains the aims of these voluntary schemes.
- .2 explains the scopes of application of Tovalop and Cristal and their differences with CLC and Fund Conventions.

9.3 Compensation principles (1 hour).

- .1 explains the basic principles of compensation.
- .2 explains which compensations for oil pollution damage are not covered by CLC and the Fund Conventions.
- .3 states some examples on settlement of damage.
- .4 mentions the documents which are used for compensation.

10. MARINE INSURANCE (3 HOURS).

10.1 Hull and Machinery (1 hour).

- .1 explains, in detail, the subject, the markets, the scope of coverage, the perils insured, the insurer's liability, and the most important features of this type of marine insurance.

10.2 Protection and Indemnity, P & I, (1 hour).

- .1 explains, in detail, the subject, the markets, the scope of coverage, the perils insured, the insurer's liability, the Clubs, and the most important features of this type of marine insurance.

10.3 Other Insurances (1 hour).

- .1 explains the main features of other insurances, and compare their advantages and disadvantages with the insurances mentioned in paragraphs 10.1 and 10.2.

11. CATEGORIES OF MARINE CASUALTIES (3 HOURS).

11.1 Characteristics of the different casualties (3 hours).

- .1 explains the typical characteristics (causes, damage, consequences, etc.) which can be expected when one of the following casualties occurs:

- * Missing.
- * Fire or Explosion.
- * Collision.
- * Pollution.
- * Stranding.
- * Lost.
- * Capsizing of fishing vessels.

- .2 explains, based on world statistical data, about the main reasons or sources which have caused the great accidents during the last decade.

12. INVESTIGATIVE PURPOSES AND PROCEDURES (18 HOURS).

12.1 Purposes and types of investigation (2 hours).

- .1 defines some technical words commonly used in MCI, i.e. allision, casualty, collision, constructive total loss, foundry, ground, strike, total loss, touch, accident, contributory cause, fault, incident, marine occurrence, negligence, proximate cause, shipping casualty, ship related accident, informal investigation, preliminary inquiry, formal investigation, public inquiry, disciplinary hearing, etc.
- .2 explains basic differences between "administrative proceedings", "civil proceedings" and "criminal proceedings" in relation to marine investigations.
- .3 explains that causal factors can only be determined by obtaining and verifying all facts and circumstances that may be pertinent and by objectively analyzing their bearing upon the accident or incident.

12.2 Initiation of Investigation (2.5 hours).

- .1 explains the necessity for prompt advice of a marine occurrence in terms of availability of witnesses and reliability of evidence.
- .2 describes how the initial report of a marine occurrence may typically be assessed to determine type of investigation to be initiated.
- .3 lists types of marine occurrences which may give rise to a marine investigation.
- .4 describes the aspects which need to be investigated in the following types of accident or incident:
 - * personal injury, poisoning or death.
 - * collision or allision.
 - * grounding, stranding or striking a fixed object.
 - * abandonment or foundering.
 - * fire or explosion in ship or cargo.
 - * boiler explosion and machinery damage.
 - * capsizing of fishing vessels.

- * other damage to the ship or to property other than the ship.
- * marine pollution.
- * ship lost with no survivors.

12.3 Documentary evidence (1.5 hours).

- .1 lists documentary evidence which should initially be gathered in preparation for holding an investigation.
- .2 explains how documentary evidence gathered during an investigation should be identified, authenticated and safeguarded.
- .3 lists documentary evidence appropriate to given accidents and identifies the sources from which such may be obtained. (Group Activity Pre-planned, hereinafter GAP).
- .4 explains group activity concepts and methodology.

12.4 Physical evidence (1 hour).

- .1 lists types of physical evidence which may be useful to an investigation.
- .2 states that a record of each item of physical evidence obtained or removed should be kept and explains the detail required.
- .3 states that if the item is damaged or it would be otherwise beneficial, a photograph should be taken of the item in situ.
- .4 explains the action to be taken if an item of physical evidence must be forwarded by post or other carrier.
- .5 lists reasons for pollution from ships as arising from:
 - * accidents resulting in damage to ships.
 - * equipment failure.
 - * faulty operations.
 - * intentional discharges of harmful substances.
- .6 describes difficulties involved in obtaining a representative sample from water surface.

- .7 gives an example of sophisticated sampling equipment and describe its use.

12.5 Examination of Witnesses (1.5 hours).

- .1 lists the witnesses who should most probably be interviewed in each type of casualty.
- .2 describes procedures for assembling witnesses.
- .3 explains the rights of witnesses and demonstrates the measures to be taken to protect the rights of witnesses.
- .4 describes and demonstrates techniques for interviewing witnesses.

