SEAFARERS TRAINING CENTER INC

BRIDGE RESOURCE MANAGEMENT

In accordance with the International Agreement of Training, Certification and Watch Keeping for Seafarers 1978 STCW as amended

Scope

This course is designed to comply with the requirements established on table A-II/1, of the International Convention on standards of training, certification and Watchkeeping for seafarers STCW1978, as amended.

This course is classroom-based and designed for the ship's bridge team personnel. The course relies heavily on the use of the simulators as tools to learn bridge resource management. The course topics and exercises are designed to expose the student to human factors and to relay the importance of these factors in managing information and bridge operations of the navigation bridge.

General objectives

The objectives of this course is to complete the learning goals of individual lectures and discussion modules (e.g. leadership, communications, team building, multicultural diversity, etc.) and to successfully participate in the simulator and team exercises, thereby displaying knowledge of Bridge Resource Management and Navigation Bridge Teambuilding Principles, and in doing so, satisfy STCW standards for the Officer in Charge of the Navigation Watch.

Prerequisites:

Students who wish to enter this course must have a minimum of service experience of listening to six months as officer in charge of a navigational watch of and they must also have completed a training course that meets or exceeds the standard established in the IMO Assembly resolution A. 483 (12th), RADAR training (see IMO model course 1.07).

The course is principally intended for candidates for certification as Master; First or Second Deck Officer on seagoing ships. Those wishing to enter this course should be the holders of certificates satisfying the requirements of regulation II/1; II/2 or II/3 of the STCW convention as deck officer in charge of the navigation watch. They should therefore have completed a course of training which meets or exceeds the standard set out in table A-II/1 of the STCW code, and completed the sea service needed for certification as Master; C/O or while qualified as a deck officer in charge of a navigation watch.

Bibliography

Knowledge, understanding and proficiency	IMO Reference	Textbooks, Bibliography	Teaching Aid
1. - ELECTRONIC NAVIGATION SYSTEMS 1.1. - IMO and navigation systems 1.2. - World-wide navigation systems 1.2.1. - 1995 Update 1.2.2. - Omega 1.2.3. - Chayka 1.2.4. - Decca 1.2.5. - Loran-C 1.3. - Satellite Navigation Systems 1.3.1. - Current Status of NAVSTAR GPS 1.4. - Satellite positioning 1.5. - GPS How it Works 1.5.1. - The Global Positioning Systems (GPS) 1.5.2. - How It Works 1.5.3. - Problems at the Satellite 1.5.4. - Where to get Differential Signals 1.6. - Future of Global navigation satellite systems			
2. - ELECTRONIC CHART SYSTEMS 2.2. - The digital Chart 2.3. - Fundamental Concepts 2.4. - Differences between Vector Charts & Raster Charts 2.5. - Performance standards for Electronic Charts 2.6. - Raster Charts Performance Standards 2.7. - Hydrographic data and charts 2.8. - Correcting the digital chart 2.9. - Differences between RCDS and ECDIS 2.10. -ECDIS 2.11. - IMO Performance standards 2.11.1. - IHO Standard, Format and Specifications 2.12. - ECDIS warnings & alarms 2.13. - ECDIS units 2.13.1. - ECDIS Priority Layers 2.14. - ECDIS calculation requirements 2.14.1. - ECDIS Additional Information 2.15. - The Risk of over reliance 2.15.1. - Training is necessary 2.15.2 - Conclusion		SOLAS CHAPTER V	

3. - INTEGRATED BRIDGE SYSTEMS 3.1. - Operating concept 3.1.1 - Navigation 3.1.2. - Collision Avoidance 3.1.3. - Ship Management 3.2. - The Integrated Bridge 3.2.1. - System Components 3.2.2. - Computer Processor and Network 3.2.3. - Chart Data Base 3.2.4. - System Display 3.2.5. - Planning Station 3.2.6. - Control System 3.2.7. - Radar			
4. - BRIDGE PROCEDURES & PASSAGE PLANING 4.1. - Clarity of Purpose 4.2. - Delegation of Authority 4.3. - Effective Organization 4.4. - Motivation 4.5. - Bridge Organization 4.5.1 - Overview 4.6. - Bridge Resource management and the Bridge Team 4.6.1. - Composition of the Navigation Watch under the STCW Code 4.6.2. - Watchkeeping arrangements under STCW Code 4.6.3. - Reassessing Manning Levels During the Voyage 4.6.4. - Sole Look-Out 4.6.5. - The Bridge team 4.6.6. - The Bridge Team & the Master 4.7. - Working within the Bridge Team 4.7.1. - Assignment of Duties 4.7.2. - Co-ordination and Communication 4.7.3. - New Personnel and Familiarization 4.7.4. - Prevention of Fatigue 4.7.5. - Use of English 4.7.6. - The Bridge Team and the Pilot 4.7.7. - Navigation Policy and Company Procedures 4.7.8. - Master´s Standing Orders 4.7.9. - Bridge Order Book 4.8. - Passage Planning 4.8.1. - Overview 4.8.2. - Responsibility for Passage Planning 4.9. - Notes on Passage Planning 4.9.1 - Plan appraisal 4.9.2. - Charts and Publications 4.9.3. - The Route Plan		STCW CODE	

4.10. - Passage planning and electronic navigation systems 4.10.1. - Planning using electronic chart display systems 4.10.2. - Transferring route plans to other navigation aids 4.10.3. - Notes on passage planning in ocean waters 4.10.4. - Monitoring the route plan 4.10.5. - Visual monitoring techniques 4.10.6. - radar monitoring techniques 4.11. - Passage planning and Piloting 4.11.1. - Pre arrival planning 4.11.2. - Pre arrival information exchange with the pilot 4.11.3. - Pilot on board 4.11.4. - Preparing the out ward bound pilotage plan 4.12. - Passage planning and ship's routeing 4.13. - Passage planning and ship reporting systems 4.14. - Passage planning and vessel traffic services			
5. - RADAR & ARPA 5.1. - Introduction 5.2. -Radar Tuning 5.2.1. - General tips tuning 5.3. - Radar Piloting 5.4. - Use of Radar Underway 5.5. - Now (finally) the method 5.6. - Collision avoidance maneuvering 5.7. - Evaluating Risk of Collision 5.7.1. - Introduction to systematic observation 5.7.2. - How to mark a target 5.8. - Radar and the Navigation Rules 5.8.1. – Introduction 5.9. – Navigation rules on radar 5.9.1. - Rule 2 - Responsibility 5.9.2. - Rule 5 - Look-out 5.9.3. - Rule 6 - Safe Speed 5.9.4. - Rule 7 - Risk of collision 5.9.5. - Rule 8 - Action of avoid collision 5.9.6. - Rule 19 – Conduct of vessels in restricted visibility 5.10. - Chart Navigation with Radar 5.10.1. - Introduction 5.10.2. - Landmass identification 5.10.3. - Resolution 5.10.4. - Range and Bearing Fix 5.10.5. - VRM as danger circle 5.10.6. - Miscellaneous tricks			

6. - SAR OPERATIONS 6.1. - Coordination of SAR operations 6.2. - Action by Ship in distress 6.3. - Action by assisting ship 6.4. - Assistance by SAR aircraft 6.5. - Planning & conducting the search 6.6. - Conclusion of search 6.7. - Communications 6.8. - Air craft casualty at sea			
7. - ONBOARD EMERGENCIES & CONTIGENCY PLANS 7.1. - Introduction			
8. - UNITED NATIONS ORGANIZATION 8.1. - The general Assembly 8.2. - The Security Council 8.3. - The Economic & Social Council 8.4. - The Trusteeship Council 8.5. - The International Court of Justice 8.6. - The Specialized Agencies 8.7. - The UN and the convention on the Law of the Sea			
9. - ILO - THE INTERNATIONAL LABOUR ORGANIZATION 9.1. - Mandate 9.2. - History		MLC CONVECTION	
10. - IMO- INTERNATIONAL MARITIME ORGANIZATION 10.1. - Introduction 10.2. - Objective 10.3. - Structure 10.4. - Assembly 10.5. - Council 10.6. - Council Members 10.7. - Increasing size of council 10.8. - Maritime Safety Committee 10.9. - The Marine Environment Protection Committee 10.10. - Sub-committee 10.11. - Legal Committee 10.12. - Technical Co-operation committee 10.13. - Facilitation Committee 10.14. - Secretarial 10.15. - Budget - 2000 - 2001 10.16. - IMO Members 10.17. - IMO - What it is? 10.18. - IMO - Conventions safety 10.19. - IMO - Code and recommendation 10.20. - Technical assistance 10.21. - IMO’s conventions 10.22. - Adopting a convention			

10.23. - Entry into Force 10.24. - Signature, ratification, acceptance, approval and accession			
11. - INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974 11.1. - Introduction & History 11.2. - Amendment Procedure 11.3. - Technical Provisions 11.4. - Chapter I 11.5. - Chapter II-1 11.6. - Chapter II-2 11.7. - Chapter III 11.8. - Chapter IV 11.9. - Chapter V 11.10. - Chapter V1 11.11. - Chapter VII 11.12. - Chapter VIII 11.13. - Chapter IX 11.14. - Chapter X 11.15. - Chapter XI 11.16. - Chapter XII 11.17. - The Protocol 1978 11.18. - The 1981 amendments 11.19. - The 1983 amendments 11.20. - The 1988 amendments 11.21. - The 1989 amendments 11.22. - The 1990 amendments 11.23. - The 1991 amendments 11.24. - The 1992 amendments 11.25. - The 1994 amendments 11.26. - The 1995 amendments 11.27. - The 1996 amendments 11.28. - The 1997 amendments 11.29. - The 1998 amendments 11.30. - The 1999 amendments 11.31. - The 2000 amendments		SOLAS CONVECTION	
12. - CONVENTION ON THE INTERNATIONAL REGULATION FOR PREVENTING COLLISION AT SEA, 1972. 12.1. - Introduction 12.2. - Technical Provisions 12.3. - Part A 12.4. - Part B 12.5. - Part C 12.6. - Annexes 12.7. - The 1987 amendments 12.8. - The 1989 amendments 12.9. - The 1993 amendments			

13. - INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR SEAFEARES, 1978 13.1. - Introduction 13.2. - The 1978 Convention 13.3. - The 1991 amendments 13.4. - The 1994 amendments 13.5. - The 1995 amendments 13.6. - Ensuring compliance with the convention 13.7. - Port state control 13.8. - The 1997 amendments 13.9. - The 1998 amendments 13.10. - The White List		STCW CONVENTION	
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15. - INTERNATIONAL CONVENTION ON LOAD LINES, 1966 15.1. - Introduction and History 15.2. - Load Lines 1966 – Annexes 15.3. - Adoption of tacit amendment procedure 15.4. - The 1995 amendments 15.5. - Revision of Load Lines Convention		LL CONVENTION	
16. - INTERNATIONAL CONVENTIO FO THE PREVENTION OF POLLUTION FROM SHIPS, 1973 AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO (MARPOL 73/78) 16.1. - Introduction 16.2. - History of MARPOL 16.3. - OILPOL Convention 16.4. - Torrey Canyon 16.5. -1973 Convention 16.6. - 1978 Conference 16.7. - Annex I 16.8. - Annex II 16.9. - Annex III 16.10. - Annex IV 16.11. - Annex V 16.12. - Annex VI 16.13. - Enforcement 16.14. - The 1984 amendments 16.15. - The 1985 amendments 16.16. - The 1987 amendments 16.17. - The 1989 amendments 16.18. - The 1990 amendments 16.19. - The 1991 amendments		MARPAL CONVENTION	

16.20. - The 1994 amendments 16.21. - The 1995 amendments 16.22. - The 1997 amendments 16.23. - The Protocol of 1997 16.24. - The 1999 amendments 16.25. - The 2000 amendments 16.26. - The 2001 amendments			
17. - THE INTERNATIONAL CONVENTION ONN THE CONTROL OF HARMFUL ANTI-FOULING SYSTEMS ON SHIPS 17.1. - Introduction 17.2. - Resolutions adopted by the Conference		ADS CONVENTION	
18. - INTERNATIONAL CONVETION ON CIVIL LIABILITY FOR BUNKER OIL POLLUTION DAMAGE 2001 18.1. - Introduction 18.2. - Resolution of limitation of liability 18.3. - Resolution on promotion of technical co-operation 18.4. - Resolution for persons taking measures to prevent or minimize the effects of oil pollution			
19. - INTERNATIONAL CONVENTION ON LIABILITY AND COMPENSANTION FOR DAMAGE IN CONNECTION WITH THE CARRIAGE OF HAZARDOUS AND NOXIOUS SUBSTANCES BY SEA (HNS), 1996. 19.1. - Introduction 19.2. - HNS Fund 19.3. - Convention			
20. - INTERNATIONAL CONVENTION ON TONNAGE MEASUREMENT OF SHIPS, 1969. 20.1. - Introduction		ITC CONVENTION	
21. - SPECIAL TRADE PASSENGER SHIPS AGREEMENT, 1971 & PROTOCOL ON SPACE REQUIREMENTS FOR SPECIAL TRADE PASSENGER SHIPS, 1973 21.1. - Introduction			
22. - ATHENS CONVENTION RELATING THE CARRIAGE OF PASSENGERS AND THEIR LUGGAGE BY SEA (PAL), 1974 22.1. - Introduction 22.2. - The 1989 Protocol 22.3. - The 1990 Protocol 22.4. - Review			
23. - CONVENTION O LIMITATION OF LIABILITY FOR MARINE CLAIMS (LLMC), 1976 23.1. - Introduction 23.2. - Protocol of 1996			

24. - INTERNATIONAL CONVENTION ON THE ESTABLISHMENT OF AN INTERNATIONAL FUND FOR COMPENSATION FOR OIL POLLUTION DAMAGE (FUND), 1971 24.1. - Introduction 24.2. - The purposes 24.3. - The Protocol of 1976 24.4. - The protocol of 1984 24.5. - The Protocol of 1992 24.6. - The 2000 amendments 24.7. - The IOPC Fund and IMO			
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26. - CONVENTION ON THE INTERNATIONAL MARITIME SATELLITE ORGANIZATION, 1976 26.1. - History 26.2. - New Structure – IMSO Created 26.3. - Amendments to the Inmarsat Convention 26.4. - The 1985 amendments 26.5. - The 1989 amendments 26.6. - The 1994 amendments 26.7. - The 1998 amendments			
27. - THE INTERNATIONAL CONVENTION ON SALVAGE, 1989 27.1. - Introduction 27.2. - Special compensation			
28. - SUMMARY OF STATUS OF CONVENTIONS			
29. - ITU – INTERNATIONAL TELECOMUNICATION UNION 29.1. - History 29.2. - The developing of the Role of the Union 29.3. - Purposes 29.4. - Structure and activities 29.5. - The Radio Regulation 29.6. - Managing the Spectrum 29.7. - The Future Today			

Course outline

Subject area and topics	Hours (film/Lecture)	Practice
1. - ELECTRONIC NAVIGATION SYSTEMS 1.1. - IMO and navigation systems 1.2. - World-wide navigation systems 1.3. - Satellite Navigation Systems 1.4. - Satellite positioning 1.5. - GPS How it Works 1.6. - Future of Global navigation satellite systems	1.5	1.0
2. - ELECTRONIC CHART SYSTEMS 2.2. - The digital Chart 2.3. - Fundamental Concepts 2.4. - Differences between Vector Charts & Raster Charts 2.5. - Performance standards for Electronic Charts 2.6. - Raster Charts Performance Standards 2.7. - Hydrographic data and charts 2.8. - Correcting the digital chart 2.9. - Differences between RCDS and ECDIS 2.10. -ECDIS 2.11. - IMO Performance standards 2.12. - ECDIS warnings & alarms 2.13. - ECDIS units 2.14. - ECDIS calculation requirements 2.15. - The Risk of over reliance	5.25	1.0
3. - INTEGRATED BRIDGE SYSTEMS 3.1. - Operating concept 3.2. - The Integrated Bridge		1.0
4. - BRIDGE PROCEDURES & PASSAGE PLANING 4.1. - Clarity of Purpose 4.2. - Delegation of Authority 4.3. - Effective Organization 4.4. - Motivation 4.5. - Bridge Organization 4.6. - Bridge Resource management and the Bridge Team 4.7. - Working within the Bridge Team 4.8. - Passage Planning 4.9. - Notes on Passage Planning 4.10. - Passage planning and electronic navigation systems 4.11. - Passage planning and Piloting 4.12. - Passage planning and ship's routeing 4.13. - Passage planning and ship reporting systems 4.14. - Passage planning and vessel traffic services	4.0	2.0
5. - RADAR & ARPA 5.1. - Introduction 5.2. -Radar Tuning 5.3. - Radar Piloting 5.4. - Use of Radar Underway 5.5. - Now (finally) the method 5.6. - Collision avoidance maneuvering 5.7. - Evaluating Risk of Collision 5.8. - Radar and the Navigation Rules 5.9. – Navigation rules on radar 5.10. - Chart Navigation with Radar	1.75	1.0 1.0 1.0

6. - SAR OPERATIONS 6.1. - Coordination of SAR operations 6.2. - Action by Ship in distress 6.3. - Action by assisting ship 6.4. - Assistance by SAR aircraft 6.5. - Planning & conducting the search 6.6. - Conclusion of search 6.7. - Communications 6.8. - Air craft casualty at sea	2.0	
7. - ONBOARD EMERGENCIES & CONTIGENCY PLANS 7.1. - Introduction	.50	1.0
8. - UNITED NATIONS ORGANIZATION 8.1. - The general Assembly 8.2. - The Security Council 8.3. - The Economic & Social Council 8.4. - The Trusteeship Council 8.5. - The International Court of Justice 8.6. - The Specialized Agencies 8.7. - The UN and the convention on the Law of the Sea	1.75	
9. - ILO - THE INTERNATIONAL LABOUR ORGANIZATION 9.1. - Mandate 9.2. - History	.50	
10. - IMO- INTERNATIONAL MARITIME ORGANIZATION 10.1. - Introduction 10.2. - Objective 10.3. - Structure 10.4. - Assembly 10.5. - Council 10.6. - Council Members 10.7. - Increasing size of council 10.8. - Maritime Safety Committee 10.9. - The Marine Environment Protection Committee 10.10. - Sub-committee 10.11. - Legal Committee 10.12. - Technical Co-operation committee 10.13. - Facilitation Committee 10.14. - Secretarial 10.15. - Budget - 2000 - 2001 10.16. - IMO Members 10.17. - IMO - What it is? 10.18. - IMO - Conventions safety 10.19. - IMO - Code and recommendation 10.20. - Technical assistance 10.21. - IMO's conventions 10.22. - Adopting a convention 10.23. - Entry into Force 10.24. - Signature, ratification, acceptance, approval and accession	1.0	

11. - INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974 11.1. - Introduction & History 11.2. - Amendment Procedure 11.3. - Technical Provisions 11.4. - Chapter I 11.5. - Chapter II-1 11.6. - Chapter II-2 11.7. - Chapter III 11.8. - Chapter IV 11.9. - Chapter V 11.10. - Chapter V1 11.11. - Chapter VII 11.12. - Chapter VIII 11.13. - Chapter IX 11.14. - Chapter X 11.15. - Chapter XI 11.16. - Chapter XII 11.17. - The Protocol 1978 11.18. - The 1981 amendments 11.19. - The 1983 amendments 11.20. - The 1988 amendments 11.21. - The 1989 amendments 11.22. - The 1990 amendments 11.23. - The 1991 amendments 11.24. - The 1992 amendments 11.25. - The 1994 amendments 11.26. - The 1995 amendments 11.27. - The 1996 amendments 11.28. - The 1997 amendments 11.29. - The 1998 amendments 11.30. - The 1999 amendments 11.31. - The 2000 amendments	1.0	
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18. - INTERNATIONAL CONVETION ON CIVIL LIABILITY FOR BUNKER OIL POLLUTION DAMAGE 2001 18.1. - Introduction 18.2. - Resolution of limitation of liability 18.3. - Resolution on promotion of technical co-operation 18.4. - Resolution for persons taking measures to prevent or minimize the effects of oil pollution	.50	

19. - INTERNATIONAL CONVENTION ON LIABILITY AND COMPENSANTION FOR DAMAGE IN CONNECTION WITH THE CARRIAGE OF HAZARDOUS AND NOXIOUS SUBSTANCES BY SEA (HNS), 1996. 19.1. - Introduction 19.2. - HNS Fund 19.3. - Convention	.50	
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23. - CONVENTION O LIMITATION OF LIABILITY FOR MARINE CLAIMS (LLMC), 1976 23.1. - Introduction 23.2. - Protocol of 1996	.50	
24. - INTERNATIONAL CONVENTION ON THE ESTABLISHENT OF AN INTERNATIONAL FUND FOR COMPENSATION FOR OIL POLLUTION DAMAGE (FUND), 1971 24.1. - Introduction 24.2. - The purposes 24.3. - The Protocol of 1976 24.4. - The protocol of 1984 24.5. - The Protocol of 1992 24.6. - The 2000 amendments 24.7. - The IOPC Fund and IMO	.50	
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28. - SUMMARY OF STATUS OF CONVENTIONS	.50	
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	30	10
TOTAL HOURS	**40**	

Course Timetable

The following timetable for a 12 hour course should be considered indicative and adjusted in accordance with the needs of course participants.

Days	Subject Area
Day 1 **(8 Hours)**	**1. - ELECTRONIC NAVIGATION SYSTEMS** **2. - ELECTRONIC CHART SYSTEMS**
Day 2 **(8 Hours)**	**2. - ELECTRONIC CHART SYSTEMS (CONTINUE)** **3. - INTEGRATED BRIDGE SYSTEMS** **4. - BRIDGE PROCEDURES & PASSAGE PLANING**
Day 3 **(8 Hours)**	**4. – BRIDGE PROCEDURES & PASSAGE PLANING (CONTINUE)** **5. - RADAR & ARPA** **6. - SAR OPERATIONS** **7. - ONBOARD EMERGENCIES & CONTIGENCY PLANS**
Day 4 **(8 Hours)**	**7. - ONBOARD EMERGENCIES & CONTIGENCY PLANS (CONTINUE)** **8. - UNITED NATIONS ORGANIZATION** **9. - ILO - THE INTERNATIONAL LABOUR ORGANIZATION** **10. - IMO- INTERNATIONAL MARITIME ORGANIZATION** **11. - INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974** **12. - CONVENTION ON THE INTERNATIONAL REGULATION FOR PREVENTING COLLISION AT SEA, 1972.** **13. - INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR SEAFEARES, 1978** **14. - INTERNATIONAL CONVENTION ON MARITIME SEARCH AND RESCUE, 1979** **15. - INTERNATIONAL CONVENTION ON LOAD LINES, 1966**

Day 5 **(8 Hours)**	**15. - INTERNATIONAL CONVENTION ON LOAD LINES, 1966 (CONTINUE)** **16. - INTERNATIONAL CONVENTIO FO THE PREVENTION OF POLLUTION FROM SHIPS, 1973 AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO (MARPOL 73/78)** **17. - THE INTERNATIONAL CONVENTION ONN THE CONTROL OF HARMFUL ANTI-FOULING SYSTEMS ON SHIPS** **18. - INTERNATIONAL CONVETION ON CIVIL LIABILITY FOR BUNKER OIL POLLUTION DAMAGE 2001** **19. - INTERNATIONAL CONVENTION ON LIABILITY AND COMPENSANTION FOR DAMAGE IN CONNECTION WITH THE CARRIAGE OF HAZARDOUS AND NOXIOUS SUBSTANCES BY SEA (HNS), 1996.** **20. - INTERNATIONAL CONVENTION ON TONNAGE MEASUREMENT OF SHIPS, 1969.** **21. - SPECIAL TRADE PASSENGER SHIPS AGREEMENT, 1971 & PROTOCOL ON SPACE REQUIREMENTS FOR SPECIAL TRADE PASSENGER SHIPS, 1973** **22. - ATHENS CONVENTION RELATING THE CARRIAGE OF PASSENGERS AND THEIR LUGGAGE BY SEA (PAL), 1974** **23. - CONVENTION O LIMITATION OF LIABILITY FOR MARINE CLAIMS (LLMC), 1976** **24. - INTERNATIONAL CONVENTION ON THE ESTABLISHENT OF AN INTERNATIONAL FUND FOR COMPENSATION FOR OIL POLLUTION DAMAGE (FUND), 1971** **25. - INTERNATIONAL CONVENTION ON CIVIL LIABILITY FOR OIL POLLUTION DAMAGE (CLC), 1969** **26. - CONVENTION ON THE INTERNATIONAL MARITIME SATELLITE ORGANIZATION, 1976** **27. - THE INTERNATIONAL CONVENTION ON SALVAGE, 1989** **28. - SUMMARY OF STATUS OF CONVENTIONS** **29. - ITU – INTERNATIONAL TELECOMUNICATION UNION**

1. ELECTRONIC NAVIGATION SYSTEMS

Since the earliest days of navigation, seafarers have sought to keep track of their direction and position. The earliest forms of the magnetic compass date back to the 12th century while the crude "dead reckoning" system involved measuring the course and distance sailed from a known position.

By the end of the 15th century navigators were using the quadrant and astrolabe to find latitudinal position from the position of the sun, moon or stars and the horizon, while the chronometer, invented in the 18th century, enabled navigators to find their longitudinal position.

The introduction of radio and wireless technology in the late 19th century permitted the development of more sophisticated navigation systems. Wireless time signals, which were first broadcast from Paris in 1910, enabled more accurate determination of longitude, while the Italians Ettore Bellini and Captain Tosi in 1906 developed a direction finding system used to determine the direction from which wireless signals were transmitted.

After the end of World War Two, the development of radar led to the possibility of ships being able to fix their position, when within 48 to 60 miles of the shore, by making reference to coastal features or responder beacons (Racons) installed on the shore. Further out to sea, hyperbolic radio systems soon enabled accurate position fixing with a range of at least 250 miles.

These early radio navigation systems - including Decca Navigator and Loran A - involved a ship's radio receiver measuring transmissions from groups of radio transmitters transmitting signals simultaneously or in a controlled sequence. By measuring the phase difference between one pair of transmissions a position line
can be established, a second measurement from another pair of stations gives a second line and the intersection of the two lines gives the navigating position.

By the 1970s, Loran C and Differential Omega radio navigation systems were also becoming operational in major areas of the world's oceans and they were combined with early computer technology to provide electronic print outs of the ship's position. The Soviet Tchaika system also became operational. Meanwhile, the world's first satellites had been launched and their potential for accurate position finding was being actively researched.

IMO and navigation systems

The importance of using navigation systems in maritime safety and preventing marine pollution, for example as an aid to avoiding hazards, was recognized by IMO in the late 1960s, and in 1968 it adopted resolution A.156(ES.IV) on *Recommendation on the Carriage of Electronic Position-Fixing Equipmen*t.

That resolution recommended that ships carrying oil or other noxious or hazardous cargoes in bulk should carry "an efficient electronic position-fixing device".

Performance Standards for Shipborne Receivers for use with Differential Omega (resolution A.479(XII) were adopted in 1981, while in 1983 the Assembly adopted resolution A.529(13) on *Accuracy Standards for Navigatio*n.

Resolution A.529(13) is aimed at providing "guidance to Administrations on the standards of navigation accuracy for assessing position-fixing systems, in particular radio-navigation systems, including satellite systems". It notes that "the navigator needs to be able to determine his position at all times".

Accuracy of navigation systems in areas such as harbour entrances and approaches depends on local circumstances, but in other waters, the resolution established that navigation systems should provide accuracy within the order of 4% of the distance from danger with a maximum of 4 nautical miles (for a ship proceeding at not more than 30 knots).

Also in 1983, IMO began a study into a world-wide radio-navigation system, in view of the need for such a system to provide ships with navigational position-fixing throughout the world - but recognizing that itwas not considered feasible for IMO to fund a world-wide radio-navigation system.

The objective of the study was to provide a basis by which Regulation 12 (covering shipborne navigational equipment) of SOLAS Chapter V might be amended to include a requirement for ships to carry equipment to receive transmissions from a radio navigation system throughout their intended voyage.

SOLAS Chapter V Regulation 12 includes a requirement for ships on international voyages over 1,600 gross tonnage to be fitted with radio direction-finding apparatus. This requirement dates back to the 1948 SOLAS Convention, while in 1988 IMO adopted an amendment which allowed ships the possibility to carry instead radionavigation equipment suitable for use throughout the intended voyage.

World-wide radio navigation system

In 1985, IMO initiated a study into a world-wide satellite position-fixing system for the safety of navigation and a report, *Study of a World-Wide Radionavigation System,* was adopted by the IMO Assembly in 1989 (resolution A.666(16).

The report gave a detailed summary of the different terrestrial-based radio navigation systems then in operation (Differential Omega, Loran-C, Chayka), and also the satellite systems which were being developed - Global Positioning System (GPS) Standard Positioning Service (SPS), which was being developed by the United States air force; and GLONASS (Global Navigation Satellite System), being developed by the then Soviet military (now managed for the Government of the Russian Federation by the Russian Space Agency.

The 1989 report said that it was not considered feasible for IMO to fund a world-wide radionavigation system, so existing and planned systems provided and operated by Governments or organizations were studied to ascertain whether they could be recognized or accepted by IMO.

When a radio-navigation system is accepted by IMO, it means the system is regarded as capable of providing adequate position information and that the carriage of receiving equipment satisfies the relevant SOLAS requirements.

The report notes that shipborne receiving equipment should conform to the general requirements for navigational equipment in resolution A.574(14) (later updated by A.694(17) and that detailed requirements for receivers for GPS, differential GPS, GLONASS, differential GLONASS, Loran-C, Chayka, Omega combined with differential Omega and Decca Navigator systems were available to manufacturers to enable them to construct the equipment.

The report set operational requirements for world-wide radionavigation systems: they should be general in nature and be capable of being met by a number of systems. All systems should be capable of being used by an unlimited number of ships. Accuracy should at least comply with the standards set out in resolution A.529(13) *Accuracy of Standards for Navigatio*n.

1995 update

The report was updated in 1995 by resolution A.815(19), *World-Wide Radionavigation syste*m, which takes into account the requirements for general navigation of ships engaged on international voyages anywhere in the world, as well as the requirements of the Global Maritime Distress and Safety System (GMDSS) for the provision of position information.

The revised report also addresses the development of high speed craft, such as fast ferries, noting that ships operating at speeds above 30 knots may need more stringent requirements.

The report states that provision of a radionavigation system is the responsibility of governments or organizations concerned and that these should inform IMO that the system is operational and available for use by merchant shipping while keeping IMO informed in good time of any changes that could affect the performance of shipborne receiving equipment.

Updated performance standards for Decca Navigator and Loran-C and Chayka receivers and performance standards for shipborne global positioning system (GPS) receiver equipment were also adopted in 1995. By then, GPS was fully operational, while GLONASS became fully operational in 1996. The future for terrestrial-based radio-navigation systems - in view of the development of the satellite-based systems - is unclear.

OMEGA was also phased out in 1997 while DECCA will be phased-out in many countries by the year 2000. The United States-controlled LORAN-C networks are under consideration for phasing out by the year 2000. However, the Russian Federation-controlled CHAYKA networks will not be considered for phasing out until at least the year 2010. Civil-controlled LORAN-C and LORAN-C/CHAYKA networks are being set up in the Far East, North-West Europe and other parts of the world with plans for extension in some areas.

Meanwhile, there are several initiatives to improve the accuracy and/or integrity of GPS and GLONASS by augmentation. The use of different differential correction signals for local augmentation of accuracy and integrity and RAIM (Receiver Autonomous Integrity Monitoring) are examples of such initiative. In addition integrated receivers are being developed, combining signals from GPS, GLONASS, LORAN-C and/or CHAYKA. Wide area augmentation systems are also being developed using differential correction signals from geostationary satellites, in particular Inmarsat III satellites, for instance by the United States and Europe.

However, the main concern is that while GPS and GLONASS are expected to be fully operational until at least the year 2010, their availability beyond that is not guaranteed.

As a result, IMO (and other users, such as civil aviation) has recognised the need for a future system to improve, replace or supplement GPS and GLONASS, which have shortcomings on integrity, availability, control and system life expectancy. As a result, IMO in 1997 adopted resolution A.860(20) on *Maritime* *policy for a future global navigation satellite system (GNSS).*

OMEGA

A very low frequency (VLF) hyperbolic radionavigation system based on phase comparison techniques, which ceased operations in September 1997.

Omega evolved from a low frequency system known as Radux first proposed in 1947 and was further developed in the 1950s, was the first world-wide radio-navigation system offering global coverage. It operated from eight Omega stations in Norway, Liberia, Hawaii, North Dakota, La Reunion, Argentina, Australia and Japan.

Differential Omega refers to the provision of increased accuracy in a local area, such as a harbour, through the use of local transmitters of the Omega signal.

CHAYKA

A radionavigation system, similar to LORAN-C, operated by the Russian Federation. Accuracy is 50 to 200 metres.

DECCA

A low frequency (LF) hyperbolic radionavigation system based on harmonically related continuous wave transmissions.

The basis principles of the Decca Navigator were invented in the United State sin 1937 and the system was used for guiding the leading minesweepers and landing craft in the Allied invasion of Normandy during World War Two.

In 1945, the Decca Navigator Co, Ltd was formed and the first commercial chain of stations established in south-east England in 1946.

The system expanded and by 1989 had 42 fully operational chains around the world, including 42 master stations and 119 slave transmitters. Chains normally comprise one master station and three slave transmitters. Stations radiate four harmonically related frequencies in the band 70 kHz to 130kHz. Coastal accuracy is 50 metres by day and 200 metres by night.

LORAN-C
A low frequency (LF) hyperbolic radionavigation system based on measurements of the differences of times of arrival of signals using pulse and phase comparison techniques.

The Loran system was initially proposed by the United States in 1940 and the first full-scale trials, of Standard Loran, or Loran-A, took place in 1942. By 1943 coverage extended over much of western and northern Atlantic and by 1945 had extended to cover north and central Pacific, Bay of Bengal, and northern Australia. It was the standard Allied long-range navigation system for ships and aircraft. Coverage in the Japanese and East China Sea Areas was extended in the 1950s and in 1965 stations were established in Portugal and the Azores. Loran-C was a modified version of Loran-A, developed to provide longer range and greater accuracy. Loran-C first came into operation in 1957.

By 1989, there were 16 Loran-C chains comprising 67 stations, transmitting on 100 kHz.
Typical coastal accuracy is 50 to 200 metres.

Satellite Navigation Systems

Satellite navigation and positioning has, during the later years, gone from something most people had not even heard anything about to something used in a large number of applications. Primarily it is the American Global Positioning System (GPS) (see e.g. *Hoffman-Wellenhof et al.* [1994] and *Parkinson and Spilker (eds.)* [1996]) that is used but there also exists another system in the shadow of GPS, namely the Russian Global Navigation Satellite System or GLONASS. GLONASS has been around since the early eighties, however information about it has been very scarce in western countries until the last five years or so. The reason for this has probably much to do with the reluctance of the former Soviet Union to reveal any information about military resources and since GLONASS was developed as a military guidance and navigation system information has been very scarce.

The interest for GLONASS has increased due to larger flow of information about the system, which made it possible to manufacture receivers capable of not only tracking GPS satellites but also GLONASS satellites. This made it possible to start exploring the possibilities of applications relying on a larger number of satellites visible than provided by GPS only as well as the challenge of trying to tie measurements together stemming from two different reference systems.

The studies undertaken and presented in this thesis have been made in order to investigate the impact and usability of GLONASS, both in its own respect and in combined use together with GPS. Further, the experience that can be drawn from GLONASS usage today can be very useful in the future when more satellite navigation systems will be developed. Today Europe has plans for its own navigation system, Galileo, and in order to utilize this from the very beginning it is important to have gained experience earlier from combined use of different satellite navigation systems, a perfect role for GLONASS in conjunction with GPS.

Current Status of NAVSTAR GPS.

The launch of the 24th Block II 28 satellite in March 1994 completed the GPS constellation. The NAVSTAR system currently consists of 25 satellites, including one Block I satellite. Initial Operational Capability (IOC) was formally declared December 8, 1993, in a joint announcement by the DoD and the Department of Transportation (DoT). The IOC notification means that the NAVSTAR GPS is capable of sustaining the Standard Positioning Service (SPS), the 100-meter positioning accuracy available to civilian users of the system on a continuous, worldwide basis. Unlike IOC for other DoD systems, IOC for GPS has purely civil connotations.

In 1995, the U.S. Air Force Space Command formally declared that GPS met the requirements for Full Operational Capability (FOC),32 meaning that the constellation of 24 operational (Block II/IIA) satellites now in orbit has successfully completed testing for military functionality. While the FOC declaration is significant to DoD because it defines a system as being able to provide full and supportable military capability, it does not have any significant impact on civil users.

An additional 21 satellites called Block IIRs are being developed by Martin Marietta (formerly General Electric Astro Space division) as replacements for the current GPS satellites. The Block IIR satellites will provide enhanced performance over the previous generation of GPS satellites, including the capability to autonomously navigate (AUTONAV) themselves and generate their own navigation message data. This means that if the control segment cannot contact the Block IIR satellites, the AUTONAV capabilities will enable these satellites to maintain full system accuracy for at least 180 days. The Block IIR satellites will be available for launch as necessary beginning in late 1996.

A follow-on set of replenishment satellites, known as Block IIFs, is planned to replace the Block IIR satellites at the end of their useful life. The Air Force in-tends to buy 33 Block IIF satellites to sustain the quality of the GPS signal as a worldwide utility for the foreseeable future. These satellites will have to meet even higher levels of performance than previous generations of GPS satellites, including a longer life cycle of 6.5 to 10 years. The IIF satellite will be launched on an Evolved Expandable Launch Vehicle (EELV). The Air Force issued a draft request for proposals (RFP) on June 20, 1995, and plans to award a con-tract for the development and procurement of the Block IIF satellites in spring 1996.

Satellite positioning

The technique used in satellite positioning today, be it in GPS, GLONASS or any other system to obtain a position solution is based on a concept called time of arrival ranging. The idea behind time of arrival ranging is to have precise atomic clocks onboard the satellites, transmitting a precise timestamp signal. This signal gets another timestamp when it arrives in the receiver and the two timestamps are compared to get an estimated travel time for the signal. If the transmitting and receiving timestamps are synchronized it is possible to measure the signal’s travelling time and use that for calculating a distance, or range measurement, to the satellite.

From this it is easy to see that high-accuracy timing is crucial for the success of this method or the range measurements would not be accurate and positioning would be more or less impossible to do. In order to be as accurate as possible and to avoid clock biases to as large extent as possible, the system is driven by precise atomic clocks aboard the satellites. A ground-based control network and a Master Control Station monitor these onboard clocks.

Furthermore each satellite broadcasts a navigation message which, among other things, contains almanac information - information about where the satellites are at any given time epoch. This is a necessity, otherwise the user would only know the distance between the receiver and an unknown point, giving no information about the user's position.

GPS

Background

In 1978, the first prototype satellite for use in the come-to-be global navigational satellite system GPS was launched. Since then GPS has developed to the well known and highly utilized system of today. However, for ordinary civilian users the accuracy is intentionally degraded down to 100 m by means of Selective Availability (SA), which consists of a degradation in the accuracy of the broadcast orbit information a dithering of the signal and. This dithering will affect both the carrier phase and the code data.

Status

The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations.

GPS uses these "man-made stars" as reference points to calculate positions accurate to a matter of meters. In fact, with advanced forms of GPS you can make measurements to better than a centimeter!

In a sense it's like giving every square meter on the planet a unique address.

GPS receivers have been miniaturized to just a few integrated circuits and so are becoming very economical. And that makes the technology accessible to virtually everyone.

These days GPS is finding its way into cars, boats, planes, construction equipment, movie making gear, farm machinery, even laptop computers.

Soon GPS will become almost as basic as the telephone. Indeed, at Trimble, we think it just may become a universal utility.

The latest GPS replenishment launch took place in 1997 and the current number of orbiting operational satellites is 27, an increase from the originally planned constellation using 24 satellites divided in six different, equally distributed, orbital planes.

How it Works

The operation of the GPS and GLONASS systems is basically the same and can be resumed in five steps.

1. The basis of GPS is "triangulation" from satellites.
2. To "triangulate," a GPS receiver measures distance using the travel time of radio signals.
3. To measure travel time, GPS needs very accurate timing which it achieves with some tricks.
4. Along with distance, you need to know exactly where the satellites are in space. High orbits and careful monitoring are the secret.
5. Finally you must correct for any delays the signal experiences as it travels through the atmosphere.

Problems at the satellite

Even though the satellites are very sophisticated they do account for some tiny errors in the system.

The atomic clocks they use are very, very precise but they're not perfect. Minute discrepancies can occur, and these translate into travel time measurement errors.

And even though the satellites positions are constantly monitored, they can't be watched every second. So slight position or "ephemeris" errors can sneak in between monitoring times.

Basic geometry itself can magnify these other errors with a principle called "Geometric Dilution of Precision" or GDOP.

It sounds complicated but the principle is quite simple.

There are usually more satellites available than a receiver needs to fix a position, so the receiver picks a few and ignores the rest.

If it picks satellites that are close together in the sky the intersecting circles that define a position will cross at very shallow angles. That increases the gray area or error margin around a position.

If it picks satellites that are widely separated the circles intersect at almost right angles and that minimizes the error region.

Good receivers determine which satellites will give the lowest GDOP.

In this section you will see how a simple concept can increase the accuracy of GPS to almost unbelievable limits.

And you will see:

- Why we need Differential GPS
- How Differential GPS works
- Where to get Differential Corrections
- Other ways to work with Differential GPS
- Advanced Concepts

Basic GPS is the most accurate radio-based navigation system ever developed. And for many applications it's plenty accurate. But it's human nature to want MORE!

So some crafty engineers came up with "Differential GPS," a way to correct the various inaccuracies in the GPS system, pushing its accuracy even farther.

Differential GPS or "DGPS" can yield measurements good to a couple of meters in moving applications and even better in stationary situations.

That improved accuracy has a profound effect on the importance of GPS as a resource. With it, GPS becomes more than just a system for navigating boats and planes around the world. It becomes a universal measurement system capable of positioning things on a very precise scale.

Differential GPS involves the cooperation of two receivers, one that's stationary and another that's roving around making position measurements.

The stationary receiver is the key. It ties all the satellite measurements into a solid local reference.

Here's how it works:

The problem

Remember that GPS receivers use timing signals from at least four satellites to establish a position. Each of those timing signals is going to have some error or delay depending on what sort of perils have befallen it on its trip down to us.

(For a complete discussion of all the errors review the "Correcting Errors" section of the tutorial.)

Since each of the timing signals that go into a position calculation has some error, that calculation is going to be a compounding of those errors.

Where to get differtential signals

In the early days of GPS, reference stations were established by private companies who had big projects demanding high accuracy - groups like surveyors or oil drilling operations. And that is still a very common approach. You buy a reference receiver and set up a communication link with your roving receivers.

But now there are enough public agencies transmitting corrections that you might be able to get them for free!

The United States Coast Guard and other international agencies are establishing reference stations all over the place, especially around popular harbors and waterways.

These stations often transmit on the radio beacons that are already in place for radio direction finding (usually in the 300kHz range).

Anyone in the area can receive these corrections and radically improve the accuracy of their GPS measurements. Most ships already have radios capable of tuning the direction finding beacons, so adding DGPS will be quite easy.

Many new GPS receivers are being designed to accept corrections, and some are even equipped with built-in radio receivers.

Future global navigation satellite system

Maritime policy for a future global navigation satellite system (GNSS) sets out IMO policy in terms of the maritime requirements for a future civil and internationally-controlled Global Navigation Satellite System (GNSS), to provide ships with navigational position-fixing throughout the world for general navigation, including navigation in harbour entrances and approaches and other waters in which navigation is restricted.

The resolution notes that development of a future GNSS is presently only in a design stage and these requirements have been limited only to basic user requirements, without specifying the organizational structure, system architecture or parameters. These maritime requirements, as well as the Organization's recognition procedures, may need to be revised as a result of any subsequent developments.

The resolution sets out the general, operational and institutional requirements for a future GNSS in terms of maritime users and envisages a review of the requirements in 1999 (21st Assembly); consideration of the proposed future GNSS in 2001 (22nd Assembly) and completion of the implementation of the proposed GNSS in 2008.

2. ELECTRONIC CHART SYSTEMS

Every day thousands of vessels arrive at or depart from harbours all over the world. Most of them manage without any problems, but despite all the modern techniques available vessels still run aground.

An aid to reducing the large number of grounding accidents is the digital chart coupled to an accurate positioning system such as GPS/DPGS (Global Positioning System/Differential GPS). Many claim that Electronic Chart Display and Information System (ECDIS) is the greatest improvement to safety at sea since radar was introduced after WWII.

ECDIS will simplify chart maintenance which until now has been a time consuming manual process. In the future updating will be carried out automatically by ECDIS.

The Digital Chart

For over 200 years all local geographical information has been supplied to the end user in the form of printed paper charts. Digital techniques have made it possible to increase the amount of information considerably, and open up new fields of opportunity.

It is important to understand the digital chart system in order to use the new techniques correctly and safely.

Fundamental Concepts

Local information of the landscape is known as geographic data. The main component of geographical data is geometric data, i.e. description of position, size and shape of objects in the land-scape (lights, buildings, perches, buoys, etc). Geometric data can be digitised by two methods, either as raster data or as vector data. To understand the difference between different types of digital charts it is important to know that:

- **ENC**
  An ENC is a digital chart produced by National Hydrographic Offices which complies with the IOH's (International Hydrographic Organisation's) S-57 Edition 3 product specification. The ENC contains all necessary naviagational information not be shown on paper charts e.g. characteristics of objects such as lighthouses, lights, bouys..etc.

  Official ENC's fulfil the IHO S-57/3.1 product specification and have the most recent updated data from originating National Hydrographic Offices. When used in an ECDIS, ENC data facilitates unique functionality that improves the safety of navigation at sea.

- **RasterData**
  Raster data is a surface coverage described by a limited area which can be divided into regular squares. The individual squares are called picture points, pixels or picture elements. Each element gives information on colours, but gives no details of which object (e.g. a lighthouse) is contained in the picture element.

- **Vector Data**
  Vector data consists of fixed coordinate points and links between them, organised so that they describe geometric figures in the form of points, lines and areas. Each object is charted and given a specific code which can be linked to other information, for example, to pictures and text from books.

  The difference between raster and vector data is that with vector data there is the possibility of having a more "intelligent" system than with raster data. Raster data is one digital picture of the chart, while vector data puts together a number of objects which can be shown in different ways as required by the user. Raster data cannot therefore be used to display different themes on the chart.

Vector data can be seen as a number of transparent "layers" on which one has coastline, another has light buoys, a third has five metre depth contours, and a fourth has ten metre depth contours etc. The whole chart can be presented with all these "layers" on a screen. Information which the user does not wish to be shown can be removed by dispensing with one or more "layers".

For example, a mariner with a boat which requires five metres may wish to eliminate depth contours greater than ten metres. An ECDIS operator will also define his own "safety depth contour". Such central safety functions connected to objects cannot be directly supported by raster systems. It is also possible to remove lights and light sectors (during day-light use), or it may be desirable to omit names. This can be achieved by removing the "layer" containing the unwanted information. By this means the clearest display of the chart is available. The information can be easily replaced. The raster chart does not have this function as it usually consists of only one "layer".

- **Raster Chart**
  Raster Charts, essentially digital scans of printed paper charts. They look identical to paper charts, they cannot be updated like vector charts, and they cannot be zoomed in to very high magnifications without losing sharpness; their data is limited to that which is on the paper charts. Raster navigational chart (RNC) data, itself, will not trigger automatic alarms (e.g. anti-grounding).

- **Vector Chart**
  Vector Charts are, in essence, a point by point hand rendering of a chart. They bear little resemblance to regular paper charts, but have some real advantages, they allow you to zoom in to large magnifications, and they can be edited to include updates from Notices to Mariners.

- **ECDIS**

In practical terms, an ECDIS shows the mariner where his ship is in real-time using digital versions of paper charts.

ECDIS is the acronym of Electronic Chart Display and Information System. It has been defined by the International Maritime and Hydrographic Organizations (IMO/IHO) as a navigation system displaying selected information from an Electronic Navigational Chart (ENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring.

- **RCDS**
  The RCDS (Raster Chart Display System) is similar to the ECDIS; however, it is limited to the presentation of Raster Charts. It not necessarily has to be a dedicated equipment and it does not meet the SOLAS requirement for Electronic Chart Display Systems; it has to be backed up by an up-to-date paper chart portfolio.

- **ECS**
  Although generally defined as a system that display real-time vessel position and relevant electronic chart data, it is not intended to comply with up-to date chart requirements of V/20 of SOLAS.

Differences between Vector Charts & Raster Charts

Electronic Navigational Charts (ENC) are basically available in two different formats that are not interchangeable: raster and vector. Only the vector format is deemed compliant with the ECDIS performance standards. Here is why: The raster format is just a plain image of the paper chart. The navigation system can not differentiate between the various objects composing the chart (i.e. it doesn't know if a certain object is a buoy or a depth area).

Zooming in on a ARCS raster chart from scale 1 : 25000 to 1 : 5000

The vector format is one where all the objects composing the chart are well defined. All the points, lines and areas are known by the navigation system. This brings "intelligence" to the ENC and hence to the navigation system.

Zooming in on a S57 ed. 3 vector chart from scale 1 : 25000 to 1 : 5000

Most chart plotters (like those from Magellan, Garmin, some Northstar models, and others) use vector charts, which bear little resemblance to regular paper charts, but have some real advantages.

Raster Chart data is a digitized "picture" of printed paper charts and they look identical to paper charts. All data is in one layer and one format. They cannot be zoomed in to very high magnifications without losing sharpness; their data is limited to that which is on the paper charts. The video display simply reproduces the picture from its digitized data file. With raster data, it is difficult to change individual elements of the chart since they are not separated in the data file. Raster data files tend to be large, since a data point must be entered for every picture element (pixel) on the chart. Further, they require the considerable computing power of a notebook computer to display the charts and drive the navigation software. All in all, raster charting systems are a heavier investment in technology than vector charting systems.

Vector Chart In essence, VECTOR charts are a point by point hand rendering of a chart. chart data is organized into many separate files. They allow you to zoom in to large magnifications, and they can be edited to include updates from Notices to Mariners. It contains graphics programs to produce certain symbols, lines, area colors, and other chart elements. The programmer can change individual elements in the file and tag elements with additional data. Vector files are smaller and more versatile than raster files of the same area. The navigator can selectively display vector data, adjusting the display according to his needs. Current IMO/IHO standards for ECDIS recognize only the vector format as adequate. As a rule, the hardware that uses this technology are all in one units that include a screen, a GPS, and a programmable interface. All you add are the chart cartridges. Vector chart plotters generally cost between $500 and $2,000. Vector chart cartridges (of which Navionics and C-MAP NT cartridges are examples) cost more than similar coverage on raster charts.

Whether a digital chart system uses a raster or vector data base, any change to that data base must come only from the hydrographic office (HO) that produced the ENC. Corrections from other sources affecting the data base should be applied only as an overlay to the official data base. This protects the integrity of the official data base.

Performance Standards for Electronic Charts

Performance standards for electronic charts were adopted in 1995, by resolution A.817(19)), which was amended in 1996 by resolution MSC.64 (67) to reflect back-up arrangements in case of ECDIS failure.

Additional amendments were made in 1998 by resolution MSC 86 (70) to permit operation of ECDIS in RCDS (Raster chart) mode.