12.6 Records of testimony (9 hours).

- .1 describes and demonstrates, as appropriate, the methods of recording evidence of witnesses, and explains their advantages and disadvantages, including the use of:
 - * depositions signed by the witness.
 - * investigators' personal notes.
 - * tape recordings.
- .2 explains the procedures for using interpreters in an investigation.
- .3 explains the procedures for using technical advisers in an investigation.
- .4 explains and demonstrates the correct way of taking down a declaration from a witness, his or her opinion on how the casualty occurred, and the witnesses' answers to principal questions.
- .5 GAP (Alleged Collision) according the Model Course from IMO.

12.7 Liaison with other authorities (0.5 hour).

- .1 explains the inquiries or hearings which may be held by harbour authorities, labour safety authorities, police and fire services and coroners in the case of a marine occurrence and states how co-operation can best be achieved.

13. ANALYSIS OF EVIDENCE (12 HOURS).

13.1 General aspects (1 hour).

- .1 defines "evidence", "hearsay", "opinion", "expert opinion", "objective evidence" and "subjective evidence".
- .2 identifies "conflict of evidence".
- .3 assesses means of verification.

13.2 Technical aspects (3 hours)

- .1 defines and gives examples of latent defect, materials defect, design defect, faulty workmanship, corrosion and fatigue in metals.
- .2 identifies technical factors which may be involved in:
 - * weather damage related cases.
 - * explosion related cases.
 - * fire related cases.
- .3 identifies technical factors which may be involved in navigational accidents occurring in restricted waters, including:
 - * Bernouilli effect.
 - * bodily sinkage.
 - * bank suction.
 - * passing ship effects.
- .4 identifies the subjects, materials or areas requiring research, tests or specific technical investigation to assist in determining the cause of an accident.

13.3 Human aspects (3 hours).

- .1 identifies factors which may affect the evidence given by a witness as including perception, recall and willingness and ability to communicate.
- .2 states human factor must be considered as interactive with technology, social organization and environment.

- .3 states how the willingness of a witness to communicate can be affected by desire to:
 - * use the information to exercise power over others or the situation.
 - * protect his of her own security.
 - * protect the ship's community.
 - * comply with obligations imposed by law.
- .4 identifies the role in human error of:
 - * knowledge, skill and experience.
 - * past individual performance.
 - * risk familiarity.
 - * organization and communication.
 - * human and authority relations.
 - * safety consciousness.
 - * fatigue.
- .5 identifies the principles set forth in IMO Resolution A.481(XII) which govern the determination of safe manning levels.
- .6 states that SOLAS Regulation V/13 requires all ships to be sufficiently and efficiently manned for the purpose of safety at sea.

13.4 Determination of causal factors (5 hours).

- .1 identifies possible sequence of events.
- .2 derives most probable sequence of events from weight of evidence.
- .3 identifies causal factors in chain of events and failures to take appropriate remedial action.
- .4 identifies proximate cause.
- .5 explains the advantages of an "events recorder".
- .6 GAP (Alleged Collision) according the Model Course from IMO.

14. INQUIRY REPORTS (12 HOURS).

14.1 Content of reports (2 hours).

.1 identifies the items necessary for incorporation within an inquiry report, including:

- * the background information.
- * the sequence of events leading to the accident.
- * the sequence of events following the accident.
- * other relevant circumstances.
- * the investigating officer's comments, conclusions and recommendations.

.2 compiles skeleton reports based on given data.

14.2 Attachment of documentary evidence (10 hours).

.1 lists the documentary evidence which may be required and explains the circumstances which would call for such items to be appended to inquiry reports, including declarations, ship plans, equipment records, statutory certificates, charts, crew and passenger lists, log extracts, cargo details, SAR reports, weather reports, press cuttings, photographs, etc.

.2 compiles appendices for attachment to reports based on given data.

.3 GAP (Missing Ship) according the Model Course from IMO.

15. ADMINISTRATION OF INVESTIGATIONS (18 HOURS).

15.1 Enabling legislation (1 hour).

.1 describes a typical framework of national legislation necessary for the effective investigation of marine accidents and incidents in terms of:

- * the reporting of accidents and incidents.
- * the appointment of investigators.
- * the powers of investigators.

- * the constitution and powers of courts or boards for formal hearings, e.g. the Maritime Court in the Chilean case.
- * the procedures to be followed by such courts or boards.
- * the implementation of findings and recommendations of formal hearings.
- * rehearing of an appeal from the findings of formal hearings.