IMO's Maritime Safety Committee (MSC), at its 73rd session from 27 November to 6 December 2000 adopted a revised Chapter V (Safety of Navigation) of SOLAS which enters into force on 1 July 2002.

Regulation 19 of the new Chapter V - Carriage requirements for shipborne navigational systems and equipment allows an electronic chart display and information system (ECDIS) to be accepted as meeting the chart carriage requirements of the regulation.

The regulation requires all ships, irrespective of size, to carry nautical charts and nautical publications to plan and display the ship's route for the intended voyage and to plot and monitor positions throughout the voyage. But the ship must also carry back up arrangements if electronic charts are used either fully or partially.

Performance standards for electronic charts were adopted in 1995, by resolution A.817(19)), which was amended in 1996 by resolution MSC.64 (67) to reflect back-up arrangements in case of ECDIS failure. Additional amendments were made in 1998 by resolution MSC 86 (70) to permit operation of ECDIS in RCDS mode.

Raster chart performance standards

The MSC, during its 70th session from 7-11 December, 1998, adopted performance standards for Raster Chart Display Systems, through amendments to the performance standards for electronic chart display and information systems (ECDIS), to allow the systems to be used with raster charts where vector electronic chart systems are not available.

- A raster chart is basically just a visual scan of a paper chart. It is a computer-based system which uses charts issued by, or under the authority of, a national hydrographic office, together with automatic continuous electronic positioning, to provide an integrated navigational tool.
- A vector chart is more complex. Each point on the chart is digitally mapped, allowing the information to be used in a more sophisticated way, such as clicking on a feature (for example, a lighthouse) to get all the details of that feature displayed.

The international standard for vector charts has been finalised by the International Hydrographic Organization (S-57, Version 3), and IMO adopted performance standards for ECDIS, using vector charts, in 1995 by Assembly Resolution A.817(19).

The amendments to Resolution A.817(19) state that some ECDIS equipment may operate in Raster Chart Display System (RCDS) mode when the relevant chart information is not available in vector mode.

The amendments to the ECDIS performance standards indicate which performance standards for vector charts apply equally to raster charts, and add specific specifications for raster charts, covering such aspects as display requirements, alarms and indicators, provision and updating of chart information and route planning. The amendments state that when used in RCDS mode, ECDIS equipment should be used together with an appropriate folio of up-to-date paper charts.

The MSC during its 70th sessionalso agreed a Safety of Navigation Circular on Differences between Raster Chart Display systems (RCDS) and Electronic Chart Display and Information Systems (ECDIS).

Hydrographic data and charts

All ships are required to carry "adequate and up-to-date charts" under SOLAS Chapter V (Regulation 20) to assist in navigation.

At present, the International Convention for the Safety of Life at Sea (SOLAS) does not specify Governmental responsibility for producing charts, but in 1983, IMO adopted a Resolution referring to the importance of the provision of accurate and up-to-date hydrographic information to safety of navigation and to the fact that many areas had not been surveyed to modern standards.

The Resolution invited Governments to conduct hydrographic surveys and co-operate with other Governments where necessary. This was followed in 1985 by a Resolution urging IMO Member Governments to establish regional hydrographic commissions or charting groups and to support groups already set up by the International Hydrographic Organization (IHO) to prepare accurate charts.

The Resolution was adopted after representation from the IHO, which had informed IMO of the inadequacy of nautical charts of many sea areas as a result of dependence on old hydrographic surveys and noted that, in order to develop up to date charts for these areas, substantial technical co-operation would be required between developed and developing coastal states on a regional basis.

In the revised chapter V of SOLAS, entry into force 2002, Regulation 9 Hydrographic services states:

1. Contracting Governments undertake to arrange for the collection and compilation of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation.
2. In particular, Contracting Governments undertake to co-operate in carrying out, as far as possible, the following nautical and hydrographic services, in the manner most suitable for the purpose of aiding navigation: .1 to ensure that hydrographic surveying is carried out, as far as possible, adequate to the requirements of safe navigation; .2 to prepare and issue nautical charts, sailing directions, lists of lights, tide

tables and other nautical publications, where applicable, satisfying the needs of safe navigation; .3 to promulgate notices to mariners in order that nautical charts and publications are kept, as far as possible, up to date; and .4 to provide data management arrangements to support these services.

3. Contracting Governments undertake to ensure the greatest possible uniformity in charts and nautical publications and to take into account, whenever possible, relevant international resolutions and recommendations. (refers to the appropriate resolutions and recommendations adopted by the International Hydrographic Organization.
4. Contracting Governments undertake to co-ordinate their activities to the greatest possible degree in order to ensure that hydrographic and nautical information is made available on a world-wide scale as timely, reliably, and unambiguously as possible.

Correcting The Digital Nautical Chart

There are currently three proposed methods for correcting the DNC data base: Interactive Entry, Semi-Automatic Entry, and Fully Automatic Entry.

Interactive Entry: This method requires the interactive application of the textual Notice to Mariners. The operator determines the corrections from the Notice. Then, using a toolkit, he selects the symbol appropriate to the correction required, identifies the location of the symbol, and adds the appropriate textual information identifying the nature of the correction. This method of It also clutters the screen display because it can be applied only as an overlay to the ENC data.

Semi-Automatic Entry: This method requires the operator to enter the correction data furnished in correct digital format by the originating hydrographic office into the system via electronic medium (a modem or floppy disc, for example). The ECDIS then processes these corrections automatically and displays an updated chart with the changed data indistinguishable from the remaining original data base.

Fully Automatic Entry: The fully automatic method of correction entry allows for a direct telecommunications link to receive the official digital update and input it into the ECDIS. This process is completely independent of any operator interface. Internal ECDIS processing is the same as that for semi-automatic updating of the data base.

DIFFERENCES BETWEEN RCDS AND ECDIS

1. The Maritime Safety Committee, at its seventieth session (7 to 11 December 1998), adopted amendments to the performance standards for Electronic Chart Display and Information Systems (ECDIS) to include the use of Raster Chart Display Systems (RCDS).
2. These amendments permit ECDIS equipment to operate in two modes: .1 the ECDIS mode when ENC data is used; and .2 the RCDS mode when ENC data is not available. However, the RCDS mode does not have the full functionality of ECDIS, and can only be used together with an appropriate portfolio of up-to-date paper charts.
3. The mariners' attention is therefore drawn to the following limitations of the RCDS mode:

   .1 unlike ECDIS where there are no chart boundaries, RCDS is a chart-based system similar to a portfolio of paper charts;

   .2 Raster navigational chart (RNC) data, itself, will not trigger automatic alarms (e.g. anti-grounding). However, some alarms can be generated by the RCDS from user-inserted information. These can include:

   - clearing lines

   - ship safety contour lines

- isolated dangers

- danger areas

.3 horizontal datums and chart projections may differ between RNCs. Mariners should understand how the chart horizontal datum relates to the datum of the position fixing system. In some instances, this may appear as a shift in position. This difference may be most noticeable at grid intersections and during route monitoring;

.4 chart features cannot be simplified or removed to suit a particular navigational circumstance or task at hand. This could affect the superimposition of radar/ARPA;

.5 without selecting different scale charts, the look-ahead capability may be somewhat limited. This may lead to some inconvenience when determining range and bearing or the identity of distant objects;

.6 orientation of the RCDS display to other than chart-up, may affect the readability of chart text and symbols (e.g., course-up, route-up);

.7 it may not be possible to interrogate RNC features to gain additional information about charted objects;

.8 it is not possible to display a ship's safety contour or safety depth and highlight it on the display, unless these features are manually entered during route planning;

.9 depending on the source of the RNC, different colours may be used to show similar chart information. There may also be differences in colours used during day and nighttime;

.10 an RNC should be displayed at the scale of the paper chart. Excessive zooming in or zooming out can seriously degrade RCDS capability, for example, by degrading the legibility of the chart image; and

.11 mariners should be aware that in confined waters, the accuracy of chart data (i.e., paper charts, ENC or RNC data) may be less than that of the position-fixing system in use. This may be the case when using differential GNSS. ECDIS provides an indication in the ENC which allows a determination of the quality of the data.

4. Member Governments are requested to bring this information to the attention of the relevant authorities and all seafarers for guidance and action, as appropriate.

ECDIS

In practical terms, an ECDIS shows the mariner where his ship is in real-time using a digitized version of the paper chart.

ECDIS is the acronym of Electronic Chart Display and Information System. It has been defined by the International Maritime and Hydrographic Organizations (IMO/IHO) as a navigation system displaying selected information from an Electronic Navigational Chart (ENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring.

The two major IMO/IHO documents governing the design requirements for ECDIS are S52 and S57.

1. S57 defines the data structure for all the information contained in the ENC.
2. S52 defines the colors and symbols to be used by the ECDIS to display the various objects contained in the ENC.

IMO Performance Standards

Performance Standards for ECDIS were formally adopted by the International Maritime Organization (IMO) on 23 November 1995 and issued as IMO Resolution A19/Res.817. These Performance Standards are the same as those first approved in draft form by the Maritime Safety Committee of IMO in May 1994, and originally issued by IMO as MSC Circ./637. Back-up arrangements for ECDIS were adopted by IMO in November 1996 (MSC/67/22-ADD.1) and will become Appendix 6 to the Performance Standard. The IMO Performance Standards permit National Maritime Safety Administrations to consider ECDIS as the legal equivalent to the charts required by regulation V/20 of the 1974 SOLAS Convention. IMO has specifically requested that Member Governments have their National Hydrographic Offices produce electronic navigational charts (ENCs) and the associated updating service as soon as possible, and to ensure that manufacturers conform to the performance standards when designing and producing ECDIS.

IHO Standard, Format and Specifications

In conjunction with the development of IMO Performance Standards for ECDIS, the International Hydrographic Organization (IHO) has developed technical standards and specifications related to the digital data format, and specifications for the ECDIS content and display. IHO Special Publication 52 (IHO S-52) is the IHO Specification for Chart Content and Display of ECDIS. It includes appendices describing the means/process for updating, colour and symbol specifications, and a glossary of ECDIS-related terms. The 4th edition of IHO S-52 was issued in December 1996. IHO Special Publication 57 (IHO S-57) is the IHO Transfer Standard for Digital Hydrographic Data that was formally adopted as the official IHO standards by the XIV International Hydrographic Conference, Monaco, 4-15 May 1992. It includes an object catalog, DX-90 format, an ENC Product Specification, and ENC updating profile. The current edition (Edition 3.0) was released in November 1996, and will be " frozen" for three years. Both IHO S-57 and S-52 are specified in the IMO Performance Standards for ECDIS.

ECDIS is much more than simply images of a chart on a computer screen. It provides a powerful decision making tool on the bridge of a ship by combining satellite and other position fixing with ship's sensors and a sophisticated electronic database containing charting and other navigation information.

The chart information in ECDIS is continuously analysed and compared with a ship's position, intended course and its manoeuvring characteristics to give warning of approaching dangers. ECDIS also provides alerts and prompts for planned course alterations. Additional material, such as photographs and views, as well as navigational notices and cautions can be accessed instantly and displayed as required on high resolution full colour screens . In addition, ECDIS provides many other sophisticated navigation and safety features, including continuous data recording for later analysis.

In the near future, ECDIS will also incorporate and display information contained in other nautical publications such as Tide Tables and Sailing Directions and incorporate additional maritime information such as radar information, weather, ice conditions and automatic vessel identification.

The chart database used in ECDIS is known as an Electronic Navigational Chart (ENC). ENCs and their updates are only published by or under the authority of governments. As such, they carry full official status and the backing of the issuing government.

The chart information in an ENC is not held as a single image or "picture" of a chart, but as individual items (vectors) in a database. Each chart feature and its associated information is recorded separately in the database. This allows all the chart data to be analysed and re-assessed continuously by ECDIS in relation to a ship's current and intended position. Dangers or hazards which will affect a ship can then be identified automatically and warnings and alarms raised.

ECDIS supports a comprehensive update mechanism to ensure ENCs can be kept up to date, with things such as Notices to Mariners. Chart maintenance is achieved in effect automatically via disk update, e-mail message or satellite data transfer.

The versatility of the ENC vector chart database and the comprehensive ECDIS display and performance standards allow the mariner to select and display navigational information most relevant to the requirements and the situation at the time. For example, ECDIS will display and respond to the safety depth contour based on a vessel's actual draft. The level of chart detail that is shown can also be adjusted according to the circumstances and alternative colour schemes can be selected for use by day or by night.

ECDIS and ENCs must conform to rigorous standards regarding how they operate and what information is displayed. The standards govern such things as chart data structure, minimum display requirements and minimum equipment specifications as well as many other aspects. The International Hydrographic Organization (IHO) and the International Maritime Organization (IMO) set the ECDIS and ENC standards.

ECDIS Warnings And Alarms

Since the ECDIS is a “smart” system which combines several different functions into one computerized system, it is possible to program it to sound alarms or display warnings when certain parameters are met or exceeded. This helps the navigator to monitor close navigation hazards. IMO standards require that certain alarms be available on the ECDIS. Among these are:

1. Deviating from a planned route.

2. Chart on a different geodetic datum from the positioning system.

3. Approach to waypoints and other critical points.

4. Exceeding cross-track limits.

5. Chart data displayed overscale (larger scale than originally digitized).

6. Larger scale chart available.

7. Failure of the positioning system.

8. Vessel crossing safety contour.

9. System malfunction or failure.

Alarms consist of audible and visible warnings. The navigator may determine some setpoints. For example, he may designate a safety depth contour or set a maximum allowed cross-track error. Operational details vary from one system to another, but all ECDIS will have the basic alarm capabilities noted. The navigator is responsible for becoming familiar with the system aboard his own ship and using it effectively.

ECDIS Units

The following units of measure will appear on the EC-DIS chart display:

• **Position:** Latitude and Longitude will be shown in degrees, minutes, and decimal minutes, normally based on WGS-84 datum.

• **Depth:** Depth will be indicated in meters and deci-meters. Fathoms and feet may be used as an interim measure only:

• when existing chart udata is held in those units only,
• when there is an urgent need for an ENC of the applicable area, and
• time does not allow for an immediate conversion of the English units to their metric equivalents.

• **Height:** Meters (preferred) or feet.

• **Distance:** Nautical miles and decimal miles, or meters.

- **Speed:** Knots and decimal knots.

ECDIS Priority Layers

ECDIS requires data layers to establish a priority of data displayed. The minimum number of information categories required and their relative priority from the highest to lowest priority, are listed below:

- ECDIS Warnings and Messages.
- Hydrographic Office Data.
- Notice to Mariners Information.
- Hydrographic Office Cautions.
- Hydrographic Office Color-Fill Area Data.
- Hydrographic Office On Demand Data.
- Radar Information.
- User's Data.
- Manufacturer's Data.
- User's Color-Fill Area Data.
- Manufacturer's Color-Fill Area Data.

IMO standards for ECDIS will require that the operator be able to deselect the radar picture from the chart with min-mum operator action for fast "uncluttering" of the chart presentation.

ECDIS Calculation Requirements

As a minimum, an ECDIS system must be able to perform the following calculations:

• Geographical coordinates to display coordinates, and display coordinates to geographical coordinates.
• Transformation from local datum to WGS-84.
• True distance and azimuth between two geographical
• Geographic position from a known position given distance and azimuth.

ECDIS - Additional information

Advantages over the paper chart

- On a single ECDIS display, the following data can be shown:
    - Nautical chart
    - Parts of the Sailing Directions, German List of Radio Signals, List of Lights
    - Radar overlay, ARPA targets
    - Lubber's line and present position of own ship
    - Alphanumerical position and navigation data (planned routes, current navigation data, recorded track information)
    - AIS symbols (Automatic Identification System)

- Time-consuming manual correction is no longer necessary. The updates are read into the system and automatically correct the ECDIS database.
- The position of one's own vessel is determined by navigation systems like (D)GPS or LORAN-C which are linked to ECDIS. The vessel positions is continuously shown on the chart display and stored at regular intervals. The chart section displayed moves along with the ship's position, and at any moment at last 25 % of the chart display shows the area ahead of the vessel. Manual chart exchange is no longer required. The elements of route planning in ECDIS are waypoints and leglines ensuring safe track keeping.
- The ECDIS display can be superimposed with radar images and with the radar targets of ARPA (Automated Radar Plotting Aid). In this way, also the movements of other vessels can be continually monitored.

- ECDIS "knows" whether a vessel can pass safely through an area, on the basis of the vessel's draugh data, and may sound an alarm if she approaches, e.g., the 10-meter contour. ECDIS "knows" the properties of all objects, and thus helps to avoid dangerous close quarters situations.

  This wide functional range is only provided by electronic charts which are supported by object-oriented data. Raster charts do not have a comparable "intelligence" because they are just digital copies of paper charts and do not provide access to any additional, digitally stored information layers. Therefore, an ECDIS system supplied with raster data only has a limited range of functions.

The Risks of Over Reliance

An ECDIS is only a navigational tool. It aids the navigator by providing automatic positioning and consolidating all information. One of the biggest risks of using an ECDIS is over reliance in the information provided. Below are some things to consider:

1. Automatic positioning is usually accomplished by GPS. GPS is accurate to 100m (SPS) 95% of the time. That means 5% of the time, its accuracy is less than 100m. There is no way of knowing when your accuracy is degraded. The only means of determining system accuracy, with military receivers, is with a Figure of Merit (FOM). This, however, is only an estimation of the accuracy of GPS.

2. DGPS improves the accuracy of GPS. The use and/or lack of use may cause large discrepancies in the positioning of the ship.

3. Approaching a hostile shore, GPS may be jammed. An understanding of traditional navigation techniques as well as the introduction of emerging inertial navigation technology are necessary to enable military operations.

4. Like any other piece of equipment, ECDIS may malfunction. To be certified, any ECDIS system must have adequate back up. A means to check the operation of ECDIS must be in place (including positioning info).

5. Electronic charts may have embedded errors. Most Hydrographic services are
compiling the first generation of electronic charts from current charts. Raster and vector pictures of nautical charts retain the inaccuracies and incongruities of the source from which they are derived. These charts may be based on old survey data, i.e. not a true "digital chart" (from original sounding and source data). Surveys are expensive and time consuming. Some estimations say it would take over 50 years with the current technology to update the worlds charts with original data. This limitation is unavoidable until some affordable, broad area means of surveying comes to the technical forefront. It is still an important limitation to understand.
Additionally, numerous commercial companies are producing their own electronic charts, which lack official (legal) certification.

6. Finally, as with any system, there must be trained human operators. Human error, primarily a lack of understanding of the system, can have serious consequences.

The electronic chart display systems require the navigator to use every means of
determining the ship's position. The US Navy, with NAVSSI and it's embedded COMDAC software, allows the navigator to do just this. On the display, radar data can be projected on the electronic chart. This immediately gives the watchstander an understanding of the accuracy of the system. Visual bearings, radar ranges and celestial observations can also be used to check the positional accuracy of the system. Without knowing the particular constraints of an ECDIS system, the safe navigation of the ship may be endangered.

Training is necessary

In January 1999, the IMO Committee on Standards for Training and Watch-keeping (STW) approved a standardized IMO Model Training Course on the Operational Use of ECDIS (IMO Model Course 1.27) [1]. Initially developed by the Institute of Ship Operation, Sea Transport and Simulation (ISSUS) in Hamburg, Germany, the primary objective of the Model Course is to ensure proper use and operation of ECDIS in terms of a thorough understanding and appreciation of its capabilities and limitations [2]. The one-week model course syllabus (40 hours of instruction) includes classroom lecture, hands-on training, and exercise scenarios.

CONCLUSION

The emergence of extremely accurate electronic positioning systems coupled with the technology to produce an electronic chart is effecting a revolution in navigation. When fully mature, this technology will replace the paper charts and plotting instruments used by navigators since the beginning of sea exploration. There are several hurdles to overcome in the process of full replacement of paper charts, some legal, some bureaucratic, and some technical. Until those hurdles are overcome, electronic charting will be in a transitional state, useful as a backup to traditional techniques, but insufficient to replace them.

3. INTEGRATED BRIDGE SYSTEMS

INTRODUCTION

Operating Concept

Bridge watch officers have three main duties:

Navigation

• Watch officers process navigation information from several different sources. They take fix positions from satellite and hyperbolic receivers. They measure bearing lines and radar ranges to suitable NAVAIDS. They then plot this information on a paper chart.

• After plotting the information on a chart, watch officers evaluate the navigation picture. They determine if the ship's present position is a safe one. They project the ship's position ahead and plan for future contingencies. The evaluation step is the most important step in the navigation process. Properly executing this step is a function of the watch officer's skill and how well the ship's actual navigation situation is represented on the chart. That representation, in turn, is a function of both plotter and sensor accuracy.

Collision Avoidance

• Watch officers evaluate the contact situation and calculate the closest points of approach (CPA's) for various contacts.

• Watch officers maneuver in accordance with the Rules of the Road to avoid close CPA's and collisions.

Ship Management

• Watch officers conduct evolutions that are part of an individual ship's routine.

The integrated bridge is designed to reduce the time spent on navigation by eliminating manual data processing and providing the navigator with a display which aids him in quickly evaluating the navigation picture. Preliminary studies seem to indicate that time spent on navigation as a percentage of total watch officer duties drops significantly when using the integrated bridge. This does not necessarily lower the overall watch officer work-load, but it does increase the percentage of time he can devote to ship management and collision avoidance.

THE INTEGRATED BRIDGE

System Components

The term "integrated bridge" encompasses several possible combinations of equipment and software designed specifically for each individual vessel's needs. Therefore, each integrated bridge system is different. This section introduces, in general terms, the major equipment likely to be found in an integrated bridge system.

• **Computer Processor and Network:** This subsystem controls the processing of information from the ship's navigation sensors and the flow of information between various system components. It takes inputs from the vessel's navigation
sensors. Electronic positioning information, contact information from radar, and gyro compass outputs, for ex-ample, can be integrated with the electronic chart to present the complete navigation and tactical picture to the conning officer. The system's computer network processes the positioning information and controls the integrated bridge system's display and control functions.

• **Chart Data Base:** At the heart of any integrated bridge system lies an electronic chart. An electronic chart system meeting International Maritime Organization (IMO) specifications for complying with chart carrying requirements is an **Electronic Chart Display and Information System (EC-DIS)**. All other electronic charts are known as **Electronic Chart Systems (ECS)**. Following sections discuss the differences between these two types of electronic charts.

An integrated bridge system may receive electronic chart data from the system manufacturer or from the appropriate government agency. The mariner can also digitize an existing paper chart if the system manufacturer provides a digitizer. Electronic charts can differentiate between and display different types of data far better than conventional charts. Paper charts are usually limited to four colors, and they display all their data continuously. An electronic chart can display several colors, and it can display only the data the user needs. If the electronic chart is part of an ECDIS, however, it must always display the minimum data required by IMO/IHO. The database for a typical civilian electronic chart contains layers consisting of hydrography, aids to navigation, obstructions, port facilities, shoreline, regulatory boundaries and certain topographic features. Other layers such as communication networks, power grids, detailed bathymetry, and radar reflectivity can also be made available. This allows the user to customize his chart according to his particular needs, something a paper chart cannot do.

• **System Display:** This unit displays the ship's position on an electronic chart and provides information on sensor status and ship's control systems. It displays heading data and ship's speed. It provides a station where the operator can in-put warning parameters such as minimum depth under the keel or maximum cross track error. It plots the ship's position and its position in relation to a predetermined track.

There are two possible modes of display, **relative** and **tru**e. In the relative mode the ship remains fixed in the center of the screen and the chart moves past it. This requires a lot of computer power, as all the screen data must be updated and re-drawn at each fix. In true mode, the chart remains fixed and the ship moves across it. The operator always has the choice of the north-up display. On some equipment, the operator can select the course-up display as well. Each time the ship approaches the edge of the display, the screen will re-draw with the ship centered or at the opposite edge.

A separate monitor, or a window in the navigation monitor, can be used for display of alpha-numeric data such as course, speed, and cross-track error. It can also be used to display small scale charts of the area being navigated, or to look at other areas while the main display shows the ship's current situation.

• **Planning Station:** The navigator does his voyage planning at this station. He calculates great circle courses, planned tracks, and waypoints. The navigator digitizes his charts, if required, at this planning station.

• **Control System:** Some integrated bridges provide a system that automatically adjusts course and speed to follow a planned track. If the system is equipped with this feature, the navigation process is reduced to monitoring system response and providing operator action when required by either a changing tactical situation or a system casualty.

• **Radar:** Radar for navigation and collision avoidance is included in the integrated bridge. Since both the chart and the radar process their data digitally, data transfer between the two is possible. The “picture” from either one can be imposed on top of the picture of the other. This allows the navigator to see an integrated navigation and tactical display and to avoid both navigation hazards and interfering contacts.

4. Bridge Procedures & Passage Planning

Safe navigation is the most fundamental attribute of good seamanship. An increasingly sophisticated range of navigational aids can today complement the basic skills of navigating officers, which have accumulated over the centuries.

But sophistication brings its own dangers and a need for precautionary measures against undue reliance on technology. Experience shows that properly formulated bridge procedures and the development of bridge teamwork are critical to maintaining a safe navigational watch.

Finally, an essential part of bridge organisation is the procedures, which should set out in clear language the operational requirements and methods that should be adopted when navigating. In this section, we have attempted to codify the main practices and provide a framework upon which masters, officers and pilots can work together to achieve consistent and reliable performance.

Seafaring will never be without its dangers but the maintenance of a safe navigational watch at all times and the careful preparation of passage plans are at the heart of good operating practice. If this Guide can help in that direction it will have served its purpose.

Safe navigation is of utmost importance to. Safe navigation means that the ship is not exposed to undue danger and that at ah times the ship can be controlled within acceptable margins.

To navigate safely at all times requires effective command, control, communication and management. It demands that the situation, the level of bridge manning, the operational status of navigational systems and the ships' engines and auxiliaries are ah taken into account.

It is people that control ships, and it is therefore people, management and teamwork which are the key to reliable performance. People entrusted with the control of ships must be competent to carry out their duties.

People also make mistakes and so it is necessary to ensure that monitoring and checking prevent chains of error from developing. Mistakes cannot be predicted, and once a mistake has been detected, it is human nature to seek to fit circumstances to the original premise, thus compounding a simple error of judgement.

Passage planning is conducted to assess the safest and most economical sea route between ports. Detailed plans, particularly in coastal waters, port approaches and pilotage areas, are needed to ensure margins of safety. Once completed, the passage plan becomes the basis for navigation. Equipment can fail and the unexpected can happen, so contingency planning is also necessary.

Ergonomics and good design are essential elements of good bridge working practices. Watchkeepers at sea need to be able to keep a look-out, as well as monitor the chart and observe the radar. They should also be able to communicate using the VHF without losing situational awareness. When boarding or disembarking pilots, handling tugs or berthing, it should be possible to monitor instrumentation, particularly helm and engine indicators, from the bridge wings. Bridge notes should be provided to explain limitations of any equipment that has been badly sited, pointing out the appropriate remedies that need to be taken.

The guiding principles behind good management practices are:

- Clarity of purpose
- Delegation of authority;
- Effective organization
- Motivation

Clarity of purpose

If more than one person is involved in navigating it is essential to agree the passage plan and to communicate the way the voyage objectives are to be achieved consistently and without ambiguity. The process starts with company instructions to the ship, as encompassed by a safety management system supported by master's standing orders and reinforced by discussion and bridge orders. Existing local pilotage legislation should also be ascertained to enable the master to be guided accordingly.

Before approaching coastal and pilotage waters, a ship's passage plan should ensure that dangers are noted and safe-water limits identified. Within the broad plan, pilotage should be carried out in the knowledge that the ship can be controlled within the established safe limits and the actions of the pilot can be monitored.

In this respect early exchange of information will enable a clearer and more positive working relationship to be established in good time before the pilot boards. Where this is not practicable the ship's plan should be sufficient to enable the pilot to be embarked and a safe commencement of pilotage made without causing undue delay.

Delegation of authority

The master has the ultimate responsibility for the safety of the ship. Delegation of authority to the officer of the watch (OOW) should be undertaken in accordance with agreed procedures and reflect the ability and experience of the watchkeeper.

Similarly, when a pilot boards the master may delegate the conduct of the ship to the pilot, bearing in mind that pilotage legislation vanes from country to country and from region to region. Pilotage can range from optional voluntary pilotage that is advisory in nature, to compulsory pilotage where the responsibility for the conduct of the navigation of the ship is placed upon the pilot.

The master cannot abrogate responsibility for the safety of the ship and he remains in command at ah times.

If the master delegates the conduct of the ship to the pilot, it will be because he is satisfied that the pilot has specialist knowledge, shiphandling skills and communications links with the port. In doing so the master must be satisfied that the pilot's intentions are safe and reasonable. The OOW supports the pilot by monitoring the progress of the ship and checking that the pilot's instructions are correctly carried out. Where problems occur which may adversely affect the safety of the ship, the master must be advised immediately.

The process of delegation can be the cause of misunderstanding and so it is recommended that a clear and positive statement of intention be made whenever handing over and receiving conduct of the ship.

When navigating with the master on the bridge it is considered good practice, when it is ascertained that it is safe to do so, to encourage the OOW to carry out the navigation, with the master maintaining a monitoring role.

The watch system provides a continuity of rested watchkeepers, but the watch changeover can give rise to errors. Consequently routines and procedures to monitor the ship's position and to avoid the possibility of mistakes must be built into the organisation of the navigational watch.

The risks associated with navigation demand positive reporting at all times, self verification, verification at handover and regular checks of instrumentation and bridge procedures. The course that the ship is following and compass errors must be displayed and checked, together with the traffic situation, at regular intervals and at every course change and watch handover.

Effective organisation

Preparing a passage plan and carrying out the voyage necessitates that bridge resources are appropriately allocated according to the demands of the different phases of the voyage.

Depending upon the level of activity likely to be experienced, equipment availability, and the time it will take should the ship deviate from her track before entering shallow water, the master may need to ensure the availability of an adequately rested officer as back-up for the navigational watch.

Where equipment is concerned, errors can occur for a variety of reasons and poor equipment calibration may be significant. In the case of integrated systems, it is possible that the failure of one component could have unpredictable consequences for the system as a whole.

It is therefore essential that navigational information is always cross checked, and where there is doubt concerning the ship's position, it is always prudent to assume a position that is closest to danger and proceed accordingly.

Motivation

Motivation comes from within and cannot be imposed. It is however the responsibility of the master to create the conditions in which motivation is encouraged.

A valuable asset in any organisation is teamwork and this is enhanced by recognising the strengths, limitations and competence of the people within a team, and organising the work of the bridge team to take best advantage of the attributes of each team member.

Working in isolation when carrying out critical operations carries the risk of an error going undetected. Working together and sharing information in a professional way enhances the bridge team and the master/pilot relationship. Training in bridge resource management can further support this.

Bridge Organisation

Overview

General principles of safe manning should be used to establish the levels of manning that are appropriate to any ship.

At ah times, ships need to be navigated safely in compliance with the COLREGS and also to ensure that protection of the marine environment is not compromised.

An effective bridge organisation should efficiently manage ah the resources that are available to the bridge and promote good communication and teamwork.

The need to maintain a proper look-out should determine the basic composition of the navigational watch. There are, however, a number of circumstances and conditions that could influence at any time the actual watchkeeping arrangements and bridge manning levels.

Effective bridge resource and team management should eliminate the risk that an error on the part of one person could result in a dangerous situation.

The bridge organisation should be properly supported by a clear navigation policy incorporating shipboard operational procedures, in accordance with the ship's safety management system as required by the SM Code.

Bridge Resource management and the bridge team

Composition of the navigational watch under the STCW Code

In determining that the composition of the navigational watch is adequate to ensure that a proper look-out can be continuously maintained, the master should take into account ah relevant factors including the following:

- visibility, state of weather and sea;
- traffic density, and other activities occurring in the area in which the ship

is navigating;

- the attention necessary when navigating in or near traffic separation schemes or other routing measures;
- the additional workload caused by the nature of the ship's functions, immediate operating requirements and anticipated maneuvers;
- the fitness for duty of any crew members on cali who are assigned as members of the watch;
- knowledge of and confidence in the professional competence of the ship's officers and crew;
- the experience of each OOW, and the familiarity of that OOW with the ship's equipment, procedures and manoeuvring capability;
- activities taking place on board the ship at any particular time, including radiocommunication activities, and the availability of assistance to be summoned immediately to the bridge when necessary;
- the operational status of bridge instrumentation and controls, including alarm systems;
- rudder and propeller control and ship manoeuvring characteristics;
- the size of the ship and the field of vision available from the conning position;
- the configuration of the bridge, to the extent such configuration might inhibit a member of the watch from detecting by sight or hearing any external development;
- any other relevant standard, procedure or guidance relating to watchkeeping arrangements and fitness for duty.

Watchkeeping arrangements under the STCW Code

When deciding the composition of the watch on the bridge, which may include appropriately qualified ratings, the following factors, inter alia, must be taken into account:

- the need to ensure that at no time should the bridge be left unattended;
- weather conditions, visibility and whether there is daylight or darkness;
- proximity of navigational hazards which may make it necessary for the OOW to carry out additional duties;

- use and operational condition of navigational aids such as radar or electronic position-indicating devices and any other equipment affecting the safe navigation of the ship;
- whether the ship is fitted with automatic steering;
- whether there are radio duties to be performed;
- unmanned machinery space (UMS) controls, alarms and indicators provided on the bridge, procedures for their use and limitations;
- any unusual demands on the navigational watch that may arise as a result of special operational circumstances.

Reassessing manning levels during the voyage

At any time on passage, it may become appropriate to review the manning levels of a navigational watch.

Changes to the operational status of the bridge equipment, the prevailing conditions, the nature of the waters in which the ship is navigating, fatigue levels and workload on the bridge are among the factors that should be taken into account.

A passage through restricted waters may, for example, necessitate a helmsman for manual steering, and calling the master or a back-up officer to support the bridge team.

Sole Look-out

Under the STCW Code, the OOW may be the sole look-out in daylight conditions.

If sole look-out watchkeeping is to be practised an any ship, clear guidance should be given in the shipboard operational procedures manual, supported by master's standing orders as appropriate, and covering as a minimum:

- under what circumstances sole look-out watchkeeping can commence;
- how sole look-out watchkeeping should be supported;

- under what circumstances sole look-out watchkeeping must be suspended.

It is also recommended that before commencing sole look-out watchkeeping the master should be satisfied, an each occasion, that:

- the OOW has had sufficient rest prior to commencing watch;
- in the judgement of the OOW, the anticipated workload is well within his capacity to maintain a proper look-out and remain in full control of the prevailing circumstances;
- back-up assistance to the OOW has been clearly designated;
- the OOW knows who will provide that back-up assistance, in what circumstances back-up must be called, and how to call it quickly;
- designated back-up personnel are aware of response times, any imitations an their movements, and are able to hear alarm or communication calls from the bridge;
- all essential equipment and alarms an the bridge are fully functional.

The Bridge Team

AIl ship's personnel who have bridge navigational watch duties will be part of the bridge team. The master and pilot(s), as necessary, will support the team, which will comprise the OOW, a helmsman and look-out(s) as required.

The OOW is in charge of the bridge and the bridge team far that watch, until relieved.

It is important that the bridge team works together closely, bath within and across watches, since decisions made on one watch may have an impact on another watch.

The bridge team also has an important role in maintaining communications with the engine room and other operating areas on the ship.

The bridge Team and the Master

It should be clearly established in the company's safety management system that the master has the overriding authority and responsibility to make decisions with respect to safety and pollution prevention. The master should not be constrained by a shipowner or charterer from taking any decision which in his professional judgement, is necessary for safe navigation, in particular in severe weather and in heavy seas.

The bridge team should have a clear understanding of the information that should be routinely reported to the master of the requirements to keep the master fully informed, and of the circumstances under which the master should be called (see bridge checklist 813).

When the master has arrived on the bridge, his decision to take over control of the bridge from the OOW must be clear and unambiguous.

Working within the Bridge team

Assignment of Duties

Duties should be clearly assigned, limited to those duties that can be performed effectively, and clearly prioritised.

Team members should be asked to confirm that they understand the tasks and duties assigned to them.

The positive reporting on events while undertaking tasks and duties is one way of monitoring the performance of bridge team members and detecting any deterioration in watchkeeping performance.

Co-ordination and communication

The ability of ship's personnel to co-ordinate activities and communicate effectively with each other is vital during emergency situations. During routine sea passages or port approaches the bridge team personnel must also work as an effective team.

A bridge team which has a plan that is understood and is well briefed, with all members supporting each other, will have good situation awareness. lts members will then be able to anticipate dangerous situations arising and recognise the development of a chain of errors, thus enabling them to take action to break the sequence.

AIl non-essential activity on the bridge should be avoided.

New Personnel and familiarization

There is a general obligation under the ISM Code and the STCW Convention for ship's personnel new to a particular ship to receive ship specific familiarisation in safety matters.

For those personnel that have a direct involvement in ship operation such as watchkeeping, a reasonable period of time must be allocated to become acquainted with the equipment that they will be using and any associated ship procedures. This must be covered in written instruction that the company is required to provide to the master.

A knowledgeable crew member must be assigned to new personnel for one-to-one training in a common language, ideally supported by checklists (see checklist B1). Self-teaching manuals, videos or computer based training programmes, are examples of other methods that could be used on board

Prevention of fatigue

In order to prevent fatigue, the STCW Code stipulates that bridge team members must take mandatory rest periods. Rest periods of at least 10 hours in any 24-haur period are required. If the rest is taken in two separate periods, one of those periods must be at least 6 hours. However the minimum period of 1 0 hours may be reduced to not less than 6 consecutive hours provided that any such reduction does not extend beyond two days, and not less than 70 hours rest is provided during each seven-day period. Detailed guidance is available in the 1SF publication 'International Shipboard Work Hour Limits'.

The STCW Code also advises governments lo prescribe a maximum blood alcohol level of 0.08% for ship's personnel during watchkeeping and to prohibit alcohol consumption within 4 hours prior to commencing a watch. Port states, flag state administrations and companies may have more stringent policies.

Use of English

The STCW Code requires the OOW to have knowledge of written and spoken English that is adequate to understand charts, nautical publications, meteorological information and messages concerning the ship's safety and operations, and adequate to communicate with other ships and coast stations. A handbook on Standard Marine Navigational Vocabulary (SMNV) has been published, and Standard Marine Communication Phrases (SMCP) are being introduced by MO.

Communications within the bridge team need to be understood. Communications between multilingual team members, and in particular with ratings, should either be in a language that is common to all relevant bridge team members or in English.

When a pilot is on board, the same rule should apply. Further when a pilot is communicating to parties external lo the ship, such as tugs, the ship should request that the pilot always communicate in English or a language that can be understood on the bridge. Alternatively, the pilot should always be asked to explain his communications to the bridge team, so that the ship is aware of the pilot's intentions at all times.

The Bridge team and the Pilot

When the pilot is on board a ship, he will temporally join the bridge team and should be supported accordingly (see section 3.3.3).

Navigation policy and company procedures
Every management of shipowning company should have a safety management policy. It should provide practical guidance concerning safe navigation and include:

- a dear statement that safety of life and safety of the ship take precedence over all other considerations;
- allocation of bridge watchkeeping duties and responsibilities for navigational procedures;
- procedures for voyage planning and execution;
- chart and nautical publication correction procedures;
- procedures to ensure that ah essential navigation equipment and main and auxiliary machinery are available and fully operational;
- advice concerning emergency responses;
- ship position reporting procedures;
- accident and near miss reporting procedures;
- recording of voyage events;
- procedures for familiarisation training and handover at crew changes;
- a recognised system for identifying special training needs;
- company contacts, including the designated person under the ISM Code

Master's standing orders
Shipboard operational procedures manuals supported by standing instructions based upon the company's navigation policy should form the basis of command and control on board.

Master's standing orders should be written to reflect the master's own particular requirements and circumstances particular to the ship, her trade and the experience of the bridge team employed at that point in time.

Standing orders and instructions should operate without conflict within the ship's safety management system.

Standing orders should be read by ah officers before the commencement of the voyage and signed accordingly. A copy of the orders should be available on the bridge for reference.

Bridge order book

In addition to general standing orders, specific instructions may be needed for special circumstances.

At night the master should write in the bridge order book what is expected of OOW. These orders must be signed by each OOW when going on watch.

Passage planning

Overview

Passage planning is necessary to support the bridge team and ensure that the ship can be navigated safely between ports from berth to berth. The passage plan should cover ocean, coastal and pilotage waters.

The plan may need to be changed during the voyage; for example a destination port may not have been known or may alter, or it may be necessary to amend the plan following consultation with the pilot.

If the plan is changed during the voyage, the bridge team on each watch should be consulted and briefed to ensure that the revised plan is understood,

The passage plan should aim to establish the most favourable route while maintaining appropriate margins of safety and safe passing distances offshore. When deciding upon the route, the following factors are amongst those that should be taken into account:

- the marine environment;
- the adequacy and reliability of charted hydrographic data along the route;
- the availability and reliability of navigation aids, coastal marks, lights and radar conspicuous targets for fixing the ship along the route;
- any routeing constraints imposed by the ship e.g. draught, type of cargo;
- areas of high traffic density;
- weather forecasts and expected current, tidal, wind, swell and visibility conditions;
- areas where onshore set could occur;
- ship operations that may require additional searoom e.g. tank cleaning or pilot embarkation;
- regulations such as ships' routeing schemes and ship reporting systems;
- the reliability of the propulsion and steering systems on board.

The intended voyage should be planned prior to departure using appropriate and available corrected charts and publications. The master should check that the tracks ¡aid down are safe, and the chief engineer should verify that the ship has sufficient fuel, water and lubricants for the intended voyage.

In addition, the duty of the master to exercise professional judgement in the light of changing circumstances remains a basic requirement for safe navigation.

Responsibility for passage planning

In most it is customary for the master to delegate the initial responsibility for preparing the passage plan to the officer responsible for navigational equipment and publications.

In small ships the master may plan the voyage himself.

While responsibility for the plan in pilotage waters rests with the ship, the pilot on boarding, or before if practicable, should advise the master of any local circumstances so that the plan can be updated (see section 2.6).

Notes on passage planning

Plan appraisal

Before planning can commence, the charts, publications and other information appropriate for the voyage will need to be gathered together and studied. A passage appraisal checklist is included in this Guide as bridge checklist B5.

Charts and publications

Only official nautical charts and publications should be used for passage planning, and they should be fully corrected to the latest available notices to mariners and radio navigation warnings. Any missing charts and publications needed for the intended voyage should be identified from the chart catalogue and obtained before the ship sails (see sections 4.9.2 and 4.9.3).

For coastal and pilotage planning and for plotting each course alteration point (or waypoint) large scale charts should be used. For ocean passage planning and open water legs smaller scale charts should be used.

The route plan

The route plan should incorporate the following details:

- planned track showing the true course of each leg;
- leg distances;
- any speed changes required en route;
- wheel over positions for each course alteration, where appropriate;
- turn radius for each course alteration, where appropriate;
- maximum allowable off-track margins for each leg.

At any time during the voyage, the ship may need to leave the planned route temporarily at short notice. Marking on the chart relatively shallow waters and minimum clearing distances in critical sea areas is but one technique which will assist the OOW when having to decide quickly to what extent to deviate without jeopardising safety and the marine environment. However, in using this technique, care should be taken not to obscure chart features. On paper charts, only pencil should be used.

The route plan should also take into account the need to monitor the ship's position along the route, identify contingency actions at waypoints, and allow for collision avoidance in line with the COLREGS.

The main details of the route plan should be recorded using sketches, if appropriate, so that the plan can be readily referred to at the main conning position.

Passage planning and electronic navigation systems

Planning using electronic chart display systems

Passage planning can be undertaken either on paper charts or using an electronic chart display and information system (ECDIS) displaying electronic navigational charts (ENC), subject to the approval of the flag state administration. Raster chart display systems (RCDS) displaying raster navigational charts (RNC) can be used for passage planning in conjunction with paper charts (see section 4.9).

When passage planning using ECDIS, the navigating officer should be aware so that a safety contour can be established around the ship. The crossing of a safety contour, by attempting to enter water which is too shallow or attempting to cross the boundary of a prohibited or specially defined area such as a traffic separation zone, will be automatically indicated by the ECDIS while both being planned and executed.

When passage planning using a combination of electronic and paper charts, particular care needs to be taken at transition points between areas o electronic and paper chart coverage. The voyage involves distinct pilotage, coastal and ocean water phases. Planning within any one phase of the voyage should be undertaken using either all electronic or all paper charts rather than a mix of types.

Where a passage is planned using paper charts, care should be taken when transferring the details of the plan to an electronic chart display system. In particular, the navigating officer should ensure that:

- positions are transferred to, and are verified on, electronic charts of an equivalent scale to that of the paper chart on which the position was originally plotted;

- any known difference in chart datum between that used by the paper chart and that used by the electronic chart display system is applied to the transferred positions;

- the complete passage plan as displayed on the electronic chart display system is checked for accuracy and completeness before it is used.

Transferring route plans to other navigation aids
Care must be taken when transferring route plans to electronic navigation aids as GPS, since the ship's position that is computed by the navaid is likely to be in WG384 datum. Route plans sent to the GPS for monitoring cross track error must therefore be of the same datum

Similarly in the case of radars, routes and maps displayed on the radar will be referenced to the position of the ship. Care must therefore be taken to ensure that maps and plans transferred to, or prepared on, the radar are created in the same datum as the navaid (typically a GPS) which is connected to, and transmitting positions to, the radar.

Notes on passage planning in ocean waters
In open waters, the route selected will be either a great circle, composite great circle or rhumb line route.

When planning ocean passages, the following should be consulted:

- small scale ocean planning and routeing charts providing information on ocean currents, winds, ice limits etc.;
- gnomonic projection ocean charts for plotting great circle routes;
- the load line zone chart to ensure that the Load Line (LL) Rules are complied with;
- charts showing any relevant ships' routeing schemes.

Anticipated meteorological conditions may have an impact on the ocean route that is selected. For example:

- favourable ocean currents may offer improved overall passage speeds

offsetting any extra distance travelled;
- ice or poor visibility may limit northerly or southerly advance;
- the presence of seasonal tropical storm activity may call for certain waters to be avoided and an allowance made for searoom.

Details of weather routeing services for ships are contained in lists of radio signals and in Volume D of the World Meteorological Organization (WMO) Publication No. 9. Long-range weather warnings are broadcast on the SafetyNET Service along with NAVAREA navigational warnings as part of the World-Wide Navigational Warning Service (WWNWS).

Landfall targets need to be considered and identified as to their likely radar and visual ranges and, in respect of lights, their rising and dipping ranges and arcs/colours of sectored lights.

Notes on passage planning in coastal or restricted waters

By comparison with open waters, margins of safety in coastal or restricted waters can be critical, as the time available to take corrective action is likely to be limited.

The manoeuvring characteristics of the ship and any limitations or peculiarities that the ship may have, including reliability problems with its propulsion and steering systems, may influence the route selected through coastal waters. In shallow water, particularly if the ship is operated at speed, ship squat can reduce underkeel clearances.

Ships' routeing schemes and reporting systems along the route, as well as vessel traffic services, should be taken into account (see sections 2.7, 2.8 and 2.9).

Coastal weather bulletins, including gale warnings and coastal navigational warnings broadcast by coast radio stations and NAVTEX, may require changes to be made to the route plan.

Monitoring the route plan

It is important that when a route is planned through coastal or restricted waters, due consideration is given to ensuring that the progress of the ship can be effectively monitored.

Of particular importance is the need to monitor the position of the ship approaching the wheel over position at the end of a track, and checking that the ship is safely on the new track after the alteration of course.

Distinctive chart features should be used for monitoring the ship's position visually, by radar and by echo sounder, and therefore need to be an integral part of the route plan.

Visual monitoring techniques

Ahead, transits can provide a leading line along which a ship can safely steer. Abeam, transits provide a ready check for use when altering course. At anchor several transits can be used to monitor the ship's position.

Bearing lines can also be effectively used. A head mark, or a bearing line of a conspicuous object lying ahead on the track line, can be used to steer the s while clearing bearings can be used to check that a ship is remaining within a safe area.

Radar monitoring techniques

When radar conspicuous targets are available, effective use can be made radar clearing bearings and ranges.

Ships with good arthwartship track control can use clearing bearings to monitor the advance of a ship towards a wheel over position, while parallel indexing can be used to check that the ship is maintaining track and not drifting to port or starboard.

Passage planning and pilotage

Pre arrival planning

A preliminary plan should be prepared covering pilotage waters and the roles of bridge team personnel.

A plan should still be prepared even if the master of the ship has a "Pilotage Exemption Certificate" for the port.

Planning for anchoring off the port or aborting port entry in the event of problems arising should feature as part of the plan. The plan should also identify charted features that will assist monitoring progress and include measures in the event of primary equipment failure, poor visibility etc.

The Pilot Card should also be updated. The Card contains information on draught and ship's speed that is liable to change as the loading conditions of the ship changes, as well as a checklist of equipment available and working.

Pre-arrival information exchange with the pilot

Particularly where the master has limited local knowledge of the pilotage waters, it is recommended that a pre-arrival exchange of information take place with the pilot before boarding.

An information exchange initiated by the ship approximately 24 hours before the pilot's ETA will allow sufficient time far more detailed planning to take place both an the ship and ashore. The exchange will also allow communications between the ship and the pilot to be firmly established before embarkation.

These forms are intended only to provide a basis; the exact detail of the forms can vary from ship to ship, trade to trade, or indeed from port to port. It is nevertheless recommended to keep preliminary information exchange to a minimum, and limit the information to that which is strictly necessary to assist in planning the pilotage. If appropriate, the Shore to Ship Pilot/Master

Exchange form can be supported by a graphical route plan.

In certain pilotage areas, the passage can last for several hours, in which time circumstances can alter significantly, necessitating changes to the plan. The preferred way of working within any pilotage area can also vary between pilots.

Detailed exchanges can take place when the pilot arrives on board, as indeed can discussions on berthing.

Pilot on board

The pilotage passage plan will need to be discussed with the pilot as soon as he comes on board. Any amendments to the plan should be agreed, and any consequential changes in individual bridge team responsibilities made, before pilotage commences.

Where pre-arrival exchange has not taken place extra time and sea room may need to be allowed before pilotage commences in order to discuss the plan fully.

The pilot should be handed the Pilot Card and shown the Wheelhouse Poster . The Wheelhouse Poster provides a summary of ship manoeuvring information. A manoeuvring booklet containing more detailed information may also be available on the bridge.

Preparing the outward bound pilotage plan

After berthing and before the pilot departs the ship, the opportunity should be taken to discuss the outward bound pilotage passage plan with the pilot, bearing in mind that the precise way of working within any pilotage area can vary between pilots.

Passage planning and ship's routeing

Ship's routeing measures have been introduced in a number of coastal waters to:

- reduce the risk of collision between ships in areas of high traffic densities;
- keep shipping away from environmentally sensitive sea areas;
- reduce the risk of grounding in shallow waters.

The use of ships' routeing measures should form part of the passage plan.

Ships' routeing measures can be adopted internationally by MO. Such schemes are recommended for use by, and may be made mandatory for all ships, certain categories of ships or ships carrying certain cargoes. Mandatory ships' routeing schemes should always be used unless the ship has compelling safety reasons for not allowing them.

IMO routeing schemes will be shown on charts with a note of any pertinent provisions as to their use. Fuller details may be described in Sailing Directions. The IMO publications Ships' Routeing and Amendments to Ships' Routeing contain full descriptions of each scheme and any rules applying, but this publication is produced primarily for the benefit of administrations. It is not kept up to date as regularly as nautical publications, which should always be consulted for the latest information.

Elements used in routing systems include:

- traffic separation scheme - a routeing measure aimed at the separation of opposing streams of traffic by establishing traffic lanes;
- traffic lane - areas within defined limits in which one-way traffic flows are established;
- separation zone or line — a means to separate traffic lanes in which ships are proceeding in opposite or nearly opposite directions in order to separate traffic lanes from adjacent sea areas or to separate different traffic lanes;

- roundabout - a separation point or circular zone and a circular traffic lane within defined limits;
- inshore traffic zone - a designated sea area between the landward boundary of a traffic separation scheme and an adjacent coast;
- recommended route - a route of undefined width, for the convenience of ships in transit, which is often marked by centreline buoys;
- deep water route - a route which has been accurately surveyed for clearance of sea bottom and submerged articles;
- archipelagic sea lane - sea lanes designated for the continuous and expeditious passage of ships through archipelagic waters;
- precautionary area - an area where ships must navigate with particular caution and within which the direction of flow of traffic may be recommended;
- area to be avoided - an area in which either navigation is particularly hazardous or it is exceptionally important to avoid casualties and which should be avoided by ah ships, or by certain classes of ships.

Passage planning and ship reporting systems

Ship reporting has been introduced by a number of coastal states so that they can keep track, via radio, radar or transponder, of ships passing through their coastal waters. Ship reporting systems are therefore used to gather or exchange information about ships, such as their position, course, speed and cargo. In addition to monitoring passing traffic, the information may be used for purposes of search and rescue and prevention of marine pollution.

The use of ship reporting systems should form a part of the passage plan.

Ship reporting systems can be adopted internationally by IMO. Such systems will be required to be used by all ships or certain categories of ships or ships carrying certain cargoes.

The master of a ship should comply with the requirements of ship reporting systems and report to the appropriate authority ah information that is

required. A report may be required upon leaving as well as on entering the area of the system, and additional reports or information may be required to update earlier reports.
Ship reporting requirements may be referred to on charts and in sailing directions, but lists of radio signals provide full details. Details of ¡MO adopted systems are contained in Part G of the ¡MO publication Ships' Routeing updated by the 1 996 Amendments to Ships' Routeing.

Passage planning and vessel traffic services
Vessel traffic services (VTS) have been introduced, particularly in ports and their approaches, to monitor ship compliance with local regulations and to optimise traffic management. VTS may only be mandatory within the territorial seas of a coastal state.

VTS requirements on ships should form part of the passage plan. This should include references to the specific radio frequencies that must be monitored by the ship for navigational or other warnings, and advice on when to proceed in areas where traffic flow is regulated.

VTS reporting requirements may be marked on charts but fuller details will be found in sailing directions and lists of radio signals.

5. RADAR & ARPA

Introduction

What is a RADAR?

Radar is an electronic nav-aid that tells the range and bearing of landmarks and vessels in your vicinity. It works by sending out microwave pulses and then detecting the signals reflected back from the "targets" around you. It is not, however, like a scanning TV camera; we only see on the radar screen the blips or echoes of the targets, not realistic representations. Consequently it takes some practice to read the radar screen and from that to interpret what is really out there.

Isolated targets like other vessels, buoys, islets, or drilling platforms are easier to interpret than large irregular land masses. At larger distances, isolated targets all appear as simple dots or small line segments. As they get closer, the target size increases, but unless the object is big and fairly close, the "size" of the echo on the screen is not a measure of the actual size of the target. More on that later.

In simplest terms, the basic elements of the system are an antenna and the radar unit itself, which has on it accessible to the user a CRT screen and a set of controls (knobs, buttons, and maybe a track ball). There are sophisticated electronics inside, and generally it takes a professional electronics person to install and calibrate the unit before use. After that it runs very dependably and requires little attention as a rule.

On the other hand, many installation manuals are quite good, and an industrious mariner could do the installation themselves. A key part of this process once done with the mechanical and electrical parts, is the calibration of the unit using a set of special adjustment buttons or knobs. These are typically accessible from outside the unit, but they are not intended for day to day adjustment. Often they are behind a hidden panel on the instrument. These adjustments are for calibration and alignment of the various functions. You must read the manual before adjusting these and generally they require your being in radar sight of a good isolated target, so you can tune up on it.

What you see on the radar screen is the region of space around you out to a maximum distance equal to the Range setting selected. The location of your vessel is always in the center of the screen, unless you have some special "offset option" that lets you shift your position back on the display. Some radars have this, so you can see farther ahead on that particular range setting. The Radar Trainer does not include that type display option.

Measuring the ranges and bearings of targets is discussed in Lesson 2. For now we just stress that when you are moving, the motion of the targets that you see on the screen is relative motion, not true motion. If you are moving toward a stationary buoy at 5 knots, it will appear on your radar screen as if that buoy is moving toward you at 5 knots. The only stationary target on a radar screen is one that happens to be moving exactly in the same direction and exactly at the same speed you are. In which case these is no relative motion between the two of you, and it appears stationary.

RADAR Tuning

Most people refer to the adjustments of these knobs or buttons as "tuning the radar," but only one is actually called "tuning." They all have to do with optimizing the image display on the screen to best show what you want to see.

- Warm-up
- Stand-by mode
- Brilliance
- Tuning (tuning bar)
- Focus
- Gain
- Sea clutter (AC sea or STC)
- Rain clutter (FTC)
- Echo stretch
- Interference rejection
- Zoom and offset (shift)

- heel angle

General tips on tuning

It is always easier to tune with targets on the screen than with none in range. If you can, practice with this where there is traffic to prepare for when there isn't. Try to watch for a case with traffic safely passing in a rain or snow squall to practice with and see the effects of rain clutter. Remember, in a squall that limits your visibility you are operating on Rule 19, so it is crucial to have the radar tuned as well as possible.

Do not "over tune." Some controls work against each other. As a general rule, keep all optional controls in the off or minimum settings. Set Gain to have a light background of speckles when set to the high ranges. Then use the others only as needed.

With no targets and significant waves present, to look for close targets, first zero the rain and sea clutter, set range to high value, increase gain till a light speckled background, reduce to lower range, and then increase sea clutter to break it up into speckled pattern of dots.

For optimum resolution (i.e. to distinguish two close vessels, or identify a landmark) , use the lowest range scale that shows the target, and lower gain.

When a big target gets close, reduce the gain or it will smear across the entire screen and block out all other targets.

When looking for targets at your maximum range, turn up the gain temporarily to a more continuous pattern of speckles... and watch the screen intently. When new targets first come into view, they may show only on every other sweep or maybe every tenth sweep.

RADAR Piloting

Radar has two basic uses underway, position fixing (or confirmation) and collision avoidance. You can with radar, for example, take the range and bearing to charted landmarks if they can be identified on the radar screen, and a range and bearing is a fix. The VRM and EBL make this very convenient.

There are definite advantages to such radar fixes as compared with other means of piloting -- speed, versatility, and use in restricted visibility are the main ones -- but there are also distinct uncertainties that must be addressed. And there are numerous variations on the piloting techniques that can be applied using radar. These matters are discussed in some detail later. Often equally important, however, is the more general question of how radar is best incorporated into navigation and watch keeping procedures. This subject of when to use radar, as opposed to how to use it, is the subject addressed in the next section.

Use of RADAR underway

It is fairly easy to argue that of all electronic navigation aids, radar is the most important. The value of radar can be illustrated by pursuing that thought a bit. In comparison, for example, GPS, and especially differential GPS, can certainly provide a more accurate position than radar can, at least with regard to absolute coordinates, but it is not often that we need this high degree of position accuracy when navigating in coastal or inland waters. If my radar can convince me, for example, that I am indeed in the middle of a narrow channel, I do not need to know my precise coordinates.

I am gratified, naturally, to see the plot of the GPS positions trailed out across some electronic chart display follow right through the middle of the channel, but many mariners are more assured by the actual vision of the channel boundaries showing clearly on the radar screen.

At sea, on the other hand, radar does not help at all with position fixing, whereas the GPS does, but at sea I also do not need to know my precise position in most cases -- not to imply low standards in navigation, I simply mean we rarely need 10-meter accuracy in the middle of the ocean.

What I want to stress is that the real value of GPS is not its position accuracy per se in most cases, but rather its ability to tell us accurate course over ground and speed over ground. With good radar targets in view we could also get this course information from the radar (see Lesson 6), but it is quicker and easier and always there with the GPS.

What the radar can do that the GPS cannot -- at least for now! -- is warn of collision risk with moving targets. If I pay attention, GPS can tell me if I am going to collide with land, but it does not tell me what other vessels in the neighborhood might be doing.

In short, with GPS alone, try as hard as I like, I am still vulnerable to the actions of other vessels. With radar as a tool to watch around me, I can spot any traffic in the neighborhood, and with some observations figure out what they are doing. If I can't figure it out, I know they are there and I can call them on the radio.

Hence the argument goes like this: with good land mass targets, often available in the dangerous situations, I can find from the radar everything that GPS tells me (only more slowly and less accurately) but the radar in addition can tell me what traffic is around and what risks they might present, whereas the GPS (for now) cannot. Hence radar is the more important aid! Furthermore, the radar is fully controlled from your own vessel -- no outside dependence. Radar produces its own navigation broadcasts, whereas we are all vulnerable to the availability of the much more complex GPS broadcasts. A minor point, but definitely favoring radar as an important nav aid for world voyagers.

Putting aside the "who's best" discussion, the truth is they are both important and every vessel should have and use both of these nav aids. These two, together with a depth sounder, are your main arsenal for safe navigation. GPS, especially interfaced to an electronic chart plotter, is the boss of the group when it comes to position navigation, because it is quickest, easiest, and most accurate.

Note that if you still have a LORAN on board and functioning, then this is a valid and useful confirmation of the GPS position. They are both black boxes, but their position assessments are completely independent, even operated by different branches of the government. If they both say you are at the same place (meaning the LORAN has been properly calibrated), then chances are that is where you are.

The key point is we need some means to confirm the GPS position, and in coastal or inland waters, radar is most often the best way.

Now (finally) the method

A normal position assessment might proceed by plotting the GPS position on the chart and then, from that position on the chart, note the range and bearing to some charted landmark that is likely to be a prominent radar target. Then go to the radar to check if that is true. At the same time, when in soundings, one should check that the depth is what it should be as well. On most electronic chart displays, the range and bearing to a landmark can be make with the mouse cursor in a matter of seconds. Without such things, we must plot the position on a chart and use parallel rulers and dividers.

This is a valuable way to use radar for position navigation whenever possible. It not only confirms your position, but also helps you identify radar targets (land masses) on the screen. Without this ongoing practice, it may be difficult to identify a headland or bay or islet or some such thing when you do need it. It also builds simple confidence in your work. If you rely solely on the GPS you will be anxious about your work and you have a right to be.

Once you detect traffic approaching, the GPS has limited value. Well offshore you might call the "vessel at 48 degrees 35 minutes north, 132 degrees 20 minutes west" or some variation, which you got from the GPS, but a broadcast on low power VHF usually provides an adequate location specification without coordinates -- not to imply this is not a good procedure, it can be. The point is, in traffic encounters, you must rely on the radar. You will even need to make careful "systematic observations" on the radar before you know which way it is headed. In other words, you can't even call "north bound vessel...." etc., when you first see it's radar image (in the fog) without making some quick computations from the radar observations.

These types of observations and the use of them for evaluating risk of collision is discussed briefly in the next section (point 1.5) and in detail in point 2.

In coastal navigation, the process of going back and forth from radar to chart has another advantage of keeping you informed of the name of the headland or bay you are nearest. It can be very helpful to have this in mind. You may hear a vessel calling for assistance in some region or another making a general call such as "This is the tanker Darth Vader, north bound at 20 knots calling the small radar target dead ahead, 2 miles off Cape Trouble" in which case it would be nice to know if it is Cape Trouble you are off of -- without having to get out a chart, plot your position and then look around for the nearest landmark, etc.

An aside...
For completeness, let me follow up on the implications left above that GPS (itself) might someday assist in collision avoidance. It is standard, often used technology these days to acquire a live GPS position on board and broadcast it back to some land based station. There are many applications of this technology. It was used in the America's Cup yacht race, for example, to show second-by-second on national TV exactly where the two yachts were relative to each other during the race -- right down to a boat length.

If these yachts each had a TV on board tuned to ESPN (I assume they did not!) they would not only have a live view of where the nearest boat was, they would also have a trail of it's past route drawn out in purple across a beautiful schematic of San Diego Bay, complete with simulated whitecaps. Someday we will all have some variation of this technology on board with a computer graphic not just of the chart but of all vessels in the neighborhood moving across it.
With all vessels broadcasting (via short-range FM) there present positions, plus COG and SOG, and with all vessels having receivers to acquire this data for nearby traffic, we have a live video type of radar that can easily be programmed to monitor risk of collision. This is not only possible, it is inevitable.

Collision Avoidance & Maneuvering
This is the premiere function of radar, telling us what traffic is out there and what it is doing. But we must do some homework to figure this out, it is not a

simple matter of just looking at the radar screen -- unless we happen to have on board the most modern and very expensive types of radar used on large ships. And ironically enough, even though these top-end radars do this analysis more or less automatically, they are so complex to use that they take a great deal of special training to operate. In fact, it may take more training to operate a radar that does all the analysis automatically than it does to learn to analyze observations from a radar that doesn't do it automatically! So there is no way to win. We have got to do some homework to use radar.

The virtue, by the way, of the larger (ARPA) radars is they do it faster, presumably better, and can do several vessels at once.
The analysis involves first and foremost to determine whether or not the target poses a risk of collision. Next is determining what the circumstance is that leads to this risk. I could, for example, determine fairly easily that a target is moving straight down the ship's heading line toward me from dead ahead on a collision course. My next job is to decide if this is someone I am going to run over from astern or if it is a target headed full steam right at me. And so on.

For targets closing in on a diagonal track, as opposed to coming from dead ahead, the analysis is a bit more involved. Our job is to develop standard simple procedures that will let us know as quickly as possible what is taking place. And the next step is to review those pertinent Navigation Rules that tell us what to do in various conditions.

Evaluating Risk Of Collision

Introduction to systematic observation

We put "systematic observations" in quotes as it is a phrase directly from Rule 7 of the Navigation Rules. In other words, it is not an option that we do some sort of systematic analysis of radar targets to evaluate risk of collision. The Rules don't say what this means, but we go over in this text what is usually considered to be prudent systematic observations.

When a target first appears on the radar screen, we know only one thing: before there was no target there and now there is one. If we go on about our business and make no other observations than that, when we next look at the radar screen we will know less than we did the first time. We will see a target, but we won't even be certain if it is the same one -- and we will have already wasted valuable time. Since we did not record nor mark where it was before (it's range and bearing), we do not know if it is closer or farther than it was, nor if it is headed towards us.

One might argue that this procedure did not break any navigation rules because there was clearly no risk of collision -- let's say the target was 12 miles off. But that argument is, if not outright wrong, at least not prudent. Rule 7 specifically calls for long range scanning to obtain early warning whenever we have radar. And even if one continues to argue about "what is long range?" whenever we are in restricted visibility, the argument fails unambiguously. Rule 19 calls for us to avoid not just the risk of collision, but the development of the risk and specifically says that we must evaluate the motion of that target when it first appears on the radar screen. Radar and the Nav Rules is covered in Lesson 5, and we will put off further discussion of the important distinctions between clear weather and fog till then.

The conclusion is that prudent operation calls for us to mark the target when first detected. The simplest approach is just to tag it with the EBL and VRM. If the range gets smaller then as time goes by, it is getting closer, and if the trail of its plotted positions tracks down or nearly down the EBL line, then it is headed in towards us. That is the first thing we need to know.
We might add here, by the way, that for distant targets (say just visible by sight or binoculars, usually some 8 to 10 miles off) a change in a the bearing to a distant ship can usually be determined from a hand-held fluxgate compass more quickly than it can with the radar's EBL. This is especially true in a sea way that is causing the plot trail on the radar screen to be significantly smeared out.

For those targets that are headed in according to these first early observations, we must make further, more specific determinations. First we want to know, how close it will pass (CPA) if neither of us alters course or speed. Then we want to know when this will occur, and finally we need to rely on the Nav rules and whatever special circumstances are at hand to decide how to maneuver appropriately if we must.

It is the subject of the rest of this Lesson to go over these procedures in detail with examples and practice with the simulator.

For those new to such encounters underway, we add that if it should turn out that we are the stand on vessel and as such should hold course or speed, then we will once again be confronted with the realization that this is indeed the more burdened of the two positions to be in, and we must, if anything, watch the development of the passing even more closely.

How To Mark a Target

Nearly every example of systematic observations of what is taking place on the radar screen, we need to somehow mark the target's position right on the screen itself and label it with the time of observation. The often mentioned method is to use a grease pencil or china marker for this job. These markers come in different colors and have traditionally been used for this job, at least according to text books. These markers have the advantage of being durable, yet they can still be erased with a rag and a little "elbow grease," or store a small bottle of alcohol in the nav table. Simple rubbing alcohol works well for cleaning up china markers. China markers work reasonably well on some radar displays. However on many displays the lighting is such that these do not show up well, no matter what color is tried.

An alternative is called an "overhead projector pen." One company that makes them is called Vis-a'-Vis. These come in various colors and also in a fine-point version. They make sharp clear marks and lines on the radar screen. They dry quickly and once dry are very durable so long as they do not get wet. These marks come off (very easily) with a damp cloth. This is the type of marker I have found most useful for radar marks.

One might be tempted to use the "dry-erase" markers for this job, since they too come in many colors and do leave sharp clear marks on a radar screen or computer screen. They clean up very easily -- in fact, too easily for this job, especially underway. If you just touch them, they smear or erase. These markers are convenient for practice at home on the simulator, but they are not a good choice for underway. Generally when you mark a target it is important to watch the marks and we do not want to risk losing them.

When you mark a target it is important to also write the time beside it. Be sure you are using the same clock for each mark. Often there is some nav output such as position and time from the GPS next to the radar which makes a convenient reference. Generally these times are only recorded to the nearest minute (i.e. 1247), but it is useful to round off the seconds to the nearest minute when doing so, or wait till an exact minute for the mark. Another good reason to have a time output in prominent display next to the radar.

If you don't have such an output in ready view next to the radar, then I would consider getting some digital clock to put there. They cost under $20 these days for some very slick models, with optional displays. I prefer those with big digits showing hours, minutes, and seconds and one that is easy to set from the front. Some come with self adhering backing that you can mount anywhere. Some oven timers are good for this. A built in stopwatch is also valuable for various jobs in navigation.

Radar and the Nav. Rules
Introduction

Needless to say, all the Navigation Rules apply when you are navigating by radar just as they do when navigating by any aid. What we want to stress in this section, however, are those aspects of the Rules that single out radar with specific instructions. These are compiled on a special page at the end of the section providing any interested mariner with a complete, up to date, set of the Rules and related Appendices which are organized in a convenient manner.

Registered owners of the Radar Trainer are provided with a registered copy of these Nav Rules, that omits the various shareware notices and encouragement to register the product.

To work through this lesson, the first step is to open those rules and read though the various Explanations to the parts marked in red (the ones relating to radar). This takes each mention of radar in the Rules and offers some elaboration on the intention and application of the rule. Access this information by clicking the word "Explanation" which follows each red section. Be sure to scroll through each of the cited rules to the end, as the references to radar are sometimes spread throughout the rule.

Navigation Rules on Radar

Rule 2 - Responsibility

(a) Nothing in these Rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to comply with these Rules or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

(b) In construing and complying with these Rules due regard shall be had to all dangers of navigation and collision and to any special circumstances, including the limitations of the vessels involved, which may make a departure from these Rules necessary to avoid immediate danger.

Explanation:
"...or of the neglect of any precaution which may be required by the ordinary practice of seamen..."

This is a catch-all clause, but one that has been investigated to some extent in the courts with numerous examples provided as guide lines.

Note that exceptional performance, experience, or knowledge is not addressed here, but rather the "ordinary practice of seamen." Knowledge of compass use fits into that category, as is the effect of tides and currents. Knowing that large ships underway are not very maneuverable is example of ordinary knowledge that could be considered related to radar usage.

The very knowledge of the existence of radar on board and its appropriateness in the fog or at night is another. Or having someone on watch rely on radar for watch keeping without proper instruction in its use could be classified as not ordinary practice.

The rule is simply a reminder that we must ultimately rely on and are obligated to be familiar with the fundamentals or at least rudiments of good seamanship if we are to take part in the safe navigation of a vessel.

Rule 5 – Look out

Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

Explanation
"Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision. "

This rule requires us to use radar as part of the look out or watch keeping in the fog or at night, or in any conditions where we can't see well otherwise, because it is very clearly an "appropriate means."

This is a distinctly different requirement than a very similar one requiring use of radar to evaluate collision risk. In particular, the requirement for evaluating collision risk requires the navigator to know how to interpret what they see. Here the requirement applies to anyone keeping watch. The look out does not always have the responsibility to interpret and make decisions about approaching traffic. Their job can be just to detect it and then find the right person to do something about it.

Consequently, it would seen reasonable that if a crew is being left with the responsibility of watch keeping, they should be given at least the minimum training required to make use of the radar according to this rule.

Rule 6 – Safe Speed

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.
In determining a safe speed the following factors shall be among those taken into account:
(a) By all vessels:

(i) the state of visibility;
(ii) the traffic density including concentrations of fishing vessels or any other vessels;
(iii) the maneuverability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions;
(iv) at night the presence of background light such as from shore lights or from back scatter of her own lights;
(v) the state of wind, sea and current, and the proximity of navigational hazards;
(vi) the draft in relation to the available depth of water.

(b) Additionally, by vessels with operational radar.

(i) the characteristics, efficiency and limitations of the radar equipment;
(ii) any constraints imposed by the radar range scale in use;
(iii) the effect on radar detection of the sea state, weather and other sources of interference;
(iv) the possibility that small vessels, ice and other floating objects may not be detected by radar at an adequate range;

(v) the number, location and movement of vessels detected by radar;
(vi) the more exact assessment of the visibility that may be possible when radar is used to determine the range of vessels or other objects in the vicinity.

Explanation

The issue of safe speed comes up often in court cases. A common problem is a vessel that believes her radar watch is so good she can justify traveling at normal high speeds in reduced visibility. Obviously, as this is being discussed in a court, the belief was wrong.

Consequently the Rules single out the precautions that must be made in radar watches. Again this is from Part B, Section I, which are rules that apply in all conditions of visibility.
(b) Additionally, by vessels with operational radar.

"(i) the characteristics, efficiency and limitations of the radar equipment..."
This section of the rule is to stress to operators and masters that one cannot without careful consideration use a radar watch as justification for high speed in the fog. It is clearly a broad warning emphasizing we need to know how it works and that unless we do, we might make wrong conclusions about present traffic and our associated choice of speed.

Under "characteristics" one might include the knowledge of warm up times, what the screen is supposed to look like, how to tune it, common types of false echoes, behavior in rain or waves, active range being a function of antenna height, blocked regions, etc. Under "efficiency" one might include the effects of different frequencies and pulse repetition intervals, open array versus radome antennas, and so on, and under "limitations" might be the reflective difference between wood and plastic versus steel, small vs. large targets, resolving power limitations, range being limited by power output, etc.

This is a ruling about using radar to determine safe speed, so the primary concerns are those elements of radar operation which tell us what the traffic is or what the visibility might be, as opposed to analyzing the specific motion of that traffic to figure collision risk -- although this latter aspect of radar use is obviously closely related, and we are determining safe speed to avoid collision risk.

"...(ii) any constraints imposed by the radar range scale in use"

Obviously distant targets will be missed if viewing only the closer ranges. But equally important, a small targets can be missed when viewing the larger ranges. See related discussion in Rule 7.

"...(iii) the effect on radar detection of the sea state, weather and other sources of interference;..."

In bad weather and rough seas the radar is less dependable for detecting small targets, maybe even larger targets in very bad conditions. There are tuning options to help with this (see Lesson x), but in severe cases it is still a problem. A severe snow storm, for example, can almost shut down the dependability of radar observations.

"...(iv) the possibility that small vessels, ice and other floating objects may not be detected by radar at an adequate range;..."

See related discussion in Rule 7. Note that this is the one place in the Nav Rules that imply the Rules are indeed intended to prevent collisions with "things" as well as with vessels
As an aside, the word "collision" implies the unintended striking together of two vessels underway. An underway vessel striking an object other than a vessel underway (moored vessel, ice berg, dock) is called an "allision." The USCG maintains separate safety statistics for these two types of accidents.

"...(v) the number, location and movement of vessels detected by radar;..."

The implication here is that a vessel that detects a large number of vessels moving about in various directions should slow down when passing through or by them. Examples are fishing fleets or yacht races.

Since the author has observed this rule violated prominently more than once, he does not hesitate to add that simply sounding the whistle is no compensation for excessive speed in these conditions. Furthermore, Rule 8 (f) (iii) applies, even if the large fleet of vessels is in fact illegally impeding its passage.

"...(vi) the more exact assessment of the visibility that may be possible when radar is used to determine the range of vessels or other objects in the vicinity."

This part of the rule is an important reminder that with radar we can very often determine the effective visibility. When a vessel or buoy first appears, note its range from the radar. Or when passing some object, note its radar range when it is no longer visible, and you have precisely what you need to anticipate in the future when to expect subsequent radar targets to emerge from the fog.
The state of the visibility can, of course, change with time, and is often different in different directions. But this remains valuable information in part because the steering rules change when a vessel is in sight.

Furthermore, if we have an estimate of the visibility, we can assess the extent of the region about us that we can see, and therefore make more reasonable estimates of what is a safe speed. The earlier parts of this rule emphasize the limits of radar in making this evaluation, and when the visibility is low these limits are even more crucial.

Rule 7 – Risk of Collision

(a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt such risk shall be deemed to exist.

(b) Proper use shall be made of radar equipment if fitted and operational, including long-range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects.

Explanation

"Proper use shall be made of radar equipment if fitted and operational..."
Rule 7 on determining risk of collision is from Part B, Section I, which includes those rules that apply to all conditions of visibility. In other words, the rule says proper use of radar "shall" be made night or day, rain or shine, in the fog, near the fog, or totally out of the fog.
Shall means must, it's not an option. If you have it, you must use it whenever there is any doubt at all about risk of collision... which of course there always is when you first see a vessel on the horizon headed toward you by sight or by radar. The term "proper use" implies we should know how radar works and how to use it.

Obviously, if by just watching an approaching vessel for some time we can tell there is absolutely no risk, then we are not obligated to start any sort of radar plot. But in some cases even when a vessel is in clear view, it is easier to track what they are doing with an automatic radar plot. A quick trip to the radar to set a proper scale and start a plot can prove valuable even with vessels in clear sight. The rule simply states that if you have any doubt, you must do this.

"...including long-range scanning to obtain early warning of risk of collision..."
This means that at night or in the fog, when you can't see far by eye, you should be frequently checking the higher ranges to see if anyone is headed toward you. On smaller radar units, this means the 12-mile range, as you won't see much beyond that, unless you are looking for land. See discussion of maximum radar range in Lesson x.
Remember too, though, the warnings of Rule 6b on radar ranges and again the word '"proper" in this rule. When local visibility is not good or at night, or in big waves, you cannot just set the radar to a high range and leave it. We must frequently check the lower ranges to see if any small target might have sneaked up on us.

A small target might not be visible at all on any range from more than 3 or 4 miles off, and at the same time not be visible even at 1 mile off if we are looking for it on the 12 mile range. On all radars, the resolution is better on lower scales.

Hence the normal procedures on a radar check would be to look carefully at a few sweeps on the higher scales, then do the same on a couple of the lower scales. In rough seas, this can take some time, as the screen can be cluttered with reflections from waves and therefore take some tuning on each scale.

It is also the author's experience (opinion) that the various styles of radar "alarms" or alarm rings on small craft radar are not very dependable for making these observations for you and warning you adequately. If you do intend to use these for any purpose, it is naturally best to carry out a thorough test of their operation.

"...and radar plotting or equivalent systematic observation of detected objects. " This is a key phrase in the Nav Rules about the use of radar. Remember it applies to all conditions of visibility -- in short, to all uses of radar involved in the evaluation of collision risk. The wording of this rule likely came about before the advent of plot options on small craft radar. We have to assume that this "plotting" does not simply mean turning on the plot or echo trail option.

"Plotting" here almost certainly referred to making some evaluation of the relative motion diagram. In the simplest case, is a target headed towards us one pointed at us or one we are overtaking. The next level of evaluation is determining the true course, speed, and aspect of the target vessel.

The "systematic observation," on the other hand, could clearly be met by engaging an automatic echo plot function with associated timer. It is the author's experience, however, that there will be cases where the interaction is so potentially critical that writing the actual observations (range, bearing, and time) in the log book or corner of the chart seems more than justified.

Think of the case of a vessel closing from ahead at two or three times your speed. Remember too, that if someone inadvertently changes the radar range on you, the trails will be erased. If such an event contributes to a collision in any manner, it will be little consolation that this was not your error. Your error was failing to recognize the possibility of losing this record and the consequences it might have.

(c) Assumptions shall not be made on the basis of scanty information, especially scanty radar information.

(d) In determining if risk of collision exists the following considerations shall be among those taken into account:

(i) such risk shall be deemed to exist if the compass bearing of an approaching vessel does not appreciably change.
(ii) such risk may sometimes exist even when an appreciable bearing change is evident, particularly when approaching a very large vessel or a tow or when approaching a vessel at close range.

Explanation.
"...especially scanty radar information."

The scanty information is typically radar conclusions made from either too far off or not long enough in time. The rule is about evaluating risk of collision which would in turn call for some action. If this action is taken without proper evaluation, it could lead to more trouble rather than less.
It is crucial that some form of "systematic observations" be made on the proper range. A crucial case is the one of a target approaching from dead ahead at a high speed. In a sea way that smears out the plot trail record of the target when viewed from far off, it cannot be determined at larger ranges whether it will indeed pass safely to the right or left. A turn to the right without proper confirmation could interfere with what would have been a safe starboard passing.

Careful plotting and visual watching is crucial in this interaction as well as radio contact if in doubt. As always, when possible the target should be monitored by sight as well as radar. Often you can tell the aspect of a vessel from a distance more precisely with binoculars and compass than you can with radar.

Rule 8 – Action to Avoid Collision

(a) Any action taken to avoid collision shall, if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship.

(b) Any alteration of course and/or speed to avoid collision shall, if the circumstances of the case admit, be large enough to be readily apparent to another vessel observing visually or by radar; a succession of small alterations of course and/or speed should be avoided.

EXPLANATION

(b) Any alteration of course and/or speed to avoid collision shall, if the circumstances of the case admit, be large enough to be readily apparent to another vessel observing visually or by radar; a succession of small alterations of course and/or speed should be avoided.

Note that this rule applies in all conditions of visibility and even to those vessels which do not carry radar. When you maneuver, it should be visible to the other vessel observing "by radar." This calls for large turns, on the order of 60° or more. The course alteration diagram provides a set of guidelines that cover most circumstances in normal conditions.
Remember too, we can always stop. A collision course situation which develops when we are moving and a target is approaching diagonally will appear as a relative motion plot aimed straight towards us on the radar screen. If we stop, the target's relative motion trail will curve up screen and the collision threat will be alleviated.

The Radar Trainer provides a very convenient means of investigating what degree of turning can be seen on another radar and the opportunity to practice with the simple expedient of stopping.

(c) If there is sufficient sea room, alteration of course alone may be the most effective action to avoid a close-quarters situation provided that it is made in good time, is substantial and does not result in another close-quarters situation.

(d) Action taken to avoid collision with another vessel shall be such as to result in passing at a safe distance. The effectiveness of the action shall be carefully checked until the other vessel is finally past and clear.
(e) If necessary to avoid collision or allow more time to assess the situation, a vessel shall slacken her speed or take all way off by stopping or reversing her means of propulsion.

(f)

(i) A vessel which, by any of these rules, is required not to impede the passage or safe passage of another vessel shall, when required by the circumstances of the case, take early action to allow sufficient sea room for the safe passage of the other vessel.
(ii) A vessel required not to impede the passage or safe passage of another vessel is not relieved of this obligation if approaching the other vessel so as to involve risk of collision and shall, when taking action, have full regard to the action which may be required by the rules of this part.

(iii) A vessel, the passage of which is not to be impeded remains fully obliged to comply with the rules of this part when the two vessels are approaching one another so as to involve risk of collision.

Rule 19 – Conduct of Vessels in restricted visibility

(a) This Rule applies to vessels not in sight of one another when navigating in or near an area of restricted visibility.
(b) Every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of restricted visibility. A power-driven vessel shall have her engines ready for immediate maneuver.
(c) Every vessel shall have due regard to the prevailing circumstances and conditions of restricted visibility when complying with the Rules of Section I of this Part.

(d) A vessel which detects by radar alone the presence of another vessel shall determine if a close-quarters situation is developing and/or risk of collision exists. If so, she shall take avoiding action in ample time, provided that when such action consists of an alteration of course, so far as possible the following shall be avoided:

(i) an alteration of course to port for a vessel forward of the beam, other than for a vessel being overtaken;
(ii) an alteration of course toward a vessel abeam or abaft the beam.

EXPLANATION
"(d) A vessel which detects by radar alone the presence of another vessel..."
The rule applies when any target is first detected anywhere on the radar screen, forward, aft, port or starboard.

It also states that you do not see the target visually, but this is also implied in that this rule is in Section II, which applies to vessels in or near conditions of restricted visibility. Remember this rule applies when you are near fog as well as in it. You could have clear skies and detect a vessel in a fog bank miles from you.

Whether or not you have heard it is another matter (it says radar "alone") -- if you have heard a vessel you can't see, there are specific rules (Rule 19e) for that situation. Furthermore, you cannot always be certain that the vessel you detect on radar is the one you hear, especially if there is more than one target present.

"...shall determine if a close-quarters situation is developing and/or risk of collision exists."

"Close quarters" is discussed in Lesson 5. It is that safety zone you need to maintain about you so that you can maneuver on your own to avoid a collision if you have to, regardless of what the other vessel might do. It is some radius the size of which depends on the circumstances. In the fog with a fast moving deep sea vessel approaching, it is certainly measured in miles, not fractions of a mile.

This can be viewed as a minimum CPA you will accept as safe passing.

Hence our first job is to track the vessel ("systematic observations") to make an evaluation as soon as possible of its relative plot to determine how this is developing with regards to actual collision risk with everyone operating normally plus the extra safety standards of preventing close quarters situation.

If you are a sailing vessel, for example, under difficult conditions of big waves and strong winds, then you must figure into this reckoning what type of wind shifts might be expected and how you might have to respond with course changes. A power-driven vessel might not understand these constraints. Radio contact is always valuable in these conditions.

"If so, she shall take avoiding action in ample time,..."

Note the crucial distinction in the wording here compared to interactions in clear weather. We are not avoiding a collision when risk of collision exists, as in clear weather, but rather are avoiding the "development" of close quarters or collision risk itself. It is a clear call for earlier, more conservative actions.

However, it is also important to remember Rule 7 c which applies to all evaluations of risk of collision: assumptions should not be made on the basis of scanty radar information. In other words, we need to make whatever systematic observations are required so that we can indeed determine if risk is developing. To just see a target and maneuver is both wrong and dangerous.

"...provided that when such action consists of an alteration of course,..."

The rule then gives explicit instructions that cover all cases.

"...so far as possible the following shall be avoided:

(i) an alteration of course to port for a vessel forward of the beam, other than for a vessel being overtaken..."

Part (i) tells us we should turn right for any vessel approaching forward of the beam.

The exception is when the approaching target is one we are overtaking. Remember the definition of overtaking -- our course within 62.5° of theirs or their aspect greater than 112.5°. To know this, however, we must evaluate the RMD. We have no other way of knowing. The vessel being overtaken can approach us on the radar screen from anywhere forward of the beam. Furthermore, the first part of this rule has already told us that we must make this evaluation as our first obligation.

When the target is moving down screen from ahead this is simple to figure. If their SRM is less than our speed, we are overtaking them. On all other diagonal approaches, we must evaluate the RMD.
When interacting with a crossing or meeting vessel in the fog, neither vessel has "right of way," in distinct contrast to vessels approaching in clear weather. Both are instructed by this rule to move as prescribed above. When overtaking, however, we do have other rules that apply in any condition of visibility. Namely Rule 4 to stay clear when overtaking and rule 6 to do so early and prominently.

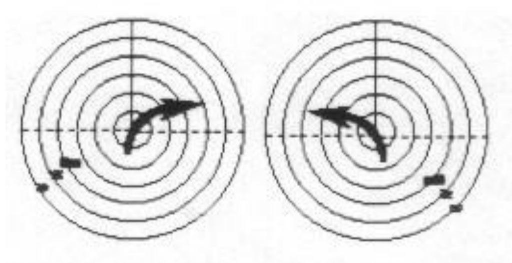
When overtaking, then, it is our obligation to make an early and prominent maneuver to stay well clear. The target in turn on his radar will see us approaching up screen from aft of his beam. His job will then be to decide if close quarters is developing and if so to turn away from us.
Note the big distinction here between navigation in sight and not in sight. When we are being overtaken in clear wheather we are instructed to hold

course and speed. But when we see someone overtaking us by radar alone, and they are headed toward close quarters, then we must move away from them.

"...so far as possible the following shall be avoided:
...

(ii) an alteration of course toward a vessel abeam or abaft the beam."

Part (ii) of this rule tells us that we should turn away from any target approaching from aft the beam. If it approaches from the port quarter, we turn right, and if from the starboard quarter, we turn left.



Note that this latter circumstance, a target approaching from the starboard quarter is the only circumstance that calls for a turn to the left. All other cases call for a turn to the right.

A more specific compilation of maneuvering guidelines is presented in Fig. - 13, which was adapted from the work of Cockcroft and Lameijer.

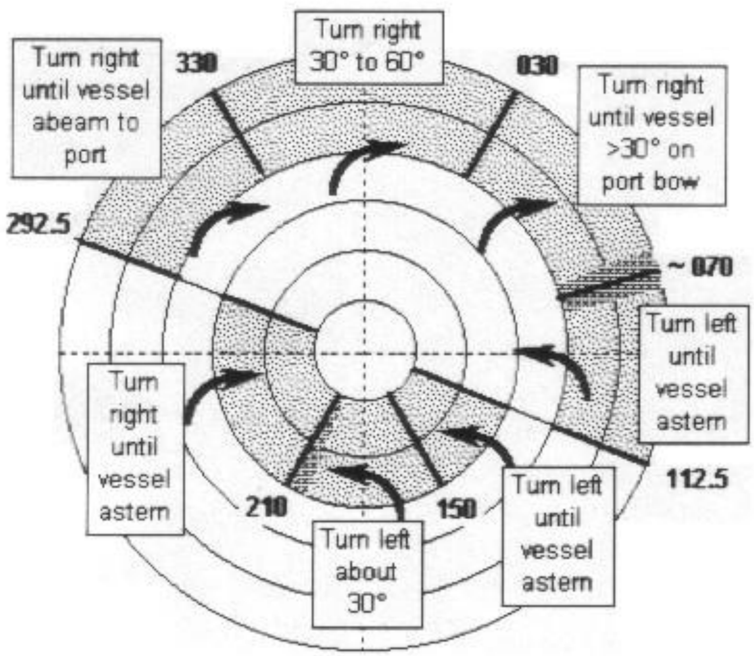


Fig. – 13. Course Alteration Diagram

This Diagram is a summary of typical course alterations in response to the detection of a radar target at various bearings. It is presumed that the target is not in sight and that maneuvering is according to Rule 19d.

For targets appearing at forward bearings (from about 292 R to 112 R) the responses are referred to as "Normal turns, made preferably at target ranges of 4 to 6 miles." This is indicated schematically by the shaded regions spanning these ranges.

Turns in response to targets appearing aft of that line are called "Escape action, taken preferably at ranges less than 3 miles." Again, shown shaded as a reminder.

Needless to say, these are only guide lines to typical turns that meet the intentions of the Rules away from special circumstances that might call for special maneuvers. The numerical values quoted here are not specified in any rule.

A notable feature included in this diagram from Cockcroft and Lameijer is the extension of the region of "starboard beam" to some two points forward of 090 R and an extension of the port turn domain some 30° into the region of the port quarter. A cursory literal reading of the rule would have these boundaries be at 090 R and 180 R, rather than the approximate 070 and 210 given in the diagram. The Radar Trainer provides an ideal way to demonstate the logic and value of the Cockcroft-Lameijer interpretation.

First note that the wording of the rule does indeed offer some flexibility on this interpretation.

A careful study of this diagram answers many of the difficult questions a navigator is confronted with when interacting with traffic in the fog and in clear weather. Needless to say, these are guidelines only. Rule 2b is a specific reminder that we must always respond to the actual circumstances at hand and to any special circumstances that may apply -- in short that there are indeed no fixed rules like those presented in Figure 19-2. A frequent example of "special circumstances" is the presence of more than 2 vessels in the interaction.

(e) Except where it has been determined that a risk of collision does not exist, every vessel which hears apparently forward of her beam the fog signal of another vessel, or which cannot avoid a close-quarters situation with another vessel forward of her beam, shall reduce her speed to the minimum at which she can be kept on her course. She shall if necessary take all her way off and in any event navigate with extreme caution until danger of collision is over.

Chart Navigation with Radar

Introduction

The primary subject matter of studing radar is the content of Point 3 on radar maneuvering and plotting. We include here, however, a few brief notes on chart navigation with radar, but want to stress that this use of radar is fairly readily picked up with practice on a real unit underway. The key factor is to have a GPS and chart at hand with the radar, and to go back and forth among these three, using EBL and VRM to locate position and from there to identify other land masses and study how they appear on the radar.

Landmass Identification

Identification of specific landmarks from their radar image can be a challenge, hence the terminology of "a good radar target" versus something else. A good landmark target is one that is easily identified on the radar screen -- usually tall or steep along all its borders, with a unique shape, or a small but reasonably tall isolated islet. A drilling platform, for example, is a very good radar target.

How well a landmark shows up on the radar depends on its range and bearing, but a so called good target would be less sensitive to this. The key issue is the height of the land and the resolution of the radar. Resolution is how well two nearby objects are resolved (separated) on the radar screen.

Height limitations and radar range

Radar range is slightly farther than visual or geographic range due to refraction of microwaves.

$$\text{Max radar range (nmi)} = 1.2 \times (\sqrt{h(ft)} + \sqrt{H(ft)})$$

where h is the height of the antenna and H is the height of the land mass or target vessel. If your antenna is 9 feet high and you are looking for a ship that is 81 feet high, then it will first faintly appear at about (3 + 9 or) 12 x 1.2 = about 14 miles. Hence even if you have a 24- or 36-mile radar, then you have to be looking for something higher than 81 feet or you won't see it from an antenna that is only 9 feet high. (The max. range scale specified on radar units has more to do with their power output, than how far you will see targets. If the target is not over the "radar horizon" given above, you won't see it, no matter how much power you are broadcasting.) If you install the antenna much higher, say from a spreader at 16 feet, then you only gain 1 mile, and if you go on up to 25 feet, you still only gain another mile.

But on a small boat at sea, an antenna that is 25 feet high will be rocking so much with the waves that some of this elevation is wasted. Most small craft find that an antenna height of 9 to 12 feet (on a post in the quarter) is perfectly adequate and avoids extra weight aloft from the long heavy cable.

Minimum range is a more subtle computation (having to do with the pulse length and processing of the microwave signal, discussed later), but there is a geometric element to it as well, which is just the "shadowed" region that lies below the beam pulse. The vertical beam width on typical radars is about +/- 15° from the horizontal. If the antenna is at height h, the beam first strikes the ground at distance = h / tan (15°). For a 25 foot antenna, this is 25 / 0.268 = 93 feet = about 30 yards from the antenna. So on a typical small craft, even one with a "high" antenna, this is no real limitation in most cases.

The electrical limitation on minimum range boils down to 164 yards per each microsecond of pulse length. Most radars switch to shorter pulse lengths at lower ranges, with something like 0.12 microsec typical for ranges less than 1 mile. This translates to 0.12 x 164 = about 20 yards from the antenna, but enhanced signal processing usually doubles this electronic limitation.
The lowest range scale on many radars is 0.25 mile or on some 0.125 miles = 750 yards. Usually that lowest 50 yards or so will be so filled with noise that these pulse length and height considerations are not the actual practical limitation to minimum range.

Resolution
Radar resolution has two separate factors: bearing resolution and range resolution. The typical horizontal width of a radar beam is about 6°. This means that any two objects separated by less than 6° will be smeared together (unresolved) into a single target. The same pulse will hit both of them. As it turns out, the tangent of 6° is 1/10, so if two adjacent objects located a

distance D away are to be resolved into separate targets on the radar screen they must be separated by a distance of at least D/10 from each other.

Two vessels, for example, seen 3 miles off, must be 0.3 miles apart or they will appear as one. If the entrance to a bay is 0.4 miles across, we would not expect to see it as an opening (when headed straight toward it), until we were within some 4 miles of the entrance. It is a good idea to practice these things and make your own measurements with chart in hand to see how this works.
Range resolution is determined by the pulse length of the radar signal. A microwave travels at the speed of light, which is 186,000 miles per second. This can be converted to a speed of 328 yards per microsecond. If two objects in line (same bearing) are separated by less than one half a pulse length, then the nearest target would still be reflecting signals from the end of the pulse when the farther one starts to reflect signals from the front of the pulse. Therefore they would appear as one object. To be resolved, two objects at the same bearing must be separated by more than 164 yards per microsecond of pulse length.

Typical pulse lengths vary from 0.1 to 1 microsecond, and the one in use depends on the range. In some few units you can select pulse length, in most small craft units this is done automatically for you when you change ranges. In one unit, for example, on range 3 miles the pulse length is 0.3 microsec and on range 4 miles it is 0.8 microsec. Note that in this case, you could have two close vessels (tug and tow) that were separated by 100 yards at 2.8 miles off.
On the 4 mile scale they would appear as one vessel (resolution 131 yards), but on the 3-mile scale they would show as two distinct close vessels (resolution 49 yards). Again, something to practice with using your own radar. You have to look up the pulse lengths used for the various range scales in the specifications section of your manual.

Needless to say, you have to have your radar tuned optimally for best resolution. If the gain is too high, for example, it will smear out the targets.

Range and Bearing Fix

Again, if not done already, please read Lesson 1.4 on use of radar underway. The standard range and bearing fix with radar is your work horse for piloting. The extreme and frequent value of this operation cannot be judged by how easy and short it is to explain it.

(1) Identify a landmark on the radar that you can identify on the chart.

(2) Set EBL and VRM on this point and read off their values. Note the time and your heading.

(3) Convert the EBL bearing to a true bearing using your heading. If the landmark is at 128 R, for example, and you are on course 215 magnetic, then the EBL bearing is 215 + 128 = 343 magnetic.

(4) Then plot your line of position on the chart exactly as you would if you had taken a compass bearing to the landmark of 343 magnetic. That is, using the magnetic compass rose on the chart, draw a line emanating from the landmark in the direction of 343 - 180 = 163 magnetic.

(5) Your distance from the landmark is what you read on the VRM. Measure this off from the landmark on the chart and you have your position.

Notes. The key issues here are two: be sure you have the right landmark and carefully judge how you draw your line on the chart relative to that landmark. If you have a steep hill some distance in from a low beach, chances are you are seeing the outline of the hill on the radar and not the outline of the beach. Small, distinct, isolated targets are best for this, or the tangent to a steep cliff or rock. You have to judge with experience if a tangent is better than an estimate to a center for extended objects. Do not rely on buoy sightings for your own position location. Buoys may not be in the right spot, or you may be looking at an anchored vessel and not a buoy at all. The exception is RACON buoys which are about the best possible radar targets.

Practice as discussed below is the key factor for good work in this area.

As mentioned in point 1.4, the key role of radar is more often to check the GPS than it is to actually establish your position from scratch. In this process, you plot your GPS position on the chart, then use parallel rulers and dividers to check the range and bearing to what might be good radar targets in range. Then look at the radar to confirm these observations. If in soundings, compare the depth as well.

VRM as Danger Circle

There are many creative ways to use the VRM circle for navigation. Here are a couple suggestions, others will occur to you underway to meet specific nav problems.

(1) Sailing parallel to a coastline within radar range, you can set the VRM circle to just touch the coastline. Then as you proceed along the coast, just a quick look at radar screen tells if you are getting set in toward or away from the coast, or if you have wandered off course for any reason.

(2) Approaching a headland or rocks in view on the radar, you can decide how close you dare get in based on the chart, then add some safety factor, and set the VRM to that distance. Then as you approach, you can tell without further reckoning when you are at the minimum distance off.

(3) Some combination of (1) and (2) can often be useful such as crossing a large bay or entrance. Set the VRM to the distance off that you were following the coast up to the entrance and then leave it set as the coast falls away into the opening. The VRM will now not be touching any land, but you can see the lay of the coastline lower on the screen. Use a parallel line (parallel to ship's heading line) to project the tangent to the VRM backwards to see if your circle is penetrating into the entrance or slipping away from it -- i.e., getting set into it or out of it.

(4) You can navigate to a particular point on the chart in an easy manner if it happens to be equal distant from two distinct radar targets separated by at least half the distance off you care to achieve. Set the VRM to the particular distance, then drive in and adjust course as needed until both targets touch the VRM circle. This will put you at a unique place on the chart.

Related navigation procedures involve sailing a natural range read from the radar. These are more EBL techniques, than VRM ones. They are covered in the next point.

Miscellaneous Tricks

Again, as with the VRM methods discussed before, there are numerous uses of the EBL line for navigation, and other general techniques that can help with navigation in some form. A few are listed here that have proved useful to the author in the past.

(1) As with visual navigation, any use of a natural range for monitoring course is especially valuable. When sailing toward or away from any two stationary radar targets in range, you have a quick and accurate means of determining if you are being set.

(2) Occasionally on approaching a coast there can be numerous small targets near the entrance. When looking for a buoy channel, read from the chart what the buoy spacing is along with the compass bearing of the channel. Then you can identify the buoys from the radar by measuring the spacing and confirming the bearing. Mark the candidates on the screen, and use portable range scale to check separation. Then set EBL parallel to the lay of these targets and confirm its bearing.

(3) In some circumstances, radar is useful for choosing a place to anchor within a crowded anchorage and then later used to confirm or check for anchor drag.

(4) In some circumstances, with a prominent landmark or well identified buoy on the radar screen, you can use the length of its plot trail as a measure of your distance run for solving the relative motion diagram and thus save or confirm this simple computation.

(5) You can use radar and the relative motion diagram to analyze squall motions. Once you confirm the motion of one or two, you can guess that subsequent ones during the night will move in the same way. Most squalls in the Northern Hemisphere, tend to move in a direction that is veered from that of the surface wind direction by about 20° or so, at typical speeds of about 15 knots.

(6) Don't forget that you can measure the dimensions of landmarks with the radar. This will often help identify it, i.e. if this is that islet, it should be 0.43 miles across. Is it? Or if that indentation is the entrance, it should be 1.2 miles wide, etc. Set the optimum range and then use a portable range scale to check it.

Again, as with the VRM methods discussed in Lesson 6.4, there are numerous uses of the EBL line for navigation, and other general techniques that can help with navigation in some form. A few are listed here that have proved useful to the author in the past.

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6. SAR OPERATIONS

SAR operations are the product of careful planning and joint work. The Basis for the procedures are completely detailed in IMO's IAMSAR Manual

The success of a SAR operation depends greatly on the speed at which it is planned and carried-out. It must be assumed that in every SAR operation there will be survivors needing assistance and that with the pass of time the chances of survival diminishes.