15.2 Appointment of investigators (1 hour).

- .1 drafts a typical appointment for an investigation officer or board to conduct a specific investigation.
- .2 explains the need for and describes the identification usually provided to marine investigation officers and boards.
- .3 describes the typical qualifications of marine investigation officers and boards.
- .4 explains advantages and disadvantages of marine investigations being conducted by:
 - * outside consultants.
 - * the Administration's ships surveyors.
 - * an independent marine investigator officer.
 - * a magistrate or judge.

15.3 Guidance to investigators (1 hour).

- .1 describes the content and use of a typical investigation manual or guidance notes provided for an investigation officer.

15.4 Informal inquiries (1 hour).

- .1 describes the procedure used to hold an informal fact-finding investigation.
- .2 explains the need to keep the level the inquiry is being held at under review.

15.5 Preliminary inquiries (10 hours).

- .1 describes the procedure used to hold a preliminary inquiry type investigation by an investigating officer or board.
- .2 GAP (Stranding) according the Model Course from IMO.

15.6 Formal hearings (3 hours).

- .1 describes the circumstances in which a formal investigation or hearing should be recommended.
- .2 describes the general content of typical rules established for the conduct of formal investigations or hearings, including:
 - * the constitution of the Maritime Court.
 - * the powers of the Maritime Court regarding seafarers' certificates and licences.
 - * the appointment of assessors and their qualifications.
 - * the admission of evidence.
 - * the examination, cross-examination and re-examination of witnesses.
 - * the opportunity for persons criticized to make their defence.
 - * the rendering of decisions and findings.
 - * the report on the case.
 - * the costs of the formal hearings.
- .3 describes the procedures typically followed regarding appeals and rehearings.

15.7 Cooperation with other States (0.5 hour).

- .1 explains that other Administrations having an interest in a formal investigation of public hearing should be given the opportunity of being represented.
- .2 explains why cooperation between States having an interest in a casualty can benefit the investigation and render its findings more effective.

15.8 Costs of inquiries and hearings (0.5 hour).

- .1 lists cost items which would typically be involved in the conduct of:
 - * informal inquiries.
 - * preliminary inquiries.
 - * formal inquiries.
- .2 describes a typical procedure for:
 - * validating costs incurred.
 - * determining an appropriate level of witness fees.
 - * determining an appropriate level of fees for assessors and legal advisors.
 - * explains the difficulties of making budgetary provision for the costs of inquiries and hearings and possible solutions.

16. FINDINGS AND RECOMMENDATIONS (3 HOURS).

16.1 Recommendations on standards (1 hour).

- .1 explains that equipment and human factor solutions to "system" weaknesses must be carefully weighed against each other.
- .2 explains what humans do best and what equipment does best.
- .3 explains need to consider the Administration's previous experience of a like nature.
- .4 explains need to ensure that recommended measures:
 - * would most probably prevent a recurrence of the accident.
 - * are the preferred solution.
 - * can be enforced if adopted.
 - * take into account the law of diminishing returns.

16.2 Recommendations on research (0.5 hour).

- .1 explains need for clear identification of the "knowledge deficiency" both in absolute terms and as a contributory cause in the accident.
- .2 explains need to identify applicability of the solutions sought or knowledge which would be gained in the context of the industry at large.

16.3 Dissemination of information (0.5 hour).

- .1 explains why findings of marine accident investigations should be made public and drawn to the attention of the Administration and other regulatory bodies, owners, seafarers and others involved.
- .2 explains how relevant information can be disseminated to the shipping community.

16.4 Implications of investigation results (0.5 hour).

- .1 states that evidence given at an informal or preliminary inquiry cannot be used in a court of law but may affect the settlement of an insurance claim.
- .2 states that the findings and recommendations of an informal or preliminary inquiry:
 - * may allow discovery of facts otherwise unknown or provide expert opinion which may assist or act against the interests of one or other party involved in a legal action or insurance claim.
 - * should so far as possible be made known to all parties involved at the same time and in the same manner.

16.5 Submissions to IMO (0.5 hour).

- .1 describes the format to be used to inform IMO of the result of investigations into serious casualties.
- .2 defines "serious casualty".
- .3 identifies other specific information on casualties requested by IMO.

- .4 explains that any proposal to improve an IMO standard must:
- * demonstrate the urgent necessity of making the improvement.
- * indicate the amount of work involved for the Organization in improving the standard.
- * give a clear indication of its cost effectiveness.

17. GROUP ACTIVITY, CASE STUDIES (26 HOURS).

17.1 Engine-room Fire (6 hours).

- .1 studies case and identifies evidence relevant to the questions raised.
- .2 prepares conclusions and recommendations of group.
- .3 presents conclusions and recommendations of group and identifies and explains any differences from those drawn up by the "investigating officers" of other groups.
- .4 discusses findings of the case upon which the group activity is based.
- .5 discusses structure of report.

17.2 Capsize (6 hours).

- .1 studies case and identifies evidence relevant to the questions raised.
- .2 prepares conclusions and recommendations of group.
- .3 presents conclusions and recommendations of group and identifies and explains any differences from those drawn up by the "investigating officers" of other groups.
- .4 discusses findings of the case upon which the group activity is based.
- .5 discusses structure of report.

17.3 Grounding (6 hours).

- .1 studies case and identifies evidence relevant to the questions raised.
- .2 prepares conclusions and recommendations of group.
- .3 presents conclusions and recommendations of group and identifies and explains any differences from those drawn up by the "investigating officers" of other groups.
- .4 discusses findings of the case upon which the group activity is based.
- .5 discusses structure of report.

17.4 Chilean cases (8 hours).

- .1 studies Chilean cases and identifies evidence relevant to the questions raised.
- .2 prepares conclusions and recommendations of group.
- .3 present conclusions and recommendations of group and identifies and explains any differences from those drawn up by the "real investigating officer" of the case.
- .4 discusses findings of the case upon which the group activity is based.
- .5 discusses structure of report.

NOTE: The Group Activities considered in paragraphs 17.1, 17.2, 17.3 are based on the GAP of the Model Course from IMO, whereas the Group Activities considered in paragraph 17.4 is based on Chilean real Marine Casualties.

A.10

Bibliography.

As was mentioned earlier, a list of recommended reference material, both in English and in Spanish, is given below :

A.10.1

English bibliography.

- * ICAO Manual of Aircraft Accident Investigation (Document 6920-AN/855/4), 4th ed. Montreal: ICAO, 1970.
- * The Institute of Marine Engineers; The Nautical Institute. "Marine Inquiries and Casualty Investigations" (proceedings of a seminar). London: The Nautical Institute, 23 November 1982.
- * Chadwick, W.A. "Marine Casualties and How to Prevent Them". Vol. 96: Paper 46 (1984). London: Marine Management (Holdings) Ltd., 1987.
- * Thomas, M., Q.C. The Role of the Naval Architect in the Maritime Courts of Law (transactions of RINA, Vol. 119). London: The Royal Institute of Naval Architects, 1977.
- * RINA/NI. "Navigation and the Human Factor" (Papers presented at a seminar). London: The Royal Institute of Navigation and the Nautical Institute, 10 December 1987.
- * The Society of Naval Architects and Marine Engineers. "Principles of Naval Architecture", New York, USA.
- * International Centre for Ocean Development, Halifax, Canada. "International Maritime Law, Basic Principles". (WMU Course), 1991.
- * International Maritime Organization. Model Course (3.11). Marine Accident and Incident Investigation.
- * International Maritime Organization and International Labour Organization, "Document for guidance", London, 1985.
- * International Maritime Organization, "International Maritime Dangerous Goods Code", London.
- * International Maritime Organization Conventions, i.a. SOLAS, MARPOL, CLC, COLREG, LL, STCW, etc.

A.10.2

Spanish bibliography.

- * Reglamento Orgánico Interno y de Funcionamiento de la Dirección General del Territorio Marítimo y de Marina Mercante, Ordinario Nº 7-50/2 de 1989.
 - * Boletín Estadístico Marítimo de la Dirección General del Territorio Marítimo y de Marina Mercante. (Última edición).
 - * Reglamento de Investigaciones Sumarias Administrativas de las Fuerzas Armadas, Ordinario Nº 9-10/1 de 1974.
 - * Ley de Navegación, Decreto Ley Nº 2.222 del 21 de Mayo de 1978.
 - * Reglamento General de Orden, Seguridad y Disciplina en las Naves y Litoral de la República de Chile.
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APPENDIX "B"

MARINE CASUALTY INVESTIGATION.

BRIEF COURSE.

B.1 Introduction.

For many reasons, i.e. geographical reasons, availability of personnel, time pressure, etc., many Directorate Officers, who will not be qualified as Maritime Casualty Investigators, will have to carry out investigations without having, at least, a minimum knowledge or background of this subject. It is the Author's intention to provide these Officers with the basic knowledge and proper tools they will need to perform this important job in a good manner.

B.2 Scope of the Course.

This course will provide the officers with a brief understanding of the international and national obligations regarding the investigation of marine casualties and their administration. At the same time, it will give them a basic knowledge about the conducting of preliminary enquiries and formal investigations, as well as the follow-up actions to be taken regarding the findings and recommendations of an investigation. This Course, unlike the Qualification Course, does not consider Group Activities in its syllabus; it is only a theoretical one.

B.3 Objective of the Course.