- **Coordination of SAR operations.**
    - Requirements for coordination
    - Coordination by Land-based authorities
    - On-scene-coordination
    - Designation of OSC and his responsibilities
    - RCC/RSC communication with OSC/CSS

Coordination between the search parties and the SAR operation coordination is of outmost importance since this will avoid unnecessary or wrong actions and will at the same time increase the chances of success.

- **Action by ship in distress**
    - Transmission of distress message
    - Components of the distress message
    - Direction-finding and homing
    - Cancellation of distress message
    - Training

Actions by the ship in distress are very important if its crew wants to improve their chances of survival. Training of the diverse survival techniques, radio-communications and the best use of their equipment are ways to achieve this.

- **Action by assisting ships**
    - Distress call and message
    - Immediate action

- Proceeding to the area of distress
- On-board preparation
- Aircraft casualties
- Establishment of the CSS
- Visual identification of the CSS
- Control of inter-ship communications
- Approaching the scene
- Arrival on scene
- Search procedures

The assistance by nearby ships might be the only available assistance especially if it the case of a distressed ship located in open ocean. The complete knowledge of the SAR procedures is important to ensure a successful operation.

- **Assistance by SAR aircraft**
  - General
  - Assistance by helicopters

- **Planning & Conducting the search**
  - General
  - Responsibilities of the CSS
  - Planning the search
  - Visual Search
  - Radar Search
  - Interval between ships
  - Searching speed
  - Search patterns
  - Initiation of Search
  - Restricted Visibility
  - Further action after phase 1
  - Use of ship/aircraft coordinated pattern
  - Evidence of casualty found
  - Manoeuvring instructions
  - Standard text of messages

Good communication and coordination between the search parties will undoubtedly contribute to the success of any SAR operation.

- **Conclusion of search**
  - Successful - Rescue
  - Unsuccessful

- **Communications**
  - GMDSS
  - Visual Communication facilities
  - Communication with assisting aircraft
  - Air-Surface visual signals

- Aircraft casualty at sea
  - Distress signals
  - Action taken to render assistance
  - Rescue Action
  - Questioning survivors

7. Onboard Emergencies & Contingency Plans.

Onboard emergencies are not as uncommon as we would have preferred and it is exactly why preparation and contingency plans are so important.

With the modernization of the shipping industry (the availability of new equipment, new construction techniques & requirements) it has become increasingly important the development and planning of contingency plans to affront all the probable situations.

In order to be as effective as possible the preparation of contingency plans is a subject that has to be addressed by every master and his crew as a team. Contingency plans should not be only the product of Master and Officers decisions but in fact the result of a team work.

What if….?

What if…?, this is the question that we all at some point have asked ourselves…….and if not we should start asking.

The alternatives to complete the question are many………..the steering gear fails,…… we have a collision,…….. we encounter boisterous weather,…………have require a medical evacuation; these are just to mention a few.

Contingency Planning is putting together all the possible answer to that question.

When preparing contingency plans there are several factor to be considered:

- Situation
  - Collision
  - Fire
  - Grounding….etc
- Resources
  - Personnel

- Equipment

- Particularities of the Ship
- External & Internal Circumstances & Influences
- Internationally Standardized Procedures & Regulations.

8. United Nations Organization

HOW THE UN WORKS

The United Nations was established on 24 October 1945 by 51 countries committed to preserving peace through international cooperation and collective security. Today, nearly every nation in the world belongs to the UN: membership now totals 189 countries.

When States become Members of the United Nations, they agree to accept the obligations of the UN Charter, an international treaty which sets out basic principles of international relations. According to the Charter, the UN has four purposes: to maintain international peace and security, to develop friendly relations among nations, to cooperate in solving international problems and in promoting respect for human rights, and to be a centre for harmonizing the actions of nations.

UN Members are sovereign countries. The United Nations is not a world government, and it does not make laws. It does, however, provide the means to help resolve international conflict and formulate policies on matters affecting all of us. At the UN, all the Member States - large and small, rich and poor, with differing political views and social systems - have a voice and vote in this process.

The United Nations has six main organs. Five of them - the General Assembly, the Security Council, the Economic and Social Council, the Trusteeship Council and the Secretariat - are based at UN Headquarters in New York. The sixth, the International Court of Justice, is located at The Hague, the Netherlands.

The General Assembly

All UN Member States are represented in the General Assembly - a kind of parliament of nations which meets to consider the world's most pressing problems. Each Member State has one vote. Decisions on "important matters," such as international peace and security, admitting new members, the UN budget and the budget for peacekeeping, are decided by two-thirds majority.

Other matters are decided by simple majority. In recent years, a special effort has been made to reach decisions through consensus, rather than by taking a formal vote.

At its 2000/2001 session, the Assembly is considering more than 170 different topics, including globalization, nuclear disarmament, development, protection of the environment and consolidation of new democracies. The Assembly cannot force action by any State, but its recommendations are an important indication of world opinion and represent the moral authority of the community of nations.

The Assembly holds its annual regular session from September to December. When necessary, it may resume its session, or hold a special or emergency session on subjects of particular concern. When the Assembly is not meeting, its work is carried out by its six main committees, other subsidiary bodies and the UN Secretariat.

The Security Council

The UN Charter gives the Security Council primary responsibility for maintaining international peace and security. The Council may convene at any time, day or night, whenever peace is threatened. Under the Charter, all Member States are obligated to carry out the Council's decisions.

There are 15 Council members. Five of these - China, France, the Russian Federation, the United Kingdom and the United States - are permanent members. The other 10 are elected by the General Assembly for two-year terms. Member States have discussed making changes in Council membership to reflect today's political and economic realities.

Decisions of the Council require nine yes votes. Except in votes on procedural questions, a decision cannot be taken if there is a no vote, or veto, by a permanent member.

When the Council considers a threat to international peace, it first explores ways to settle the dispute peacefully. It may suggest principles for a settlement or undertake mediation. In the event of fighting, the Council tries to secure a ceasefire. It may send a peacekeeping mission to help the parties maintain the truce and to keep opposing forces apart.

The Council can take measures to enforce its decisions. It can impose economic sanctions or order an arms embargo. On rare occasions, the Council has authorized Member States to use "all necessary means," including collective military action, to see that its decisions are carried out.

The Council also makes recommendations to the General Assembly on the appointment of a new Secretary-General and on the admission of new Members to the UN.

The Economic and Social Council

The Economic and Social Council, under the overall authority of the General Assembly, coordinates the economic and social work of the United Nations and the UN family. As the central forum for discussing international economic and social issues and for formulating policy recommendations, the Council plays a key role in fostering international cooperation for development. It also consults with non-governmental organizations (NGOs), thereby maintaining a vital link between the United Nations and civil society.

The Council has 54 members, elected by the General Assembly for three-year terms. It meets throughout the year and holds a major session in July, during which a special meeting of Ministers discusses major economic and social issues. Beginning in 1998, the Council expanded its discussions to include humanitarian themes.

The Council's subsidiary bodies meet regularly and report back to it. The Commission on Human Rights, for example, monitors the observance of human rights throughout the world. Other bodies focus on such issues as social development, the status of women, crime prevention, narcotic drugs and environmental protection. Five regional commissions promote economic development and strengthened economic relations in their respective regions.

The Trusteeship Council

The Trusteeship Council was established to provide international supervision for 11 Trust Territories administered by 7 Member States and ensure that adequate steps were taken to prepare the Territories for self-government or independence. By 1994, all Trust Territories had attained self-government or independence, either as separate States or by joining neighbouring independent countries. The last to do so was the Trust Territory of the Pacific Islands (Palau), administered by the United States, which became the 185th Member State.

Its work completed, the Trusteeship Council now consists only of the five permanent members of the Security Council. It has amended its rules of procedure to allow it to meet as and when occasion requires.

The International Court of Justice

The International Court of Justice, also known as the World Court, is the main judicial organ of the UN. Consisting of 15 judges elected by the General Assembly and the Security Council, the Court decides disputes between countries. Participation by States in a proceeding is voluntary, but if a State agrees to participate, it is obligated to comply with the Court's decision. The Court also provides advisory opinions to the General Assembly and the Security Council upon request.

The Secretariat

The Secretariat carries out the substantive and administrative work of the United Nations as directed by the General Assembly, the Security Council and the other organs. At its head is the Secretary-General, who provides overall administrative guidance.

The Secretariat consists of departments and offices with a total staff of about 8,900 under the regular budget, drawn from some 160 countries. Duty stations include UN Headquarters in New York as well as UN offices in Geneva, Vienna and Nairobi.

THE SPECIALIZED AGENCIES

Autonomous organizations joined to the UN through special agreements:

ILO (International Labour Organization)

Formulates policies and programmes to improve working conditions and employment opportunities, and sets labour standards used by countries around the world.

FAO (Food and Agriculture Organization of the UN)

Works to improve agricultural productivity and food security, and to better the living standards of rural populations.

UNESCO (UN Educational, Scientific and Cultural Organization)

Promotes education for all, cultural development, protection of the world's natural and cultural heritage, international cooperation in science, press freedom and communication.

WHO (World Health Organization)

Coordinates programmes aimed at solving health problems and the attainment by all people of the highest possible level of health. It works in areas such as immunization, health education and the provision of essential drugs.

World Bank group

Provides loans and technical assistance to developing countries to reduce poverty and advance sustainable economic growth.

IMF (International Monetary Fund)

Facilitates international monetary cooperation and financial stability and provides a permanent forum for consultation, advice and assistance on financial issues.

ICAO (International Civil Aviation Organization)

Sets international standards for the safety, security and efficiency of air transport and serves as the coordinator for international cooperation in all areas of civil aviation.

UPU (Universal Postal Union)

Establishes international regulations for postal services, provides technical assistance and promotes cooperation in postal matters.

ITU (International Telecommunication Union)

Fosters international cooperation to improve telecommunications of all kinds, coordinates usage of radio and TV frequencies, promotes safety measures and conducts research.

WMO (World Meteorological Organization)

Promotes scientific research on the Earth's atmosphere and on climate change and facilitates the global exchange of meteorological data.

IMO (International Maritime Organization)

Works to improve international shipping procedures, raise standards in marine safety and reduce marine pollution by ships.

WIPO (World Intellectual Property Organization)

Promotes international protection of intellectual property and fosters cooperation on copyrights, trademarks, industrial designs and patents.

IFAD (International Fund for Agricultural Development)

Mobilizes financial resources to raise food production and nutrition levels among the poor in developing countries.

UNIDO (UN Industrial Development Organization)

Promotes the industrial advancement of developing countries through technical assistance, advisory services and training.

IAEA (International Atomic Energy Agency)

An autonomous intergovernmental organization under the aegis of the UN, works for the safe and peaceful uses of atomic energy.

The UN is working to make the world a better place:

The UN formulated the historic Universal Declaration of Human Rights (1948), as well as more than 80 human rights treaties which help protect and promote specific rights.

UN peacekeeping is a vital instrument for peace. Currently some 37,400 UN military and civilian personnel, provided by 89 countries, are engaged in 15 operations around the world.

UN environmental conventions have helped reduce acid rain in Europe and North America, cut marine pollution worldwide, and phase out production of gases destroying the Earth's ozone layer.

The UN and its agencies, including the World Bank and the UN Development Programme, are the premier vehicle for furthering development in poorer countries, providing assistance worth more than $30 billion a year.

More international law has been developed through the UN in the past five decades than in all previous history.

A joint UNICEF-World Health Organization (WHO) programme has immunized 80 per cent of the world's children against six killer diseases, saving the lives of more than 2 million children a year.

The World Food Programme provides each year about one third of the world's food aid.

Air traffic the world over is safer, thanks to rules and regulations agreed on through the International Civil Aviation Organization.

UN appeals raise more than $1 billion a year for emergency assistance to victims of war and natural disaster.

Smallpox was eradicated from the world through a global campaign coordinated by WHO. Another WHO campaign has eliminated polio from the Americas, and aims at eradicating it globally by 2005.

UN agencies help to aid and protect more than 25 million refugees and displaced persons throughout the world.

Expenditures of the UN system on operational activities for development - mostly for economic and social programmes to help the world's poorest countries - amount to some $4 billion a year (excluding the World Bank and the International Monetary Fund). This is equal to 0.2 per cent of world military expenditures.

United Nations Convention on the Law of the Sea of 10 December 1982

Overview

The United Nations Convention on the Law of the Sea lays down a comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources. It enshrines the notion that all problems of ocean space are closely interrelated and need to be addressed as a whole.

The Convention was opened for signature on 10 December 1982 in Montego Bay, Jamaica. This marked the culmination of more than 14 years of work involving participation by more than 150 countries representing all regions of the world, all legal and political systems and the spectrum of socio/economic development. At the time of its adoption, the Convention embodied in one instrument traditional rules for the uses of the oceans and at the same time introduced new legal concepts and regimes and addressed new concerns. The Convention also provided the framework for further development of specific areas of the law of the sea.

The Convention entered into force in accordance with its article 308 on 16 November 1994, 12 months after the date of deposit of the sixtieth instrument of ratification or accession. Today, it is the globally recognized regime dealing with all matters relating to the law of the sea.

The Convention comprises 320 articles and nine annexes, governing all aspects of ocean space, such as delimitation, environmental control, marine scientific research, economic and commercial activities, transfer of technology and the settlement of disputes relating to ocean matters.

Some of the key features of the Convention are the following:

* Coastal States exercise sovereignty over their territorial sea which they have the right to establish its breadth up to a limit not to exceed 12 nautical miles; foreign vessels are allowed "innocent passage" through those waters;

* Ships and aircraft of all countries are allowed "transit passage" through straits used for international navigation; States bordering the straits can regulate navigational and other aspects of passage;

* Archipelagic States, made up of a group or groups of closely related islands and interconnecting waters, have sovereignty over a sea area enclosed by straight lines drawn between the outermost points of the islands; all other States enjoy the right of archipelagic passage through such designated sea lanes;

* Coastal States have sovereign rights in a 200-nautical mile exclusive economic zone (EEZ) with respect to natural resources and certain economic activities, and exercise jurisdiction over marine science research and environmental protection;

* All other States have freedom of navigation and overflight in the EEZ, as well as freedom to lay submarine cables and pipelines;

* Land-locked and geographically disadvantaged States have the right to participate on an equitable basis in exploitation of an appropriate part of the surplus of the living resources of the EEZ's of coastal States of the same region or sub-region; highly migratory species of fish and marine mammals are accorded special protection;

* Coastal States have sovereign rights over the continental shelf (the national area of the seabed) for exploring and exploiting it; the shelf can extend at least 200 nautical miles from the shore, and more under specified circumstances;

* Coastal States share with the international community part of the revenue derived from exploiting resources from any part of their shelf beyond 200 miles;

* The Commission on the Limits of the Continental Shelf shall make recommendations to States on the shelf's outer boundaries when it extends beyond 200 miles;

* All States enjoy the traditional freedoms of navigation, overflight, scientific research and fishing on the high seas; they are obliged to adopt, or cooperate with other States in adopting, measures to manage and conserve living resources;

* The limits of the territorial sea, the exclusive economic zone and continental shelf of islands are determined in accordance with rules applicable to land territory, but rocks which could not sustain human habitation or economic life of their own would have no economic zone or continental shelf;

* States bordering enclosed or semi-enclosed seas are expected to cooperate in managing living resources, environmental and research policies and activities;

* Land-locked States have the right of access to and from the sea and enjoy freedom of transit through the territory of transit States;

* States are bound to prevent and control marine pollution and are liable for damage caused by violation of their international obligations to combat such pollution;

* All marine scientific research in the EEZ and on the continental shelf is subject to the consent of the coastal State, but in most cases they are obliged to grant consent to other States when the research is to be conducted for peaceful purposes and fulfils specified criteria;
* States are bound to promote the development and transfer of marine technology "on fair and reasonable terms and conditions", with proper regard for all legitimate interests;

* States Parties are obliged to settle by peaceful means their disputes concerning the interpretation or application of the Convention;

* Disputes can be submitted to the International Tribunal for the Law of the Sea established under the Convention, to the International Court of Justice, or

to arbitration. Conciliation is also available and, in certain circumstances, submission to it would be compulsory. The Tribunal has exclusive jurisdiction over deep seabed mining disputes.

20 YEARS OF THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA 1982-2002

On 10 December 1982, the United Nations Convention on the Law of the Sea was opened for signature at Montego Bay, Jamaica. This marked the culmination of over 14 years of work involving participation by more than 150 countries representing all regions of the world, all legal and political systems, all degrees of socio-economic development. They comprised coastal States, States described as geographically disadvantaged with regard to ocean space, archipelagic States, island States and land-locked States. These countries convened for the purpose of establishing a comprehensive regime "dealing with all matters relating to the law of the sea, . . . bearing in mind that the problems of ocean space are closely interrelated and need to be considered as a whole." The fruits of their labours are embodied in the United Nations Convention on the Law of the Sea.

On that first day, signatures from 119 delegations comprising 117 States, the Cook Islands (a self-governing associated state) and the United Nations Council for Namibia, were appended to the Convention. In addition, one ratification, that of Fiji, was deposited that day. Never before had such overwhelming support been demonstrated so concretely on the first day that a treaty was opened for signature. The Convention's first achievement in its own right was unprecedented in the history of treaty law. In total, the Convention has been signed by 159 States (including the former German Democratic Republic and the former Yugoslavia) and has been ratified or acceded to by more than 130 States and the European Community.

The Convention is multifaceted and represents a monument to international cooperation in the treaty-making process: the need to elaborate a new and comprehensive regime for the law of the sea was perceived, and the international community expressed its collective will to cooperate in this effort on a scale the magnitude of which was unprecedented in treaty history. The elaboration of the Convention represents an attempt to establish true universality in the effort to achieve a "just and equitable international economic order" governing ocean space.

These ideals were transformed through the treaty-making process into the substance of the text, which itself is of unique nature. It comprises 320 articles and nine annexes, governing all aspects of ocean space from delimitations to environmental control, scientific research, economic and commercial activities, technology and the settlement of disputes relating to ocean matters. An examination of the character of the individual provisions reveals that the Convention represents not only the codification of customary norms, but also and more significantly the progressive development of international law, and contains the constituent instruments of two major new international organizations.

It is, however, the conceptual underpinnings of the Convention as a "package" which is its most significant quality, and has contributed most distinctly to the remarkable achievement of the Convention. Its quality as a package is a result of the singular nature of the circumstances from which it emerged, including the close interrelationship of the many different issues involved, the large number of participating States and the vast number of often conflicting interests which frequently cut across the traditional lines of negotiation by region. In addition, the strong desire that the Convention allow for flexibility of practice in order to ensure durability over time to avoid encroaching upon the sovereignty of States was recognized as another important consideration. All of these factors necessitated that every individual provision of the text be weighed within the context of the whole, producing an intricately balanced text to provide a basis for universality.

The concept of the package pervaded all work on the elaboration of the Convention and was not limited to consideration of substance alone. It became the leitmotiv of the Conference and in fact permeates the law of the sea as it exists today.

9. ILO – International Labour Organization

Mandate

The International Labour Organization is the UN specialized agency which seeks the promotion of social justice and internationally recognized human and labour rights. It was founded in 1919 and is the only surviving major creation of the Treaty of Versailles which brought the League of Nations into being and it became the first specialized agency of the UN in 1946.

The ILO formulates international labour standards in the form of Conventions and Recommendations setting minimum standards of basic labour rights: freedom of association, the right to organize, collective bargaining, abolition of forced labour, equality of opportunity and treatment, and other standards regulating conditions across the entire spectrum of work related issues. It provides technical assistance primarily in the fields of vocational training and vocational rehabilitation; employment policy; labour administration; labour law and industrial relations; working conditions; management development; cooperatives; social security; labour statistics and occupational safety and health. It promotes the development of independent employers' and workers' organizations and provides training and advisory services to those organizations. Within the UN system, the ILO has a unique tripartite structure with workers and employers participating as equal partners with governments in the work of its governing organs.

History

The International Labour Organization was created in 1919, at the end of the First World War, at the time of the Peace Conference which convened first in Paris, then at Versailles. The need for such an organization had been advocated in the nineteenth century by two industrialists, Robert Owen (1771-1853) of Wales and Daniel Legrand (1783-1859) of France.

After having been put to the test within the International Association for Labour Legislation, founded in Basel in 1901, their ideas were incorporated into the Constitution of the International Labour Organization, adopted by the Peace Conference in April of 1919.

The initial motivation was humanitarian. The condition of workers, more and more numerous and exploited with no consideration for their health, their family lives and their advancement, was less and less acceptable. This preoccupation appears clearly in the Preamble of the Constitution of the ILO, where it is stated, "conditions of labour exist involving ... injustice, hardship and privation to large numbers of people. "

The second motivation was political. Without an improvement in their condition, the workers, whose numbers were ever increasing as a result of industrialization, would create social unrest, even revolution. The Preamble notes that injustice produces "unrest so great that the peace and harmony of the world are imperilled."

The third motivation was economic. Because of its inevitable effect on the cost of production, any industry or country adopting social reform would find itself at a disadvantage vis-à-vis its competitors. The Preamble states that "the failure of any nation to adopt humane conditions of labour is an obstacle in the way of other nations which desire to improve the conditions in their own countries."

Another reason for the creation of the International Labour Organization was added by the participants of the Peace Conference, linked to the end of the war to which workers had contributed significantly both on the battlefield and in industry. This idea appears at the very beginning of the Constitution: "universal and lasting peace can be established only if it is based upon social justice."

The ILO Constitution was written between January and April, 1919, by the Labour Commission set up by the Peace Conference. The Commission was composed of representatives from nine countries, Belgium, Cuba, Czechoslovakia, France, Italy, Japan, Poland, the United Kingdom and the United States, under the chairmanship of Samuel Gompers, head of the American Federation of Labour (AFL). It resulted in a tripartite organization, the only one of its kind bringing together representatives of governments, employers and workers in its executive bodies. The ILO Constitution became Part XIII of the Treaty of Versailles.

The first annual International Labour Conference, composed of two representatives from the government, and one each from employers' and workers' organizations from each member State, met in Washington beginning on 29 October 1919. It adopted the first six International Labour Conventions, which dealt with hours of work in industry, unemployment, maternity protection, night work for women, minimum age and night work for young persons in industry.

The Governing Body, the ILO executive council elected by the Conference, half of whose members are government representatives, one-fourth workers' representatives and one-fourth employers' representatives, chose Albert Thomas as the first Director of the International Labour Office, which is the permanent Secretariat of the Organization. He was a French politician with a deep interest in social questions and a member of the wartime government responsible for munitions. He gave the Organization a strong impetus from the very beginning. In less than two years, 16 International Labour Conventions and 18 Recommendations had been adopted.

The ILO was set up in Geneva in the summer of 1920. The zeal which drove the Organization was very quickly toned down. Certain governments felt that there were too many Conventions, the publications were too critical and the budget too high. Thus everything had to be reduced. Nevertheless, the International Court of Justice, under pressure from the Government of France, declared that the ILO's domain extended also to international regulation of conditions of work in the agricultural sector.

In 1926, an important innovation was introduced when the International Labour Conference set up a supervisory system on the application of its standards, which still exists today. It created the Committee of Experts composed of independent jurists responsible for examining government reports and presenting its own report each year to the Conference.

In 1932, after having assured the ILO's strong presence in the world for thirteen years, Albert Thomas suddenly died. His successor, Harold Butler of England, his deputy since the birth of the Organization, was soon confronted by the Great Depression with its resulting massive unemployment. During this period, workers' and employers' representatives confronted each other on the subject of the reduction of working hours, without any appreciable results. In 1934, under the presidency of Franklin D. Roosevelt, the United States, which did not belong to the League of Nations, became a Member of the ILO.

In 1939, John Winant, an American who was a former Governor of New Hampshire, the first head of the American Social Security System, then Deputy Director of the ILO, succeeded Harold Butler who had resigned. His main task was to prepare the Organization for the imminent war. In May,1940, the situation in Switzerland, isolated and threatened in the heart of a Europe at war, led the new Director to move the headquarters of the Organization temporarily to Montreal, Canada. In 1941, President Roosevelt named him Ambassador of the United States in London, where he replaced Joseph Kennedy.

Edward Phelan of Ireland was named Director in 1941. He knew the ILO in depth, having participated in the drafting of its Constitution. He played an important role once again during the Philadelphia meeting of the International Labour Conference, in the midst of the Second World War, attended by representatives of governments, employers and workers from 41 countries. The delegates adopted the Declaration of Philadelphia which, annexed to the Constitution, still constitutes the Charter of the aims and objectives of the ILO. In 1948, still during the period of his leadership of the ILO, the International Labour Conference adopted Convention No. 87 on freedom of association and the right to organize.

In 1948, an American, David Morse, who played an important role in the administration of President Harry Truman, was named to head the ILO, where he remained until 1970. During this long twenty-two year period, the number of member States doubled, the Organization took on its universal character, industrialized countries became a minority among developing countries, the budget grew five-fold and the number of officials quadrupled. In 1960, the ILO created the International Institute for Labour Studies at its Geneva headquarters, and the International Training Centre in Turin in 1965. And finally, in 1969, the ILO was awarded the Nobel Peace Prize as it commemorated its 50th anniversary.

David Morse accepting the Nobel Peace Prize on behalf of the ILO

The Englishman Wilfred Jenks, Director-General from 1970 until his death in 1973, was faced with a politicization of labour problems resulting from the East-West conflict. His profound knowledge of the Organization served him well in this task. In fact, he had been co-author with Edward Phelan of the Declaration of Philadelphia. A renowned jurist, he was a firm advocate of human rights, the rule of the law, tripartism and the moral authority of the ILO in international problems. He made a major contribution to the development of standards and the mechanisms for supervising their application, and particularly to the promotion of freedom of association and of the right to organize.

He was succeeded by Francis Blanchard, formerly a senior French Government official. Mr. Blanchard had spent the best part of his career with the ILO, where he played an active part in the large-scale development of technical cooperation. Both a diplomat and a man of conviction, he remained in that post for fifteen years, from 1974 to 1989. He succeeded in averting major damage to the ILO when a crisis triggered by the withdrawal of the United States from the Organization (1977 to 1980) resulted in the loss of one-fourth of its budget. The United States returned to the Organization at the beginning of the Reagan Administration. During this period, the ILO resolutely continued its work in defence of human rights. Thus, the ILO played a major role in the emancipation of Poland from dictatorship, by giving its full support to the legitimacy of the Solidarnosc Union based on respect for Convention No. 87 on freedom of association which Poland had ratified in 1957.

David Morse and President John F. Kennedy at the White House in 1963

In 1989, Michel Hansenne, former Belgian Minister of Employment and Labour and of the Civil Service, became the first Director-General of the post-Cold War period. Re-elected for a second term in 1993, he indicated that his primary responsibility was to lead the ILO into the 21st century with all the moral authority, professional competence and administrative efficiency which the Organization has demonstrated for 75 years. In the face of new challenges, he intends to give the ILO the means to play a full part in the major international councils on economic and social development, in order to place social justice at the heart of the debate. He has set the ILO on a course of greater decentralization of activities and resources away from Geneva under the ILO's Active Partnership Policy.

On 4 March 1999 Juan Somavia, an attorney by profession, took up office as the ILO's ninth Director-General. Mr. Somavia has had a long and distinguished career in civil and international affairs, serving, inter alia, as Chairman of the preparatory Council of the World Summit for Social Development (held in Copenhagen in 1995) and President of the UN Economic and Social Council (from 1993 to 1994). He has held the post of Ambassador of Chile and served as an Adviser to the Foreign Minister of Chile on Economic and Social Affairs. He was born on 21 April, 1941, and earned degrees in law and economics from the Catholic University of Chile and the University of Paris.

10. IMO

Introduction to the IMO

Shipping is perhaps the most international of all the world's great industries

and one of the most dangerous. It has always been recognized that the best way of improving safety at sea is by developing international regulations that are followed by all shipping nations and from the mid-19th century onwards a number of such treaties were adopted. Several countries proposed that a permanent international body should be established to promote maritime safety more effectively, but it was not until the establishment of the United Nations itself that these hopes were realized. In 1948 an international conference in Geneva adopted a convention formally establishing IMO (the original name was the Inter-Governmental Maritime Consultative Organization, or IMCO, but the name was changed in 1982 to IMO).

The IMO Convention entered into force in 1958 and the new Organization met for the first time the following year.

The purposes of the Organization, as summarized by Article 1(a) of the Convention, are "to provide machinery for cooperation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage and facilitate the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and prevention and control of marine pollution from ships". The Organization is also empowered to deal with administrative and legal matters related to these purposes.

IMO's first task was to adopt a new version of the International Convention for the Safety of Life at Sea (SOLAS), the most important of all treaties dealing with maritime safety. This was achieved in 1960 and IMO then turned its attention to such matters as the facilitation of international maritime traffic, load lines

and the carriage of dangerous goods, while the system of measuring the tonnage of ships was revised.
But although safety was and remains IMO's most important responsibility, a new problem began to emerge - pollution. The growth in the amount of oil being transported by sea and in the size of oil tankers was of particular concern and the Torrey Canyon disaster of 1967, in which 120,000 tonnes of oil was spilled, demonstrated the scale of the problem.

During the next few years IMO introduced a series of measures designed to prevent tanker accidents and to minimize their consequences. It also tackled the environmental threat caused by routine operations such as the cleaning of oil cargo tanks and the disposal of engine room wastes - in tonnage terms a bigger menace than accidental pollution.

The most important of all these measures was the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78). It covers not only accidental and operational oil pollution but also pollution by chemicals, goods in packaged form, sewage, garbage and air pollution.

IMO was also given the task of establishing a system for providing compensation to those who had suffered financially as a result of pollution. Two treaties were adopted, in 1969 and 1971, which enabled victims of oil pollution to obtain compensation much more simply and quickly than had been possible before. Both treaties were amended in 1992, and again in 2000, to increase the limits of compensation payable to victims of pollution.

IMO also developed a number of other legal conventions, most of which concern liability and compensation issues.
Shipping, like all of modern life, has seen many technological innovations and changes. Some of these have presented challenges for the Organization and others have presented opportunities. The enormous strides made in

communications technology, for example, have made it possible for IMO to introduce major improvements to the maritime distress system.

In the 1970s a global search and rescue system was initiated. The 1970s also saw the establishment of the International Mobile Satellite Organization (INMARSAT), which has greatly improved the provision of radio and other messages to ships.
In 1992 a further advance was made when the Global Maritime Distress and Safety System began to be phased in. In February 1999, the GMDSS became fully operational, so that now a ship that is in distress anywhere in the world can be virtually guaranteed assistance, even if the ship's crew do not have time to radio for help, as the message will be transmitted automatically.

Other measures introduced by IMO have concerned the safety of containers, bulk cargoes, liquefied gas tankers and other ship types. Special attention has been paid to crew standards, including the adoption of a special convention on standards of training, certification and watchkeeping.

The adoption of maritime legislation is still IMO's most important concern. Around 40 conventions and protocols have been adopted by the Organization and most of them have been amended on several occasions to ensure that they are kept up to date with changes taking place in world shipping.

But adopting treaties is not enough - they have to be put into effect. This is the responsibility of Governments and there is no doubt that the way in which this is done varies considerably from country to country.
IMO has introduced measures to improve the way legislation is implemented, by assisting flag States (the countries whose flag a ship flies) and by encouraging the establishment of regional port State control systems. When ships go to foreign ports they can be inspected to ensure that they meet IMO standards. By organizing these inspections on a regional rather than a purely national basis resources can be used more efficiently.

IMO has also developed a technical co-operation programme which is designed to assist Governments which lack the technical knowledge and resources that are needed to operate a shipping industry successfully. The emphasis of this programme is very much on training and perhaps the best example is the World Maritime University in Malmö, Sweden, which was established in 1983 and provides advanced training for the men and women involved in maritime administration, education and management.

Two initiatives in recent years are especially important. On 1 July 1998 the International Safety Management Code entered into force and became applicable to passenger ships, oil and chemical tankers, bulk carriers, gas carriers and cargo high speed craft of 500 gross tonnage and above. It becomes applicable to other cargo ships and mobile offshore drilling units of 500 gross tonnage and above not later than 1 July 2002.

On 1 February 1997, the 1995 amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 entered into force. They greatly improve seafarer standards and, for the first time, give IMO itself powers to check Government actions.

It is expected that these two measures, by raising standards of management and
shipboard personnel, will greatly improve safety and pollution prevention in the years to come.
With a staff of 300 people, IMO is one of the smallest of all United Nations agencies. But it has achieved considerable success in achieving its aim of "safer shipping and cleaner oceans". Ship casualty rates have declined and the amount of oil entering the sea from ships has been cut.

The challenge now facing IMO and its 161 Member States is how to maintain this success at a time when shipping is changing more rapidly than ever before.

Objective

IMO’s objectives can be summarised by the phrase:

Safer shipping and cleaner oceans

IMO is the United Nations' specialized agency responsible for improving maritime safety and preventing pollution from ships.

In 1999, the IMO's Assembly, at is 21st session adopted resolution A.900(21) Objectives of the Organization in the 2000s, which identifies IMO's main objectives for the 2000s as follows:

- Taking measures to implement the proactive policy agreed in the 1990s more actively than in the past, so that trends which might adversely affect the safety of ships and those on board and/or the environment may be identified at the earliest feasible stage and action taken to avoid or mitigate such effects. In implementing this directive, Formal Safety Assessment should be used to the extent possible in any rule-making process;
- Shifting emphasis onto people;
- Ensuring the effective uniform implementation of existing IMO standards and regulations;
- Ensuring the wide early acceptance of those Annexes to the MARPOL Convention which have not yet entered into force;
- Developing a safety culture and environmental conscience;
- Avoiding excessive regulation;
- Strengthening the Organization's technical co-operation programmes; and
- Promoting the intensification by Governments and industry of efforts to prevent and suppress unlawful acts which threaten the security of ships, the safety of those on board and the environment (in particular, terrorism at sea, piracy and armed robbery against ships, illicit drug trafficking, illegal migration by sea and stowaway cases).
- to continue observing resolution A.500(XII) **Objectives of the Organization in the 1980s** and resolution A.777(18) Work methods and organization of work.

The resolution highlights the efforts of the Secretary-General to promote:

- the objectives of the Organization (in particular, his decisive action and leadership provided towards enhancing the safety of ro-ro passenger ships and bulk carriers and the expeditious revision of the STCW Convention); and

- the world-wide implementation of the standards and regulations adopted by the Organization (in particular, his efforts to ensure the wide and effective implementation of the revised STCW Convention, ISM Code, MARPOL 73/78 and the FAL Convention),

The resolution also notes the special contribution of the World Maritime University, the IMO International Maritime Law Institute and the IMO International Maritime Academy in achieving the IMO objectives

Structure

The Organization consists of an Assembly, a Council and four main Committees: the Maritime Safety Committee; the Marine Environment Protection Committee; the Legal Committee; and the Technical Co-operation Committee. There is also a Facilitation Committee and a number of Sub-Committees support the work of the main technical committees.

Assembly

This is the highest Governing Body of the Organization. It consists of all Member States and it meets once every two years in regular sessions, but may also meet in an extraordinary session if necessary. The Assembly is responsible for approving the work programme, voting the budget and determining the financial arrangements of the Organization. The Assembly also elects the Council.

Council

The Council is elected by the Assembly for two-year terms beginning after each regular session of the Assembly.

The Council is the Executive Organ of IMO and is responsible, under the Assembly, for supervising the work of the Organization. Between sessions of the Assembly the Council performs all the functions of the Assembly, except the function of making recommendations to Governments on maritime safety and pollution prevention which is reserved for the Assembly by Article 15(j) of the Convention.
Other functions of the Council are to:

(a) co-ordinate the activities of the organs of the Organization;

(b) consider the draft work programme and budget estimates of the Organization and submit them to the Assembly;

(c) receive reports and proposals of the Committees and other organs and submit them to the Assembly and Member States, with comments and recommendations as appropriate;

(d) appoint the Secretary-General, subject to the approval of the Assembly;

(e) enter into agreements or arrangements concerning the relationship of the Organization with other organizations, subject to approval by the Assembly.

Council members

The IMO Convention provides that in electing the Members of the Council the Assembly shall observe the following criteria (but see Increasing size of Council below):

(a) eight shall be States with the largest interest in providing international shipping services;

(b) eight shall be other States with the largest interest in international seaborne trade; and

(c) sixteen shall be States not elected under (a) or (b) above which have special interests in maritime transport or navigation and whose election to the Council will ensure the representation of all major geographic areas of the world.
The Members of the Council elected by the 21st Assembly in 1999 for 2000-2001 are as follows:

(a) China, Greece, Italy, Japan, Norway, Russian Federation, United Kingdom, United States;

(b) Argentina, Brazil, Canada, France, Germany, India, Netherlands, Sweden; and

(c) Australia, Bahamas, Cyprus, Egypt, Finland, Indonesia, Malta, Mexico, Morocco, Panama, Philippines, Republic of Korea, Singapore, South Africa, Spain, Turkey.

The Members of the Council elected by the 22nd Assembly in 2001 for **2002 up to 7 November 2002** are as follows:

(a) China, Greece, Italy, Japan, Norway, Russian Federation, United Kingdom, United States;

(b) Argentina, Brazil, Canada, France, Germany, India, Netherlands, Sweden; and

(c) Australia, Bahamas, Cyprus, Egypt, Indonesia, Malta, Mexico, Nigeria, Panama, the Philippines, Poland, Republic of Korea, Singapore, South Africa, Spain, Turkey.

Increasing size of Council

In November 1993 the Assembly adopted an amendment to the IMO Convention which, upon entry into force, will increase the size of the Council to

40. Groups (a) and (b) will be increased to 10 Members and Group (c) to 20. The amendment will enter into force on 7 November 2002.

Therefore, the Members of the Council elected by the 22^{nd} Assembly in 2001 for **2002 (from 7 November 2002) and 2003** are as follows:

(a) China, Greece, Italy, Japan, Norway, Panama, Republic of Korea, Russian Federation, United Kingdom, United States;

(b) Argentina, Bangladesh, Brazil, Canada, France, Germany, India, Netherlands, Spain, Sweden; and

(c) Australia, Bahamas, Chile, Cyprus, Denmark, Egypt, Ghana, Honduras, Kenya, Indonesia, Lebanon, Malta, Mexico, Nigeria, the Philippines, Poland, Singapore, South Africa, Turkey, Venezuela.

Maritime Safety Committee (MSC)

The MSC is the highest technical body of the Organization. It consists of all Member States. The functions of the Maritime Safety Committee are to "consider any matter within the scope of the Organization concerned with aids to navigation, construction and equipment of vessels, manning from a safety standpoint, rules for the prevention of collisions, handling of dangerous cargoes, maritime safety procedures and requirements, hydrographic information, log-books and navigational records, marine casualty investigations, salvage and rescue and any other matters directly affecting maritime safety".

The Committee is also required to provide machinery for performing any duties assigned to it by the IMO Convention or any duty within its cope of work which may be assigned to it by or under any international instrument and accepted by the Organization. It also has the responsibility for considering and submitting recommendations and guidelines on safety for possible adoption by the Assembly.

The “expanded MSC” adopts amendments to conventions such as SOLAS and includes all Member States as well as those countries which are Party to conventions such as SOLAS even if they are not IMO Member States.

The Marine Environment Protection Committee (MEPC)

The MEPC, which consists of all Member States, is empowered to consider any matter within the scope of the Organization concerned with prevention and control of pollution from ships. In particular it is concerned with the adoption and amendment of conventions and other regulations and measures to ensure their enforcement.

The MEPC was first established as a subsidiary body of the Assembly and raised to full constitutional status in 1985.

Sub-Committees

The MSC and MEPC are assisted in their work by nine sub-committees which are also open to all Member States. They deal with the following subjects:

Bulk liquids and Gases (BLG)
Carriage of Dangerous Goods, Solid Cargoes and Containers(DSC)
Fire Protection (FP)
Radio-communications and Search and Rescue (COMSAR)
Safety of Navigation (NAV)
Ship Design and Equipment (DE)
Stability and Load Lines and Fishing Vessels Safety (SLF)
Standards of Training and Watchkeeping (STW)
Flag State Implementation (FSI)

Legal Committee

The Legal Committee is empowered to deal with any legal matters within the scope of the Organization. The Committee consists of all Member States of IMO.

It was established in 1967 as a subsidiary body to deal with legal questions which arose in the aftermath of the **Torrey Canyon** disaster.

The Legal Committee is also empowered to perform any duties within its scope which may be assigned by or under any other international instrument and accepted by the Organization.

Technical Co-operation Committee

The Technical Co-operation Committee is required to consider any matter within the scope of the Organization concerned with the implementation of technical co-operation projects for which the Organization acts as the executing or co-operating agency and any other matters related to the Organization's activities in the technical co-operation field.

The Technical Co-operation Committee consists of all Member States of IMO, was established in 1969 as a subsidiary body of the Council, and was institutionalized by means of an amendment to the IMO Convention which entered into force in 1984.

Facilitation Committee

The Facilitation Committee is a subsidiary body of the Council. It was established in May 1972 and deals with IMO's work in eliminating unnecessary formalities and "red tape" in international shipping. Participation in the Facilitation Committee is open to all Member States of IMO.

The 1991 amendments to the IMO Convention, when they come into force, will institutionalise the Facilitation Committee, putting it on the same standing as the other Committees. However, these amendments have not yet received enough acceptances to come into force. See **Status of conventions – summary.**

Secretariat

The Secretariat of IMO consists of the Secretary-General and nearly 300 personnel based at the headquarters of the Organization in London.
The Secretary-General of the Organization is Mr. W.A. O'Neil of Canada who was appointed to the position with effect from 1 January 1990. The holders of the office have been:

Ove Nielsen (*Denmark*) 1959-1961
William Graham (*United* Kingdom, Acting) 1961-1963
Jean Roullier (*France*) 1964-1967
Colin Goad (*United Kingdom*) 1968-1973
Chandrika Prasad Srivastava (India) 1974-1989
William A. O'Neil (*Canada*) 1990-

Budget 2000-2001

The IMO Assembly in November 2001 approved budgetary appropriations of £39,531,100 for 2002-2003. This compares with an appropriation of £36,612,200 for 2000-2001.

Contributions to the IMO budget are based on a formula which is different from that used in other United Nations agencies: the amount paid by each Member State depends primarily on the tonnage of its merchant fleet.

The top ten contributors for 2000 were assessed as follows (the figures show the amount payable and as a percentage of the total budget):

1	Panama	2.90	15.80
2	Liberia	1.86	10.17

3	Japan	0.96	5.23
4	Bahamas	0.81	4.36
5	Greece	0.80	4.32
6	USA	0.76	4.12
7	Malta	0.73	3.96
8	Cyprus	0.72	3.91
9	Norway	0.71	3.86

10 Singapore 0.61 3.31

Regional Co-ordination

IMO has appointed three regional co-ordinators in Africa.

Conference

Co-ordination and Servicing of Meetings

The Conference Division is responsible for the co-ordination and servicing of all IMO Meetings in the six official languages of the Organization: Arabic, Chinese, English, French, Russian and Spanish.

Documents

IMO Documents are available to Member States, IGOs which have concluded agreements of co-operation with IMO and NGOs in Consultative Status with IMO, through a dedicated password-protected website: IMODOCS

IMO Member States with year of joining

Albania 1993
Algeria 1963
Angola 1977
Antigua and Barbuda 1986
Argentina 1953
Australia 1952
Austria 1975
Azerbaijan 1995
Bahamas 1976
Bahrain 1976
Bangladesh 1976
Barbados 1970
Belgium 1951
Belize 1990
Benin 1980
Bolivia 1987
Bosnia and Herzegovina 1993
Brazil1 963
Brunei Darussalam 1984
Bulgaria 1960
Cambodia 1961
Cameroon 1961
Canada 1948
Cape Verde 1976
Chile 1972
China 1973
Colombia 1974
Comoros Islands 2001
Congo 1975
Costa Rica 1981
Côte d'Ivoire 1960
Croatia 1992
Cuba 1966
Cyprus 1973
Czech Republic 1993
Democratic People's Republic of Korea 1986
Democratic Republic of the Congo* 1973
Denmark 1959
Djibouti 1979
Dominica 1979
Dominican Republic 1953
Ecuador 1956
Egypt 1958
El Salvador 1981
Equatorial Guinea 1972
Eritrea 1993
Estonia 1992
Ethiopia 1975
Fiji 1983
Finland 1959
France 1952
Gabon 1976
Gambia 1979
Georgia 1993
Germany 1959
Ghana 1959
Greece 1958
Grenada 1998
Guatemala 1983
Guinea 1975
GuineaBissau 1977
Guyana 1980
Haiti 1953
Honduras 1954
Hurgar 1970
Iceland 1960

India 1959
Indonesia 1961
Iran (Islamic Republic of) 1958
Iraq 1973
Ireland 1951
Israel 1952
Italy 1957
Jamaica 1976
Japan 1958
Jordan 1973
Kazakhstan 1994
Kenya1973
Kuwait1960
Latvia1993
Lebanon1966
Liberia1959
Libyan Arab Jamahiriya1970
Lithuania1995
Luxembourg 1991
Madagascar 1961
Malawi 1989
Malaysia 1971
Maldives 1967
Malta 1966
Marshall Islands 1998
Mauritania 1961
Mauritius 1978
Mexico 1954
Monaco 1989
Mongolia 1996
Morocco 1962
Mozambique 1979
Myanmar 1951
Namibia 1994
Nepal 1979
Netherlands 1949
New Zealand 1960
Nicaragua 1982
Nigeria 1962
Norway 1958
Oman 1974
Pakistan 1958
Panama 1958
Papua New Guinea 1976
Paraguay 1993
Peru 1968
Philippines 1964
Poland 1960
Portugal 1976
Qatar 1977
Republic of Korea 1962
Republic of Moldova 2001
Romania 1965
Russian Federation 1958
Saint Kitts and Nevis 2001
Saint Lucia 1980
Saint Vincent and the Grenadines
1981
San Marino 2002
Samoa 1996
Sao Tome and Principe 1990
Saudi Arabia1 969
Senegal 1960
Seychelles 1978
Sierra Leone 1973
Singapore 1966
Slovakia 1993
Slovenia 1993
Solomon Islands 1988
Somalia 1978

South Africa 1995
Spain 1962
Sri Lanka 1972
Sudan 1974
Suriname 1976
Sweden 1959
Switzerland 1955
Syrian Arab Republic 1963
Thailand 1973
The former Yugoslav Republic of Macedonia 1993
Togo 1983
Tonga 2000
Trinidad and Tobago 1965
Tunisia 1963
Turkey 1958
Turkmenistan 1993
Ukraine 1994
United Arab Emirates 1980
United Kingdom of Great Britain and Northern Ireland 1949
United Republic of Tanzania 1974
United States of America 1950
Uruguay 1968
Vanuatu 1986
Venezuela 1975
Viet Nam 1984
Yemen 1979
Yugoslavia 2000

Associate Members:
Hong Kong, China1967
Macao, China 1990
* Formerly Zaire

IMO
WHAT IT IS

When the establishment of a specialized agency of the United Nations dealing with maritime affairs was first proposed, the main concern was to improve safety at sea.

Because of the international nature of the shipping indu stry, it had long been recognized that action to improve safety in maritime operations would be more effective if carried out at an international level rather than by individual countries acting unilaterally and without co-ordination with others. Although a number of important international agreements had already been adopted, many States believed that there was a need for a permanent body which would be able to co-ordinate and promote further measures on a more regular basis.

It was against this background that a conference held by the United Nations in 1948 adopted a convention establishing the International Maritime Organization (IMO) as the first ever international body devoted exclusively to maritime matters.

In the 10-year period between the adoption of the convention and its entry into force in 1958, other problems related to safety but requiring slightly different emphases had attracted international attention. One of the most important of these was the threat of marine pollution from ships, particularly pollution by oil carried in tankers. An international convention on this subject was actually adopted in 1954, four years before IMO came into existence, and responsibility for administering and promoting it was assumed by IMO in January 1959. From the very beginning, the improvement of maritime safety and the prevention of marine pollution have been IMO's most important objectives.

The Organization is based at 4 Albert Embankment, London, and is the only United Nations specialized agency to have its headquarters in the United Kingdom. Its governing body is the Assembly, which meets once every two years. It currently consists of 161 Member States and two Associate Members. Between sessions of the Assembly a Council, consisting of 32 Member Governments elected by the Assembly, acts as IMO's governing body. (The Council will be increased in size to 40 Members in 2002.)

IMO is a technical organization and most of its work is carried out in a number of committees and sub-committees. The Maritime Safety Committee (MSC) is the most senior of these.

The Marine Environment Protection Committee (MEPC) was established by the Assembly in November 1973. It is responsible for co-ordinating the Organization's activities in the prevention and control of pollution of the marine environment from ships.

There are a number of sub-committees whose titles indicate the subjects they deal with: Safety of Navigation (NAV); Radiocommunications and Search and Rescue (COMSAR); Training and Watchkeeping (STW); Carriage of Dangerous Goods, Solid Cargoes and Containers (DSC); Ship Design and Equipment (DE); Fire Protection (FP); Stability and Load Lines and Fishing Vessel Safety (SLF); Flag State Implementation (FSI); and Bulk Liquids and Gases (BLG).

The Legal Committee was originally established to deal with the legal problems arising from the *Torrey Canyon* accident of 1967, but it was subsequently made a permanent committee. It is responsible for considering any legal matters within the scope of the Organization.

The Technical Co-operation Committee is responsible for co-ordinating the work of the Organization in the provision of technical assistance in the maritime field, in particular to developing countries.

The Facilitation Committee is responsible for IMO's activities and functions relating to the facilitation of international maritime traffic. These are aimed at reducing the formalities and simplifying the documentation required of ships when entering or leaving ports or other terminals.

All the committees of IMO are open to participation by all Member Governments on an equal basis.
The IMO Secretariat is headed by the Secretary-General, who is assisted by a staff of some 300 international civil servants. The Secretary-General is appointed by the Council, with the approval of the Assembly.

What it does

In order to achieve its objectives, IMO has promoted the adoption of some 40 conventions and protocols and adopted well over 800 codes and recommendations concerning maritime safety, the prevention of pollution and related matters.
The initial work on a convention is normally done by a committee or sub-committee; a draft instrument is then produced which is submitted to a conference to which delegations from all States within the United Nations system – including States which may not be IMO Members – are invited. The conference adopts a final text, which is submitted to Governments for ratification.

An instrument so adopted comes into force after fulfilling certain requirements, which always include ratification by a specified number of countries. Generally speaking, the more important the convention the more stringent are the requirements for entry into force. Implementation of the requirements of a convention is mandatory on countries which are parties to it. Codes and recommendations which are adopted by the IMO Assembly are not binding on Governments; however, their contents can be just as important, and in many cases they are implemented by Governments through incorporation into domestic legislation.

IMO's Conventions
Safety

The first conference organized by IMO in 1960 was, appropriately enough, concerned with maritime safety. That conference adopted the International Convention on Safety of Life at Sea (SOLAS), which came into force in 1965, replacing a version adopted in 1948. The 1960 SOLAS Convention covered a wide range of measures designed to improve the safety of shipping. They included subdivision and stability; machinery and electrical installations; fire protection, detection and extinction; life-saving appliances; radiotelegraphy and „radiotelephony; safety of navigation; carriage of grain; carriage of dangerous goods; and nuclear ships.

The 1960 Convention was amended several times. However, because of the difficult requirements for bringing amendments into force, none of these amendments actually became binding internationally. To remedy this situation and introduce needed improvements more speedily, IMO adopted a new version of SOLAS in 1974 which incorporated the amendments adopted to the 1960 Convention as well as other changes, including an improved amendment procedure. Under the new procedure, amendments adopted by the MSC would enter into force on a predetermined date unless they were objected to by a specific number of States. The 1974 SOLAS Convention entered into force on 25 May 1980.