The objective of the Course is to provide a basic knowledge on Marine Casualty Investigation to all Directorate Officers once in their careers, preferentially during the Sub-lieutenant rank period in order to improve and standardize the Marine Casualty Investigation Procedures carried out within Chilean jurisdiction.

B.4 Course Contents.

The contents of this course are divided into 9 main subjects, which in turn are divided into many different topics.

The main subjects of the course are:

- * National Laws and Regulations.
- * International Regulations.
- * Categories of Marine Casualties (Characteristics).
- * Investigative Purposes and Procedures.
- * Analysis of Evidence.
- * Inquiry Reports.
- * Administration of Investigations.
- * Findings and Recommendations.

To develop the present Course, like in the case of the Qualification Course, the Model Course from IMO was mainly considered.

Figures B-1 and B-2 illustrate the Course Outline.

SUBJECT AREA	LECTURING HOURS
1. Course Introduction	1.0
2. National Laws and Regulations	
2.1 The Merchant Shipping Act	0.5
2.2 The Regulation for Incidents Investigation	2.0
2.3 Directorate's Organizational Law	0.5
2.4 Discipline Code for Seafarers	2.0
3. International Regulations	
3.1 Conventions and Protocols	0.5
3.2 Convention provisions regarding MCI	1.0
3.3 Resolutions and Circulars regarding MCI	0.5
4. Categories of Marine Casualties	
4.1 Characteristics of the different casualties	1.5
5. Investigative Purposes and Procedures	
5.1 Purposes and types of investigation	1.0
5.2 Initiation of investigation	1.0
5.3 Documentary evidence	0.5
5.4 Physical evidence	0.5
5.5 Examination of witnesses	0.5
5.6 Records of testimony	1.0
5.7 Liaison with other authorities	0.5
6. Analysis of evidence	
6.1 General aspects	0.5
6.2 Technical aspects	1.5
6.3 Human aspects	1.5
6.4 Determination of causal factors	1.0
7. Inquiry Reports	
7.1 Content of reports	1.0
7.2 Attachment of documentary evidence	0.5
8. Administration of Investigations	
8.1 Enabling legislation	0.5
8.2 Appointment of investigators	0.5
8.3 Guidance to investigators	0.5
8.4 Informal inquiries	0.5
8.5 Preliminary inquiries	0.5
8.6 Formal hearings	1.5
8.7 Cooperation with other States	0.5
8.8 Costs of inquiries and hearings	0.5

FIGURE B-1 COURSE OUTLINE.

9.	Findings and Recommendations	
9.1	Recommendations on standards	0.5
9.2	Recommendations on research	0.5
9.3	Dissemination of information	0.5
9.4	Implications of investigation results	0.5
9.5	Submissions to IMO	0.5
SUBTOTAL:		28.0
EXAMINATION:		2.0
TOTAL:		30.0

FIGURE B-2 COURSE OUTLINE (Contd.).

B.5 General Information about the Course.

B.5.1 Duration of the Course.

As was shown in the previous Figures B-1 and B-2, the duration of the course would be 30 teaching hours. If we consider that:

- * 1 Teaching hour = 45 minutes.
- * Daily teaching hours = 6 hours.
- * Number of working days per week = 5 days.
- * Total weekly teaching hours = 30 hours.

Thus, the duration of the course shall be equal to 1 week.

B.5.2 Facilities.

This course does not consider field training, but in any case, like in the Qualification Course, all the facilities of the Maritime Instruction Center and the Directorate Academy would be available for this course, i.a.

- * Radar simulator.
- * Arpa simulator.
- * Computer center.
- * Language laboratory.

Besides these facilities, all the educational and training establishments of the Navy would also be available, i.a.

- * Automatic Control Laboratory.
- * Fire Fighting Center.
- * Diving Training Center.

B.6 Staff Requirements.

The requirements of Staff in this case are not as stringent as in the Qualification Course case. Most instructors could be Directorate Officers qualified as Marine Casualty Investigators with some years of practical experience.

B.7 Assessment and Examinations.

The students are subject to continuous assessment throughout the course but it is considered that one examination (2 hours) should be sat at the end of the course.

B.8 Teaching Syllabus.

The Teaching Syllabus is illustrated in the following pages, but before looking at that, it is important to realize that, like in the syllabus of the IMO's Model Course, the detailed teaching activities have been written in learning objective formats, in which the objectives describe what the trainee must do to demonstrate that the specified knowledge has been transferred .

In order to assist the instructor, besides the instructor manual of the IMO's Model Course, at the end of the previous Annex "A" (paragraph A-10), under the title of "Bibliography", a list of recommended reference material is given both in English and in Spanish.

LEARNING OBJECTIVES.

1. COURSE INTRODUCTION (1 HOUR).

- .1 explains scope and objectives of the course.
- .2 explains relationship of this course with other IMO model courses.
- .3 explains the need to supplement what is learnt on the course with practical experience, which unfortunately is not considered to be given in this course.
- .4 explains what is the reference material which is going to be used during the course.
- .5 describes the general aspects of marine accidents and incident investigations.

2. NATIONAL LAWS AND REGULATIONS (3 HOURS).

2.1 The Merchant Shipping Act (0.5 hour).

- .1 states the duties of the Master of a ship which is involved in a casualty.
- .2 explains the main subjects related with marine casualties under the provisions of Title No. 8, Paragraph 3rd.
- .3 explains the relationship between a "marine pollution" and a "marine casualty", regarding investigations, sanctions and fines, according what is mentioned in Title No. 9.

2.2 The Regulation for Incidents Investigation (1 hour).

- .1 explains the concept of an Investigation (what is and when should be carried out ?).
- .2 states the organizational aspect of the investigations within the Armed Forces in Chile.
- .3 states the procedures used to carry out investigations within the Armed Forces in Chile.
- .4 explains the relationship between this regulation and the Directorate, according what is mentioned in Article 125.

2.3 Directorate's Organizational Law (0.5 hour).

- .1 explains the aims of the Directorate.
- .2 explains the general organization of the Directorate.
- .3 explains the organization of the Directorate regarding Marine Casualty Investigations.
- .4 explains the duties of the Legal Board and the Maritime Court.

2.4 Discipline Code for Seafarers (1 hour).

- .1 defines many words, i.a. casualty, serious casualty, etc., related with Maritime Casualty Investigations.
- .2 explains, in detail, the procedures for the disciplinary aspects of Marine Casualty Investigations.

3. INTERNATIONAL REGULATIONS (2 HOURS).

3.1 Conventions and Protocols (0.5 hour).

- .1 explains that a convention, protocol or agreement is a treaty between States.
- .2 explains the steps that should be done to ratify a convention.
- .3 states the steps which are necessary for a convention to enter into force.
- .4 explains the difference between explicit and tacit acceptance.
- .5 defines flag State, port State, coastal State, etc., and their respective role in enforcing conventions.

3.2 Convention provisions regarding MCI (1 hour).

- .1 explains the main requirements related to MCI under the United Nations Convention on the Law of the Sea (UNCLOS).
- .2 explains the main requirements related to MCI under the SOLAS Convention.

- .3 explains the main requirements related to MCI under the LL Convention.
- .4 explains the main requirements related to MCI under the STCW Convention.
- .5 explains the main requirements related to MCI under the SFV Convention.
- .6 explains the main requirements related to MCI under the MARPOL Convention.
- .7 states that the ILO Prevention of Accidents (Seafarers) Convention, requires occupational accidents to be reported and investigated.
- .8 states that the ILO Occupational Safety and Health (Dock Work) Convention, requires that measures shall be taken to ensure that occupational accidents and diseases are reported and, where necessary, investigated.

3.3 Resolutions and Circulars regarding MCI (0.5 hour).

- .1 explains the main requirements related to MCI under the following Resolutions and Circulars:
 - * IMO Resolution A.422
 - * IMO Resolution A.173 (ES.IV)
 - * IMO Resolution A.322 (IX)
 - * IMO Resolution A.440 (XI)
 - * IMO MSC/Circ.433
 - * IMO Resolution A.147 (ES.IV)
 - * IMO Resolution MEPC.30 (25)
 - * IMO MSC/Circ.360/Rev.1
 - * IMO Resolution A.598 (15)

4. CATEGORIES OF MARINE CASUALTIES (1 HOUR).

4.1 Characteristics of the different casualties (1 hour).

- .1 explains the typical characteristics that can be expected when one of the followings casualties occurs:

- * Missing.
- * Fire or Explosion.
- * Collision.
- * Pollution.
- * Stranding.
- * Lost.

- .2 explains, based on world statistical data, about the main reasons or sources which have caused the great accidents during the last decade.

5. INVESTIGATIVE PURPOSES AND PROCEDURES (5 HOURS).

5.1 Purposes and types of investigation (1 hour).

- .1 defines some technical words commonly used in MCI, i.a. casualty, collision, total loss, accident, cause, formal investigation, etc.
- .2 explains basic differences between "administrative proceedings", "civil proceedings", and "criminal proceedings" in relation to marine investigations.
- .3 explains that causal factors can only be determined by obtaining and verifying all facts and circumstances that may be pertinent and by objectively analyzing their bearing upon the accident or incident.