Since then, the Convention has been modified on a number of occasions, some of which are indicated below:

1981: Chapters II-1 and II-2, which deal respectively with construction and fire safety, were virtually rewritten. Entered into force in 1984.

1983: Chapter III, which deals with life-saving appliances, was completely rewritten and changes were made to a number of other regulations. Entered into force in 1986.

1988 (April): Changes were introduced as a consequence of the capsizing of the ferry Herald of Free Enterprise; they were intended to improve the safety of ro–ro passenger ships. Entered into force in 1989.

1988 (October): Amendments were adopted which also aimed to improve passenger ship safety. The most important change was designed to improve the stability of passenger ships after damage. Entered into force in 1990.

1988 (GMDSS): Amendments were adopted to introduce the global maritime distress and safety system (GMDSS), the biggest change to maritime communications since the introduction of radio. Entered into force in February 1992 but will not be finally phased in until 1999.

1989: The amendments mainly concerned watertight doors and fire safety. Entered into force in 1992.

1990: The amendments concerned the way in which the subdivision and damage stability of dry cargo ships was to be calculated. Entered into force in 1992.

1991: One group of amendments dealt with fire safety on passenger ships; the other extended chapter VI, which only dealt with grain, to other dry cargoes; a third dealt with pilot safety. Entered into force in 1994.

1992: The amendments, which were adopted in April and December, dealt principally
with the stability of existing passenger ro–ro ships and the fire protection of tankers and passenger ships. Entered into force in 1994.

1994: The Convention was increased to 11 chapters by the addition of chapters IX, Management for the Safe Operation of Ships; X, Safety of High-Speed Craft; and XI, Special Measures to Enhance Safety. Other amendments included provisions for mandatory ship reporting systems. Entered into force in 1996.

1995 (November): Changes were made to the requirements concerning the stability of passenger ro–ro ships.

1996 (June): Chapter III was re-written and a new International Life-Saving Appliance Code introduced.

1997 (November): A new chapter XII was added, dealing with bulk carrier safety.
Additionally, two protocols have been adopted to the Convention: the 1978 Protocol, which modified inspection and survey procedures and introduced mandatory annual surveys and inspections for tankers (in force since 1984),

and the 1988 Protocol, which introduced a harmonized system of survey and certification, among other things (in force since 2000).

In 1966 a conference convened by IMO adopted the International Convention on Load Lines. Limitations on the draught to which a ship may be loaded, in the form of freeboards, are an important contribution to its safety. An international convention on the subject had been adopted in 1930; the new instrument brought this up to date and incorporated new and improved measures. It came into force in 1968.

The tonnage measurement of ships has been one of the most difficult problems in international shipping. IMO began work on this subject soon after coming into being, and in 1969 the International Convention on Tonnage Measurement of Ships was adopted. It is an indication of the complexity of the matter that the Convention did not enter into force until 1982.

A Special Trade Passenger Ships Agreement to safeguard ships and passengers engaged in the "pilgrim" trade was adopted in 1971 and came into force three years later. A protocol to this agreement, adopted in 1973, came into force in 1977.

Among the most common accidents at sea are collisions. Regulations for preventing collisions were adopted by the 1960 SOLAS Conference and annexed to the Final Act of the Conference. However, these rules were not part of the SOLAS Convention and were therefore not legally binding internationally. In 1972 IMO adopted the Convention on International Regulations for Preventing Collisions at Sea (COLREG). This included a number of new features, including a provision which made traffic separation schemes adopted by IMO mandatory. Traffic separation schemes had been introduced, as recommendations, in several parts of the world where maritime traffic was particularly congested. The adoption of such schemes has considerably reduced the number of collisions in many areas, and the coming into force of the Convention in 1977 led to further improvements in the implementation of these schemes.

Another convention adopted by IMO in 1972 dealt with the safety of containers, which had become an important feature of international maritime trade. The International Convention on Safe Containers was designed both to facilitate this trade, by introducing uniform international regulations, and also to maintain a high level of safety in the carriage of containers by providing generally acceptable test procedures and related strength requirements. The Convention entered into force in 1977. That such a convention was considered necessary is an indication of the rate of change in shipping. Containers had scarcely been invented when IMO came into existence.

Another sign of IMO's response to changes in maritime transport was the adoption in 1976 of the Convention on the International Maritime Satellite Organization (Inmarsat) and its Operating Agreement. Conventional radio facilities have become increasingly congested in recent years and it is physically impossible to expand the number of wavelengths available. But by using space satellites these difficulties can be overcome. This is of great benefit for commercial and other aspects of ship operation, but its greatest advantage is in the field of safety. The Convention came into force in July 1979 and resulted in the establishment of the Inmarsat Organization which, like IMO, is based in London.

In contrast to space technology, fishing is one of the world's oldest industries. Yet it was not until 1977 that the first ever international convention dealing with the safety of fishing vessels was finally adopted. One of the reasons for this relative delay was the extremely varied and complex nature of the fishing industry. Fishing is so different from other forms of maritime activity that hardly any of the conventions of IMO could be made directly applicable to fishing vessels. The 1977 Torremolinos International Convention for the Safety of Fishing Vessels was intended to remedy some of these problems, but technical difficulties meant that the Convention never entered into force. It was modified by a protocol in 1993.

Ultimately, safety rests very largely with the crews of ships rather than with the ships themselves. For this reason IMO has attached the utmost importance to

the training of ships' personnel. In 1978 the Organization convened a conference which adopted the first ever Convention on Standards of Training, Certification and Watchkeeping for Seafarers.
The Convention entered into force in April 1984. It established, for the first time, internationally acceptable minimum standards for crews. It is not intended as a model on which all States must necessarily base their crew requirements, for in many countries the requirements are actually higher than those laid down in the Convention.

The Convention was revised in 1995. Apart from bringing the Convention up to date from a technical point of view, the revision also gave IMO the power to audit the administrative, training and certification procedures of Parties to the Convention. The amendments entered into force in 1997.

In April 1979 IMO adopted the International Convention on Maritime Search and Rescue. As its title implies, this Convention is designed to improve existing arrangements for carrying out search and rescue operations following accidents at sea. Although many countries have their own established plans for such emergencies, this was the first time international procedures had been adopted. The Convention entered into force in 1985.

Preventing pollution ... providing compensation

The 1954 Oil Pollution Convention was the first major convention designed to curb the impact of oil pollution. But in the years that followed the pollution threat increased dramatically and, since coming into existence, IMO has devoted increasing attention to the problem of marine pollution. The 1954 Convention was amended in 1962, but the wreck of the *Torrey Canyon* in 1967 dramatically alerted the world to the great dangers which the transport of oil poses to the marine environment.

Following this disaster, IMO produced a series of conventions and other instruments, including further amendments to the 1954 Convention which were adopted in 1969.
In 1969 two conventions were adopted. One was the International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, which established the right of coastal States to intervene in incidents on the high seas which are likely to result in oil pollution. It entered into force in 1975.

The second was the International Convention on Civil Liability for Oil Pollution Damage, which dealt with the civil liability of the owner of a ship or cargo for damage suffered as a result of an oil pollution incident. The Convention is intended to ensure that adequate compensation will be readily available to victims of pollution, and places the obligation for paying such compensation on the shipowner. That Convention also entered into force in 1975.

It was felt by some Governments that the liability limits established by this system were too low, and that the compensation made available could, in some cases, prove to be inadequate. As a result, another conference was convened by IMO in 1971 which adopted the Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage. This Convention came into force in 1978.

Unlike the Civil Liability Convention, which puts the onus on the shipowner, the Fund Convention is designed to provide additional compensation to victims where an accident results in pollution damage which exceeds the compensation available under the Civil Liability Convention. Thus the burden of compensation is spread evenly between shipowners and cargo interests. The International Oil Pollution Compensation (IOPC) Fund is operated by the IOPC Fund Organization, which has its headquarters in London.

The limits of liability in the 1969 Civil Liability and 1971 Fund Conventions were increased in 1992 by means of protocols to amend them which were adopted by a conference convened by IMO. The protocols entered into force in July 1996 and increase the total amount of compensation payable to victims. The limits were further increased by amendments adopted in 2000.

In addition to the conventions dealing with the legal aspects of oil pollution, IMO gave attention to other aspects. The continuing boom in the transportation of oil and the increasing scale of oil pollution incidents resulted in serious international concern for the marine environment, not only as a result of accidents but also through routine tanker operations, such as the cleaning of cargo tanks.

In 1971 the 1954 Oil Pollution Convention was further amended to limit the hypothetical outflow of oil resulting from an accident and also to provide special protection for the Great Barrier Reef of Australia. It was generally felt, however, that a completely new instrument was required to control pollution of the seas from ships, and in 1973 IMO convened a major conference to discuss the whole problem of marine pollution from ships. It resulted in the adoption of the first ever comprehensive anti-pollution convention, the International Convention for the Prevention of Pollution from Ships (MARPOL).

The Convention deals not only with pollution by oil, but also pollution from chemicals, other harmful substances, garbage and sewage. The MARPOL Convention greatly reduces the amount of oil which may be discharged into the sea by ships, and bans such discharges completely in certain areas (such as the Black Sea, Red Sea and other regions). It gives statutory support for such operational procedures as “load on top” (which greatly reduces the amount of mixtures which have to be disposed of after tank cleaning) and segregated ballast tanks.

Certain technical problems made it difficult for many States to ratify the Convention, and a series of tanker accidents in the winter of 1976/77 led to demands for further action. IMO convened the Conference on Tanker Safety and Pollution Prevention in 1978. This Conference adopted a protocol to the 1973 MARPOL Convention which introduced further measures, including requirements for such operational techniques as crude oil washing (a development of the earlier “load on top” system) and a number of modified constructional requirements such as protectively located segregated ballast tanks. The Protocol of 1978 relating to the 1973 MARPOL Convention in effect absorbs the parent Convention with modifications. This combined instrument is commonly referred to as MARPOL 73/78 and entered into force in October 1983. The Convention has been amended on several occasions since then.

In 1990 IMO adopted the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC). It is designed to improve the ability of nations to cope with a sudden emergency, such as a tanker accident. It entered into force in May 1995, but some of its provisions were used as the basis for IMO's response to the massive pollution of the Persian Gulf resulting from hostilities in the area in the spring of 1991. These measures, assisted by a special IMO fund, helped to save many ecologically important sites from major damage.

In 1996 IMO adopted the International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea. The Convention establishes a two-tier system for providing compensation up to a total of around £250 million. It covers not only pollution aspects but other risks such as fire and explosion. It is not yet in force.

In 2001, IMO adopted the International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001, which is intended to ensure that adequate, prompt, and effective compensation is available to persons who suffer damage caused by spills of oil, when carried as fuel in ships' bunkers.

Other matters

While safety and the prevention of pollution are IMO's chief concerns, the Organization is also involved in many other areas.

One of these is the facilitation of maritime traffic. In the past the lack of internationally standardized documentation procedures has imposed a heavy burden upon both shipborne and shore-based personnel and caused considerable delays.

A special IMO convention is designed to reduce unnecessary delays in maritime traffic and thereby improve port efficiency

IMO started working on these problems soon after coming into existence and, in 1965, adopted the Convention on Facilitation of International Maritime Traffic. Its primary objectives are to prevent unnecessary delays in maritime traffic, to aid co-operation between Governments, and to secure the highest practicable degree of uniformity in formalities and procedures in connection with the arrival, stay and departure of ships at ports. The Convention came into force in 1967.
IMO's work on establishing regimes of liability for pollution has already been referred to, but the Organization has also adopted various conventions dealing with other legal matters.

In 1971 IMO, in association with the International Atomic Energy Agency and the European Nuclear Agency of the Organization for Economic Co-operation and Development, convened a conference which adopted a convention to regulate civil liability in respect of damage arising from the maritime carriage of nuclear substances.

In 1974 IMO turned its attention to the question of passengers and their luggage and adopted a convention, the Athens Convention relating to the Carriage of Passengers and their Luggage by Sea, which established a regime of liability for damage suffered by passengers carried on seagoing vessels. It makes the carrier liable for damage or loss suffered by passengers if the incident is due to the fault or neglect of the carrier. The liability is limited to amounts specified in the relevant provisions of the Convention. The compensation limits were raised substantially by means of a protocol adopted in 1990. It is not yet in force.

The general question of the liability of owners of ships was dealt with in a convention adopted in 1957. By the end of the 1960s, however, it had become clear that the limits of liability established in the 1957 convention were too low. In 1976 IMO convened a conference which adopted a new convention, the Convention on Limitation of Liability for Maritime Claims, which raised the limits, in some cases by 300%. Limits are specified for two types of claim –

those for loss of life or personal injury and property claims, such as damage to ships, property or harbour works.
In 1988 the Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation was adopted. It is intended to improve measures for dealing with incidents such as terrorist attacks on commercial shipping. It entered into force in March 1992.

For most of the century salvage at sea has been based on a formula known as "no cure, no pay". While it has been successful in most cases, the formula does not take pollution into account: a salvor who prevents massive pollution damage but does not save the ship and its cargo can expect no compensation. The 1989 International Convention on Salvage was adopted to remedy this defect. It entered into force in July 1996.

IMO's codes and recommendations

In addition to conventions and other formal treaty instruments, IMO has adopted several hundred recommendations dealing with a wide range of subjects.

Some of these constitute codes, guidelines or recommended practices on important matters not considered suitable for regulation by formal treaty instruments. Although recommendations – whether in the form of codes or otherwise – are not usually binding on Governments, they provide guidance in framing national regulations and requirements. Many Governments do in fact apply the provisions of the recommendations by incorporating them, in whole or in part, into national legislation or regulations. In some cases, important codes have been made mandatory by including appropriate references in a convention.

These recommendations are generally intended to supplement or assist the implementation of the relevant provisions of the conventions and, in some cases, the principal codes, guidelines, etc.

In appropriate cases the recommendations may incorporate further requirements which have been found to be useful or necessary in the light of experience gained in the application of the previous provisions. In other cases the recommendations clarify various questions which arise in connection with specific measures and thereby ensure their uniform interpretation and application in all countries.

Examples of the principal recommendations, codes, etc. adopted over the years are:
International Maritime Dangerous Goods Code (IMDG Code – first adopted in 1965); Code of Safe Practice for Solid Bulk Cargoes (BC Code – 1965); International Code of Signals (all functions in respect of the Code were assumed by the Organization in 1965); Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code – 1971); Code of Safe Practice for Ships Carrying Timber Deck Cargoes (1973); Code of Safety for Fishermen and Fishing Vessels (1974); Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (1975); Code of Safety for Dynamically Supported Craft (1977); Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU Code – 1979); Code on Noise Levels on Board Ships (1981); Code of Safety for Nuclear Merchant Ships (1981); Code of Safety for Special Purpose Ships (1983); International Gas Carrier Code (IGC Code – 1983); International Bulk Chemicals Code (IBC Code – 1983); Code of Safety for Diving Systems (1983); International Code for the Safe Carriage of Grain in Bulk (International Grain Code – 1991); International Safety Management Code (ISM Code – 1993); International Code of Safety for High-Speed Craft (HSC Code – 1994),International Life-Saving Appliance Code (LSA Code – 1996).

Other important recommendations have dealt with such matters as traffic separation schemes (which separate ships moving in opposite directions by creating a central prohibited area); the adoption of technical manuals such as the Standard Marine Navigational Vocabulary, the IMO Search and Rescue Manual and the IMO Manual on Oil Pollution; crew training; performance standards for shipborne equipment; and many other matters. There are also guidelines to help the implementation of particular conventions and instruments. Many of the texts are availabel as an IMO publication.

The provisions of recommendations are sometimes incorporated into amendments to the relevant conventions. Recommendations enable provisions or requirements to be suggested relatively quickly to Governments for consideration and action. It is also easier for Governments to act on such matters than in respect of provisions in formal treaty instruments, which involve international legal obligations.

Dumping at sea

In addition to other aspects of marine pollution prevention, IMO also carries out Secretariat functions in connection with the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. This Convention, now called the London Convention, was adopted in 1972 at a conference held under the auspices of the United Kingdom. It entered into force in 1975.

The Convention controls and regulates on a global level the disposal at sea of wastes and other material of any kind (including ships and platforms). The disposal of certain substances which from the environmental point of view are known to be particularly harmful (such as organohalogen compounds, mercury, cadmium, plastics, mineral oils and radioactive wastes) is prohibited.

The Convention also contains specific regulations concerning the dumping of several other materials which may present a risk to the marine environment and human health. In addition, it bans the incineration of wastes on board ships.

Technical assistance

While the adoption of conventions, codes and recommendations has in the past been IMO's most important function, in recent years the Organization has devoted increasing attention to securing the effective implementation of these measures throughout the world.

As a result, the Organization's technical assistance activities have become more and more important and in 1977 IMO took steps to institutionalize its Technical Co-operation Committee – the first United Nations body to do so.

The purpose of the technical assistance programme is to help States, many of them developing countries, to ratify IMO conventions and to reach the standards contained in the SOLAS Convention and other instruments. As part of this programme, a number of advisers and consultants are employed by IMO to give advice to Governments, and each year the Organization arranges or participates in numerous seminars, workshops and other events which are designed to assist in the implementation of IMO measures. Some are held at IMO headquarters or in developed countries, others in the developing countries themselves.

In the field of environmental protection IMO has actively co-operated with the Regional Seas Programme of the United Nations Environment Programme (UNEP) in the development of regional anti-pollution arrangements. A particularly interesting outcome of this co-operation is the Regional Marine Pollution Emergency Centre for the Mediterranean Sea (REMPEC), which was established by IMO in conjunction with UNEP in 1976.

But the most important subject of all is training. IMO measures can only be implemented effectively if those responsible are fully trained, and IMO has helped to develop or improve maritime training academies in many countries around the world. Some of them cater purely for national needs. Others have been developed to deal with the requirements of a region – a very useful approach where the demand for trained personnel in individual countries is not sufficient to justify the considerable financial outlay needed to establish such institutions. IMO has also developed a series of model courses for use in training academies.

While IMO supplies the expertise for these projects, the finance comes from various sources. The United Nations Development Programme (UNDP) is the most important of these, with other international bodies such as the United Nations Environment Programme (UNEP) contributing in some cases. Individual countries also provide generous funds or help in other ways – for example, by providing training opportunities for cadets and other personnel from developing countries. This has enabled IMO to build up a successful fellowship programme which, over the years, has helped to train many thousands of people.

The most ambitious and exciting of all IMO's technical assistance projects is the World Maritime University in Malmö, Sweden, which opened in 1983. Its objective is to provide high-level training facilities for people from developing countries who have already reached a relatively high standard in their own countries but who would benefit from further intensive training. Many of those currently at the University have served as captains or chief engineers at sea and have moved into administrative positions ashore. Others are teachers at maritime academies, examiners or surveyors, technical port managers, and so on.

The University can train about 200 students at a time on one- or two-year courses. The University is necessary because training of the specialized type provided at Malmö is not available in developing countries – or indeed anywhere else in the world. It has proved to be so successful that since 1985 a limited number of places have been made available to students from developed maritime nations.

IMLI

The IMO International Maritime Law Institute, in Malta, provides specialist year-long training courses for maritime lawyers.

The International Maritime Academy (IMA) of Trieste is an international institution in the training field for postgraduate studies.

How it works

The International Maritime Organization works through a number of specialist committees and sub-committees. All these bodies are composed of representatives of Member States who discharge their functions with the assistance and advice of appropriate bodies of the United Nations or the specialized agencies, as well as international governmental and non-governmental organizations with which formal relationships have been established.

Formal arrangements for co-operation have been established with more than 30 intergovernmental organizations, while more than 50 non-governmental international organizations have been granted consultative status to participate in the work of various bodies in an observer capacity. These organizations represent a wide spectrum of maritime, legal and environmental interests and they contribute to the work of the various organs and committees through the provision of information, documentation and expert advice. However, none of these organizations has a vote.

The future

Over the years IMO has continually evolved to meet changing conditions and requirements. In its early days it concentrated on formulating international conventions and codes. Today, however, IMO is just as concerned to ensure that the conventions, codes and other instruments already adopted are effectively enforced and implemented.

There is significant evidence that IMO measures have already proved beneficial in many areas. Oil pollution of the sea, for example, is less of a threat now than it was 20 years ago and the number of collisions between ships has been greatly reduced in areas where IMO-approved traffic separation schemes have been introduced.

But because of economic factors, the average age of the world's ships has risen steadily over the same period and statistics show that old ships have more accidents than young ones. The fleets of the traditional maritime countries – which tend to have good safety records – have declined, while many of the flags that are growing most rapidly have relatively poor records.

As a result, nobody can afford to be complacent and IMO is concentrating not only on better implementation but also on improving such factors as management and training. All the evidence shows that most accidents happen because people do not obey the regulations, not because the regulations are themselves defective.

IMO
CONVENTIONS

Introduction

The industrial revolution of the eighteenth and nineteenth centuries and the upsurge in international commerce which followed resulted in the adoption of a number of international treaties related to shipping, including safety. The subjects covered included tonnage measurement, the prevention of collisions, signalling and others.

By the end of the nineteenth century suggestions had even been made for the creation of a permanent international maritime body to deal with these and future measures. The plan was not put into effect, but international co-operation continued in the twentieth century, with the adoption of still more internationally developed treaties.

By the time IMO came into existence in 1958, several important international conventions had already been developed, including the International Convention for the Safety of Life at Sea of 1948, the International Convention for the Prevention of Pollution of the Sea by Oil of 1954 and treaties dealing with load lines and the prevention of collisions at sea.

IMO was made responsible for ensuring that the majority of these conventions were kept up to date. It was also given the task of developing new conventions as and when the need arose.

The creation of IMO coincided with a period of tremendous change in world shipping and the Organization was kept busy from the start developing new conventions and ensuring that existing instruments kept pace with changes in shipping technology. It is now responsible for more than 40 international conventions and agreements and has adopted numerous protocols and amendments.

Adopting a convention

This is the part of the process with which IMO as an Organization is most closely involved. IMO has six main bodies concerned with the adoption or implementation of conventions. The Assembly and Council are the main organs, and the committees involved are the Maritime Safety Committee, Marine Environment Protection Committee, Legal Committee and the Facilitation Committee. Developments in shipping and other related industries are discussed by Member States in these bodies, and the need for a new convention or amendments to existing conventions can be raised in any of them.

Normally the suggestion is first made in one of the committees, since these meet more frequently than the main organs. If agreement is reached in the committee, the proposal goes to the Council and, as necessary, to the Assembly.

If the Assembly or the Council, as the case may be, gives the authorization to proceed with the work, the committee concerned considers the matter in greater detail and ultimately draws up a draft instrument. In some cases the subject may be referred to a specialized sub-committee for detailed consideration.

Work in the committees and sub-committees is undertaken by the representatives of Member States of the Organization. The views and advice of intergovernmental and international non-governmental organizations which have a working relationship with IMO are also welcomed in these bodies. Many of these organizations have direct experience in the various matters under consideration, and are therefore able to assist the work of IMO in practical ways.

The draft convention which is agreed upon is reported to the Council and Assembly with a recommendation that a conference be convened to consider the draft for formal adoption.

Invitations to attend such a conference are sent to all Member States of IMO and also to all States which are members of the United Nations or any of its specialized agencies. These conferences are therefore truly global conferences open to all Governments who would normally participate in a United Nations conference. All Governments participate on an equal footing. In addition, organizations of the United Nations system and organizations in official relationship with IMO are invited to send observers to the conference to give the benefit of their expert advice to the representatives of Governments.

Before the conference opens, the draft convention is circulated to the invited Governments and organizations for their comments. The draft convention, together with the comments thereon from Governments and interested organizations is then closely examined by the conference and necessary changes are made in order to produce a draft acceptable to all or the majority of the Governments present. The convention thus agreed upon is then adopted by the conference and deposited with the Secretary-General who sends copies to Governments. The convention is opened for signature by States, usually for a period of 12 months. Signatories may ratify or accept the convention while non-signatories may accede.

The drafting and adoption of a convention in IMO can take several years to complete although in some cases, where a quick response is required to deal with an emergency situation, Governments have been willing to accelerate this process considerably.

Entry into force

The adoption of a convention marks the conclusion of only the first stage of a long process. Before the convention comes into force - that is, before it becomes binding upon Governments which have ratified it - it has to be accepted formally by individual Governments.

Each convention includes appropriate provisions stipulating conditions which have to be met before it enters into force. These conditions vary but generally speaking, the more important and more complex the document, and the more stringent are the conditions for its entry into force. For example, the International Convention for the Safety of Life at Sea, 1974, provided that entry into force requires acceptance by 25 States whose merchant fleets comprise not less than 50 per cent of the world's gross tonnage; for the International Convention on Tonnage Measurement of Ships, 1969, the requirement was acceptance by 25 States whose combined merchant fleets represent not less than 65 per cent of world tonnage.

When the appropriate conditions have been fulfilled, the convention enters into force for the States which have accepted - generally after a period of grace intended to enable all the States to take the necessary measures for implementation.

In the case of some conventions which affect a few States or deal with less complex matters, the entry into force requirements may not be so stringent. For example, the Convention Relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material, 1971, came into force 90 days after being accepted by five States; the Special Trade Passenger Ships Agreement, 1971, came into force six months after three States (including two with ships or nationals involved in special trades) had accepted it.

For the important technical conventions, it is necessary that they be accepted and applied by a large section of the shipping community. It is therefore essential that these should, upon entry into force, be applicable to as many of the maritime states as possible. Otherwise they would tend to confuse, rather than clarify, shipping practice since their provisions would not apply to a significant proportion of the ship they were intended to deal with.

Accepting a convention does not merely involve the deposit of a formal instrument. A Government's acceptance of a convention necessarily places on it the obligation to take the measures required by the convention. Often national law has to be enacted or changed to enforce the provisions of the convention; in some case, special facilities may have to be provided; an inspectorate may have to be appointed or trained to carry out functions under the convention; and adequate notice must be given to shipowners, shipbuilders and other interested parties so they make take account of the provisions of the convention in their future acts and plans.

At present IMO conventions enter into force within an average of five years after adoption. The majority of these instruments are now in force or are on the verge of fulfilling requirements for entry into force.

Signature, ratification, acceptance, approval and accession

The terms signature, ratification, acceptance, approval and accession refer to some of the methods by which a State can express its consent to be bound by a treaty.

Signature

Consent may be expressed by signature where:

- the treaty provides that signature shall have that effect;
- it is otherwise established that the negotiating States were agreed that signature should have that effect;
- the intention of the State to give that effect to signature appears from the full powers of its representatives or was expressed during the

negotiations (Vienna Convention on the Law of Treaties, 1969, Article 12.1).

A State may also sign a treaty "subject to ratification, acceptance or approval". In such a situation, signature does not signify the consent of a State to be bound by the treaty, although it does oblige the State to refrain from acts which would defeat the object and purpose of the treaty until such time as it has made its intention clear not to become a party to the treaty (Vienna Convention on the Law of Treaties, Article 18(a))

Signature subject to ratification, acceptance or approval

Most multilateral treaties contain a clause providing that a State may express its consent to be bound by the instrument by signature subject to ratification. In such a situation, signature alone will not suffice to bind the State, but must be followed up by the deposit of an instrument of ratification with the depositary of the treaty.

This option of expressing consent to be bound by signature subject to ratification, acceptance or approval originated in an era when international communications were not instantaneous, as they are today.

It was a means of ensuring that a State representative did not exceed their powers or instructions with regard to the making of a particular treaty. The words acceptance and approval basically mean the same as ratification, but they are less formal and non-technical and might be preferred by some States which might have constitutional difficulties with the term ratification.

Many States nowadays choose this option, especially in relation to multinational treaties, as it provides them with an opportunity to ensure that any necessary legislation is enacted and other constitutional requirements fulfilled before entering into treaty commitments.

The terms for consent to be expressed by signature subject to acceptance or approval are very similar to ratification in their effect. This is borne out by Article 14.2 of the Vienna Convention on the Law of Treaties which provides that "the consent of a State to be bound by a treaty is expressed by acceptance or approval under conditions similar to those which apply to ratification."

Accession

Most multinational treaties are open for signature for a specified period of time. Accession is the method used by a State to become a party to a treaty which it did not sign whilst the treaty was open for signature.

Technically, accession requires the State in question to deposit an instrument of accession with the depositary. Article 15 of the Vienna Convention on the Law of Treaties provides that consent by accession is possible where the treaty so provides, or where it is otherwise established that the negotiating States were agreed or subsequently agreed that consent by accession could occur.

Amendment

Technology and techniques in the shipping industry change very rapidly these days. As a result, not only are new conventions required but existing ones need to be kept up to date. For example, the International Convention for the Safety of Life at Sea (SOLAS), 1960 was amended six times after it entered into force in 1965 - in 1966, 1967, 1968, 1969, 1971 and 1973. In 1974 a completely new convention was adopted incorporating all these amendments (and other minor changes) and has itself been modified on numerous occasions.

In early conventions, amendments came into force only after a percentage of Contracting States, usually two thirds, had accepted them. This normally meant that more acceptances were required to amend a convention than were originally required to bring it into force in the first place, especially where the number of States which are Parties to a convention is very large.

This percentage requirement in practice led to long delays in bringing amendments into force. To remedy the situation a new amendment procedure was devised in IMO. This procedure has been used in the case of conventions such as the Convention on the International Regulations for Preventing Collisions at Sea, 1972, the International Convention for the Prevention of Pollution from Ships, 1973 and SOLAS 1974, all of which incorporate a procedure involving the "tacit acceptance" of amendments by States.

Instead of requiring that an amendment shall enter into force after being accepted by, for example, two thirds of the Parties, the “tacit acceptance” procedure provides that an amendment shall enter into force at a particular time unless before that date, objections to the amendment are received from a specified number of Parties.

In the case of the 1974 SOLAS Convention, an amendment to most of the Annexes (which constitute the technical parts of the Convention) is `deemed to have been accepted at the end of two years from the date on which it is communicated to Contracting Governments...' unless the amendment is objected to by more than one third of Contracting Governments, or Contracting Governments owning not less than 50 per cent of the world's gross merchant tonnage. This period may be varied by the Maritime Safety Committee with a minimum limit of one year.

As was expected the "tacit acceptance" procedure has greatly speeded up the amendment process. The 1981 amendments to SOLAS 1974, for example, entered into force on 1 September 1984. Compared to this, none of the amendments adopted to the 1960 SOLAS Convention between 1966 and 1973 received sufficient acceptances to satisfy the requirements for entry into force.

Enforcement

The enforcement of IMO conventions depends upon the Governments of Member Parties

Contracting Governments enforce the provisions of IMO conventions as far as their own ships are concerned and also set the penalties for infringements, where these are applicable.

They may also have certain limited powers in respect of the ships of other Governments.

In some conventions, certificates are required to be carried on board ship to show that they have been inspected and have met the required standards. These certificates are normally accepted as proof by authorities from other States that the vessel concerned has reached the required standard, but in some cases further action can be taken.

The 1974 SOLAS Convention, for example, states that "the officer carrying out the control shall take such steps as will ensure that the ship shall not sail until it can proceed to sea without danger to the passengers or the crew".

This can be done if "there are clear grounds for believing that the condition of the ship and its equipment does not correspond substantially with the particulars of that certificate".

An inspection of this nature would, of course, take place within the jurisdiction of the port State. But when an offence occurs in international waters the responsibility for imposing a penalty rests with the flag State.

Should an offence occur within the jurisdiction of another State, however, that State can either cause proceedings to be taken in accordance with its own law or give details of the offence to the flag State so that the latter can take appropriate action.

Under the terms of the 1969 Convention Relating to Intervention on the High Seas, Contracting States are empowered to act against ships of other countries

which have been involved in an accident or have been damaged on the high seas if there is a
grave risk of oil pollution occurring as a result.

The way in which these powers may be used are very carefully defined, and in most conventions the flag State is primarily responsible for enforcing conventions as far as its own ships and their personnel are concerned.

The Organization itself has no powers to enforce conventions.

However, IMO has been given the authority to vet the training, examination and certification procedures of Contracting Parties to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978. This was one of the most important changes made in the 1995 amendments to the Convention which entered into force on 1 February 1997. Governments will have to provide relevant information to IMO's Maritime Safety Committee which will judge whether or not the country concerned meets the requirements of the Convention.

IMO conventions

The majority of conventions adopted under the auspices of IMO or for which the Organization is otherwise responsible fall into three main categories.

The first group is concerned with maritime safety; the second with the prevention of marine pollution; and the third with liability and compensation, especially in relation to damage caused by pollution. Outside these major groupings are a number of other conventions dealing with facilitation, tonnage measurement, unlawful acts against shipping and salvage.

11. International Convention for the Safety of Life at Sea (SOLAS), 1974

Adoption: 1 November 1974
Entry into force: 25 May 1980

Introduction and history

The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The first version was adopted in 1914, in response to the Titanic disaster, the second in 1929, the third in 1948 and the fourth in 1960.

The 1960 Convention - which was adopted on 17 June 1960 and entered into force on 26 May 1965 - was the first major task for IMO after the Organization's creation and it represented a considerable step forward in modernizing regulations and in keeping pace with technical developments in the shipping industry.

The intention was to keep the Convention up to date by periodic amendments but in practice the amendments procedure incorporated proved to be very slow. It became clear that it would be impossible to secure the entry into force of amendments within a reasonable period of time.

As a result, a completely new Convention was adopted in 1974 which included not only the amendments agreed up until that date but a new amendment procedure - the tacit acceptance procedure - designed to ensure that changes could be made within a specified (and acceptably short) period of time.

Instead of requiring that an amendment shall enter into force after being accepted by, for example, two thirds of the Parties, the tacit acceptance procedure provides that an amendment shall enter into force on a specified date unless, before that date, objections to the amendment are received from an agreed number of Parties.

As a result the 1974 Convention has been updated and amended on numerous occasions. The Convention in force today is sometimes referred to as SOLAS, 1974, as amended.

Amendment procedure

Article VIII of the SOLAS 1974 Convention states that amendments can be made either:

After consideration within IMO
Amendments proposed by a Contracting Government are circulated at least six months before consideration by the Maritime Safety Committee (MSC) - which may refer discussions to one or more IMO Sub-Committees - and amendments are adopted by a two-thirds majority of Contracting Governments present and voting in the MSC. Contracting Governments of SOLAS, whether or not Members of IMO are entitled to participate in the consideration of amendments in the so-called "expanded MSC".

Amendments by a Conference
A Conference of Contracting Governments is called when a Contracting Government requests the holding of a Conference and at least one-third of Contracting Governments agree to hold the Conference. Amendments are adopted by a two-thirds majority of Contracting Governments present and voting.

In the case of both a Conference and the expanded MSC, amendments (other than to Chapter I) are deemed to have been accepted at the end of a set period of time following communication of the adopted amendments to Contracting Governments, unless a specified number of Contracting Governments object. The length of time from communication of amendments to deemed acceptance is set at two years unless another period of time - which must not be less than one year - is determined by two-thirds of Contracting Governments at the time of adoption.
Amendments to Chapter I are deemed accepted after positive acceptance by two-thirds of Contracting Governments.

Amendments enter into force six months after their deemed acceptance.

The minimum length of time from circulation of proposed amendments through entry into force is 24 months - circulation: six months, adoption to deemed acceptance date: 12 months minimum; deemed acceptance to entry into force: six months.

However, a resolution adopted in 1994 makes provision for an accelerated amendment procedure to be used in exceptional circumstances - allowing for the length of time from communication of amendments to deemed acceptance to be cut to six months in exceptional circumstances and when this is decided by a Conference. In practice to date, the expanded MSC has adopted most amendments to SOLAS, while Conferences have been held on several occasions - notably to adopt whole new Chapters to SOLAS or to adopt amendments proposed in response to a specific incident.

Technical provisions

The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag States are responsible for ensuring that ships under their flag comply with its requirements, and a number of certificates are prescribed in the Convention as proof that this has been done. Control provisions also allow Contracting Governments to inspect ships of other Contracting States if there are clear grounds for believing that the ship and its equipment do not substantially comply with the requirements of the Convention - this procedure is known as port State control.The current SOLAS Convention includes Articles setting out general obligations, amendment procedure and so on, followed by an Annex divided into 12 Chapters.

Chapter I - General Provisions

Includes regulations concerning the survey of the various types of ships and the issuing of documents signifying that the ship meets the requirements of the

Convention. The Chapter also includes provisions for the control of ships in ports of other Contracting Governments.

Chapter II-1 - Construction - Subdivision and stability, machinery and electrical installations

The subdivision of passenger ships into watertight compartments must be such that after assumed damage to the ship's hull the vessel will remain afloat and stable. Requirements for watertight integrity and bilge pumping arrangements for passenger ships are also laid down as well as stability requirements for both passenger and cargo ships.

The degree of subdivision - measured by the maximum permissible distance between two adjacent bulkheads - varies with ship's length and the service in which it is engaged. The highest degree of subdivision applies to passenger ships.

Requirements covering machinery and electrical installations are designed to ensure that services which are essential for the safety of the ship, passengers and crew are maintained under various emergency conditions. The steering gear requirements of this Chapter are particularly important.

Chapter II-2 - Fire protection, fire detection and fire extinction Includes detailed fire safety provisions for all ships and specific measures for passenger ships, cargo ships and tankers.

They include the following principles: division of the ship into main and vertical zones by thermal and structural boundaries; separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries; restricted use of combustible materials; detection of any fire in the zone of origin; containment and extinction of any fire in the space of origin; protection of the means of escape or of access for fire-fighting purposes; ready availability of fire-extinguishing appliances; minimization of the possibility of ignition of flammable cargo vapour.

A new revised chapter II-2 was adopted in December 2000, entering into force on 1 July 2002.

Chapter III - Life-saving appliances and arrangements

A revised Chapter was adopted in 1996 and entered into force on 1 July 1998. The revisions took into account changes in technology since the Chapter was last revised in 1983. Under the 1996 revision, specific technical requirements were moved to a new International Life-Saving Appliance (LSA) Code, made mandatory under Regulation 34, which states that all life-saving appliances and arrangements shall comply with the applicable requirements of the LSA Code.

The Chapter entered into force on 1 July 1998 and applies to all ships built on or after 1 July 1998, with some new amendments to the previous Chapter also applying to ships built before that date.

The text of the 1996 Chapter takes into account technological changes, such as the development of marine evacuation systems: these systems involve the use of slides, similar to those installed on aircraft. The 1996 revision of Chapter III also reflects public concern over safety issues, raised by a series of major accidents in the 1980s and 1990s. Many of the passenger ship regulations have been made applicable to existing ships, and extra regulations were introduced specifically for ro-ro passenger ships.

Chapter IV – Radiocommunications

The Chapter was completely revised in 1988 to incorporate amendments to introduce the Global Maritime Distress and Safety System (GMDSS).

The amendments entered into force on 1 February 1992 with a phase-in period to 1 February 1999. By that date the Morse Code was phased out and all passenger ships and all cargo ships of 300 gross tonnage and upwards on international voyages are now required to carry equipment designed to improve the chances of rescue following an accident, including satellite emergency position indicating radio beacons (EPIRBs) and search and rescue transponders (SARTs) for the location of the ship or survival craft. Chapter IV of SOLAS was previously titled Radiotelegraphy and radiotelephony, reflecting the forms of radio communication available prior to the introduction of satellites.

Regulations in Chapter IV cover undertakings by contracting governments to provide radiocommunciation services as well as ship requirements for carriage of radiocommunications equipment. The Chapter is closely linked to the Radio Regulations of the International Telecommunication Union.

Chapter V - Safety of navigation

Chapter V identifies certain navigation safety services which should be provided by Contracting Governments and sets forth provisions of an operational nature applicable in general to all ships on all voyages. This is in contrast to the Convention as a whole, which only applies to certain classes of ship engaged on international voyages.

The subjects covered include the maintenance of meteorological services for ships; the ice patrol service; routeing of ships; and the maintenance of search and rescue services.

This Chapter also includes a general obligation for masters to proceed to the assistance of those in distress and for Contracting Governments to ensure that all ships shall be sufficiently and efficiently manned from a safety point of view.

A new revised chapter V was adopted in December 2000, entering into force on

1 July 2002. The new chapter makes mandatory the carriage of voyage data recorders (VDRs) and automatic ship identification systems (AIS) for certain ships.

Chapter VI - Carriage of Cargoes

The Chapter covers all types of cargo (except liquids and gases in bulk) "which, owing to their particular hazards to ships or persons on board, may require special precautions".

The regulations include requirements for stowage and securing of cargo or cargo units (such as containers).

Before 1991, this Chapter only covered the carriage of grain - which due to its inherent capability to shift can have disastrous effects on a ship's stability if not stowed, trimmed and secured properly. The current Chapter requires cargo ships carrying grain to comply with the IMO International Grain Code.

Chapter VII - Carriage of dangerous good

The regulations are contained in three parts:

Part A - Carriage of dangerous goods in packaged form or in solid form or in bulk - includes provisions for the classification, packing, marking, labelling and placarding, documentation and stowage of dangerous goods. Contracting Governments are required to issue instructions at the national level and the Chapter refers to International Maritime Dangerous Goods (IMDG) Code, developed by IMO, which is constantly updated to accommodate new dangerous goods and to supplement or revise existing provisions.

Part B covers Construction and equipment of ships carrying dangerous liquid chemicals in bulk and requires chemical tankers built after 1 July 1986 to comply with the International Bulk Chemical Code (IBC Code).

Part C covers Construction and equipment of ships carrying liquefied gases in bulk and gas carriers constructed after 1 July 1986 to comply with the requirements of the International Gas Carrier Code (IGC Code).

Chapter VIII - Nuclear ships

Gives basic requirements for nuclear-powered ships and is particularly concerned with radiation hazards. It refers to detailed and comprehensive Code of Safety for Nuclear Merchant Ships which was adopted by the IMO Assembly in 1981.

Chapter IX - Management for the Safe Operation of Ship

The Chapter makes mandatory the International Safety Management (ISM) Code, which requires a safety management system to be established by the shipowner or any person who has assumed responsibility for the ship (the "Company").

The Chapter was adopted in May 1994 and entered into force on 1 July 1998.

Safety management

A number of very serious accidents which occurred during the late 1980's, were manifestly caused by human errors, with management faults also identified as contributing factors.

Lord Justice Sheen in his inquiry into the loss of the Herald of Free Enterprise famously described the management failures as "the disease of sloppiness".
At its 16th Assembly in October 1989, IMO adopted resolution A.647(16), Guidelines on Management for the Safe Operation of Ships and for Pollution Prevention.

The purpose of these Guidelines was to provide those responsible for the operation of ships with a framework for the proper development, implementation and assessment of safety and pollution prevention management in accordance with good practice.

The objective was to ensure safety, to prevent human injury or loss of life, and to avoid damage to the environment, in particular, the marine environment, and to property. The Guidelines were based on general principles and objectives so as to promote evolution of sound management and operating practices within the industry as a whole.

The Guidelines recognised the importance of the existing international instruments as the most important means of preventing maritime casualties and pollution of the sea and included sections on management and the importance of a safety and environmental policy.

After some experience in the use of the Guidelines, in 1993 IMO adopted the International Management Code for the Safe Operation of Ships and for Pollution Prevention (the ISM Code).

In 1998, the ISM Code became mandatory under SOLAS . The ISM Code entered into force on 1 July 1998 for passenger ships, including passenger high-speed craft; and oil tankers, chemical tankers, gas carriers, bulk carriers and cargo high-speed craft of 500 gross tonnage and above. It applies to other cargo ships and mobile offshore drilling units of 500 gross tonnage and above not later than 1 July 2002.

The Code establishes safety-management objectives and requires a safety management system (SMS) to be established by "the Company", which is defined as the shipowner or any person, such as the manager or bareboat charterer, who has assumed responsibility for operating the ship.

Chapter X - Safety measures for high-speed craft

The Chapter makes mandatory the International Code of Safety for High-Speed Craft (HSC Code), which applies to high-speed craft built on or after 1 January 1996. The Chapter was adopted in May 1994 and entered into force on 1 January 1996.

A new HSC Code was adopted in December 2000 and it applies to ships built on or after 1 July 2002.

Chapter XI - Special measures to enhance maritime safety

The Chapter was adopted in May 1994 and entered into force on 1 January 1996. The Chapter clarifies requirements relating to authorization of recognized organizations (responsible for carrying out surveys and inspections on Administrations' behalves); enhanced surveys; ship identification number scheme; and port State control on operational requirements.

Chapter XII - Additional safety measures for bulk carriers

The Chapter was adopted in November 1997 and entered into force on 1 July 1999. It includes structural requirements for new bulk carriers over 150 metres in length built after 1 July 1999 carrying cargoes with a density of 1,000 kg/m3 and above and also includes specific structural requirements for existing bulk carriers carrying cargoes with a density of 1,780 kg/m3 and above - these include cargoes such as iron ore, pig iron, steel, bauxite and cement. Cargoes with a density above 1,000 kg/m3 but below 1,780 kg/m3 include grains, such as wheat and rice, and timber.

The Protocol of 1978

Adoption: 17 February 1978
Entry into force: 1 May 1981
The 1978 Protocol was adopted at the International Conference on Tanker Safety and Pollution Prevention, which was convened in response to a spate of tanker accidents in 1976-1977.

The conference adopted measures affecting tanker design and operation, which were incorporated into both the SOLAS Protocol of 1978 as well as the Protocol of 1978 relating to the 1973 International Convention for the Prevention of Pollution from Ships (1978 MARPOL Protocol).

The 1978 SOLAS Protocol made a number of important changes to Chapter I, including the introduction of unscheduled inspections and/or mandatory annual surveys and the strengthening of port State control requirements. Chapter II-1, Chapter II-2 and Chapter V were also improved.

The main amendments included the following:
New crude oil carriers and product carriers of 20,000 dwt and above are required to be fitted with an inert gas system.

An inert gas system became mandatory for existing crude oil carriers of 70,000 dwt and above by 1 May 1983, and by 1 May 1985 for ships of 20,000-70,000 dwt.

In the case of crude oil carriers of 20-40,000 dwt there is provision for exemption by flag States where it is considered unreasonable or impracticable to fit an inert gas system and high-capacity fixed washing machines are not used. But an inert gas system is always required when crude oil washing is operated.

An inert gas system was required on existing product carriers from 1 May 1983 and by 1 May 1985 for ships of 40-70,000 dwt and down to 20,000 dwt which are fitted with high capacity washing machines.

In addition to requiring that all ships of 1,600 grt and above shall be fitted with radar, the Protocol requires that all ships of 10,000 grt and above have two radars, each capable of being operated independently.

All tankers of 10,000 grt and above shall have two remote steering gear control systems, each operable separately from the navigating bridge.

The main steering gear of new tankers of 10,000 grt and above shall comprise two or more identical power units, and shall be capable of operating the rudder with one or more power units.

The 1981 amendments
Adoption: 20 November 1981
Entry into force: 1 September 1984

Chapters II-1 and II-2 were re-written and updated.

In Chapter II-1, the provisions of resolution A.325(IX) Recommendation concerning regulations for machinery and electrical installations in passenger and cargo ships (adopted in November 1975) were incorporated and made mandatory. Changes to regulations 29 and 30 on steering gear introduced the concept of duplication of steering gear control systems in tankers. These measures were agreed taking into account concerns following the 1978 Amoco Cadiz disaster and relevant provisions in the 1978 SOLAS Protocol.

Chapter II-2 was re-arranged to take into account strengthened fire safety requirements for cargo ships and passenger ships.

The revised Chapter II-2 incorporated the requirements of resolution A.327(IX) Recommendation concerning fire safety requirements for cargo ships, which includes 21 regulations based on the principles of: separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries; protection of means of escape; early detection, containment or extinction of any fire; and restricted use of combustible materials. Other amendments to Chapter II-2 related to provisions for halogenated hydrocarbon extinguishing systems, special requirements for ships carrying dangerous goods, and a new regulation 62 on inert gas systems.

Some important changes were also made to Chapter V, including the addition of new requirements concerning the carriage of shipborne navigational equipment, covering such matters as gyro and magnetic compasses; the mandatory carriage of two radars and of automatic radar plotting aids in ships of 10,000 grt and above; echo-sounders; devices to indicate speed and distance; rudder angle indicators; propeller revolution indicators; rate of turn indicators; radio-direction finding apparatus; and equipment for homing on the radiotelephone distress frequency.

In addition, a few minor changes were made to Chapter III; seven regulations in Chapter IV were replaced, amended or added and a number of small changes were made to Chapter VII.

The 1983 amendments
Adoption: 17 June 1983
Entry into force: 1 July 1986

The most extensive changes involved Chapter III, which was completely rewritten. The Chapter in the 1974 Convention differed little from the texts which appeared in the 1960 and 1948 SOLAS Conventions and the amendments were designed not only to take into account the many technical advances which had taken place since then but also to expedite the evaluation and introduction of further improvements.

There were also a few minor changes to Chapter II-1 and some further changes to Chapter II-2 (including improvements to the 1981 amendments) designed particularly to increase the safety of bulk carriers and passenger ships. Some small changes were made to Chapter IV.

Amendments to Chapter VII extended its application to chemical tankers and liquefied gas carriers by making reference to two new Codes, the International

Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code). Both apply to ships built on or after 1 July 1986.

The 1988 (April) amendment.
Adoption: 21 April 1988
Entry into force: 22 October 1989

In March 1987 the car ferry Herald of Free Enterprise capsized shortly after leaving Zeebrugge in Belgium and sank with the loss of 193 lives. The United Kingdom proposed a series of measures designed to prevent a recurrence, the first package of which was adopted in April 1988.

They included new regulations 23-2 and 42-1 of Chapter II-1 intended to improve monitoring of doors and cargo areas and to improve emergency lighting. Because of the urgency, the Maritime Safety Committee agreed the amendments should come into force only 18 months after their adoption, using the "tacit acceptance" procedure.

The 1988 (October) amendments
Adoption: 28 October 1988
Entry into force: 29 April 1990

Some of these amendments also resulted from the Herald of Free Enterprise disaster and included details of how stability of passenger ships in a damaged condition should be determined and a requirement for all cargo loading doors to be locked before a ship leaves the berth.

The amendments also made it compulsory for passenger ships to have a lightweight survey at least every five years to ensure their stability has not been adversely affected by the accumulation of extra weight or any alterations to the superstructure.

Other amendments concerning the stability of passenger ships in the damaged condition were also adopted. These regulations had been in preparation before the Herald of Free Enterprise incident and their adoption was brought forward.

The 1988 Protocol (HSSC)
Adoption: 11 November 1988
Entry into force: 3 February 2000

The Protocol introduces a new harmonized system of surveys and certification (HSSC) to harmonize with two other Conventions, Load Lines and MARPOL 73/78. The aim is to alleviate problems caused by the fact that as requirements in the three instruments vary, ships may be obliged to go into dry-dock for a survey required by one convention shortly after being surveyed in connection with another.

By enabling the required surveys to be carried out at the same time, the system is intended to reduce costs for shipowners and administrations alike.

The 1988 (GMDSS) amendments
Adoption: 11 November 1988
Entry into force: 1 February 1992

IMO had begun work on the Global Maritime Distress and Safety System (GMDSS) in the 1970s and its introduction marked the biggest change to maritime communications since the invention of radio.

The amendments which replaced the existing Chapter IV phased in the introduction of the GMDSS in stages between 1993 and 1 February 1999. The basic concept of the system is that search and rescue authorities ashore, as well as ships in the vicinity, will be rapidly alerted in the event of an emergency.

The GMDSS makes great use of the satellite communications provided by Inmarsat but also uses terrestrial radio.