5.2 Initiation of investigation (1 hour).

- .1 explains the necessity for prompt advice of a marine occurrence in terms of availability of witnesses and reliability of evidence.
- .2 describes how the initial report of a marine occurrence may typically be assessed to determine type of investigation to be initiated.
- .3 describes the aspects which need to be investigated in the following types of accident or incident:
 - * personal injury, poisoning or death.
 - * collision or allision.

- * grounding, stranding or striking a fixed object.
- * abandonment or foundering.
- * fire or explosion in ship or cargo.
- * boiler explosion or damage.
- * machinery damage.
- * marine pollution.
- * ship lost with no survivors.

5.3 Documentary evidence (0.5 hour).

- .1 lists documentary evidence which should initially be gathered in preparation for holding an investigation.
- .2 explains how documentary evidence gathered during an investigation should be identified, authenticated and safeguarded.

5.4 Physical evidence (0.5 hour).

- .1 lists types of physical evidence which may be useful to an investigation.
- .2 states that a record of each item of physical evidence obtained or removed should be kept and explains the detail required.
- .3 explains the action to be taken if an item of physical evidence must be forwarded by post or other carrier.
- .4 lists reasons for pollution from ships as arising from:
 - * accidents resulting in damage to ships.
 - * equipment failure.
 - * faulty operations.
 - * intentional discharges of harmful substances.
- .5 gives an example of sophisticated sampling equipment and describe its use.
- .6 describes difficulties involved in obtaining a representative sample from the water surface.

5.5 Examination of witnesses (0.5 hour).

- .1 lists the witnesses who should most probably be interviewed in each type of casualty.
- .2 describes procedures for assembling witnesses.
- .3 describes and demonstrates techniques for interviewing witnesses.

5.6 Records of testimony (1 hour).

- .1 describes and demonstrates, as appropriate, the methods of recording evidence of witnesses, and explains their advantages and disadvantages, including the use of:
 - * depositions signed by the witness.
 - * investigators' personal notes.
 - * tape recordings.
- .2 explains the procedures for using interpreters in an investigation.
- .3 explains the procedures for using technical advisers in an investigation.
- .4 explains and demonstrates the correct way of taking down a declaration from a witness, his or her opinion on how the casualty occurred, and the witnesses' answers to principal questions.

5.7 Liaison with other authorities (0.5 hour).

- .1 explains the inquiries or hearings which may be held by harbour authorities, labour safety authorities, police and fire services and coroners in the case of a marine occurrence and states how co-operation can best be achieved.

6. ANALYSIS OF EVIDENCE (3.5 HOURS).

6.1 General aspects (0.5 hour).

- .1 defines evidence, opinion, expert opinion, objective evidence and subjective evidence.

- .2 identifies "conflict of evidence".
- .3 assesses means of verification.

6.2 Technical aspects (1 hour).

- .1 defines and gives examples of latent defect, materials defect, design defect, faulty workmanship, corrosion and fatigue in metals.
- .2 identifies technical factors which may be involved in:
 - * weather damage related cases.
 - * explosion related cases.
 - * fire related cases.
- .3 identifies technical factors which may be involved in navigational accidents occurring in restricted waters, including:
 - * Bernoulli effect.
 - * bodily sinkage.
 - * bank suction.
 - * passing ship effects.
- .4 identifies the subjects, materials or areas requiring research, tests or specific technical investigation to assist in determining the cause of an accident.

6.3 Human aspects (1 hour).

- .1 identifies factors which may affect the evidence given by a witness as including perception, recall and willingness and ability to communicate.
- .2 states that human factor must be considered as interactive with technology, social organization and environment.
- .3 identifies the role in human error of:
 - * knowledge, skill and experience.
 - * past individual performance.
 - * human and authority relations.
 - * fatigue.

- .4 identifies the principles set forth in IMO Resolution A.481 (XII) which govern the determination of safe manning levels.
- .5 states that SOLAS Regulation V/13 requires all ships to be sufficiently and efficiently manned for the purpose of safety at sea.

6.4 Determination of causal factors (1 hour).

- .1 identifies possible sequence of events.
- .2 derives most probable sequence of events from weight of evidence.
- .3 identifies causal factors in chain of events and failures to take appropriate remedial action.
- .4 identifies proximate cause.
- .5 explains the advantages of an "events recorder".

7. INQUIRY REPORTS (1.5 HOURS).

7.1 Content of reports (1 hour).

- .1 identifies the items necessary for incorporation within an inquiry report, including:
 - * the background information.
 - * the sequence of events leading to the accident.
 - * other relevant circumstances.
 - * the investigating officer's comments, conclusions and recommendations.
- .2 compiles skeleton reports based on given data.

7.2 Attachment of documentary evidence (0.5 hour).

- .1 lists the documentary evidence which may be required and explains the circumstances which would call for such items to be appended to inquiry reports, including declarations, ship plans, equipment records, weather reports, press cuttings, photographs, statutory certificates, crew and passenger lists, etc.