The equipment required by ships varies according to the sea area in which they operate - ships travelling to the high seas must carry more communications equipment than those which remain within reach of specified shore-based radio facilities. In addition to distress communications, the GMDSS also provides for the dissemination of general maritime safety information (such as navigational and meteorological warnings and urgent information to ships).

The 1989 amendments
Adoption: 11 April 1989
Entry into force: 1 February 1992

The main changes concern Chapter II-1 and II-2 of the Convention and deal with ships' construction and with fire protection, detection and extinction.

In Chapter II-1, one of the most important amendments is designed to reduce the number and size of openings in watertight bulkheads in passenger ships and to ensure that they are closed in the event of an emergency.

In Chapter II-2, improvements were made to regulations concerning fixed gas fire-extinguishing systems, smoke detection systems, arrangements for fuel and other oils, the location and separation of spaces and several other regulations.

The International Gas Carrier Code - which is mandatory under SOLAS - was also amended.

The 1990 amendments
Adoption: May 1990
Entry into force: 1 February 1992

Important changes were made to the way in which the subdivision and stability of dry cargo ships is determined. They apply to ships of 100 metres or more in length built on or after 1 February 1992.

The amendments introduced a new part B-1 of Chapter II-1 containing subdivision and damage stability requirements for cargo ships based upon the so-called "probabilistic" concept of survival, which was originally developed through study of data relating to collisions collected by IMO.

This showed a pattern in accidents which could be used in improving the design of ships: most damage, for example, is sustained in the forward part of ships and it seemed logical, therefore, to improve the standard of subdivision there rather than towards the stern. Because it is based on statistical evidence as to what actually happens when ships collide, the probabilistic concept provides a far more realistic scenario than the earlier "deterministic" method, whose principles regarding the subdivision of passenger ships are theoretical rather than practical in concept.

Amendments were also made to the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code).

The 1991 amendments
Adoption: 24 May 1991
Entry into force: 1 January 1994

Chapter VI (Carriage of grain) was completely revised to extend it to include other cargoes and it was retitled Carriage of cargoes. The text is shorter, but the Chapter is backed up by two new Codes. The International Grain Code is mandatory while the Code of Safe Practice for Cargo Stowage and Securing is recommended. The Chapter also refers to the Code of Safe Practice for Ships Carrying Timber Deck Cargoes and the Code of Safe Practice for Solid Bulk

Cargoes.In Chapter II-2, fire safety requirements for passenger ships were improved and other changes were made to Chapter III and Chapter V.

The April 1992 amendments
Adoption: 10 April 1992
Entry into force: 1 October 1994

New standards concerning the stability of existing ro-ro passenger ships after damage were included in amendments to Chapter II-1. They were based on measures to improve the damage stability of new ro-ro passenger ships which came into force on 29 April 1990 but were slightly modified. The measures are phased in over an 11-year period beginning 1 October 1994.

A number of other amendments to SOLAS were adopted, including improved fire safety measures for existing passenger ships carrying more than 36 passengers, including mandatory requirements for smoke detection and alarm and sprinkler systems in accommodation and service spaces, stairway enclosures and corridors. Other improvements involved the provision of emergency lighting, general emergency alarm systems and other means of communication.

Some of these measures became applicable for existing ships on 1 October 1994. Those dealing with smoke detection and alarm systems and sprinklers applied from 1 October 1997. Requirements concerning stairways of steel-frame construction, for fire-extinguishing systems in machinery spaces and for fire doors are mandatory from 1 October 2000.

The April 1992 amendments are particularly important because they apply to existing ships. In the past, major changes to SOLAS had been restricted to new ships by so-called "grandfather clauses". The reason for this is that major changes involve expensive modifications to most ships, and there had previously been a reluctance to make such measures retroactive.

The December 1992 amendments
Adoption: 11 December 1992
Entry into force: 1 October 1994

The most important amendments were concerned with the fire safety of new passenger ships. They made it mandatory for new ships (i.e. those built after 1 October 1994) carrying more than 36 passengers to be fitted with automatic sprinklers and a fire detection and alarm system centralized in a continuously-manned remote control station. Controls for the remote closing of fire doors and shutting down of ventilation fans must be located at the same place.

New standards for the fire integrity of bulkheads and decks were introduced and improvements made to standards for corridors and stairways used as a means of escape in case of fire. Emergency lighting which can be used by passengers to identify escape routes is required.

Other amendments affect the fire safety of ships carrying 36 passengers or less and also oil tanker fire safety.

Three Codes were also amended. Amendments to the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) entered into force on 1 July 1994 and affect ships built after that date.

Amendments to the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code) entered into force on 1 July 1994. The Code is voluntary and applies to existing ships.

The May 1994 amendments (Conference)
Adoption: 24 May 1994
Entry into force: 1 January 1996 (Chapters X, XI) 1 July 1998 (Chapter IX)

The Conference adopted three new SOLAS Chapters as well as a resolution on an accelerated amendment procedure.

Accelerated amendment procedure

The Conference adopted a resolution on an accelerated amendment procedure to be used in exceptional circumstances. It states that a Conference of Contracting Governments can reduce the period after which an amendment to the technical Chapters of the Convention (which excludes the articles and Chapter I) is deemed to have been accepted from 12 months to six months, in exceptional circumstances.

Article VIII of SOLAS deals with the procedures for amending the Convention. The existing text says that proposed amendments have to be circulated to Governments at least six months prior to adoption and cannot enter into force until at least 18 months after adoption. This makes a total of 24 months, from circulation (six months), through adoption, to deemed acceptance date (12 months after adoption), to entry into force (six months after deemed acceptance date).

The resolution adopted by the conference states that the circulation period will remain at six months as will the period between the date on which the amendment is deemed to have been accepted and the date of entry into force. But the period between adoption and deemed acceptance date can be reduced to six months from 12. The total period between circulation of an amendment and its entry into force could thus be reduced from 24 months to 18 - in exceptional circumstances.

Chapter IX: Management for the Safe Operation of Ships

This new Chapter to the Convention was designed to make mandatory the International Safety Management Code, which was adopted by IMO in November 1993 (Assembly resolution A.741(18)).

The amendments introducing the new Chapter IX entered into force under tacit acceptance on 1 July 1998. The Chapter applies to passenger ships and tankers from that date and to cargo ships and mobile drilling units of 500 gross tonnage and above from 1 July 2002.

The Code establishes safety management objectives which are:

- to provide for safe practices in ship operation and a safe working environment;

- to establish safeguards against all identified risks;

- to continuously improve safety management skills of personnel, including preparing for emergencies.

The Code requires a safety management system (SMS) to be established by "the Company", which is defined as the shipowner or any person, such as the manager or bareboat charterer, who has assumed responsibility for operating the ship.

The company is then required to establish and implement a policy for achieving these objectives. This includes providing the necessary resources and shore-based support. Every company is expected "to designate a person or persons ashore having direct access to the highest level of management".

The procedures required by the ISM Code should be documented and compiled in a Safety Management Manual, a copy of which should be kept on board.

Chapter X: Safety Measures for High Speed Craft

The new Chapter makes mandatory the International Code of Safety for High-Speed Craft, which was adopted by the Maritime Safety Committee (MSC) held concurrently with the Conference.

The Chapter entered into force under tacit acceptance on 1 January 1996 and applies to high-speed craft built on or after that date.

Chapter XI: Special Measures to Enhance Safety:

The new Chapter entered into force under tacit acceptance on 1 January 1996.

Regulation 1 states that organizations entrusted by an Administration with the responsibility for carrying out surveys and inspections shall comply with the guidelines adopted by IMO in resolution A.739(18) in November 1993.

Regulation 2 extends to bulk carriers aged five years and above, the enhanced programme of surveys applicable to tankers under MARPOL 73/78. The enhanced surveys should be carried out during the periodical, annual and intermediate surveys prescribed by the MARPOL and SOLAS Conventions.

The related guidelines on enhanced surveys pay special attention to corrosion. Coatings and tank corrosion prevention systems must be thoroughly checked and measurements must also be carried out to check the thickness of plates.

Regulation 3 provides that all passenger ships of 100 gross tonnage and above and all cargo ships of 300 gross tonnage and above shall be provided with an identification number conforming to the IMO ship identification number scheme, as adopted by resolution A.600(15) in 1987.

Regulation 4 makes it possible for port State control officers inspecting foreign ships to check operational requirements "when there are clear grounds for believing that the master or crew are not familiar with essential shipboard procedures relating to the safety of ships"

Reference is made to resolution A.742(18), adopted in November 1993. The resolution acknowledges the need for port States to be able to monitor not only the way in which foreign ships comply with IMO standards but also to be able to assess "the ability of ships' crews in respect of operational requirements relevant to their duties, especially with regard to passenger ships and ships which may present a special hazard".

The "clear grounds" referred to are defined in the annex to the resolution. They include such factors as operational shortcomings, cargo operations not being conducted properly, the involvement of the ship in incidents caused by operational mistakes, absence of an up-to-date muster list and indications that crew members may not be able to communicate with each other.

Port State control inspections are normally limited to checking certificates and documents. But if certificates are not valid or if there are clear grounds for believing that the condition of the ship or of its equipment, or its crew, does not substantially meet the requirements of a relevant instrument, a more detailed inspection may be carried out.

The operations and procedures selected for special attention include ascertaining that crew members are aware of their duties as indicated in the muster list; communications; fire and abandon ship drills; familiarity with the ship's damage control and fire control plans; bridge, cargo and machinery operations; and ability to understand manuals and other instructions.

The May 1994 amendments (MSC)
Adoption: 25 May 1994
Entry into force: 1 January 1996

Three new regulations were added to Chapter V

.Regulation 15.1 requires all tankers of 20,000 dwt and above built after 1 January 1996 to be fitted with an emergency towing arrangement to be fitted at both ends of the ship. Tankers built before that date had to be fitted with a similar arrangement not later than 1 January 1999.

Regulation 22 is aimed at improving navigation bridge visibility.

Regulation 8.1 makes mandatory the use of ship reporting systems approved by IMO. General principles for ship reporting systems were previously adopted by IMO in 1989 as a recommendation. The systems are used to provide, gather or exchange information through radio reports.

The regulation makes it mandatory for ships entering areas covered by ship reporting systems to report in to the coastal authorities giving details of sailing plans.

In Chapter II-2 improvements were made to regulation 15, which deals with fire protection arrangements for fuel oil, lubrication oil and other flammable oils.

Amendments to the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) and the Code for the Construction and Equipment of Ships Carrying Liquefied Gases (Gas Carrier Code) relate to the filling limits for cargo tanks.

The December 1994 amendments
Adoption: 9 December 1994
Entry into force: 1 July 1996

In Chapter VI (Carriage of Cargoes), the Code of Safe Practice for Cargo Stowage and Securing is made mandatory. The Code was adopted as a recommendation in 1991. The amendments make it mandatory to provide the cargo information required by the Code and for cargo units, including containers, to be loaded, stowed and secured in accordance with a manual that must be at least equivalent to the Code.

The Code is also made mandatory under Chapter VII (Carriage of dangerous goods).

The May 1995 amendments

Adoption: 16 May 1995
Entry into force: 1 January 1997

Regulation 8 of Chapter V was amended to make ships' routeing systems compulsory. Governments are responsible for submitting proposals for ships' routeing systems to IMO in accordance with amendments to the General Provisions on Ships' Routeing, which were adopted at the same time.

The November 1995 amendments (Conference)
Adopted: 29 November 1995
Entry into force: 1 July 1997

The conference adopted a series of amendments to SOLAS, based on proposals put forward by the Panel of Experts on the safety of roll on-roll off passenger ships which was established in December 1994 following the sinking of the ferry Estonia.

The most important changes relate to the stability of ro-ro passenger ships in Chapter II-1.

The SOLAS 90 damage stability standard, which had applied to all ro-ro passenger ships built since 1990, was extended to existing ships in accordance with an agreed phase-in programme. Ships that only meet 85% of the standard had to comply fully by 1 October 1998 and those meeting 97.5% or above, by 1 October 2005. (The SOLAS 90 standard refers to the damage stability standard in the 1988 (October) amendments to SOLAS adopted 28 October 1988 and entering into force on 29 April 1990.)

The conference also adopted a new regulation 8-2, containing special requirements for ro-ro passenger ships carrying 400 passengers or more. This is intended to phase out ships built to a one-compartment standard and ensure that they can survive without capsizing with two main compartments flooded following damage.

Amendments to other Chapters in the SOLAS Convention included changes to Chapter III, which deals with life saving appliances and arrangements, including the addition of a section requiring ro-ro passenger ships to be fitted with public address systems, a regulation providing improved requirements for life-saving appliances and arrangements and a requirement for all passenger ships to have full information on the details of passengers on board and requirements for the provision of a helicopter pick-up or landing area.

Other amendments were made to Chapter IV (radiocommunications); Chapter V (safety of navigation) - including a requirement that all ro-ro passenger ships should have an established working language - and Chapter VI (carriage of cargoes).

The conference also adopted a resolution which permits regional arrangements to be made on special safety requirements for ro-ro passenger ships.

The June 1996 amendments
Adoption: 4 June 1996
Entry into force: 1 July 1998

A completely revised Chapter III on life-saving appliances and arrangements was adopted. The amendments take into account changes in technology since the Chapter was last re-written in 1983.

Many of the technical requirements were transferred to a new International Life-Saving Appliance (LSA) Code, applicable to all ships built on or after 1 July 1998. Some of the amendments apply to existing ships as well as new ones.

Other SOLAS Chapters were also amended.

In Chapter II-1, a new part A-1 dealing with the structure of ships was added. Regulation 3-1 requires ships to be designed, constructed and maintained in compliance with structural requirements of a recognized classification society or with applicable requirements by the Administration. Regulation 3-2 deals with corrosion prevention of seawater ballast tanks and other amendments to Chapter II-1 concern the stability of passenger and cargo ships in the damaged condition.

In Chapter VI, Regulation 7 was replaced by a new text dealing with the loading, unloading and stowage of bulk cargoes. It is intended to ensure that no excessive stress is placed on the ship's structure during such operations. The ship must be provided with a booklet giving advice on cargo handling operations and the master and terminal representative must agree on a plan to ensure that loading and unloading is carried out safely.

In Chapter XI, an amendment was made regarding authorization of recognized organizations.

The International Bulk Chemicals (IBC) and Bulk Chemicals (BCH) Codes were also amended. The IBC Code is mandatory under SOLAS and applies to ships carrying dangerous chemicals in bulk that were built after 1 July 1986. The BCH is recommended and applies to ships built before that date.

The December 1996 amendments
Adoption: 6 December 1996
Entry into force: 1 July 1998

Chapter II-2 was considerably modified, with changes to the general introduction, Part B (fire safety measures for passenger ships), Part C (fire safety measures for cargo ships) and Part D (fire safety measures for tankers). The changes made mandatory a new International Code for Application of Fire Test Procedures intended to be used by Administrations when approving products for installation in ships flying their flag.

Amendments to Chapter II-1 included a requirement for ships to be fitted with a system to ensure that the equipment necessary for propulsion and steering are maintained or immediately restored in the case of loss of any one of the generators in service.

An amendment to Chapter V aims to ensure that the crew can gain safe access to the ship's bow, even in severe weather conditions. Amendments were also made to two regulations in Chapter VII relating to carriage of dangerous goods and the IBC Code was also amended.

The June 1997 amendments
Adoption: 4 June 1997
Entry into force: 1 July 1999 (Under tacit acceptance)

The amendments included a new Regulation 8.2 on Vessel Traffic Services (VTS) in Chapter V. VTS are traffic management systems, for example those used in busy straits. This Regulation sets out when VTS can be implemented. It says Vessel Traffic Services should be designed to contribute to the safety of life at sea, safety and efficiency of navigation and the protection of the marine environment, adjacent shore areas, worksites and offshore installations from possible adverse effects of maritime traffic.

Governments may establish VTS when, in their opinion, the volume of traffic or the degree of risk justifies such services. But no VTS should prejudice the "rights and duties of governments under international law" and a VTS may only be made mandatory in sea areas within a State's territorial waters.

In Chapter II-1, a new regulation 8.3 on "Special requirements for passenger ships, other than ro-ro passenger ships, carrying 400 persons or more" effectively makes these ships comply with the special requirements for ro-ro passenger ships in Regulation 8.2 which were adopted in November 1995. The special requirements are aimed at ensuring the ships can survive without capsizing with two main compartments flooded following damage.

The November 1997 amendments (Conference)
Adoption: 27 November 1997
Entry into force: 1 July 1999

The Conference adopted a Protocol adding a new Chapter XII to the Convention entitled Additional Safety Measures for Bulk Carriers.

The regulations state that all new bulk carriers 150 metres or more in length (built after 1 July 1999) carrying cargoes with a density of 1,000 kg/m3 and above should have sufficient strength to withstand flooding of any one cargo hold, taking into account dynamic effects resulting from presence of water in the hold and taking into account the recommendations adopted by IMO.

For existing ships (built before 1 July 1999) carrying bulk cargoes with a density of 1,780 kg/m3 and above, the transverse watertight bulkhead between the two foremost cargo holds and the double bottom of the foremost cargo hold should have sufficient strength to withstand flooding and the related dynamic effects in the foremost cargo hold.

Cargoes with a density of 1,780 kg/m3 and above (heavy cargoes) include iron ore, pig iron, steel, bauxite and cement. Lighter cargoes, but with a density of more than 1,000 kg/m3, include grains such as wheat and rice, and timber.

The amendments take into account a study into bulk carrier survivability carried out by the International Association of Classification Societies (IACS) at the request of IMO. IACS found that if a ship is flooded in the forward hold, the bulkhead between the two foremost holds may not be able to withstand the pressure that results from the sloshing mixture of cargo and water, especially if the ship is loaded in alternate holds with high density cargoes (such as iron ore). If the bulkhead between one hold and the next collapses, progressive flooding could rapidly occur throughout the length of the ship and the vessel would sink in a matter of minutes.

IACS concluded that the most vulnerable areas are the bulkhead between numbers one and two holds at the forward end of the vessel and the double bottom of the ship at this location. During special surveys of ships, particular attention should be paid to these areas and, where necessary, reinforcements should be carried out.

The criteria and formulae used to assess whether a ship currently meets the new requirements, for example in terms of the thickness of the steel used for bulkhead structures, or whether reinforcement is necessary, are laid out in IMO standards adopted by the 1997 Conference.

Under Chapter XII, surveyors can take into account restrictions on the cargo carried in considering the need for, and the extent of, strengthening of the transverse watertight bulkhead or double bottom. When restrictions on cargoes are imposed, the bulk carrier should be permanently marked with a solid triangle on its side shell. The date of application of the new Chapter to existing bulk carriers depends on their age. Bulk carriers which are 20 years old and over on 1 July 1999 have to comply by the date of the first intermediate or periodic survey after that date, whichever is sooner. Bulk carriers aged 15-20 years must comply by the first periodical survey after 1 July 1999, but not later than 1 July 2002. Bulk carriers less than 15 years old must comply by the date of the first periodical survey after the ship reaches 15 years of age, but not later than the date on which the ship reaches 17 years of age.

The May 1998 amendments

Adoption: 18 May 1998

Entry into force: 1 July 2002 (Under tacit acceptance)

Amendments were made to regulation 14 on Construction and initial testing of watertight bulkheads, etc., in passenger ships and cargo ships in Chapter II-1. Paragraph 3 is replaced to allow visual examination of welded connections, where filling with water or a hose test are not practicable.

In Chapter IV, the amendments included:

a new regulation 5-1 requiring Contracting Governments to ensure suitable arrangements are in place for registering Global Maritime Distress and Safety System (GMDSS) identities (including ship's call sign, Inmarsat identities) and making the information available 24 hours a day to Rescue Co-ordination

Centres;

a new paragraph 9 to regulation 15 Maintenance requirements covering testing intervals for satellite emergency position indicating radio beacons (EPIRBs);

a new regulation 18 on Position updating requiring automatic provision of information regarding the ship's position where two-way communication equipment is capable of providing automatically the ship's position in the distress alert.

Amendments in Chapter VI to paragraph 6 of regulation 5 *Stowage and securing* make it clear that "all cargoes, other than solid and liquid bulk cargoes" should be loaded, stowed and secured in accordance with the Cargo Securing Manual. A similar amendment was adopted for Regulation 6 of Chapter VII, also covering Stowage and securing.

The May 1999 amendments
Adoption: 27 May 1999
Entry into force: 1 January 2001 (Under tacit acceptance)

Amendments to Chapter VII make the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (INF Code) mandatory.

The INF Code sets out how the material covered by the Code should be carried, including specifications for ships. The material covered by the code includes:

- *Irradiated nuclear fuel* - material containing uranium, thorium and/or plutonium isotopes which has been used to maintain a self-sustaining nuclear chain reaction.

- *Plutonium* - the resultant mixture of isotopes of that material extracted from irradiated nuclear fuel from reprocessing

- *High-level radioactive wastes* - liquid wastes resulting from the operation of the first stage extraction system or the concentrated wastes from subsequent extraction stages, in a facility for reprocessing irradiated fuel, or solids into which such liquid wastes have been converted.

The INF Code applies to all ships regardless of the date of construction and size, including cargo ships of less than 500 gross tonnage, engaged in the carriage of INF cargo. The INF Code does not apply to warships, naval auxiliary or other ships used only on government non-commercial service, although Administrations are expected to ensure such ships are in compliance with the Code.

Specific regulations in the Code cover a number of issues, including: damage stability, fire protection, temperature control of cargo spaces, structural consideration, cargo securing arrangements, electrical supplies, radiological protection equipment and management, training and shipboard emergency plans.

Ships carrying INF cargo are assigned to one of three classes, depending on the total radioactivity of INF cargo which is carried on board, and regulations vary slightly according to the Class:
Class INF 1 ship - Ships which are certified to carry INF cargo with an aggregate activity less than 4,000 TBq (TeraBecquerel - measurement of radioactivity).

Class INF 2 ship - Ships which are certified to carry irradiated nuclear fuel or high-level radioactive wastes with an aggregate activity less than 2 x 106 TBq and ships which are certified to carry plutonium with an aggregate activity less than 2 x 105 TBq.

Class INF 3 ship - Ships which are certified to carry irradiated nuclear fuel or high-level radioactive wastes and ships which are certified to carry plutonium with no restriction of the maximum aggregate activity of the materials.

The INF Code was first adopted as a recommendatory Code by the eighteenth session of the Assembly on 4 November 1993 (resolution A.748(18)). The twentieth session of the Assembly adopted amendments to the INF Code to include specific requirements for shipboard emergency plans and notification in the event of an incident (resolution A.853(20), adopted on 27 November 1997).

The Maritime Safety Committee also adopted a redrafted text of the INF Code incorporating amendments reflecting its mandatory nature.

The May 2000 amendment
Adoption: 26 May 2000
Entry into force: 1 January 2002 (Under tacit acceptance)

SOLAS Chapter III, regulation 28.2 for helicopter landing areas is amended to require a helicopter landing area only for ro-ro passenger ships. Regulation 28.1 of SOLAS Chapter III requires all ro-ro passenger ships to be provided with a helicopter pick-up area and existing ro-ro passenger ships were required to comply with this regulation not later than the first periodical survey after 1 July 1997.

The requirement for a helicopter landing area for all passenger ships of 130 metres in length and upwards was deferred to 1 July 1999 but it was decided to amend the regulation to make this requirement applicable to ro-ro passenger ships only.

The December 2000 amendments
Adoption: 6 December 2000
Entry into force: 1 July 2002 (Under tacit acceptance)

A number of amendments were adopted.

A revised SOLAS chapter V (Safety of Navigation) brings in a new mandatory requirement for voyage data recorders voyage data recorders (VDRs) to assist in accident investigations. Regulation 20 requires the following ships to fit VDRs:

- passenger ships constructed on or after 1 July 2002;

- ro-ro passenger ships constructed before 1 July 2002 not later than the first survey on or after 1 July 2002

- passenger ships other than ro-ro passenger ships constructed before 1 July 2002 not later than 1 January 2004; and·

- ships, other than passenger ships, of 3,000 gross tonnage and upwards constructed on or after 1 July 2002.

The new chapter also requires automatic identification systems (AIS), capable of providing information about the ship to other ships and to coastal authorities automatically, to be fitted aboard all ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size built on or after 1 July 2002.

It also applies to ships engaged on international voyages constructed before 1 July 2002, according to the following timetable:

- passenger ships, not later than 1 July 2003;

- tankers, not later than the first survey for safety equipment on or after 1 July 2003;

- ships, other than passenger ships and tankers, of 50,000 gross tonnage and upwards, not later than 1 July 2004; ships, other than passenger ships and tankers, of 10,000 gross tonnage and upwards but less than 50,000 gross tonnage, not later than 1 July 2005;

- ships, other than passenger ships and tankers, of 3,000 gross tonnage and upwards but less than 10,000 gross tonnage, not later than 1 July 2006.

- ships, other than passenger ships and tankers, of 300 gross tonnage and upwards but less than 3,000 gross tonnage, not later than 1 July 2007.

Amendments to SOLAS chapter X (Safety measures for high-speed craft) make mandatory for new ships the High-Speed Craft Code 2000. The 2000 HSC Code updates the mandatory High-Speed Craft Code adopted in 1994. The 2000 HSC will apply to all HSC built after the date of entry into force, 1 July 2002. The original HSC Code was adopted by IMO in May 1994, but the rapid pace of development in this sector of shipping has meant an early revision of the Code. The original Code will continue to apply to existing high-speed craft. The changes incorporated in the new Code are intended to bring it into line with amendments to SOLAS and new recommendations that have been adopted in the past four years - for example, requirements covering public address systems and helicopter pick-up areas

A revised SOLAS chapter II-2 (Construction, - Fire protection, fire detection and fire extinction) as well as a new International Code for Fire Safety Systems (FSS Code) were adopted. The revised chapter is intended to be clear, concise and user-friendly, incorporating the substantial changes introduced in recent years following a number of serious fire casualties. The revised chapter includes seven parts, each including requirements applicable to all or specified ship types, while the Fire Safety Systems (FSS) Code, which is made mandatory under the new chapter, includes detailed specifications for fire safety systems in 15 Chapters.

A new regulation in SOLAS Chapter II-1 (Construction - Structure, subdivision and stability, machinery and electrical installations) prohibits the new installation of materials which contain asbestos on all ships. The new regulation 3-5 is included in SOLAS Chapter II-1 (Construction - Structure, Subdivision and stability, machinery and electrical installations.

Amendments to the 1988 SOLAS Protocol include amendments to reflect the changes to SOLAS chapter V, such as the details of navigational systems and equipment referred to in the records of equipment attached to certificates.

Amendments to the International Code for the Application of Fire Test Procedures (FTP Code) add new parts 10 and 11 to annex 1 on Test for fire-restricting material for high-speed craft and test for fire-resisting divisions of high-speed craft.

Amendments to the International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code) and the Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (BCH Code) relate to cargo hose requirements, protection of personnel and carriage of carbon disulphide. Entry into force 1 July 2002 under tacit acceptance.

Amendments to the International Safety Management Code (ISM Code) include the replacement of Chapter 13 Certification, verification and control with chapters 13 Certification; and adding of chapters 14 Interim Certification; 15 Forms of Certificate; and 16 Verification; as well as a new appendix giving forms of documents and certificates.

Amendments to the Code for the Construction and equipment of ships carrying dangerous chemicals in bulk (BCH Code) relate to ship's cargo hoses, tank vent systems, safety equipment, operational requirements; and amendments to the Code for the construction and equipment of ships carrying liquefied gases in bulk (GC Code) relate to ship's cargo hoses, personnel protection and operating requirements.

12. Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs)

Adoption: 20 October 1972
Entry into force: 15 July 1977

Introduction

The 1972 Convention was designed to update and replace the Collision Regulations of 1960 which were adopted at the same time as the 1960 SOLAS Convention.

One of the most important innovations in the 1972 COLREGs was the recognition given to traffic separation schemes - Rule 10 gives guidance in determining safe speed, the risk of collision and the conduct of vessels operating in or near traffic separation schemes.

The first such traffic separation scheme was established in the Dover Strait in 1967. It was operated on a voluntary basis at first but in 1971 the IMO Assembly adopted a resolution stating that that observance of all traffic separation schemes be made mandatory - and the COLREGs make this obligation clear.

Amendment procedureUnder the "tacit acceptance" procedure incorporated in the Convention, an amendment must first be adopted by two-thirds of those present and voting in the Maritime Safety Committee. It is then communicated to Contracting Parties and considered by the IMO Assembly. If adopted by two-thirds of the States present and voting in the Assembly, it automatically enters into force on a specified date unless more than one third of the Contracting Parties notify the Organization of their objection.In addition, a Conference for the purpose of revising the Convention or its regulations or both may be convened by IMO at the request of not less than one-third of Contracting Parties.

Technical provisions

The COLREGs include 38 rules divided into five sections: Part A - General; Part B - Steering and Sailing; Part C - Lights and Shapes; Part D - Sound and Light signals; and Part E - Exemptions. There are also four Annexes containing technical requirements concerning lights and shapes and their positioning; sound signalling appliances; additional signals for fishing vessels when operating in close proximity, and international distress signals.

Part A - General (Rules 1-3)

Rule 1 states that the rules apply to all vessels upon the high seas and all waters connected to the high seas and navigable by seagoing vessels.

Rule 2 covers the responsibility of the master, owner and crew to comply with the rules.

Rule 3 includes definitions.

Part B- Steering and Sailing (Rules 4-19)

Section 1 - Conduct of vessels in any condition of visibility (Rules 4-10)

Rule 4 says the section applies in any condition of visibility.

Rule 5 requires that "every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

Rule 6 deals with safe speed. It requires that: "Every vessel shall at all times proceed at a safe speed...". The Rule describes the factors which should be taken into account in determining safe speed. Several of these refer specifically to vessels equipped with radar.The importance of using "all available means" is further stressed in **Rule 7** covering risk of collision, which warns that "assumptions shall not be made on the basis of scanty information, especially scanty radar information"

Rule 8 covers action to be taken to avoid collision.

In **Rule 9** a vessel proceeding along the course of a narrow channel or fairway is obliged to keep "as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable." The same Rule obliges a vessel of less than 20 metres in length or a sailing vessel not to impede the passage of a vessel "which can safely navigate only within a narrow channel or fairway."

The Rule also forbids ships to cross a narrow channel or fairway "if such crossing impedes the passage of a vessel which can safely navigate only within such channel or fairway." The meaning "not to impede" was classified by an amendment to Rule 8 in 1987. A new paragraph (f) was added, stressing that a vessel which was required not to impede the passage of another vessel should take early action to allow sufficient sea room for the safe passage of the other vessel. Such vessel was obliged to fulfil this obligation also when taking avoiding action in accordance with the steering and sailing rules when risk of collision exists.

Rule 10 of the Collision Regulations deals with the behaviour of vessels in or near traffic separation schemes adopted by the Organization. By regulation 8 of Chapter V (Safety of Navigation) of SOLAS, IMO is recognized as being the only organization competent to deal with international measures concerning the routeing of ships.

The effectiveness of traffic separation schemes can be judged from a study made by the International Association of Institutes of Navigation (IAIN) in 1981. This showed that between 1956 and 1960 there were 60 collisions in the Strait of Dover; twenty years later, following the introduction of traffic separation schemes, this total was cut to only 16.

In other areas where such schemes did not exist the number of collisions rose sharply. New traffic separation schemes are introduced regularly and existing ones are amended when necessary to respond to changed traffic conditions. To enable this to be done as quickly as possible the MSC has been authorized to adopt and amend traffic separation schemes on behalf of the Organization.

Rule 10 states that ships crossing traffic lanes are required to do so "as nearly as practicable at right angles to the general direction of traffic flow." This reduces confusion to other ships as to the crossing vessel's intentions and course and at the same time enables that vessel to cross the lane as quickly as possible.

Fishing vessels "shall not impede the passage of any vessel following a traffic lane" but are not banned from fishing. This is in line with Rule 9 which states that "a vessel engaged in fishing shall not impede the passage of any other vessel navigating within a narrow channel or fairway."In 1981 the regulations were amended. Two new paragraphs were added to Rule 10 to exempt vessels which are restricted in their ability to manoeuvre "when engaged in an operation for the safety of navigation in a traffic separation scheme" or when engaged in cable laying.

In 1987 the regulations were again amended. It was stressed that Rule 10 applies to traffic separation schemes adopted by the Organization (IMO) and does not relieve any vessel of her obligation under any other rule. It was also to clarify that if a vessel is obliged to cross traffic lanes it should do so as nearly as practicable at right angles to the general direction of the traffic flow. In 1989 Regulation 10 was further amended to clarify the vessels which may use the "inshore traffic zone."

Section II - Conduct of vessels in sight of one another (Rules 11-18)

Rule 11 says the section applies to vessels in sight of one another.

Rule 12 states action to be taken when two sailing vessels are approaching one another.

Rule 13 covers overtaking - the overtaking vessel should keep out of the way of the vessel being overtaken.

Rule 14 deals with head-on situations. Crossing situations are covered by **Rule 15** and action to be taken by the give-way vessel is laid down in **Rule 16**.

Rule 17 deals with the action of the stand-on vessel, including the provision that the stand-on vessel may "take action to avoid collision by her manoeuvre alone as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action.

Rule 18 deals with responsibilities between vessels and includes requirements for vessels which shall keep out of the way of others.

Section III - conduct of vessels in restricted visibility (Rule 19)

Rule 19 states every vessel should proceed at a safe speed adapted to prevailing circumstances and restricted visibility. A vessel detecting by radar another vessel should determine if there is risk of collision and if so take avoiding action. A vessel hearing fog signal of another vessel should reduce speed to a minimum.

Part C Lights and Shapes (Rules 20-31)

Rule 20 states rules concerning lights apply from sunset to sunrise. **Rule 21** gives definitions.

Rule 22 covers visibility of lights - indicating that lights should be visible at minimum ranges (in nautical miles) determined according to the type of vessel.

Rule 23 covers lights to be carried by power-driven vessels underway.

Rule 24 covers lights for vessels towing and pushing.

Rule 25 covers light requirements for sailing vessels underway and vessels under oars.

Rule 26 covers light requirements for fishing vessels.

Rule 27 covers light requirements for vessels not under command or restricted in their ability to manoeuvre.

Rule 28 covers light requirements for vessels constrained by their draught.

Rule 29 covers light requirements for pilot vessels.

Rule 30 covers light requirements for vessels anchored and aground.

Rule 31 covers light requirements for seaplanes

Part D - Sound and Light Signals (Rules 32-37)

Rule 32 gives definitions of whistle, short blast, and prolonged blast.

Rule 33 says vessels 12 metres or more in length should carry a whistle and a bell and vessels 100 metres or more in length should carry in addition a gong.

Rule 34 covers manoeuvring and warning signals, using whistle or lights.

Rule 35 covers sound signals to be used in restricted visibility.

Rule 36 covers signals to be used to attract attention.

Rule 37 covers distress signals.

Part E - Exemptions (Rule 38)

Rule 38 says ships which comply with the 1960 Collision Regulations and were built or already under construction when the 1972 Collision Regulations entered into force may be exempted from some requirements for light and sound signals for specified periods.

Annexes

The COLREGs include four annexes:

Annex I - Positioning and technical details of lights and shapes

Annex II - Additional signals for fishing vessels fishing in close proximity

Annex III - Technical details of sounds signal appliances

Annex IV - Distress signals, which lists the signals indicating distress and need of assistance.

Annexes I and IV were amended in 1987 to clarify the positioning of certain lights carried on smaller vessels and to add "approved signals transmitted by radiocommunications systems" (ie distress alerts transmitted in the GMDSS). A section on location signals from search and rescue radar transponders was added in 1993.

The 1981 amendments
Adoption: 19 November 1981
Entry into force: 1 June 1983
A number of rules are affected but perhaps the most important change concerns rule 10, which has been amended to enable vessels carrying out various safety operations, such as dredging or surveying, to carry out these functions in traffic separation schemes.

The 1987 amendments
Adoption: 19 November 1987
Entry into force: 19 November 1989

The amendments affect several rules, including rule 1(e) ? vessels of special construction: the amendment classifies the application of the Convention to such ships; Rule 3(h), which defines a vessel constrained by her draught; Rule 10(c) ? crossing traffic lanes.

The 1989 amendments
Adoption: 19 October 1989
Entry into force: 19 April 1991

The amendment concerns Rule 10 and is designed to stop unnecessary use of the inshore traffic zone.

The 1993 amendments
Adoption: 4 November 1993
Entry into force: 4 November 1995

The amendments are mostly concerned with the positioning of lights.

13. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978

Adoption: 7 July 1978
Entry into force: 28 April 1984

The 1995 amendments, which completely revised the Convention, entered into force on 1 February 1997. However, until 1 February 2002, Parties may continue to issue, recognize and endorse certificates which applied before 1 February 1997 in respect of seafarers who began training or seagoing service before 1 August 1998. This means that the original 1978 text will continue to apply to many of the world's ships and seafarers until the year 2002.

The 1978 STCW Convention – Introduction

The 1978 STCW Convention was the first to establish basic requirements on training, certification and watchkeeping for seafarers on an international level. Previously the standards of training, certification and watchkeeping of officers and ratings were established by individual governments, usually without reference to practices in other countries. As a result standards and procedures varied widely, even though shipping is the most international of all industries.

The Convention prescribes minimum standards relating to training, certification and watchkeeping for seafarers which countries are obliged to meet or exceed.

The Convention did not deal with manning levels: IMO provisions in this area are covered by regulation 13 of Chapter V of the International Convention for the Safety of Life at Sea (SOLAS), 1974, whose requirements are backed up by resolution A.890(21) Principles of safe manning, adopted by the IMO Assembly in 1999, which replaced an earlier resolution A.481(XII) adopted in 1981.

The Articles of the Convention include requirements relating to issues surrounding certification and port State control.

One especially important feature of the Convention is that it applies to ships of non-party States when visiting ports of States which are Parties to the Convention. Article X requires Parties to apply the control measures to ships of all flags to the extent necessary to ensure that no more favourable treatment is given to ships entitled to fly the flag of a State which is not a Party than is given to ships entitled to fly the flag of a State that is a Party.

The difficulties which could arise for ships of States which are not Parties to the Convention is one reason why the Convention has received such wide acceptance. By December 2000, the STCW Convention had 135 Parties, representing 97.53 percent of world shipping tonnage.

The 1978 Convention – Chapter I

The technical provisions of the 1978 Convention are contained in an Annex, divided into six Chapters:

The 1978 Convention - Chapter I:General provisions

Includes a list of definitions of terms used in the annex. Regulation I/2 deals with the content of the certificate and endorsement form. All certificates must include a translation into English, if that is not the official language of the issuing country.

The 1978 Convention - Chapter II: Master-deck department

The Chapter establishes basic principles to be observed in keeping a navigational watch, covering such matters as watch arrangements, fitness for duty, navigation, navigational equipment, navigational duties and responsibilities, the duties of the look-out, navigation with a pilot on board and protection of the marine environment.

The regulations include mandatory minimum requirements for certificating masters and chief mates; for certification of officers in charge of a navigational watch; and for certification of deck ratings forming part of a navigational watch. The regulations also include basic principles to be observed in keeping watch in port and mandatory minimum requirements for a watch in port on ships carrying hazardous cargo.

The 1978 Convention - Chapter III: Engine department

Includes basic principles to be observed in keeping an engineering watch; mandatory minimum requirements for certification of chief engineer officers and second engineer officers; mandatory minimum requirements for certification of engineer officers in charge of a watch in a traditionally manned engine room or designated duty officers in a periodically unmanned engine room; requirements to ensure the continued proficiency and updating of knowledge for engineer officers; mandatory minimum requirements for ratings forming part of an engine room watch.

The 1978 Convention - Chapter IV: Radio department

Notes that mandatory provisions relating to radio watchkeeping are set forth in the ITU Radio Regulations and safety radio watchkeeping and maintenance provisions are included in the same regulations and in SOLAS. The Chapter in STCW includes mandatory minimum requirements for certification of radio officers; provisions designed to ensure the continued proficiency and updating of knowledge of radio officers; and minimum requirements for certification of radiotelephone operators.

The 1978 Convention - Chapter V: Special requirements for tankers

The Chapter was designed to ensure that officers and ratings who are to have specific duties related to the cargo and cargo equipment of tankers shall have completed an appropriate shore-based fire-fighting course; and have completed either an appropriate period of shipboard service or an approved familiarization course. Requirements are more stringent for masters and senior officers. Attention is paid not only to safety aspects but also to pollution prevention. The Chapter contains three regulations dealing with oil tankers, chemical tankers and liquefied gas tankers, respectively.

The 1978 Convention - Chapter VI: Proficiency in survival craft

The Chapter establishes requirements governing the issuing of certificates of proficiency in survival craft. An appendix lists the minimum knowledge required for the issue of certificates of proficiency.

Resolutions adopted by the 1978 Conference

The 1978 Conference which adopted the STCW Convention also adopted a number of resolutions designed to back up the Convention itself. The resolutions, which are recommendatory rather than mandatory, incorporate more details than some of the Convention regulations.

Resolution 1 - Basic principles to be observed in keeping a navigational watch. An annex contains a recommendation on operational guidance for officers in charge of a navigational watch.

Resolution 2 - Operational guidance for engineer officers in charge of an engineering watch. An annex to the resolution deals with engineering watch underway and at an unsheltered anchorage.

Resolution 3 - Principles and operational guidance for deck officers in charge of a watch in port. Detailed recommendations are contained in an annex.

Resolution 4 - Principles and operational guidance for engineer officers in charge of an engineering watch in port. Recommendations are in an annex.

Resolution 5 - Basic guidelines and operational guidance relating to safety radio watchkeeping and maintenance for radio officers. A comprehensive annex is divided into basic guidelines and safety radio watchkeeping and maintenance.

Resolution 6 - Basic guidelines and operational guidance relating to safety radio watchkeeping for radio telephone operators.

Resolution 7 - Radio operators. Four recommendations are annexed to this resolution dealing with (i) minimum requirements for certification of radio officers; (ii) minimum requirements to ensure the continued proficiency and updating of knowledge for radio operators; (iii) basic guidelines and operational guidance relating to safety radio watchkeeping and maintenance for radio operators; and (iv) training for radio operators.

Resolution 8 - Additional training for ratings forming part of a navigational watch. Recommends that such ratings be trained in use and operation of appropriate bridge equipment and basic requirements for the prevention of pollution.

Resolution 9 - Minimum requirements for a rating nominated as the assistant to the engineer officer in charge of the watch. Recognizes that suitable training arrangements are not widely available. Detailed requirements are contained in an annex.

Resolution 10 - Training and qualifications of officers and ratings of oil tankers. Refers to resolution 8 adopted by the International Conference on Tanker Safety and Pollution Prevention, 1978 (TSPP), which deals with the improvement of standards of crews on tankers. Recommendation in annex.

Resolution 11 - Training and qualifications of officers and ratings of chemical tankers.

Resolution 12 - Training and qualifications of masters, officers and ratings of liquefied gas tankers.

Resolution 13 - Training and qualifications of officers and ratings of ships carrying dangerous and hazardous cargo other than in bulk.

Resolution 14 - Training for radio officers. Detailed recommendations in annex.

Resolution 15 - Training for radiotelephone operators

Resolution 16 - Technical assistance for the training and qualifications of masters and other responsible personnel of oil, chemical and liquefied gas tankers. Refers to requirements in several Convention regulations and recognizes that training facilities may be limited in some countries. Urges Governments which can provide assistance to do so.· Back to top

Resolution 17 - Additional training for masters and chief mates of large ships and of ships with unusual manoeuvring characteristics. Is designed to assist those moving to ships of this type from smaller vessels, where characteristics may be quite different.

Resolution 18 - Radar simulator training. Recommends that such training be given to all masters and deck officers.

Resolution 19 - Training of seafarers in personal survival techniques. A recommendation is annexed.

Resolution 20 - Training in the use of collision avoidance aids.

Resolution 21 - International Certificate of Competency. Invites IMO to develop a standard form and title for this certificate.

Resolution 22 - Human relationships. Emphasizes the importance to safety of good human relationships between seafarers on board.

Resolution 23 - Promotion of technical co-operation. Records appreciation of IMO's work in assisting developing countries to establish maritime training facilities in conformity with global standards of training and invites the organization to intensify its efforts with a view to promoting universal acceptance and implementation of the STCW Convention.

Amendment Procedure

Amendments to the 1978 STCW Convention's technical Annex may be adopted by a Conference of STCW Parties or by IMO's Maritime Safety Committee, expanded to include all Contracting Parties, some of whom may not be members of the Organization.

Amendments to the STCW Annex will normally enter into force one and a half years after being communicated to all Parties unless, in the meantime, they are rejected by one-third of the Parties or by Parties whose combined fleets represent 50 per cent of world tonnage.

The 1991 amendment.
Adoption: 22 May 1991
Entry into force: 1 December 1992
The amendments were mostly concerned with additional requirements made necessary by the implementation of the Global Maritime Distress and Safety System (GMDSS).

The 1994 amendments
Adoption: 25 May 1994
Entry into force: 1 January 1996

The amendments replaced Chapter V on special training for crews on tankers.

The 1995 amendments
Adoption: 7 July 1995
Entry into force: 1 February 1997

The 1995 amendments, adopted by a Conference, represented a major revision of the Convention, in response to a recognized need to bring the Convention up to date and to respond to critics who pointed out the many vague phrases, such as "to the satisfaction of the Administration", which resulted in different interpretations being made.

Others complained that the Convention was never uniformly applied and did not impose any strict obligations on Parties regarding implementation. The 1995 amendments entered into force on 1 February 1997. However, until 1 February 2002, Parties may continue to issue, recognize and endorse certificates which applied before that date in respect of seafarers who began training or seagoing service before 1 August 1998.

One of the major features of the revision was the division of the technical annex into regulations, divided into Chapters as before, and a new STCW Code, to which many technical regulations have been transferred. Part A of the Code is mandatory while Part B is recommended.

Dividing the regulations up in this way makes administration easier and it also makes the task of revising and updating them more simple: for procedural and legal reasons there is no need to call a full conference to make changes to Codes.

Some of the most important amendments adopted by the Conference concern Chapter I - General Provisions. They include the following:

Ensuring compliance with the Convention

Parties to the Convention are required to provide detailed information to IMO concerning administrative measures taken to ensure compliance with the Convention. This represented the first time that IMO had been called upon to act in relation to compliance and implementation - generally, implementation is down to the flag States, while port State control also acts to ensure compliance. Under Chapter I, regulation I/7 of the revised Convention, Parties are required to provide detailed information to IMO concerning administrative measures taken to ensure compliance with the Convention, education and training courses, certification procedures and other factors relevant to implementation.

By 1 August 1998 - the deadline for submission of information established in section A-I/7 of the STCW Code - 82 out of the 133 STCW Parties had communicated information on compliance with the requirements of the revised Convention. The 82 Parties which met the deadline represent well over 90% of the world's ships and seafarers.

The information is reviewed by panels of competent persons, nominated by Parties to the STCW Convention, who report on their findings to the IMO Secretary-General, who, in turn, reports to the Maritime Safety Committee (MSC) on the Parties which fully comply. The MSC then produces a list of

Parties in compliance with the 1995 amendments.

The first list of countries was approved by the MSC at its 73rd session held from 27 November to 6 December 2000 – it included 71 countries and one Associate Member of IMO.

Port State control

The revised Chapter I includes enhanced procedures concerning the exercise of port State to allow intervention in the case of deficiencies deemed to pose a danger to persons, property or the environment (regulation I/4). This can take place if certificates are not in order or if the ship is involved in a collision or grounding, if there is an illegal discharge of substances (causing pollution) or if the ship is manoeuvred in an erratic or unsafe manner, etc.

Other regulations in chapter I include:

Measures are introduced for watchkeeping personnel to prevent fatigue.

Parties are required to establish procedures for investigating acts by persons to whom they have issued certificates that endanger safety or the environment. Penalties and other disciplinary measures must be prescribed and enforced where the Convention is not complied with.

Technical innovations, such as the use of simulators for training and assessment purposes have been recognized. Simulators are mandatory for training in the use of radar and automatic radar plotting aids (regulation I/12 and section A-I/12 of the STCW Code).

Parties are required to ensure that training, certification and other procedures are continuously monitored by means of a quality standards system (regulation I/8).

Every master, officer and radio operator are required at intervals not exceeding five years to meet the fitness standards and the levels of professional competence contained in Section A-I/11 of the STCW Code. In order to assess the need for revalidation of certificates after 1 February 2002, Parties must compare the standards of competence previously required with those specified in the appropriate certificate in part A of the STCW Code. If necessary, the holders of certificates may be required to undergo training or refresher courses (regulation I/11).

Chapter II: Master and deck department
The Chapter was revised and updated.

Chapter III: Engine department
The Chapter was revised and updated.

Chapter IV: Radiocommunication and radio personnel

The Chapter was revised and updated.

Chapter V: Special training requirements for personnel on certain types of ships
Special requirements were introduced concerning the training and qualifications of personnel on board ro-ro passenger ships. Previously the only special requirements in the Convention concerned crews on tankers. This change was made in response to proposals made by the Panel of Experts set up to look into ro-ro safety following the capsize and sinking of the ferry Estonia in September 1994. Crews on ro-ro ferries have to receive training in technical aspects and also in crowd and crisis management and human behaviour.

Chapter VI: Emergency, occupational safety, medical care and survival functions
The Chapter incorporates the previous Chapter VI: Proficiency in survival craft and includes mandatory minimum requirements for familiarization, basic safety training and instruction for all seafarers; mandatory minimum requirements for the issue of certificates of proficiency in survival craft, rescue boats and fast rescue boats; mandatory minimum requirements for training in advanced firefighting; and mandatory minimum requirements relating to medical first aid and medical care.

Chapter VII: Alternative certification
Regulations regarding alternative certification (also known as the functional approach) are included in a new Chapter VII. This involves enabling crews to gain training and certification in various departments of seafaring rather than being confined to one branch (such as deck or engine room) for their entire career.Although it is a relatively new concept, the 1995 Conference was anxious not to prevent its development. At the same time, the new Chapter is intended to ensure that safety and the environment are not threatened in any way. The use of equivalent educational and training arrangements is permitted under article IX.

Chapter VIII: Watchkeeping
Measures were introduced for watchkeeping personnel to prevent fatigue. Administrations are required to establish and enforce rest periods for watchkeeping personnel and to ensure that watch systems are so arranged that the efficiency of watchkeeping personnel is not impaired by fatigue.

The STCW Code
The regulations contained in the Convention are supported by sections in the STCW Code. Generally speaking, the Convention contains basic requirements which are then enlarged upon and explained in the Code.

Part A of the Code is mandatory. The minimum standards of competence required for seagoing personnel are given in detail in a series of tables. Chapter II of the Code, for example, deals with standards regarding the master and deck department.

Part B of the Code contains recommended guidance which is intended to help Parties implement the Convention. The measures suggested are not mandatory and the examples given are only intended to illustrate how certain Convention requirements may be complied with. However, the recommendations in general represent an approach that has been harmonized by discussions within IMO and consultation with other international organizations.

The 1997 Amendments
Adoption: June 1997
Entry into force: 1 January 1999

The amendments concern training for personnel on passenger ships. The amendments include an additional Regulation V/3 in Chapter V on Mandatory minimum requirements for the training and qualifications of masters, officers, ratings and other personnel on passenger ships other than ro-ro passenger ships. Related additions are also made to the STCW Code, covering Crowd management training; Familiarization training; Safety training for personnel providing direct service to passengers in passenger spaces; Passenger safety; and Crisis management and human behaviour training.

The 1998 Amendments
Adoption: 9 December 1998
Entry into force: 1 January 2003 (under tacit acceptance)

Amendments to the STCW Code are aimed at improving minimum standards of competence of crews, in particular relating to cargo securing, loading and unloading on bulk carriers, since these procedures have the potential to put undue stresses on the ship's structure. The amendments concern sections A-II/1 and A-II/2 under "Cargo handling and stowage at the operational and management levels".

The White List
The first so-called "White List" of countries deemed to be giving "full and complete effect" to the revised STCW Convention (STCW 95) was published by IMO following the 73rd session of the Organization's Maritime Safety Committee (MSC), meeting from 27 November to 6 December 2000.

It is expected that ships flying flags of countries that are not on the White List will be increasingly targeted by Port State Control inspectors. A Flag state Party that is on the White List may, as a matter of policy, elect not to accept seafarers with certificates issued by non White List countries for service on its ships. If it does accept such seafarers, they will be required by 1 February 2002 also to have an endorsement, issued by the flag state, to show that their certificate is recognized by the flag state.

By 1 February 2002, masters and officers should hold STCW 95 certificates or endorsements issued by the flag State. Certificates issued and endorsed under the provisions of the 1978 STCW Convention will be valid until their expiry date.

The list will be kept under review and may be added to as other countries meet the criteria for inclusion.

14. International Convention on Maritime Search and Rescue, 1979

Adoption: 27 April 1979
Entry into force: 22 June 1985

Introduction

The 1979 Convention, adopted at a Conference in Hamburg, was aimed at developing an international SAR plan, so that, no matter where an accident occurs, the rescue of persons in distress at sea will be co-ordinated by a SAR organization and, when necessary, by co-operation between neighbouring SAR organizations.

Although the obligation of ships to go to the assistance of vessels in distress was enshrined both in tradition and in international treaties (such as the International Convention for the Safety of Life at Sea (SOLAS), 1974), there was, until the adoption of the SAR Convention, no international system covering search and rescue operations. In some areas there was a well-established organization able to provide assistance promptly and efficiently, in others there was nothing at all.

The technical requirements of the SAR Convention are contained in an Annex, which was divided into five Chapters. Parties to the Convention are required to ensure that arrangements are made for the provision of adequate SAR services in their coastal waters.

Parties are encouraged to enter into SAR agreements with neighbouring States involving the establishment of SAR regions, the pooling of facilities, establishment of common procedures, training and liaison visits. The Convention states that Parties should take measures to expedite entry into its territorial waters of rescue units from other Parties.

The Convention then goes on to establish preparatory measures which should be taken, including the establishment of rescue co-ordination centres and subcentres. It outlines operating procedures to be followed in the event of emergencies or alerts and during SAR operations. This includes the designation of an on-scene commander and his duties.

Parties to the Convention are required to establish ship reporting systems, under which ships report their position to a coast radio station. This enables the interval between the loss of contact with a vessel and the initiation of search operations to be reduced. It also helps to permit the rapid determination of vessels which may be called upon to provide assistance including medical help when required.

Amendment Procedure

The SAR Convention allowed for amendments to the technical Annex to be adopted by a Conference of STCW Parties or by IMO's Maritime Safety Committee, expanded to include all Contracting Parties, some of whom may not be members of the Organization. Amendments to the SAR Convention enter into force on a specified date unless objections are received from a required number of Parties.

IMO search and rescue areas

Following the adoption of the 1979 SAR Convention, IMO's Maritime Safety Committee divided the world's oceans into 13 search and rescue areas, in each of which the countries concerned have delimited search and rescue regions for which they are responsible.

Provisional search and rescue plans for all of these areas were completed when plans for the Indian Ocean were finalized at a conference held in Fremantle, Western Australia in September 1998.

Revision of SAR Convention

The 1979 SAR Convention imposed considerable obligations on Parties - such as setting up the shore installations required - and as a result the Convention was not being ratified by as many countries as some other treaties. Equally important, many of the world's coastal States had not accepted the Convention and the obligations it imposed.

It was generally agreed that one reason for the small number of acceptances and the slow pace of implementation was due to problems with the SAR Convention itself and that these could best be overcome by amending the Convention.

At a meeting in October 1995 in Hamburg, Germany, it was agreed that there were a number of substantial concerns that needed to be taken into account, including:

- lessons learned from SAR operations;
- experiences of States which had implemented the Convention;
- questions and concerns posed especially by developing States which were not yet Party to the Convention;
- need to further harmonize the IMO and International Civil Aviation Organization (ICAO) SAR provisions;
- inconsistent use of Convention terminology and phraseology.

IMO's Sub-Committee on Radio-Communications and Search and Rescue (COMSAR) was requested to revise the technical Annex of the Convention. A draft text was prepared and was approved by the 68th session of the MSC in May 1997, and was then adopted by the 69th MSC session in May 1998.

The 1998 amendments
Adopted: 18 May 1998
Entry into force: 1 January 2000

The revised technical Annex of the SAR Convention clarifies the responsibilities of Governments and puts greater emphasis on the regional approach and co-ordination between maritime and aeronautical SAR operations.

The revised Annex includes five Chapters:

Chapter 1 - Terms and Definitions
This Chapter updates the original Chapter 1 of the same name.

Chapter 2 - Organization and Co-ordination
Replaces the 1979 Chapter 2 on Organization. The Chapter has been re-drafted to make the responsibilities of Governments clearer. It requires Parties, either individually or in co-operation with other States, to establish basic elements of a search and rescue service, to include:
- Legal framework
- Assignment of a responsible authority
- Organization of available resources
- Communication facilities
- Co-ordination and operational functions
- Processes to improve the service including planning, domestic and international co-operative relationships and training.

Parties should establish search and rescue regions within each sea area - with the agreement of the Parties concerned. Parties then accept responsibility for providing search and rescue services for a specified area.

The Chapter also describes how SAR services should be arranged and national capabilities be developed. Parties are required to establish rescue co-ordination centres and to operate them on a 24-hour basis with trained staff who have a working knowledge of English.

Parties are also required to "ensure the closest practicable co-ordination between maritime and aeronautical services".

Chapter 3 - Co-operation between States
Replaces the original Chapter 3 on Co-operation.

Requires Parties to co-ordinate search and rescue organizations, and, where necessary, search and rescue operations with those of neighbouring States. The Chapter states that unless otherwise agreed between the States concerned, a Party should authorize, subject to applicable national laws, rules and regulations, immediate entry into or over its territorial sea or territory for rescue units of other Parties solely for the purpose of search and rescue.

Chapter 4 - Operating Procedures
Incorporates the previous Chapters 4 (Preparatory Measures) and 5 (Operating Procedures).

The Chapter says that each RCC (Rescue Co-ordination Centre) and RSC (Rescue Sub-Centre) should have up-to-date information on search and rescue facilities and communications in the area and should have detailed plans for conduct of search and rescue operations. Parties - individually or in co-operation with others should be capable of receiving distress alerts on a 24-hour basis. The regulations include procedures to be followed during an emergency and state that search and rescue activities should be co-ordinated on scene for the most effective results. The Chapter says that "Search and rescue operations shall continue, when practicable, until all reasonable hope of rescuing survivors has passed".

Chapter 5 - Ship reporting systems
Includes recommendations on establishing ship reporting systems for search and rescue purposes, noting that existing ship reporting systems could provide adequate information for search and rescue purposes in a given area.

IAMSAR Manual
Concurrently with the revision of the SAR Convention, the IMO and the International Civil Aviation Organization (ICAO) jointly developed the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual, published in three volumes covering Organization and Management; Mission Co-ordination; and Mobile Facilities.

The IAMSAR Manual revises and replaces the IMO Merchant Ship Search and Rescue Manual (MERSAR), first published in 1971, and the IMO Search and Rescue Manual (IMOSAR), first published in 1978.

The MERSAR Manual was the first step towards developing the 1979 SAR Convention and it provided guidance for those who, during emergencies at sea, may require assistance from others or who may be able to provide assistance themselves. In particular, it was designed to aid the master of any vessel who might be called upon to conduct SAR operations at sea for persons in distress. The manual was updated several times with the latest amendments being adopted in 1992 - they entered into force in 1993.

The second manual, the IMOSAR Manual, was adopted in l978. It was designed to help Governments to implement the SAR Convention and provided guidelines rather than requirements for a common maritime search and rescue policy, encouraging all coastal States to develop their organizations on similar lines and enabling adjacent States to co-operate and provide mutual assistance. It was also updated in 1992, with the amendments entering into force in 1993.

This manual was aligned as closely as possible with ICAO Search and Rescue Manual to ensure a common policy and to facilitate consultation of the two manuals for administrative or operational reasons. MERSAR was also aligned, where appropriate, with IMOSAR.

15. International Convention on Load Lines, 1966

Adoption: 5 April 1966
Entry into force: 21 July 1968

Introduction and history

It has long been recognized that limitations on the draught to which a ship may be loaded make a significant contribution to her safety. These limits are given in the form of freeboards, which constitute, besides external weathertight and watertight integrity, the main objective of the Convention.

The first International Convention on Load Lines, adopted in 1930, was based on the principle of reserve buoyancy, although it was recognized then that the freeboard should also ensure adequate stability and avoid excessive stress on the ship's hull as a result of overloading.

In the 1966 Load Lines convention, adopted by IMO, provisions are made determining the freeboard of tankers by subdivision and damage stability calculations.

The regulations take into account the potential hazards present in different zones and different seasons. The technical annex contains several additional safety measures concerning doors, freeing ports, hatchways and other items. The main purpose of these measures is to ensure the watertight integrity of ships' hulls below the freeboard deck.

All assigned load lines must be marked amidships on each side of the ship, together with the deck line. Ships intended for the carriage of timber deck cargo are assigned a smaller freeboard as the deck cargo provides protection against the impact of waves

Load Lines 1966 – Annexes

The Convention includes Annex I, divided into four Chapters.

· Chapter I - General;

· Chapter II - Conditions of assignment of freeboard;

· Chapter III - Freeboards;
· Chapter IV - Special requirements for ships assigned timber freeboards.·

Annex II covers Zones, areas and seasonal periods.

Annex III contains certificates, including the International Load Line Certificate.

Amendments 1971, 1975, 1979, 1983
The 1966 Convention provided for amendments to be made by positive acceptance. Amendments could be considered by the Maritime Safety Committee, the IMO Assembly or by a Conference of Governments. Amendments would then only come into force 12 months after being accepted by two-thirds of Contracting Parties.In practice, amendments adopted between 1971 and 1983 never received enough acceptances to enter into force. These included:

· the 1971 amendments - to make certain improvements to the text and to the chart of zones and seasonal areas;
· the 1975 amendments - to introduce the principle of 'tacit acceptance' into the Convention;
· the 1979 amendments - to make some alterations to zone boundaries off the coast of Australia; and
· the 1983 amendments - to extend the summer and tropical zones southward off the coast of Chile.

Adoption of tacit amendment procedure 1988
The 1988 Protocol
Adoption: 11 November 1988
Entry into force: 3 February 2000

The Protocol was primarily adopted in order to harmonize the Convention's survey and certification requirement with those contained in SOLAS and MARPOL 73/78.

All three instruments require the issuing of certificates to show that requirements have been met and this has to be done by means of a survey which can involve the ship being out of service for several days.

The harmonized system alleviates the problems caused by survey dates and intervals between surveys which do not coincide, so that a ship should no longer have to go into port or repair yard for a survey required by one Convention shortly after doing the same thing in connection with another instrument.

The 1988 Load Lines Protocol revised certain regulations in the technical Annexes to the Load Lines Convention and introduced the tacit amendment procedure (which was already applicable to the 1974 SOLAS Convention).Amendments to the Convention may be considered either by the Maritime Safety Committee or by a Conference of Parties.

Amendments must be adopted by a two-thirds majority of Parties to the Convention present and voting. Amendments enter into force six months after the deemed date of acceptance - which must be at least a year after the date of communication of adoption of amendments unless they are rejected by one-third of Parties. Usually, the date from adoption to deemed acceptance is two years.

The 1995 amendments

Adopted: 23 November 1995

Entry into force: 12 months after being accepted by two-thirds of Contracting Governments.

Status: 7 acceptances have been received (currently, 95 acceptances are required before the amendments can enter into force).The amendments concern the southern tropical zone off the coast of Australia and are now likely to be incorporated in a general revision of the Convention.

Revision of Load Lines Convention

The 1966 Load Lines Convention (as revised by the 1988 Protocol entering into force on 3 February 2000) is currently being revised by IMO's Sub-Committee on Stability, Load lines and Fishing Vessel Safety (SLF). In particular, the revision is focusing on wave loads and permissible strengths of hatch covers for bulk carriers and other ship types.

16. International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78)

Introduction

The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and updated by amendments through the years.

The International Convention for the Prevention of Pollution from Ships (MARPOL) was adopted on 2 November 1973 at IMO and covered pollution by oil, chemicals, harmful substances in packaged form, sewage and garbage. The Protocol of 1978 relating to the 1973 International Convention for the Prevention of Pollution from Ships (1978 MARPOL Protocol) was adopted at a Conference on Tanker Safety and Pollution Prevention in February 1978 held in response to a spate of tanker accidents in 1976-1977. (Measures relating to tanker design and operation were also incorporated into a Protocol of 1978 relating to the 1974 Convention on the Safety of Life at Sea, 1974).

As the 1973 MARPOL Convention had not yet entered into force, the 1978 MARPOL Protocol absorbed the parent Convention. The combined instrument is referred to as the International Convention for the Prevention of Marine Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), and it entered into force on 2 October 1983 (Annexes I and II).

The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes:

Annex I - Regulations for the Prevention of Pollution by Oil
Annex II - Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk
Annex III - Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form

Annex IV - Prevention of Pollution by Sewage from Ships (not yet in force)
Annex V - Prevention of Pollution by Garbage from Ships
Annex VI - Prevention of Air Pollution from Ships (adopted September 1997 - not yet in force)
States Parties must accept Annexes I and II, but the other Annexes are voluntary.

History of MARPOL 73/78

Oil pollution of the seas was recognized as a problem in the first half of the 20th century and various countries introduced national regulations to control discharges of oil within their territorial waters. In 1954, the United Kingdom organized a conference on oil pollution which resulted in the adoption of the International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL), 1954. Following entry into force of the IMO Convention in 1958, the depository and Secretariat functions in relation to the Convention were transferred from the United Kingdom Government to IMO.

OILPOL Convention

The 1954 Convention, which was amended in 1962, 1969 and 1971, primarily addressed pollution resulting from routine tanker operations and from the discharge of oily wastes from machinery spaces - regarded as the major causes of oil pollution from ships.

The 1954 OILPOL Convention, which entered into force on 26 July 1958, attempted to tackle the problem of pollution of the seas by oil - defined as crude oil, fuel oil, heavy diesel oil and lubricating oil - in two main ways:
-it established "prohibited zones" extending at least 50 miles from the nearest land in which the discharge of oil or of mixtures containing more than 100 parts of oil per million was forbidden;
-it required Contracting Parties to take all appropriate steps to promote the provision of facilities for the reception of oily water and residues.

In 1962, IMO adopted amendments to the Convention which extended its application to ships of a lower tonnage and also extended the "prohibited zones". Amendments adopted in 1969 contained regulations to further restrict operational discharge of oil from oil tankers and from machinery spaces of all ships.

Although the 1954 OILPOL Convention went some way in dealing with oil pollution, growth in oil trade and developments in industrial practices were beginning to make it clear that further action, was required. Nonetheless, pollution control was at the time still a minor concern for IMO, and indeed the world was only beginning to wake up to the environmental consequences of an increasingly industrialised society.

Torrey Canyon

In 1967, the tanker Torrey Canyon ran aground while entering the English Channel and spilled her entire cargo of 120,000 tons of crude oil into the sea. This resulted in the biggest oil pollution incident ever recorded up to that time. The incident raised questions about measures then in place to prevent oil pollution from ships and also exposed deficiencies in the existing system for providing compensation following accidents at sea.

First, IMO called an Extraordinary session of its Council, which drew up a plan of action on technical and legal aspects of the Torrey Canyon incident. Then, the IMO Assembly decided in 1969 to convene an international conference in 1973 to prepare a suitable international agreement for placing restraints on the contamination of the sea, land and air by ships.

In the meantime, in 1971, IMO adopted further amendments to OILPOL 1954 to afford additional protection to the Great Barrier Reef of Australia and also to limit the size of tanks on oil tankers, thereby minimizing the amount of oil which could escape in the event of a collision or stranding.

1973 Convention

Finally, an international Conference in 1973 adopted the International Convention for the Prevention of Pollution from Ships. While it was recognized that accidental pollution was spectacular, the Conference considered that operational pollution was still the bigger threat. As a result, the 1973

Convention incorporated much of OILPOL 1954 and its amendments into Annex I, covering oil.

But the Convention was also intended to address other forms of pollution from ships and therefore other annexes covered chemicals, harmful substances carried in packaged form, sewage and garbage. The 1973 Convention also included two Protocols dealing with *Reports on Incidents involving Harmful Substances* and *Arbitration.*

The 1973 Convention required ratification by 15 States, with a combined merchant fleet of not less than 50 percent of world shipping by gross tonnage, to enter into force. By 1976, it had only received three ratifications - Jordan, Kenya and Tunisia - representing less than one percent of the world's merchant shipping fleet. This was despite the fact that States could become Party to the Convention by only ratifying Annexes I (oil) and II (chemicals). Annexes III to V, covering harmful goods in packaged form, sewage and garbage, were optional.

It began to look as though the 1973 Convention might never enter into force, despite its importance.

1978 Conference

In 1978, in response to a spate of tanker accidents in 1976-1977, IMO held a Conference on Tanker Safety and Pollution Prevention in February 1978. The conference adopted measures affecting tanker design and operation, which were incorporated into both the Protocol of 1978 relating to the 1974 Convention on the Safety of Life at Sea (1978 SOLAS Protocol) and the Protocol of 1978 relating to the 1973 International Convention for the Prevention of Pollution from Ships (1978 MARPOL Protocol) - adopted on 17 February 1978.

More importantly in terms of achieving the entry into force of MARPOL, the 1978 MARPOL Protocol allowed States to become Party to the Convention by first implementing Annex I (oil), as it was decided that Annex II (chemicals) would not become binding until three years after the Protocol entered into force.

This gave States time to overcome technical problems in Annex II, which for some had been a major obstacle in ratifying the Convention.

As the 1973 Convention had not yet entered into force, the 1978 MARPOL Protocol absorbed the parent Convention. The combined instrument - the International Convention for the Prevention of Marine Pollution from Ships, 1973 as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) - finally entered into force on 2 October 1983 (for Annexes I and II).

Annex V, covering garbage, achieved sufficient ratifications to enter into force on 31 December 1988, while Annex III, covering harmful substances carried in packaged form, entered into force on 1 July 1992. Annex IV, covering sewage, has not yet entered into force. Annex VI, covering air pollution, was adopted in September 1997 and has also not yet entered into force.

Annex I: Prevention of pollution by oil

Entry into force: 2 October 1983

The 1973 Convention maintained the oil discharge criteria prescribed in the 1969 amendments to the 1954 Oil Pollution Convention, without substantial changes, namely:

Operational discharges of oil from tankers are allowed only when all of the following conditions are met:

1. the total quantity of oil which a tanker may discharge in any ballast voyage whilst under way must not exceed 1/15,000 of the total cargo carrying capacity of the vessel;

2. the rate at which oil may be discharged must not exceed 60 litres per mile travelled by the ship; and

3. no discharge of any oil whatsoever must be made from the cargo spaces of a tanker within 50 miles of the nearest land.

An oil record book is required, in which is recorded the movement of cargo oil and its residues from loading to discharging on a tank-to-tank basis.

In addition, in the 1973 Convention, the maximum quantity of oil permitted to be discharged on a ballast voyage of new oil tankers was reduced from 1/15,000 of the cargo capacity to 1/30,000 of the amount of cargo carried. These criteria applied equally both to persistent (black) and non-persistent (white) oils.

As with the 1969 OILPOL amendments, the 1973 Convention recognized the "load on top" (LOT) system which had been developed by the oil industry in the 1960s. On a ballast voyage the tanker takes on ballast water (departure ballast) in dirty cargo tanks. Other tanks are washed to take on clean ballast. The tank washings are pumped into a special slop tank. After a few days, the departure ballast settles and oil flows to the top. Clean water beneath is then decanted while new arrival ballast water is taken on. The upper layer of the departure ballast is transferred to the slop tanks. After further settling and decanting, the next cargo is loaded on top of the remaining oil in the slop tank, hence the term load on top.

A new and important feature of the 1973 Convention was the concept of "special areas" which are considered to be so vulnerable to pollution by oil that oil discharges within them have been completely prohibited, with minor and well-defined exceptions. The 1973 Convention identified the Mediterranean Sea, the Black Sea, and the Baltic Sea, the Red Sea and the Gulfs area as special areas. All oil-carrying ships are required to be capable of operating the method of retaining oily wastes on board through the "load on top" system or for discharge to shore reception facilities.

This involves the fitting of appropriate equipment, including an oil-discharge monitoring and control system, oily-water separating equipment and a filtering system, slop tanks, sludge tanks, piping and pumping arrangements.

New oil tankers (i.e. those for which the building contract was placed after 31 December 1975) of 70,000 tons deadweight and above, must be fitted with segregated ballast tanks large enough to provide adequate operating draught without the need to carry ballast water in cargo oil tanks.

Secondly, new oil tankers are required to meet certain subdivision and damage stability requirements so that, in any loading conditions, they can survive after damage by collision or stranding.

The Protocol of 1978 made a number of changes to Annex I of the parent convention. Segregated ballast tanks (SBT) are required on all new tankers of 20,000 dwt and above (in the parent convention SBTs were only required on new tankers of 70,000 dwt and above). The Protocol also required SBTs to be protectively located - that is, they must be positioned in such a way that they will help protect the cargo tanks in the event of a collision or grounding.

Another important innovation concerned crude oil washing (COW), which had been developed by the oil industry in the 1970s and offered major benefits. Under COW, tanks are washed not with water but with crude oil - the cargo itself. COW was accepted as an alternative to SBTs on existing tankers and is an additional requirement on new tankers.

For existing crude oil tankers (built before entry into force of the Protocol) a third alternative was permissible for a period of two to four years after entry into force of MARPOL 73/78. The dedicated clean ballast tanks (CBT) system meant that certain tanks are dedicated solely to the carriage of ballast water. This was cheaper than a full SBT system since it utilized existing pumping and piping, but when the period of grace has expired other systems must be used.

Drainage and discharge arrangements were also altered in the Protocol, regulations for improved stripping systems were introduced.

Some oil tankers operate solely in specific trades between ports which are provided with adequate reception facilities. Some others do not use water as ballast. The TSPP Conference recognized that such ships should not be subject to all MARPOL requirements and they were consequently exempted from the SBT, COW and CBT requirements. It is generally recognized that the effectiveness of international conventions depends upon the degree to which they are obeyed and this in turn depends largely upon the extent to which they are enforced. The 1978 Protocol to MARPOL therefore introduced stricter regulations for the survey and certification of ships.

The 1992 amendments to Annex I made it mandatory for new oil tankers to have double hulls – and it brought in a phase-in schedule for existing tankers to fit double hulls.

Annex II: Control of pollution by noxious liquid substances

Entry into force: 6 April 1987

Annex II details the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk.

Some 250 substances were evaluated and included in the list appended to the Convention. The discharge of their residues is allowed only to reception facilities until certain concentrations and conditions (which vary with the category of substances) are complied with.

In any case, no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land. More stringent restrictions applied to the Baltic and Black Sea areas.

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Annex III: Prevention of pollution by harmful substances in packaged form

Entry into force: 1 July 1992

The first of the convention's optional annexes. States ratifying the Convention must accept Annexes I and II but can choose not to accept the other three - hence they have taken much longer to enter into force.

Annex III contains general requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications for preventing pollution by harmful substances.
The International Maritime Dangerous Goods (IMDG) Code has, since 1991, included marine pollutants.

Annex IV: Prevention of pollution by sewage from ships
Entry into force: 12 months after being ratified by 15 States whose combined fleets of merchant shipping constitute at least 50% of the world fleet.
Status: The Annex has been accepted by 75 States whose fleets represent 43.11 percent of world tonnage

The second of the optional Annexes, Annex IV contains requirements to control pollution of the sea by sewage.
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Annex V: Prevention of pollution by garbage from ships
Entry into force: 31 December 1988
This deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of. The requirements are much stricter in a number of "special areas" but perhaps the most important feature of the Annex is the complete ban imposed on the dumping into the sea of all forms of plastic.

Annex VI: Prevention of Air Pollution from Ships
Adopted September 1997
Entry into force: 12 months after being ratified by 15 States whose combined fleets of merchant shipping constitute at least 50% of the world fleet.
Status: See status of conventions

Note: A Resolution (adopted by the conference which adopted Annex VI) invites IMO's Marine Environment Protection Committee (MEPC) to identify any impediments to entry into force of the Protocol, if the conditions for entry into force have not been met by 31 December 2002.

The regulations in this annex, when they come into force, will set limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibit deliberate emissions of ozone depleting substances.
See 1997 amendments

Enforcement

Any violation of the MARPOL 73/78 Convention within the jurisdiction of any Party to the Convention is punishable either under the law of that Party or under the law of the flag State. In this respect, the term "jurisdiction" in the Convention should be construed in the light of international law in force at the time the Convention is applied or interpreted.

With the exception of very small vessels, ships engaged on international voyages must carry on board valid international certificates which may be accepted at foreign ports as prima facie evidence that the ship complies with the requirements of the Convention.
If, however, there are clear grounds for believing that the condition of the ship or its equipment does not correspond substantially with the particulars of the certificate, or if the ship does not carry a valid certificate, the authority carrying out the inspection may detain the ship until it is satisfied that the ship can proceed to sea without presenting unreasonable threat of harm to the marine environment.

Under Article 17, the Parties to the Convention accept the obligation to promote, in consultation with other international bodies and with the assistance of UNEP, support for those Parties which request technical assistance for various purposes, such as training, the supply of equipment, research, and combating pollution.

Amendment Procedure

Amendments to the technical Annexes of MARPOL 73/78 can be adopted using the "tacit acceptance" procedure, whereby the amendments enter into force on a specified date unless an agreed number of States Parties object by an agreed date.
In practice, amendments are usually adopted either by IMO's Marine Environment Protection Committee (MEPC) or by a Conference of Parties to MARPOL.

The 1984 amendments
Adoption: 7 September 1984
Entry into force: 7 January 1986

The amendments to Annex I were designed to make implementation easier and more effective. New requirements were designed to prevent oily water being discharged in special areas, and other requirements were strengthened. But in some cases they were eased, provided that various conditions were met: some discharges were now permitted below the waterline, for example, which helps to cut costs by reducing the need for extra piping.

The 1985 (Annex II) amendments
Adoption: 5 December 1985
Entry into force: 6 April 1987

The amendments to Annex II, which deals with liquid noxious substances (such as chemicals), were intended to take into account technological developments since the Annex was drafted in 1973 and to simplify its implementation. In particular, the aim was to reduce the need for reception facilities for chemical wastes and to improve cargo tank stripping efficiencies.

The amendments also made the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) mandatory for ships built on or after 1 July 1986. This is important because the Annex itself is concerned only with discharge procedures: the Code contains carriage requirements. The Code itself was revised to take into account anti-pollution requirements and therefore make the amended Annex more effective in reducing accidental pollution

The 1985 (Protocol I) amendments
Adoption: 5 December 1985
Entry into force: 6 April 1987
The amendments made it an explicit requirement to report incidents involving discharge into the sea of harmful substances in packaged form.

The 1987 Amendments
Adoption: December 1987
Entry into force: 1 April 1989
The amendments extended Annex I Special Area status to the Gulf of Aden

The 1989 (March) amendments
Adoption: March 1989
Entry into force: 13 October 1990

The amendments affected the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code), mandatory under both MARPOL 73/78 and SOLAS and applies to ships built on or after 1 July 1986 and the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH). In both cases, the amendments included a revised list of chemicals. The BCH Code is mandatory under MARPOL 73/78 but voluntary under SOLAS 1974.

Further amendments affected Annex II of MARPOL - updating and replacing the lists of chemicals in appendices II and III.

The October 1989 amendments

Adoption: 17 October 1989
Entry into force: 18 February 1991
The amendments make the North Sea a "special area" under Annex V of the convention. This greatly increases the protection of the sea against the dumping of garbage from ships

The 1990 (HSSC) amendments
Adoption: March 1990
Entry into force: 3 February 2000 (Coinciding with the entry into force of the 1988 SOLAS and Load Lines Protocols.
The amendments are designed to introduce the harmonized system of survey and certificates (HSSC) into MARPOL 73/78 at the same time as it enters into force for the SOLAS and Load Lines Conventions.

All three instruments require the issuing of certificates to show that requirements have been met and this has to be done by means of a survey which can involve the ship being out of service for several days.

The harmonized system alleviates the problems caused by survey dates and intervals between surveys which do not coincide, so that a ship should no longer have to go into port or repair yard for a survey required by one convention shortly after doing the same thing in connection with another instrument.

The 1990 (IBC Code) amendments
Adoption: March 1990
Entry into force: On the same date as the March 1990 HSSC amendments i.e. 3 February 2000.
The amendments introduced the HSSC into the IBC Code

The 1990 (BCH) amendments
Adoption: March 1990

Entry into force: On the same date as the March 1990 HSSC amendments i.e. 3 February 2000.
The amendments introduced the HSSC into the BCH Code.
The 1990 (Annexes I and V) amendments
Adoption: November 1990
Entry into force: 17 March 1992
The amendments extended Special Area Status under Annexes I and V to the Antarctic.

The 1991 amendments
Adoption: 4 July 1991
Entry into force: 4 April 1993
The amendments made the Wider Caribbean a Special Area under Annex V.
Other amendments added a new chapter IV to Annex I, requiring ships to carry an oil pollution emergency plan.

The 1992 amendments
Adoption: 6 March 1992
Entry into force: 6 July 1993

The amendments to Annex I of the convention which deals with pollution by oil brought in the "double hull" requirements for tankers, applicable to new ships (tankers ordered after 6 July 1993, whose keels were laid on or after 6 January 1994 or which are delivered on or after 6 July 1996) as well as existing ships built before that date, with a phase-in period.

New-build tankers are covered by Regulation 13F, while regulation 13G applies to existing crude oil tankers of 20,000 dwt and product carriers of 30,000 dwt and above. Regulation 13G came into effect on 6 July 1995.

Regulation 13F requires all new tankers of 5,000 dwt and above to be fitted with double hulls separated by a space of up to 2 metres (on tankers below 5,000 dwt the space must be at least 0.76m).

As an alternative, tankers may incorporate the "mid-deck" concept under which the pressure within the cargo tank does not exceed the external hydrostatic water pressure. Tankers built to this design have double sides but not a double bottom. Instead, another deck is installed inside the cargo tank with the venting arranged in such a way that there is an upward pressure on the bottom of the hull.

Other methods of design and construction may be accepted as alternatives "provided that such methods ensure at least the same level of protection against oil pollution in the event of a collision or stranding and are approved in principle by the Marine Environment Protection Committee based on guidelines developed by the Organization.

For oil tankers of 20,000 dwt and above new requirements were introduced concerning subdivision and stability.

The amendments also considerably reduced the amount of oil which can be discharged into the sea from ships (for example, following the cleaning of cargo tanks or from engine room bilges). Originally oil tankers were permitted to discharge oil or oily mixtures at the rate of 60 litres per nautical mile. The amendments reduced this to 30 litres. For non-tankers of 400 grt and above the permitted oil content of the effluent which may be discharged into the sea is cut from 100 parts per million to 15 parts per million.

Regulation 24(4), which deals with the limitation of size and arrangement of cargo tanks, was also modified.
Regulation 13G applies to existing crude oil tankers of 20,000 dwt and product carriers of 30,000 dwt and above.

Tankers that are 25 years old and which were not constructed according to the requirements of the 1978 Protocol to MARPOL 73/78 have to be fitted with double sides and double bottoms. The Protocol applies to tankers ordered after 1 June 1979, which were begun after 1 January 1980 or completed after 1 June

1982. Tankers built according to the standards of the Protocol are exempt until they reach the age of 30.

Existing tankers are subject to an enhanced programme of inspections during their periodical, intermediate and annual surveys. Tankers that are five years old or more must carry on board a completed file of survey reports together with a conditional evaluation report endorsed by the flag Administration.

Tankers built in the 1970s which are at or past their 25th must comply with Regulation 13F. If not, their owners must decide whether to convert them to the standards set out in regulation 13F, or to scrap them.

Another set of tankers built according to the standards of the 1978 protocol will soon be approaching their 30th birthday - and the same decisions must be taken.

The 1994 amendments

Adoption: 13 November 1994
Entry into force: 3 March 1996
The amendments affect four of the Convention's five technical annexes (II III, V, and I) and are all designed to improve the way it is implemented. They make it possible for ships to be inspected when in the ports of other Parties to the Convention to ensure that crews are able to carry out essential shipboard procedures relating to marine pollution prevention. These are contained in resolution A.742 (18), which was adopted by the IMO Assembly in November 1993.

The amendments are similar to those made to SOLAS in May 1994. Extending port State control to operational requirements is seen as an important way of improving the efficiency with which international safety and anti-pollution treaties are implemented.

The 1995 amendments

Adoption: 14 September 1995
Entry into force: 1 July 1997
The amendments concern Annex V. They are designed to improve the way the Convention is implemented. Regulation 2 was clarified and a new regulation 9 added dealing with placards, garbage management plans and garbage record keeping.

The 1996 amendments
Adoption: 10 July 1996
Entry into force: 1 January 1998
One set of amendments concerned Protocol I to the Convention which contains provisions for reporting incidents involving harmful substances. The amendments included more precise requirements for the sending of such reports.
Other amendments brought requirements in MARPOL concerning the IBC and BCH Codes into line with amendments adopted to SOLAS.

The 1997 amendments
Adoption: 23 September 1997
Entry into force: 1 February 1999
Regulation 25A to Annex 1 specifies intact stability criteria for double hull tankers.
Another amendment made the North West European waters a "special area" under Regulation 10 of Annex 1. The waters cover the North Sea and its approaches, the Irish Sea and its approaches, the Celtic Sea, the English Channel and its approaches and part of the North East Atlantic immediately to the West of Ireland.
In special areas, discharge into the sea of oil or oily mixture from any oil tanker and ship over 400 gt is prohibited. Other special areas already designated under Annex I of MARPOL include: the Mediterranean Sea area, the Baltic Sea area, the Red Sea area, the Gulf of Aden area and the Antarctic area.

The Protocol of 1997 (Annex VI - Regulations for the Prevention of Air Pollution from Ships)

Adoption: 26 September 1997
Entry into force: 12 months after being accepted by at least 15 states with not less than 50% of world merchant shipping tonnage
Note: The Conference also adopted a Resolution which invites IMO's Marine Environment Protection Committee (MEPC) to identify any impediments to entry into force of the Protocol, if the conditions for entry into force have not been met by 31 December 2002.
Status: Not yet in force: see Status of conventions summary
The Protocol was adopted at a Conference held from 15 to 26 September 1997 and adds a new Annex VI on Regulations for the Prevention of Air Pollution from Ships to the Convention.

The rules, when they come into force, will set limits on sulphur oxide (SOx) and nitrogen oxide (NOx) emissions from ship exhausts and prohibit deliberate emissions of ozone depleting substances.
The new Annex VI includes a global cap of 4.5% m/m on the sulphur content of fuel oil and calls on IMO to monitor the worldwide average sulphur content of fuel once the Protocol comes into force.
Annex VI contains provisions allowing for special "SOx Emission Control Areas" to be established with more stringent control on sulphur emissions. In these areas, the sulphur content of fuel oil used on board ships must not exceed 1.5% m/m. Alternatively, ships must fit an exhaust gas cleaning system or use any other technological method to limit SOx emissions.
The Baltic Sea is designated as a SOx Emission Control area in the Protocol.
Annex VI prohibits deliberate emissions of ozone depleting substances, which include halons and chlorofluorocarbons (CFCs). New installations containing ozone-depleting substances are prohibited on all ships. But new installations containing hydro-chlorofluorocarbons (HCFCs) are permitted until 1 January 2020.
The requirements of the IMO Protocol are in accordance with the Montreal Protocol of 1987, as amended in London in 1990. The Montreal Protocol is an international environmental treaty, drawn up under the auspices of the United Nations, under which nations agreed to cut CFC consumption and production in order to protect the ozone layer.

Annex VI sets limits on emissions of nitrogen oxides (NOx) from diesel engines. A mandatory NOx Technical Code, developed by IMO, defines how this is to be done.

The Annex also prohibits the incineration on board ship of certain products, such as contaminated packaging materials and polychlorinated biphenyls (PCBs).

Format of Annex VI

Annex VI consists of three Chapters and a number of Appendices:

- Chapter 1 - General
- Chapter II - Survey, Certification and Means of Control
- Chapter III - Requirements for Control of Emissions from Ships
- Appendices including the form of the International Air Pollution Prevention

Certificate; criteria and procedures for designation of SOx emission control areas; information for inclusion in the bunker delivery note; approval and operating limits for shipboard incinerators; test cycles and weighting factors for verification of compliance of marine diesel engines with the NOx limits; and details of surveys and inspections to be carried out.

The 1999 amendments

Adoption: 1 July 1999

Entry into force: 1 January 2001 (under tacit acceptance)

Amendments to Regulation 13G of Annex I (Regulations for the Prevention of Pollution by Oil) make existing oil tankers between 20,000 and 30,000 tons deadweight carrying persistent product oil, including heavy diesel oil and fuel oil, subject to the same construction requirements as crude oil tankers.

Regulation 13G requires, in principle, existing tankers to comply with requirements for new tankers in Regulation 13F, including double hull requirements for new tankers or alternative arrangements, not later than 25 years after date of delivery.

The amendments extend the application from applying to crude oil tankers of 20,000 tons deadweight and above and product carriers of 30,000 tons deadweight and above, to also apply to tankers between 20,000 and 30,000 tons deadweight which carry heavy diesel oil or fuel oil.

The aim of the amendments is to address concerns that oil pollution incidents involving persistent oils are as severe as those involving crude oil, so regulations applicable to crude oil tankers should also apply to tankers carrying persistent oils.

Related amendments to the Supplement of the IOPP (International Oil Pollution Prevention) Certificate, covering in particular oil separating/filtering equipment and retention and disposal of oil residues were also adopted.

A third MARPOL 73/78 amendment adopted relates to Annex II of MARPOL Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk. The amendment adds a new regulation 16 requiring a Shipboard marine pollution emergency plan for noxious liquid substances.

Amendments were also made to the International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code) and the Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (BCH Code). The amendments address the maintenance of venting systems,

The 2000 amendments
Adoption: 13 March 2000
Entry into force: 1 January 2002 (under tacit acceptance)
The amendment to Annex III *(Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form*) deletes tainting as a criterion for marine pollutants from the Guidelines for the identification of harmful substances in packaged form. Tainting refers to the ability of a product to be taken up by an organism and thereby affect the taste or smell of seafood making it

unpalatable. A substance is defined as tainting when it has been found to taint seafood.

The amendment means that products identified as being marine pollutants solely on the basis of their tainting properties will no longer be classified as marine pollutants.

The 2001 amendments
Adoption: 27 April 2001
Entry into force: 1 September 2002
The amendment to Annex I brings in a new global timetable for accelerating the phase-out of single-hull oil tankers. The timetable will see most single-hull oil tankers eliminated by 2015 or earlier. Double-hull tankers offer greater protection of the environment from pollution in certain types of accident. All new oil tankers built since 1996 are required to have double hulls.

The revised regulation identifies three categories of tankers, as follows:
"Category 1 oil tanker" means oil tankers of 20,000 tons deadweight and above carrying crude oil, fuel oil, heavy diesel oil or lubricating oil as cargo, and of 30,000 tons deadweight and above carrying other oils, which do not comply with the requirements for protectively located segregated ballast tanks (commonly known as Pre-MARPOL tankers).

"Category 2 oil tanker" means oil tankers of 20,000 tons deadweight and above carrying crude oil, fuel oil, heavy diesel oil or lubricating oil as cargo, and of 30,000 tons deadweight and above carrying other oils, which do comply with the protectively located segregated ballast tank requirements (MARPOL tankers), while

"Category 3 oil tanker" means an oil tanker of 5,000 tons deadweight and above but less than the tonnage specified for Category 1 and 2 tankers.

Although the new phase-out timetable sets 2015 as the principal cut-off date for all single-hull tankers, the flag state administration may allow for some newer single hull ships registered in its country that conform to certain technical specifications to continue trading until the 25th anniversary of their delivery.

However, under the provisions of paragraph 8(b), any Port State can deny entry of those single hull tankers which are allowed to operate until their 25th anniversary to ports or offshore terminals. They must communicate their intention to do this to IMO.

As an additional precautionary measure, a Condition Assessment Scheme (CAS) will have to be applied to all Category 1 vessels continuing to trade after 2005 and all Category 2 vessels after 2010. A resolution adopting the CAS was passed at the meeting.

Although the CAS does not specify structural standards in excess of the provisions of other IMO conventions, codes and recommendations, its requirements stipulate more stringent and transparent verification of the reported structural condition of the ship and that documentary and survey procedures have been properly carried out and completed.

The requirements of the CAS include enhanced and transparent verification of the reported structural condition and of the ship and verification that the documentary and survey procedures have been properly carried out and completed. The Scheme requires that compliance with the CAS is assessed during the Enhanced Survey Programme of Inspections concurrent with intermediate or renewal surveys currently required by resolution A.744(18), as amended.

17. International Convention on the Control of Harmful Anti-fouling Systems on Ships

Adoption: 5 October 2001

Entry into force: 12 months after 25 States representing 25% of the world's merchant shipping tonnage have ratified it.

A new IMO convention will prohibit the use of harmful organotins in anti-fouling paints used on ships and will establish a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.

The International Convention on the control of harmful anti-fouling systems on ships was adopted on 5 October 2001 at the end of a five-day Diplomatic Conference held at IMO Headquarters in London.

Under the terms of the new Convention, Parties to the Convention are required to prohibit and/or restrict the use of harmful anti-fouling systems on ships flying their flag, as well as ships not entitled to fly their flag but which operate under their authority and all ships that enter a port, shipyard or offshore terminal of a Party.

Ships of above 400 gross tonnage and above engaged in international voyages (excluding fixed or floating platforms, FSUs and FPSOs) will be required to undergo an initial survey before the ship is put into service or before the International Anti-fouling System Certificate is issued for the first time; and a survey when the anti-fouling systems are changed or replaced.

Ships of 24 metres or more in length but less than 400 gross tonnage engaged in international voyages (excluding fixed or floating platforms, FSUs and FPSOs) will have to carry a Declaration on Anti-fouling Systems signed by the owner or authorized agent. The Declaration will have to be accompanied by appropriate documentation such as a paint receipt or contractor invoice.

Anti-fouling systems to be prohibited or controlled will be listed in an annex (Annex 1) to the Convention, which will be updated as and when necessary.

The adoption of the new Convention marks the successful outcome of the task set by Chapter 17 of Agenda 21 developed by the 1992 Rio Conference on Environment and Development. Chapter 17 called on States to take measures to reduce pollution caused by organotins compounds used in anti-fouling systems.

As recommended by the 21st session of the IMO Assembly, the Conference agreed to an effective implementation date of 1 January 2003 for a ban on the application of organotin-based systems.

Conference Resolution 1, on Early and Effective Application of the Convention, invites Member States of the Organization to do their utmost to prepare for implementing the Convention as a matter of urgency. It also urges the relevant industries to refrain from marketing, sale and application of the substances controlled by the Convention.

The conference was attended by representatives of 75 Member States of IMO and one Associate Member; as well as by representatives of two intergovernmental organizations that hold agreements of co-operation with IMO and representatives of 23 non-governmental organizations in consultative status with IMO.

The harmful environmental effects of organotin compounds were recognized by IMO in 1989. In 1990 IMO's Marine Environment Protection Committee (MEPC) adopted a resolution which recommended that Governments adopt measures to eliminate the use of anti-fouling paint containing TBT on non-aluminium hulled vessels of less than 25 metres in length and eliminate the use of anti-fouling paints with a leaching rate of more than four microgrammes of TBT per day.

In November 1999, IMO adopted an Assembly resolution that called on the MEPC to develop an instrument, legally binding throughout the world, to address the harmful effects of anti-fouling systems used on ships. The resolution called for a global prohibition on the application of organotin compounds which act as biocides in anti-fouling systems on ships by 1 January 2003, and a complete prohibition by 1 January 2008.

The new convention will enter into force 12 months after 25 States representing 25% of the world's merchant shipping tonnage have ratified it.
Annex I attached to the Convention and adopted by the Conference states that by an effective date of 1 January 2003, all ships shall not apply or re-apply organotins compounds which act as biocides in anti-fouling systems.

By 1 January 2008 (effective date), ships either:

(a) shall not bear such compounds on their hulls or external parts or surfaces; or

(b) shall bear a coating that forms a barrier to such compounds leaching from the underlying non-compliant anti-fouling systems.

This applies to all ships (including fixed and floating platforms, floating storage units (FSUs), and Floating Production Storage and Offtake units (FPSOs).
The Convention includes a clause in Article 12 which states that a ship shall be entitled to compensation if it is unduly detained or delayed while undergoing inspection for possible violations of the Convention.

The Convention provides for the establishment of a “technical group”, to include people with relevant expertise, to review proposals for other substances used in anti-fouling systems to be prohibited or restricted. Article 6 on Process for Proposing Amendments to controls on Anti-fouling systems sets out how the evaluation of an anti-fouling system should be carried out.

Resolutions adopted by the Conference
The Conference adopted four resolutions:

Resolution 2 Future work of the Organization pertaining to the Convention – The resolution invites IMO to develop guidelines for brief sampling of anti-fouling systems; guidelines for inspection of ships; and guidelines for surveys of ships. The guidelines are needed in order to ensure global and uniform application of the articles of the Convention which require sampling, inspection and surveys.

Resolution 3 Approval and Test Methodologies for Anti-Fouling Systems on Ships – This resolution invites States to approve, register or license anti-fouling systems applied in their territories. It also urges States to continue the work, in appropriate international fora, for the harmonization of test methods and performance standards for anti-fouling systems containing biocides.

Resolution 4 Promotion of Technical Co-operation – The resolution requests IMO Member States, in co-operation with IMO, other interested States, competent international or regional organizations and industry programmes, to promote and provide directly, or through IMO, support to States in particular developing States that request technical assistance for:

(a) the assessment of the implications of ratifying, accepting, approving, or acceding to and complying with the Convention;
(b) the development of national legislation to give effect to the Convention; and
(c) the introduction of other measures, including the training of personnel, for the effective implementation and enforcement of the Convention.

It also requests Member States, in co-operation with IMO, other interested States, competent international and regional organisation and industry programmes, to promote co-operation for scientific and technical research on the effects of anti-fouling systems as well as monitoring these effects.
Background

Anti-fouling paints are used to coat the bottoms of ships to prevent sealife such as algae and molluscs attaching themselves to the hull – thereby slowing down the ship and increasing fuel consumption.

The new Convention defines “anti-fouling systems” as “a coating, paint, surface treatment, surface or device that is used on a ship to control or prevent attachment of unwanted organisms”.

In the early days of sailing ships, lime and later arsenic were used to coat ships' hulls, until the modern chemicals industry developed effective anti-fouling paints using metallic compounds.

These compounds slowly "leach" into the sea water, killing barnacles and other marine life that have attached to the ship. But the studies have shown that these compounds persist in the water, killing sealife, harming the environment and possibly entering the food chain. One of the most effective anti-fouling paints, developed in the 1960s, contains the organotin tributylin (TBT), which has been proven to cause deformations in oysters and sex changes in whelks.

18. International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001

Adoption: 23 March 2001.
Entry into force: Enters into force 12 months following the date on which 18 States, including five States each with ships whose combined gross tonnage is not less than 1 million gt have either signed it without reservation as to ratification, acceptance or approval or have deposited instruments of ratification, acceptance, approval or accession with the IMO Secretary-General.

The Convention was adopted to ensure that adequate, prompt, and effective compensation is available to persons who suffer damage caused by spills of oil, when carried as fuel in ships' bunkers.

The Convention applies to damage caused on the territory, including the territorial sea, and in exclusive economic zones of States Parties.

The bunkers convention provides a free-standing instrument covering pollution damage only.

"Pollution damage" means:
(a) loss or damage caused outside the ship by contamination resulting from the escape or discharge of bunker oil from the ship, wherever such escape or discharge may occur, provided that compensation for impairment of the environment other than loss of profit from such impairment shall be limited to costs of reasonable measures of reinstatement actually undertaken or to be undertaken; and

(b) the costs of preventive measures and further loss or damage caused by preventive measures.
The convention is modelled on the International Convention on Civil Liability for Oil Pollution Damage, 1969. As with that convention, a key requirement in the draft bunkers convention is the need for the registered owner of a vessel to maintain compulsory insurance cover.

Another key provision is the requirement for direct action - this would allow a claim for compensation for pollution damage to be brought directly against an insurer. The Convention requires ships over 1,000 gross tonnage to maintain insurance or other financial security, such as the guarantee of a bank or similar financial institution, to cover the liability of the registered owner for pollution damage in an amount equal to the limits of liability under the applicable national or international limitation regime, but in all cases, not exceeding an amount calculated in accordance with the Convention on Limitation of Liability for Maritime Claims, 1976, as amended.

Resolutions of the Conference

The Conference which adopted the Convention also adopted three resolutions:

Resolution on limitation of liability - the resolution urges all States that have not yet done so, to ratify, or accede to the Protocol of 1996 to amend the Convention on Limitation of Liability for Maritime Claims, 1976. The 1996 LLMC Protocol raises the limits of liability and therefore amounts of compensation payable in the event of an incident, compared to the 1976 Convention. The LLMC Protocol will enter into force 90 days after being accepted by 10 States - it has received four acceptances to date.

Resolution on promotion of technical co-operation - the resolution urges all IMO Member States, in co-operation with IMO, other interested States, competent international or regional organizations and industry programmes, to promote and provide directly, or through IMO, support to States that request technical assistance for:

(a) the assessment of the implications of ratifying, accepting, approving, or acceding to and complying with the Convention;

(b) the development of national legislation to give effect to the Convention;

(c) the introduction of other measures for, and the training of personnel charged with, the effective implementation and enforcement of the Convention.

The resolution also urges all States to initiate action without awaiting the entry into force of the Convention.

Resolution on protection for persons taking measures to prevent or minimize the effects of oil pollution - the resolution urges States, when implementing the Convention, to consider the need to introduce legal provision for protection for persons taking measures to prevent or minimize the effects of bunker oil pollution. It recommends that persons taking reasonable measures to prevent or minimize the effects of oil pollution be exempt from liability unless the liability in question resulted from their personal act or omission, committed with the intent to cause damage, or recklessly and with knowledge that such damage would probably result. It also recommends that States consider the relevant provisions of the International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 1996, as a model for their legislation.

19. International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS), 1996

Adoption: 3 May 1996
Entry into force: 18 months after the following conditions have been fulfilled:
- 12 States have accepted the Convention, four of which have not less than two million units of gross tonnage
- Provided that persons in these States who would be responsible to pay contributions to the general account have received a total quantity of at least 40 million tonnes of contributing cargo in the preceding calendar year.

Status: See status of conventions

Introduction

The Convention will make it possible for up to 250 million SDR (about US$320 million) to be paid out in compensation to victims of accidents involving HNS, such as chemicals.

The HNS Convention is based on the two-tier system established under the CLC and Fund Conventions . However, it goes further in that it covers not only pollution damage but also the risks of fire and explosion, including loss of life or personal injury as well as loss of or damage to property.