- .2 compiles appendices for attachment to reports based on given data.

8. ADMINISTRATION OF INVESTIGATIONS (4.5 HOURS).

8.1 Enabling legislation (0.5 hour).

- .1 describes a typical framework of national legislation necessary for the effective investigation of marine accidents and incidents in terms of, i.a.:
 - * the reporting of accidents and incidents.
 - * the appointment of investigators.
 - * the powers of investigators.
 - * the constitution and powers of courts or boards for formal hearings.

8.2 Appointment of investigators (0.5 hour).

- .1 drafts a typical appointment for an investigator officer or board to conduct a specific investigation.
- .2 explains the need for and describes the identification usually provided to marine investigation officers and boards.
- .3 describes the typical qualifications of marine investigation officers and boards.
- .4 explains advantages and disadvantages of marine investigations being conducted by:
 - * outside consultants.
 - * the Administration's ships surveyors.
 - * an independent marine investigator officer.
 - * a magistrate or judge.

8.3 Guidance to investigators (0.5 hour).

- .1 describes the content and use of a typical investigation manual or guidance notes provided for an investigation officer.

8.4 Informal inquiries (0.5 hour).

- .1 describes the procedure used to hold an informal fact-finding investigation.
- .2 explains the need to keep the level the inquiry is being held at under review.

8.5 Preliminary inquiries (0.5 hour).

- .1 describes the procedure used to hold a preliminary inquiry type investigation by an investigating officer or board.

8.6 Formal hearings (1 hour).

- .1 describes the circumstances in which a formal investigation or hearing should be recommended.
- .2 describes the general content of typical rules established for the conduct of formal investigations or hearings, including :
 - * the constitution of the Maritime Court.
 - * the powers of the Maritime Court regarding seafarers' certificates and licences.
 - * the appointment of assessors and their qualifications.
 - * the admission of evidence.
 - * the examination, cross-examination and re-examination of witnesses.
 - * the opportunity for persons criticized to make their defence.
 - * the report on the case.
- .3 describes the procedures typically followed regarding appeals and rehearings.

8.7 Cooperation with other States (0.5 hour).

- .1 explains that other Administrations having an interest in a formal investigation of public hearing should be given the opportunity of being represented.
- .2 explains why cooperation between States having an interest in a casualty can benefit the investigation.

8.8 Costs of inquiries and hearings (0.5 hour).

.1 lists cost items which would typically be involved in the conduct of:

- * informal inquiries.
- * preliminary inquiries.
- * formal inquiries.

.2 describes a typical procedure for:

- * validating costs incurred.
- * determining an appropriate level of fees for assessors and legal advisors.

9. FINDINGS AND RECOMMENDATIONS (2.5 HOURS).

9.1 Recommendations on standards (0.5 hour).

.1 explains that equipment and human factor solutions to "system" weaknesses must be carefully weighed against each other.

.2 explains what human do best and what equipment does best.

.3 explains need to ensure that recommended measures:

- * would most probably prevent a recurrence of the accident.
- * are the preferred solution.
- * can be enforced if adopted.
- * take into account the law of diminishing returns.

9.2 Recommendations on research (0.5 hours).

.1 explains need for clear identification of the "knowledge deficiency" both in absolute terms and as a contributory cause in the accident.

.2 explains need to identify applicability of the solutions sought or knowledge which be gained in the context of the industry at large.

9.3 Dissemination of information (0.5 hours).

- .1 explains why findings of marine accident investigations should be made public and drawn to the attention of the Administration and other regulatory bodies, owners, seafarers and others involved.
- .2 explains how relevant information can be disseminated to the shipping community.

9.4 Implications of investigation results (0.5 hour).

- .1 states that evidence given at an informal or preliminary inquiry cannot be used in a court of law but may affect the settlement of an insurance claim.
- .2 states that the findings and recommendations of an informal or preliminary inquiry:
- * may allow discovery of facts otherwise unknown or provide expert opinion which may assist or act against the interests of one or other party involved in a legal action or insurance claim.
- * should so far as possible be made known to all parties involved at the same time and in the same manner.

9.5 Submissions to IMO (0.5 hour).

- .1 describes the format to be used to inform IMO of the result of investigations into serious casualties.
- .2 defines "serious casualty".
- .3 identifies other specific information on casualties requested by IMO.
- .4 explains that any proposal to improve an IMO standard must:
- * demonstrate the urgent necessity of making the proposed improvement.
- * indicate the amount of work involved for the Organization in improving the standard.
- * give a clear indication of its cost / effectiveness.