HNS are defined by reference to lists of substances included in various IMO Conventions and Codes. These include oils; other liquid substances defined as noxious or dangerous; liquefied gases; liquid substances with a flashpoint not exceeding 60°C; dangerous, hazardous and harmful materials and substances carried in packaged form; and solid bulk materials defined as possessing chemical hazards. The Convention also covers residues left by the previous carriage of HNS, other than those carried in packaged form.

The Convention defines damage as including loss of life or personal injury; loss of or damage to property outside the ship; loss or damage by contamination of the environment; the costs of preventative measures and further loss or damage caused by them.

The Convention introduces strict liability for the shipowner and a system of compulsory insurance and insurance certificates.

The unit of account used in the Convention is the Special Drawing Right (SDR) of the International Monetary Fund (IMF).

Limits of liability

For ships not exceeding 2,000 units of gross tonnage, the limit is set at 10 million SDR (about US$12.8 million). For ships above that tonnage, an additional 1,500 SDR is added for each unit of tonnage from 2001 to 50,000; and 360 SDR for each unit of tonnage in excess of 50,000 units of tonnage. The total possible amount the shipowner is liable for is limited to 100 million SDR (US$128 million).

States which are Parties to the Convention can decide not to apply it to ships of 200 gross tonnage and below, which carry HNS only in packaged form and are engaged on voyages between ports in the same State. Two neighbouring States can further agree to apply similar conditions to ships operating between ports in the two countries.

In order to ensure that shipowners engaged in the transport of HNS are able to meet their liabilities, the Convention makes insurance compulsory for them. A certificate of insurance must be carried on board and a copy kept by the authorities who keep record of the ship's registry.

HNS Fund

It has generally been agreed that it would not be possible to provide sufficient cover by the shipowner liability alone for the damage that could be caused in connection with the carriage of HNS cargo. This liability, which creates a first tier of the convention, is therefore supplemented by the second tier, the HNS Fund, financed by cargo interests.

The Fund will become involved:

- because no liability for the damage arises for the shipowner. This could occur, for example, if the shipowner was not informed that a shipment contained HNS or if the accident resulted from an act of war.
- because the owner is financially incapable of meeting the obligations under this Convention in full and any financial security that may be provided does not cover or is insufficient to satisfy the claims for compensation for damage
- because the damage exceeds the owner's liability limits established in the

Convention.

Contributions to the second tier will be levied on persons in the Contracting Parties who receive a certain minimum quantity of HNS cargo during a calendar year. The tier will consist of one general account and three separate accounts for oil, liquefied natural gas (LNG) and liquefied petroleum gas (LPG). The system with separate accounts has been seen as a way to avoid cross-subsidization between different HNS substances.

As with the CLC and Fund Conventions, when an incident occurs where compensation is payable under the HNS Convention, compensation would first be sought from the shipowner, up to the maximum limit of 100 million SDR (US$128 million).

Once this limit are reached, compensation would be paid from the second tier, the HNS Fund, up to a maximum of 250 million SDR (US$320 million) (including compensation paid under the first tier).

The Fund will have an Assembly consisting of all States which are Parties and a Secretariat headed by a Director. The Assembly will normally meet once a year.
HNS and the CLC/Fund Conventions

The HNS Convention excludes pollution damage as defined in the International Convention on Civil Liability for Oil Pollution Damage and the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, to avoid an overlap with these Conventions.

However, HNS covers other damage (including death or personal injury) as well as damage caused by fire and/or explosion when oils are carried.

Special Drawing Rights Conversion Rates

The daily conversion rates for Special Drawing Rights (SDRs) can be found on the International Monetary Fund website at http://www.imf.org/ under "Fund Rates".

20. International Convention on Tonnage Measurement of Ships, 1969

Adoption: 23 June 1969
Entry into force: 18 July 1982

Introduction
The Convention, adopted by IMO in 1969, was the first successful attempt to introduce a universal tonnage measurement system.

Previously, various systems were used to calculate the tonnage of merchant ships. Although all went back to the method devised by George Moorsom of the British Board of Trade in 1854, there were considerable differences between them and it was recognized that there was a great need for one single international system.

The Convention provides for gross and net tonnages, both of which are calculated independently.

The rules apply to all ships built on or after 18 July 1982 - the date of entry into force

- while ships built before that date were allowed to retain their existing tonnage for 12 years after entry into force, or until 18 July 1994.

This phase-in period was intended to ensure that ships were given reasonable economic safeguards, since port and other dues are charged according to ship tonnage. At the same time, and as far as possible, the Convention was drafted to ensure that gross and net tonnages calculated under the new system did not differ too greatly from those calculated under previous methods.

Gross tons and net tons
The Convention meant a transition from the traditionally used terms gross register tons (grt) and net register tons (nrt) to gross tons (GT) and net tons (NT).

Gross tonnage forms the basis for manning regulations, safety rules and registration fees. Both gross and net tonnages are used to calculate port dues.

The gross tonnage is a function of the moulded volume of all enclosed spaces of the ship. The net tonnage is produced by a formula which is a function of the moulded volume of all cargo spaces of the ship. The net tonnage shall not be taken as less than 30 per cent of the gross tonnage.

21. Special Trade Passenger Ships Agreement, 1971& Protocol on Space Requirements for Special Trade Passenger Ships, 1973

Special Trade Passenger Ships Agreement, 1971
Adoption: 6 October 1971
Entry into force: 2 January 1974

The carriage of large numbers of unberthed passengers in special trades such as the pilgrim trade in a restricted sea area around the Indian Ocean ? is of particular interest to countries in that area. It was regulated by the Simla Rules of 1931, which became outdated following the adoption of the 1948 and 1960 SOLAS Conventions.

As a result, IMO convened an International Conference in 1971 to consider safety requirements for special trade passenger ships in relation to the 1960 SOLAS Convention.

Included in an Annex to the Agreement are Special Trade Passenger Ships Rules, 1971, which provide modifications to the regulations of Chapters II and III of the 1960 SOLAS Convention.

Protocol on Space Requirements for Special Trade Passenger Ships, 1973
Adoption: 13 July 1973
Entry into force: 2 June 1977

Following the International Conference on Special Trade Passenger Ships, 1971, IMO, in co?operation with other Organizations, particularly the World Health Organisation (WHO), developed technical rules covering the safety aspects of carrying passengers on board such ships.

The Protocol on Space Requirements for Special Trade Passenger Ships was adopted in 1973. Annexed to this Protocol are technical rules covering the safety aspect of the carriage of passengers in special trade passenger ships.

The space requirements for special trade passenger ships are complementary to the 1971 Special Trade Passenger Ships Agreement.

22. Athens Convention relating to the Carriage of Passengers and their Luggage by Sea (PAL), 1974

Adoption: 13 December 1974
Entry into force: 28 April 1987

Introduction
A Conference, convened in Athens in 1974, adopted the Athens Convention relating to the Carriage of Passengers and their Luggage by Sea, 1974.

The Convention is designed to consolidate and harmonize two earlier Brussels conventions dealing with passengers and luggage and adopted in 1961 and 1967 respectively.

The Convention establishes a regime of liability for damage suffered by passengers carried on a seagoing vessel. It declares a carrier liable for damage or loss suffered by a passenger if the incident causing the damage occurred in the course of the carriage and was due to the fault or neglect of the carrier.

However, unless the carrier acted with intent to cause such damage, or recklessly and with knowledge that such damage would probably result, he can limit his liability. For the death of, or personal injury to, a passenger, this limit of liability is set at 46,666 Special Drawing Rights (SDR) (about US$59,700) per carriage.

As far as loss of or damage to luggage is concerned, the carrier's limit of liability varies, depending on whether the loss or damage occurred in respect of cabin luggage, of a vehicle and/or luggage carried in or on it, or in respect of other luggage.

The 1989 Protocol
Adoption: 19 November 1976
Entry into force: 30 April 1989
The Athens Convention also used the "Poincaré franc", based on the "official" value of gold, as the applicable unit of account.

A Protocol to the Convention, with the same provisions as in the Protocols to the 1971 Fund Convention and the 1969 Liability Convention, was accordingly adopted in November 1976, making the unit of account the Special Drawing Right (SDR).

The 1990 Protocol
Adoption: 29 March 1990
Entry into force: 90 days after being accepted by 10 States
Status: See status of conventions

The main aim of the Protocol is to raise the amount of compensation available in the event of deaths or injury at 175,000 SDR (around US$224,000). Other limits are 1,800 SDR (about US$2,300) for loss of or damage to cabin luggage and 10,000 SDR (about US$12,800) for loss of or damage to vehicles.

The Protocol also makes provision for the "tacit acceptance" procedure to be used to amend the limitation amounts in the future.

Review of the Athens Convention – new Protocol
IMO's Legal Committee is currently carrying out a review of the Athens Convention, with the aim of drafting amendments to the Convention, taking into account the work of the International Civil Aviation Organization (ICAO) in amending the Warsaw Convention, which covers liability in respect of the carriage by air of passengers, luggage and goods.

The review of the Athens Convention focuses on the introduction of provision of financial security (compulsory insurance) as well as on other subjects such as the introduction of strict liability and the updating of limits of compensation. It is hoped that these amendments, once adopted, will encourage wider acceptance of the Athens Convention.

The Legal Committee at its 82nd session in October 2000 agreed that a draft protocol to the Athens Convention would be ready for consideration by a diplomatic conference during the biennium 2002-2003.

The draft Protocol introduces, among other things, the requirement of compulsory insurance for passenger claims, and proposes changes to the purely fault-based liability system which is a feature of the 1974 Convention.

Special Drawing Rights

The daily conversion rates for Special Drawing Rights (SDRs) can be found on the International Monetary Fund website at www.imf.org

23. Convention on Limitation of Liability for Maritime Claims (LLMC), 1976

Adoption: 19 November 1976
Entry into force: 1 December 1986

Introduction

The Convention replaces the International Convention Relating to the Limitation of the Liability of Owners of Seagoing Ships, which was signed in Brussels in 1957, and came into force in 1968.

Under the 1976 Convention, the limit of liability for claims covered is raised considerably, in some cases up to 250-300 per cent. Limits are specified for two types of claims - claims for loss of life or personal injury, and property claims (such as damage to other ships, property or harbour works).

In the Convention, the limitation amounts are expressed in terms of units of account. Each unit of account is equivalent in value to the Special Drawing Right (SDR) as defined by the International Monetary Fund (IMF), although States which are not members of the IMF and whose law does not allow the use of SDR may continue to use the old gold franc (referred to as "monetary unit" in the Convention).

With regard to personal claims, liability for ships not exceeding 500 tons is limited to 330,000 SDR (equivalent to around US$422,000). For larger vessels the following additional amounts are used in calculating claims:

For each ton from 501 to 3,000 tons, 500 SDR (about US$640)
For each ton from 3,001 to 30,000 tons, 333 SDR (US$426)
For each ton from 30,001 to 70,000 tons, 250 SDR (US$320)
For each ton in excess of 70,000 tons, 167 SDR (US$214)
For other claims, the limit of liability is fixed at 167,000 (US$214,000) for ships not exceeding 500 tons. For larger ships the additional amounts will be:
For each ton from 501 to 30,000 tons, 167 (US$214).
For each ton from 30,001 to 70,000 tons, 125 SDR (US$160)
For each ton in excess of 70,000 tons, 83 SDR (US$106)

The Convention provides for a virtually unbreakable system of limiting liability. It declares that a person will not be able to limit liability only if "it is proved that the loss resulted from his personal act or omission, committed with the intent to cause such a loss, or recklessly and with knowledge that such loss would probably result".

Protocol of 1996

Adoption: 3 May 1996

Entry into force: 90 days after being accepted by 10 States.

Status: See status of conventions.

The Protocol will result in the amount of compensation payable in the event of an incident being substantially increased and also introduces a "tacit acceptance" procedure for updating these amounts.

For ships not exceeding 2,000 gt, liability is limited to 2 million SDR (US$2.56million) for loss of life or personal injury and 1 million SDR (US$1.28 million) for other claims.

Liability then increases with tonnage to a maximum above 70,000 gt of 2 million SDR (US$2.56 million) + 400 SDR (US$512) per ton for loss of life or personal injury and 1 million SDR (US$1.28 million) + 200 SDR (US$256) per ton for other claims.

Special Drawing Rights

The daily conversion rates for Special Drawing Rights (SDRs) can be found on the International Monetary Fund website at http://www.imf.org/

24- International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND), 1971

Adoption: 18 December 1971
Entry into force: 16 October 1978
Note: The 1992 protocol replaces the 1971 Convention

Introduction

Although the 1969 Civil Liability Convention provided a useful mechanism for ensuring the payment of compensation for oil pollution damage, it did not deal satisfactorily with all the legal, financial and other questions raised during the Conference adopting the CLC Convention.

Some States objected to the regime established, since it was based on the strict liability of the shipowner for damage which they could not foresee and, therefore, represented a dramatic departure from traditional maritime law which based liability on fault. On the other hand, some States felt that the limitation figures adopted were likely to be inadequate in cases of oil pollution damage involving large tankers. They therefore wanted an unlimited level of compensation or a very high limitation figure.

In the light of these reservations, the 1969 Brussels Conference considered a compromise proposal to establish an international fund, to be subscribed to by the cargo interests, which would be available for the dual purpose of, on the one hand, relieving the shipowner of the burden by the requirements of the new convention and, on the other hand, providing additional compensation to the victims of pollution damage in cases where compensation under the 1969 Civil Liability Convention was either inadequate or unobtainable.

The Conference recommended that IMO should prepare such a scheme. The Legal Committee accordingly prepared draft articles and the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage was adopted at a Conference held in Brussels in 1971. It is supplementary to the 1969 Civil Liability Convention.

The purposes of the Fund Convention are:

- To provide compensation for pollution damage to the extent that the protection afforded by the 1969 Civil Liability Convention is inadequate.
- To give relief to shipowners in respect of the additional financial burden imposed on them by the 1969 Civil Liability Convention, such relief being subject to conditions designed to ensure compliance with safety at sea and other conventions.
- To give effect to the related purposes set out in the Convention.

Under the first of its purposes, the Fund is under an obligation to pay compensation to States and persons who suffer pollution damage, if such persons are unable to obtain compensation from the owner of the ship from which the oil escaped or if the compensation due from such owner is not sufficient to cover the damage suffered.

Under the Fund Convention, victims of oil pollution damage may be compensated beyond the level of the shipowner's liability. However, the Fund's obligations are limited so that the total payable to victims by the shipowner and the Fund shall not exceed 30 million SDR (about US$41 million) for any one. In effect, therefore, the Fund's maximum liability for each incident is limited to 16 million SDR incident (under the 1971 convention - limits were raised under the 1992 Protocol).

Where, however, there is no shipowner liable or the shipowner liable is unable to meet their liability, the Fund will be required to pay the whole amount of compensation due. Under certain circumstances, the Fund's maximum liability may increase to not more than 60 million SDR (about US$82 million) for each incident.

With the exception of a few cases, the Fund is obliged to pay compensation to the victims of oil pollution damage who are unable to obtain adequate or any compensation from the shipowner or his guarantor under the 1969 Convention.

The Fund's obligation to pay compensation is confined to pollution damage suffered in the territories including the territorial sea of Contracting States.

The Fund is also obliged to pay compensation in respect of measures taken by a Contracting State outside its territory.

The Fund can also provide assistance to Contracting States which are threatened or affected by pollution and wish to take measures against it. This may take the form of personnel, material, credit facilities or other aid.

In connection with its second main function, the Fund is obliged to indemnify the shipowner or his insurer for a portion of the shipowner's liability under the Liability Convention. This portion is equivalent to 100 SDR (about US$128) per ton or 8.3 million SDR (about US$10.6 million), whichever is the lesser.

The Fund is not obliged to indemnify the owner if damage is caused by his wilful misconduct or if the accident was caused, even partially, because the ship did not comply with certain international conventions.

The Convention contains provisions on the procedure for claims, rights and obligations, and jurisdiction.

Contributions to the Fund should be made by all persons who receive oil by sea in Contracting States. The Fund's Organization consists of an Assembly of States, a Secretariat headed by a director appointed by the Assembly; and an Executive Committee.

The Protocol of 1976
Adoption: 19 November 1976
Entry into force: 22 November 1994

The 1971 Fund Convention applied the same unit of account as the 1969 Civil Liability Convention, i.e. the "Poincaré franc". For similar reasons the Protocol provides for a unit of account, based on the Special Drawing Right (SDR) as used by the International Monetary Fund (IMF).

The Protocol of 1984

Adoption: 25 May 1984
Entry into force: 12 months after being accepted by at least 8 States whose combined total of contributing oil amounted to at least 600 million tons during the previous calendar year.
Status: Superseded by the Protocol of 1992
The Protocol was primarily intended to raise the limits of liability contained in the convention and thereby enable greater compensation to be paid to victims of oil pollution incidents.

But as with the 1984 CLC Protocol, it became clear that the Protocol would never secure the acceptances required for entry into force and it has been superseded by the 1992 version

The Protocol of 1992
Adoption: 27 November 1992
Entry into force: 30 May 1996
As was the case with the 1992 Protocol to the CLC Convention, the main purpose of the Protocol was to modify the entry into force requirements and increase compensation amounts. The scope of coverage was extended in line with the 1992 CLC Protocol.

The 1992 Protocol established a separate, 1992 International Oil Pollution Compensation Fund, known as the 1992 Fund, which is managed in London by a Secretariat, as with the 1971 Fund. In practice, the Director of the 1971 Fund is currently also the Director of the 1992 Fund.

Under the 1992 Protocol, the maximum amount of compensation payable from the Fund for a single incident, including the limit established under the 1992 CLC Protocol, is 135 million SDR (about US$173 million). However, if three States contributing to the Fund receive more than 600 million tonnes of oil per annum, the maximum amount is raised to 200 million SDR (about US$256 million).

From 16 May 1998, Parties to the 1992 Protocol ceased to be Parties to the 1971 Fund Convention due to a mechanism for compulsory denunciation of the "old" regime established in the 1992 Protocol.

However, for the time being, two Funds (the 1971 Fund and the 1992 Fund) are in operation, since there are some States which have not yet acceded to the 1992 Protocol, which is intended to completely replace the 1971 regimes.
IMO and the IOPC Fund Secretariat are actively encouraging Governments who have not already done so to accede to the 1992 Protocols and to denounce the 1969 and 1971 regimes. Member States who remain in the 1971 Fund will face financial disadvantages, since the financial burden is spread over fewer contributors. For both the 1971 and 1992 Funds, annual contributions are levied on the basis of anticipated payments of compensation and estimated administrative expenses during the forthcoming yea

The 2000 Amendments
Adoption: 18 October 2000
Entry into force: 1 November 2003 (under tacit acceptance)
The amendments raise the maximum amount of compensation payable from the IOPC Fund for a single incident, including the limit established under the 2000 CLC amendments, to 203 million SDR (US$260 million), up from 135 million SDR (US$173 million). However, if three States contributing to the Fund receive more than 600 million tonnes of oil per annum, the maximum amount is raised to 300,740,000 SDR (US$386 million), up from 200 million SDR (US$256 million).

The IOPC funds and IMO
Although the 1971 and 1992 Funds were established under Conventions adopted under the auspices of IMO, they are completely independent legal entities.

Unlike IMO, the IOPC Funds are not United Nations (UN) agencies and are not part of the UN system. They are intergovernmental organisations outside the UN, but follow procedures which are similar to those of the UN.

Only States can become Members of the IOPC Funds. States should consider becoming Members of the 1992 Fund, but not of the 1971 Fund which will be wound up in the near future.

To become a member of the Fund, a State must accede to the 1992 Civil Liability Convention and to the 1992 Fund Convention by depositing a formal instrument of accession with the Secretary-General of IMO. These Conventions should be incorporated into the national law of the State concerned.

See the IOPC Funds website at http://www.iopcfund.org/

Special drawing rights
The daily conversion rates for Special Drawing Rights (SDRs) can be found on the International Monetary Fund website at http://www.imf.org/
Winding up of 1971 fund

Contracting Parties to the 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (IOPC Fund) on 27 September 2000 signed a Protocol allowing for the early winding-up of the 1971 Fund, which was established to provide compensation to victims of oil pollution from ships carrying oil as cargo.

The 2000 Protocol was signed following a Diplomatic Conference held from 25 to 27 September 2000.

From 16 May 1998, Members of the 1992 Fund ceased to be Members of the 1971 Fund Convention due to a mechanism in the Protocol which established the 1992 Fund allowing for compulsory denunciation of the "old" regime. However, with the departure of these States, the total quantity of contributing oil on the basis of which contributions to the Fund are assessed has been dramatically reduced. The effect of this reduction in the contributions base is two-fold.

In the first place, a considerably increased financial burden will fall on the contributors in those States which remain Members of the 1971 Fund if a major oil spill occurs in any of those States, since the contributors will be legally responsible for the funding of the total amount of compensation due from the 1971 Fund.

In addition, as long as the 1971 Fund remains in existence, the concern remains that it will face a situation in which an incident occurs where the 1971 Fund has an obligation to pay compensation to victims, but where there are no contributors in any of the remaining Member States.

In such a situation, if a tanker spill should occur, the remaining 1971 Fund Member States would not have the financial protection which they would expect under the provisions of the 1971 Fund Convention.

Under Article 43.1 of the 1971 Convention, the 1971 Fund ceases to exist when the number of Contracting States falls below three. In order to allow the Convention to terminate sooner, the Conference agreed to amend Article 43.1 so that the Convention ceases to be in force:

(a) on the date when the number of Contracting States falls below twenty-five; or

(b) twelve months following the date on which the Assembly notes that, according to the information provided by the Director on the basis of the latest available oil reports submitted by Contracting States in accordance with article 15, the total quantity of contributing oil received in the remaining Contracting States by those persons who would be liable to contribute pursuant to article 10 of the Convention during the preceding calendar year falls below 100 million tonnes, whichever is the earlier.

The 2000 Protocol will be brought into force by the tacit acceptance procedure, whereby it is deemed to have been accepted six months from the date of its adoption unless objections are received by not less than one-third of the Contracting States.

25. International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969

Adoption: 29 November 1969
Entry into force: 19 June 1975
Note: The 1969 Convention is being replaced by its 1992 Protocol as amended in 2000

Introduction

The Civil Liability Convention was adopted to ensure that adequate compensation is available to persons who suffer oil pollution damage resulting from maritime casualties involving oil-carrying ships.

The Convention places the liability for such damage on the owner of the ship from which the polluting oil escaped or was discharged.

Subject to a number of specific exceptions, this liability is strict; it is the duty of the owner to prove in each case that any of the exceptions should in fact operate. However, except where the owner has been guilty of actual fault, they may limit liability in respect of any one incident to 133 Special Drawing Rights (SDR) for each ton of the ship's gross tonnage, with a maximum liability of 14 million SDR (around US$18 million) for each incident. (1 SDR is approximately US$1.28 - exchange rates fluctuate daily).

The Convention requires ships covered by it to maintain insurance or other financial security in sums equivalent to the owner's total liability for one incident.

The Convention applies to all seagoing vessels actually carrying oil in bulk as cargo, but only ships carrying more than 2,000 tons of oil are required to maintain insurance in respect of oil pollution damage.

This does not apply to warships or other vessels owned or operated by a State and used for the time being for Government non-commercial service. The Convention, however, applies in respect of the liability and jurisdiction provisions, to ships owned by a State and used for commercial purposes. The only exception as regards such ships is that they are not required to carry insurance. Instead they must carry a certificate issued by the appropriate authority of the State of their registry stating that the ship's liability under the Convention is covered.

The Convention covers pollution damage resulting from spills of persistent oils suffered in the territory (including the territorial sea) of a State Party to the Convention. It is applicable to ships which actually carry oil in bulk as cargo, i.e. generally laden tankers. Spills from tankers in ballast or bunker spills from ships other than other than tankers are not covered, nor is it possible to recover costs when preventive measures are so successful that no actual spill occurs. The shipowner cannot limit liability if the incident occurred as a result of the owner's personal fault.

The Protocol of 1976
Adoption: 9 November 1976
Entry into force: 8 April 1981

The 1969 Civil Liability Convention used the "Poincaré franc", based on the "official" value of gold, as the applicable unit of account. However, experience showed that the conversion of this gold-franc into national currencies was becoming increasingly difficult. The 1976 Protocol therefore provided for provides for a new unit of account, based on the Special Drawing Rights (SDR) as used by the International Monetary Fund (IMF). The exchange rate for currencies versus the SDR fluctuates daily. However, in order to cater for those countries which are not members of the IMF and whose laws do not permit the use of the SDR, the Protocol provides for an alternate monetary unit - based, as before, on gold.

The Protocol of 1984
Adoption: 25 May 1984
Entry into force: 12 months after being accepted by 10 States, including six with tanker fleets of at least 1 million gross tons.

Status: Superseded by 1992 Protocol

While the compensation system established by the 1969 CLC and 1971 Fund Convention had proved very useful, by the mid-1980s it was generally agreed that the limits of liability were too low to provide adequate compensation in the event of a major pollution incident.

The 1984 Protocol set increased limits of liability, but it gradually became clear that the Protocol would never secure the acceptance required for entry into force and it was superseded by the 1992 version.

A major factor in the 1984 Protocol not entering into force was the reluctance of the United States, a major oil importer, to accept the Protocol. The United States preferred a system of unlimited liability, introduced in its Oil Pollution Act of 1990. As a result, the 1992 Protocol was drawn up in such a way that the ratification of the United States was not needed in order to secure entry into force conditions.

The Protocol of 1992
Adoption: 27 November 1992
Entry into force: 30 May 1996
The Protocol changed the entry into force requirements by reducing from six to four the number of large tanker-owning countries that are needed. The compensation

limits are those originally agreed in 1984:
- For a ship not exceeding 5,000 gross tonnage, liability is limited to 3 million SDR (about US$3.8 million)
- or a ship 5,000 to 140,000 gross tonnage: liability is limited to 3 million SDR plus 420 SDR (about US$538) for each additional unit of tonnage
- For a ship over 140,000 gross tonnage: liability is limited to 59.7 million SDR (about US$76.5 million)

The 1992 protocol also widened the scope of the Convention to cover pollution damage caused in the exclusive economic zone (EEZ) or equivalent area of a State Party. The Protocol covers pollution damage as before but environmental damage compensation is limited to costs incurred for reasonable measures to reinstate the contaminated environment. It also allows expenses incurred for preventive measures to be recovered even when no spill of oil occurs, provided there was grave and imminent threat of pollution damage.

The Protocol also extended the Convention to cover spills from sea-going vessels constructed or adapted to carry oil in bulk as cargo so that it applies apply to both laden and unladen tankers, including spills of bunker oil from such ships.
Under the 1992 Protocol, a shipowner cannot limit liability if it is proved that the pollution damage resulted from the shipowner's personal act or omission, committed with the intent to cause such damage, or recklessly and with knowledge that such damage would probably result.

From 16 May 1998, Parties to the 1992 Protocol ceased to be Parties to the 1969 CLC due to a mechanism for compulsory denunciation of the "old" regime established in the 1992 Protocol. However, for the time being, the two regimes are co-existing, since there are a number of States which are Party to the 1969 CLC and have not yet ratified the 1992 regime - which is intended to eventually replace the 1969 CLC.

The 1992 Protocol allows for States Party to the 1992 Protocol to issue certificates to ships registered in States which are not Party to the 1992 Protocol, so that a shipowner can obtain certificates to both the 1969 and 1992 CLC, even when the ship is registered in a country which has not yet ratified the 1992 Protocol. This is important because a ship which has only a 1969 CLC may find it difficult to trade to a country which has ratified the 1992 Protocol, since it establishes higher limits of liability.

The 2000 Amendments
Adoption: 18 October 2000

Entry into force: 1 November 2003 (under tacit acceptance)
The amendments raised the compensation limits by 50 percent compared to the limits set in the 1992 Protocol, as follows:
- For a ship not exceeding 5,000 gross tonnage, liability is limited to 4.51 million SDR (US$5.78 million)
(Under the 1992 Protocol, the limit was 3 million SDR (US$3.8 million)
- For a ship 5,000 to 140,000 gross tonnage: liability is limited to 4.51 million SDR (US$5.78 million) plus 631 SDR (US$807) for each additional gross tonne over 5,000
(Under the 1992 Protocol, the limit was 3 million SDR (US$3.8 million) plus 420 SDR (US$537.6) for each additional gross tonne)
- For a ship over 140,000 gross tonnage: liability is limited to 89.77 million SDR (US$115 million)
(Under the 1992 Protocol, the limit was 59.7 million SDR (US$76.5 million)

Special Drawing Rights Conversion Rates
The daily conversion rates for Special Drawing Rights (SDRs) can be found on the International Monetary Fund website at http://www.imf.org/

26. Convention on the International Maritime Satellite Organization, 1976

Adoption: 3 September 1976
Entry into force: 16 July 1979

History

IMO recognised the potential for satellite communications to assist in distress situations at sea soon after the launch of the world's first telecommunications satellite, Telstar, in 1962.

In February 1966, IMO's Maritime Safety Committee (MSC) decided to study the operational requirements for a satellite communications system devoted to maritime purposes.

In 1973, IMO decided to convene a conference with the object of establishing a new maritime communications system based on satellite technology.

The Conference first met in 1975 and held three sessions, at the third of which, in 1976, the Convention on the International Maritime Satellite Organization was adopted, together with an Operating Agreement.

The Convention defines the purposes of Inmarsat as being to improve maritime communications, thereby assisting in improving distress and safety of life at sea communications, the efficiency and management of ships, maritime public correspondence services, and radiodetermination capabilities.

The Organization consists of an Assembly, composed of all Parties to the Inmarsat Convention; Council composed of 22 representatives of signatories; and a Directorate headed by a Director?General. An Annex to the Convention outlines procedures for the settlement of disputes.

The Operating Agreement set an initial capital ceiling for the Organization of US$ 200 million. Investment shares were determined on the basis of utilization of the Inmarsat space segment.Inmarsat, headquartered in London, began operations in 1982.

Inmarsat's obligation to provide maritime distress and safety services via satellite were enshrined within the 1988 amendments to SOLAS which introduced the Global Maritime Distress and Safety System (GMDSS). Ships sailing in specified sea areas are required to carry Inmarsat communications equipment for distress and safety calls and to receive navigational warnings. At present, the Inmarsat system is the only mobile-satellite system recognized by SOLAS Contracting Governments for use in the GMDSS.

New structure - IMSO created

In 1998, Inmarsat's Assembly of member Governments agreed to privatize Inmarsat from April 1999. The new structure comprises two entities:

- Inmarsat Ltd - a public limited company which forms the commercial arm of Inmarsat.

- International Mobile Satellite Organization (IMSO) - an intergovernmental body established to ensure that Inmarsat continues to meet its public service obligations, including obligations relating to the GMDSS. IMSO replaces Inmarsat as observer at IMO meetings.

Amendments to the Inmarsat Convention

The Inmarsat Convention states Amendments should be considered and adopted by the Inmarsat Assembly and that amendments enter into force 120 days after two-thirds of States representing at least two-thirds of investment shares become Party to the amendments

The 1985 amendments

Adoption: 16 October 1985

Entry into force: 13 October 1989

The amendments enabled Inmarsat to provide services to aircraft as well as ships.

The 1989 amendments

Adoption: 19 January 1989 by Inmarsat Assembly

Entry into force: 26 June 1997

The amendments enabled Inmarsat to provide services to land based vehicles as well as ships and aircraft.

The 1994 amendments
Adoption: 9 December 1994 by Inmarsat Assembly
Entry into force: 120 days after being accepted by two-thirds of Contracting Parties representing two-thirds of the total investment share.
Status: see status of conventions

One of the amendments changed the name of the Organization to the International Mobile Satellite Organization, abbreviated to Inmarsat. The change reflected changes since the Organization was formed and the extension of its services from the maritime sector to other modes of transport.

There were also changes to Article 13 on the composition of the Inmarsat Council.

The April 1998 amendments
Adoption: 24 April 1998 by Inmarsat Assembly
Entry into force: 120 days after being accepted by two-thirds of Contracting Parties representing two-thirds of the total investment share.
Status: see status of conventions.
Amendments to the Inmarsat Convention and Operating Agreement to permit the restructuring of Inmarsat.

Links
Inmarsat - www.inmarsat.org
IMSO

27.International Convention on Salvage, 1989

Adoption: 28 April 1989
Entry into force: 14 July 1996

Introduction

The Convention replaced a convention on the law of salvage adopted in Brussels in 1910 which incorporated the "'no cure, no pay" principle under which a salvor is only rewarded for services if the operation is successful.

Although this basic philosophy worked well in most cases, it did not take pollution into account. A salvor who prevented a major pollution incident (for example, by towing a damaged tanker away from an environmentally sensitive area) but did not manage to save the ship or the cargo got nothing. There was therefore little incentive to a salvor to undertake an operation which has only a slim chance of success.

The 1989 Convention seeks to remedy this deficiency by making provision for an enhanced salvage award taking into account the skill and efforts of the salvors in preventing or minimizing damage to the environment.

Special compensation

The 1989 Convention introduced a "special compensation" to be paid to salvors who have failed to earn a reward in the normal way (i.e. by salving the ship and cargo).

Damage to the environment is defined as "substantial physical damage to human health or to marine life or resources in coastal or inland waters or areas adjacent thereto, caused by pollution, contamination, fire, explosion or similar major incidents."

The compensation consists of the salvor's expenses, plus up to 30% of these expenses if, thanks to the efforts of the salvor, environmental damage has been minimized or prevented. The salvor's expenses are defined as "out-ofpocket expenses reasonably incurred by the salvor in the salvage operation and a fair rate for equipment and personnel actually and reasonably used".

The tribunal or arbitrator assessing the reward may increase the amount of compensation to a maximum of 100% of the salvor's expenses, "if it deems it fair and just to do so".

If, on the other hand, the salvor is negligent and has consequently failed to prevent or minimize environmental damage, special compensation may be denied or reduced. Payment of the reward is to be made by the vessel and other property interests in proportion to their respective salved values.

28.SUMMARY OF STATUS OF CONVENTIONS

as at 31 March 2002

Instrument	Entry into force date	No. of Contracting States	% world tonnage*
IMO Convention	17-Mar-58	162	98.58
1991 amendments	-	62	71.38
SOLAS 1974	25-May-80	145	98.53
SOLAS Protocol 1978	01-May-81	99	94.45
SOLAS Protocol 1988	03-Feb-00	58	63.53
Stockholm Agreement 1996	01-Apr-97	8	9.46
LL 1966	21-Jul-68	149	98.45
LL Protocol 1988	03-Feb-00	55	63.37
TONNAGE 1969	18-Jul-82	132	98.19
COLREG 1972	15-Jul-77	140	97.05
CSC 1972	06-Sep-77	72	59.77
1993 amendments	-	6	3.57
SFV Protocol 1993	-	8	7.89
STCW 1978	28-Apr-84	139	98.39
STCW-F 1995	-	2	3.12
SAR 1979	22-Jun-85	72	47.48
STP 1971	02-Jan-74	17	22.06
SPACE STP 1973	02-Jun-77	16	20.80
INMARSAT C 1976	16-Jul-79	88	92.64
INMARSAT OA 1976	16-Jul-79	86	91.53
1994 amendments	-	39	30.87
FAL 1965	05-Mar-67	90	54.87
MARPOL 73/78 (Annex I/II)	02-Oct-83	120	95.90
MARPOL 73/78 (Annex III)	01-Jul-92	101	81.46
MARPOL 73/78 (Annex IV)	-	85	46.34
MARPOL 73/78 (Annex V)	31-Dec-88	106	87.88
MARPOL Protocol 1997 (Annex VI)	-	5	15.80
LC 1972	30-Aug-75	78	69.06

1978 amendments	-	20	20.48
LC Protocol 1996	-	16	10.66
INTERVENTION 1969	06-May-75	77	70.32
INTERVENTION Protocol 1973	30-Mar-83	44	44.15
CLC 1969	19-Jun-75	51	6.44
CLC Protocol 1976	08-Apr-81	55	57.41
CLC Protocol 1992	30-May-96	81	90.55
FUND 1971	16-Oct-78	26	2.21
FUND Protocol 1976	22-Nov-94	33	46.51
FUND Protocol 1992	30-May-96	76	86.53
FUND Protocol 2000	27-Jun-01	-	
NUCLEAR 1971	15-Jul-75	16	20.62
PAL 1974	28-Apr-87	28	33.53
PAL Protocol 1976	30-Apr-89	22	33.27
PAL Protocol 1990	-	3	0.74
LLMC 1976	01-Dec-86	37	41.91
LLMC Protocol 1996	-	6	8.39
SUA 1988	01-Mar-92	67	54.81
SUA Protocol 1988	01-Mar-92	60	54.46
SALVAGE 1989	14-Jul-96	40	32.70
OPRC 1990	13-May-95	64	53.83
HNS Convention 1996	-	2	1.89
OPRC/HNS 2000	-	1	0.05
BUNKERS CONVENTION 2001	-	-	-
AFS CONVENTION 2001		-	
* *Source: Lloyd's Register of Shipping/World Fleet Statistics as at 31 December 2000*			

29.International Telecommunication Union

History

On 24 May 1844, Samuel Morse sent his first public message over a telegraph line between Washington and Baltimore, and through that simple act, ushered in the tele-communication age.

Barely ten years later, telegraphy was available as a service to the general public. In those days, however, telegraph lines did not cross national borders. Because each country used a different system, messages had to be transcribed, translated and handed over at frontiers, then re-transmitted over the telegraph network of the neighbouring country.

Given the slow and unwieldy nature of this system, many countries eventually decided to establish arrangements which would facilitate interconnection of their national networks. However, because such arrangements were managed by each country at a national level, setting up telegraph links often required a huge number of separate agreements. In the case of Prussia, for example, no less than fifteen agreements were required for the link between the capital and the frontier localities bordering other German States. To simplify matters, countries began to develop bilateral or regional agreements, so that by 1864 there were several regional conventions in place.

The continuing rapid expansion of telegraph networks in a growing number of countries finally prompted 20 European States to meet to develop a framework agreement covering international interconnection. At the same time, the group decided on common rules to standardize equipment to facilitate international interconnection, adopted uniform operating instructions which would apply to all countries, and laid down common international tariff and accounting rules.

On 17 May 1865, after two and a half months of arduous negotiation, the first International Telegraph Convention was signed in Paris by the 20 founding members, and the *International Telegraph Union* (ITU) was established to facilitate subsequent amendments to this initial agreement. Today, some 135 years later, the reasons which led to the establishment of ITU still apply, and the fundamental objectives of the organization remain basically unchanged.

A New Industry Evolves

Following the patenting of the telephone in 1876 and the subsequent expansion of telephony, the International Telegraph Union began, in 1885, to draw up international legislation governing tele-phony. With the invention in 1896 of wireless telegraphy — the first type of radiocommunication — and the utilization of this new technique for maritime and other purposes, it was decided to convene a preliminary radio conference in 1903 to study the question of international regulations for radiotelegraph communications. The first International Radiotelegraph Conference held in 1906 in Berlin signed the first International Radiotelegraph Convention, and the annex to this Convention contained the first regulations governing wireless telegraphy. These regulations, which have since been expanded and revised by numerous radio conferences, are now known as the *Radio Regulations*.

The year 1920 saw the beginning of sound broadcasting at the improvised studios of the Marconi Company, and in 1927, the International Radio Consultative Committee (CCIR) was established at a conference held in Washington D.C. The International Telephone Consultative Committee (CCIF, set up in 1924), the International Telegraph Consultative Committee (CCIT, set up in 1925), and the CCIR were made responsible for coordinating the technical studies, tests and measurements being carried out in the various fields of telecommunications, as well as for drawing up international standards.

The 1927 International Radiotelegraph Conference also allocated frequency bands to the various radio services in existence at the time (fixed, maritime and aeronautical mobile, broadcasting, amateur and experimental), to ensure greater efficiency of operation in view of the increase in the number of radiocommunication services and the technical peculiarities of each service.

At the 1932 Madrid Conference, the Union decided to combine the *International Telegraph Convention* of 1865 and the *International*

Radiotelegraph Convention of 1906 to form the *International Telecommunication Convention.* It was also decided to change the name of the Union to *International Telecommunication Union.* The new name, which came into effect on 1 January 1934, was chosen to properly reflect the full scope of the Union's responsibilities, which by this time covered all forms of wireline and wireless communication.

A Modern Approach

In 1947, after the Second World War, ITU held a conference in Atlantic City with the aim of developing and modernizing the organization. Under an agreement with the newly created United Nations, it became a UN specialized agency on 15 October 1947, and the headquarters of the organization were transferred in 1948 from Bern to Geneva. At the same time, the International Frequency Registration Board (IFRB) was established to coordinate the increasingly complicated task of managing the radio-frequency spectrum, and the Table of Frequency Allocations, introduced in 1912, was declared mandatory.

In 1956, the CCIT and the CCIF were merged to form the International Telephone and Telegraph Consultative Committee (CCITT), in order to respond more effectively to the requirements generated by the development of these two types of communication.

The following year was marked by the launch of the first artificial satellite, Sputnik-1, and the beginning of the space age. In 1963, the first geostationary communications satellite (Syncom-1) was put into orbit following the suggestion, made by writer Arthur C. Clarke in 1945, that satellites could be used for the transmission of information.

In order to meet the challenges of new space communications systems, in 1959 CCIR set up a study group responsible for studying space radiocommunication. In addition, an Extraordinary Administrative Conference for space communications was held in 1963 in Geneva to allocate frequencies to the various space services. Subsequent conferences made further allocations and put in place regulations governing the use, by satellites, of the radio-frequency spectrum and associated orbital slots. In 1992, allocations were made for the first time to serve the needs of a new kind of space service using non-geostationary satellites, known as Global Mobile Personal Communications by Satellite (GMPCS). The same year, spectrum was identified for IMT-2000, the ITU-developed next-generation global standard for digital mobile telephony. Due for commercial implementation early in this new millennium, IMT-2000 will harmonize the incompatible mobile systems currently in use around the world while providing a technical foundation for new, high-speed wireless devices capable of handling voice, data and connection to online services such as the Internet.

The Developing Role of the Union

In 1989, the Plenipotentiary Conference held in Nice recognized the importance of placing technical assistance to developing countries on the same footing as its traditional activities of standardization and spectrum management. To this end, it established the Telecommunication Development Bureau (BDT) to step up efforts being made to improve communications in the developing regions of the world.

At the same time, against a background of increasing globalization and the gradual liberalization of world telecommunication markets, the Nice Plenipotentiary Conference initiated a re-evaluation of the Union's structures, operation, working methods and the resources allocated to enable it to achieve its objectives. The conference established a committee of experts whose task was to make recommendations on changes which would ensure that the Union continued to respond effectively to the needs of its members. In 1992, a plenipotentiary conference, known as the Additional Plenipotentiary Conference, took place in Geneva and dramatically remodelled ITU, with the aim of giving it greater flexibility to adapt to today's increasingly complex, interactive and competitive environment.

As a result of the reorganization, the Union was streamlined into three Sectors, corresponding to its three main areas of activity — Telecommunication Standardization (ITU-T), Radiocommunication (ITU-R) and Telecommunication

Development (ITU-D). The new system also introduced a regular cycle of conferences to help the Union rapidly respond to new technological advances.

Into the Next Millennium

The Kyoto Plenipotentiary Conference in 1994 adopted the first-ever strategic plan for ITU, which advocated a more client-oriented approach and a programme of activities centred around the changing roles, needs and functions of ITU members.

In addition, the Kyoto conference identified a need for a forum where members engage in broad, informal discussions on global telecommunication policies and strategies. It thus established the World Telecommunication Policy Forum (WTPF), an ad hoc meeting which encourages the free exchange of ideas and information on emerging policy issues arising from the changing telecommunication environment. The first WTPF was held in Geneva in 1996 on the theme of global mobile personal communications by satellite, and the second in Geneva in 1998, on trade in telecommunication services.

The Union's most recent plenipotentiary conference, held in Minneapolis from 12 October to 6 November 1998, focused on strengthening the participation of the private sector in the work of the Union, and adopted a number of resolutions which enhance the rights of Sector Members, as well as measures to provide ITU with the flexibility and latitude needed to match the industry's time-frames and operational practices. The conference approved the establishment of a new World Summit on the Information Society, and called for greater ITU participation in the evolution of the Internet as a means of global communication.

Into the new millennium, ITU will continue to review and adjust its priorities and its working methods to ensure it remains relevant and responsive in the face of rapid changes in the global telecommunication environment. As the world becomes ever more reliant on telecommunication technologies for commerce, communication and access to information, ITU's role in standardizing emerging new systems and fostering common global policies will be more vital than ever before.

Purposes

Every time someone, somewhere, picks up a telephone and dials a number, answers a call on a mobile phone, sends a fax or receives an e-mail, takes a plane or a ship, listens to the radio, watches a favourite television programme or helps a small child master the latest radio-controlled toy, they benefit from the work of the International Telecommunication Union.

The Union was established last century as an impartial, international organization within which governments and the private sector could work together to coordinate the operation of telecommunication networks and services and advance the development of communications technology. Whilst the organization remains relatively unknown to the general public, ITU's work over more than one hundred years has helped create a global communications network which now integrates a huge range of technologies, yet remains one of the most reliable man-made systems ever developed.

As the use of telecommunication technology and radiocommunication-based systems spreads to encompass an ever-wider range of activities, the vital work carried out by ITU is taking on growing importance in the day-to-day lives of people all around the world.

The Union's standardization activities, which have already helped foster the growth of new technologies such as mobile telephony and the Internet, are now being put to use in defining the building blocks of the emerging global information infrastructure, and designing advanced multimedia systems which deftly handle a mix of voice, data, audio and video signals.

Meanwhile, ITU's continuing role in managing the radio-frequency spectrum ensures that radio-based systems like cellular phones and pagers, aircraft and maritime navigation systems, scientific research stations, satellite communication systems and radio and television broadcasting all continue to function smoothly and provide reliable wireless services to the world's inhabitants.

Finally, ITU's increasingly important role as a catalyst for forging development partnerships between government and private industry is helping bring about rapid improvements in telecommunication infrastructure in the world's under-developed economies.

Whether in telecommunication development, standards-setting or spectrum sharing, ITU's consensus-building approach helps governments and the telecommunication industry confront and deal with a broad range of issues which would be difficult to resolve bilaterally.

The result is real-life, workable agreements which benefit not only the telecommunication industry as a whole but, ultimately, telecommunication users everywhere.

Under the Constitution of the International Telecommunication Union, the purposes of ITU are:

- To maintain and extend international cooperation between all its Member States for the improvement and rational use of telecommunications of all kinds.

- To promote and enhance participation of entities and organizations in the activities of the Union, and to foster fruitful cooperation and partnership between them and Member States for the fulfilment of the overall objectives embodied in the purposes of the Union.

- To promote and offer technical assistance to developing countries in the field of telecommunications, and also to promote the mobilization of the material, human and financial resources needed to improve access to telecommunications services in such countries.

- To promote the development of technical facilities and their most efficient operation, with a view to improving the efficiency of telecommunication services, increasing their usefulness and making them, so far as possible, generally available to the public.

- To promote the extension of the benefits of new telecommunication technologies to all the world's inhabitants.

- To promote the use of telecommunication services with the objective of facilitating peaceful relations.

- To harmonize the actions of Member States and promote fruitful and constructive cooperation and partnership between Member States and Sector Members in the attainment of those ends.

- To promote, at the international level, the adoption of a broader approach to the issues of telecommunications in the global information economy and society, by cooperating with other world and regional intergovernmental organizations and those non-governmental organizations concerned with telecommunications.

Structure and Activities

The three Sectors of the Union - Radiocommunication (ITU-R), Telecommunication Standardization (ITU-T), and Telecommunication Development (ITU-D) - work today to build and shape tomorrow's networks and services. Their activities cover all aspects of telecommunication, from setting standards that facilitate seamless interworking of equipment and systems on a global basis to adopting operational procedures for the vast and growing array of wireless services and designing programmes to improve telecommunication infrastructure in the developing world. ITU's work has provided the essential background that has enabled telecommunications to grow into a US$1 trillion industry worldwide.

Each of the three ITU Sectors works through conferences and meetings, where members negotiate the agreements which serve as the basis for the operation of global telecommunication services.

Study groups made up of experts drawn from leading telecommunication organizations worldwide carry out the technical work of the Union, preparing the detailed studies that lead to authoritative ITU Recommendations.

ITU-R draws up the technical characteristics of terrestrial and space-based wireless services and systems, and develops operational procedures. It also undertakes the important technical studies which serve as a basis for the regulatory decisions made at radiocommunication conferences.

In ITU-T, experts prepare the technical specifications for tele-communication systems, networks and services, including their operation, performance and maintenance. Their work also covers the tariff principles and accounting methods used to provide international service.

ITU-D experts focus their work on the preparation of recommendations, opinions, guidelines, handbooks, manuals and reports, which provide decision-makers in developing countries with `best business practices' relating to a host of issues ranging from development strategies and policies to network management.

There are currently 24 study groups spanning the Union's three Sectors (7 in ITU-R, 14 in ITU-T, 2 in ITU-D), which together produce around 550 new or revised Recommendations every year. All ITU Recommendations are non-binding, voluntary agreements.

Each Sector also has its own Bureau which ensures the implementation of the Sector's work plan and coordinates activities on a day-to-day basis.

The Radio Regulations

Since the global use and management of frequencies requires a high level of international cooperation, one of the principal tasks of ITU-R is to oversee and facilitate the complex inter-governmental negotiations needed to develop legally binding agreements between sovereign states. These agreements are embodied in the *Radio Regulations* and in regional plans adopted for broadcasting and mobile services.

The first set of *Radio Regulations* was put in place in 1906 at the Berlin International Radiotelegraph Conference, which adopted the first Radiotelegraph Convention. By 1947, the popularity of radio-based systems had reached such a point that the Table of Frequency Allocations, drawn up in 1912 to monitor the use of various parts of the radio-frequency spectrum, was made mandatory in order to provide interference-free operation of different services. The *Radio Regulations* apply to frequencies ranging from 9 kHz to 400 GHz, and now incorporate over 1000 pages of information describing how the spectrum may be used and shared around the globe. In an increasingly 'unwired' world, some 40 different radio services now compete for spectrum allocations to provide the bandwidth needed to extend services or support larger numbers of users.

Managing the Spectrum

The portion of the radio-frequency spectrum suitable for communications is divided into `blocks', the size of which varies according to individual services and their requirements. These blocks are called `frequency bands', and are allocated to services on an exclusive or shared basis. The full list of services and frequency bands allocated in different regions forms the Table of Frequency Allocations, which is itself part of the *Radio Regulations*.

Changes to the Table, and to the *Radio Regulations* themselves, can only be made by a world radiocommunication conference. Alterations are made on the basis of negotiations between national delegations, which work to reconcile demands for greater capacity with the need to protect existing services. If a country or group of countries wishes a frequency band to be used for a purpose other than the one listed in the Table of Frequency Allocations, changes may be made provided a consensus is obtained from other Member States. In such a case, the change may be indicated by a footnote, or authorized by the application of a *Radio Regulations* procedure under which the parties concerned must formally seek the agreement of any other nations affected by the change before any new use of the band can begin.

In addition to managing the Table of Frequency Allocations, world radiocommunication conferences may also adopt *assignment plans* or *allotment plans* for services where transmission and reception are not necessarily restricted to a particular country or territory. In the case of *assignment plans*, frequencies are allocated on the basis of requirements expressed by each country for each station within a given service, while in the case of *allotment plans*, each country is allotted frequencies to be used by a given service, which the national authorities then assign to the relevant stations within that service.

ITU-R prepares the technical groundwork which enables radio communication conferences to make sound decisions, developing regulatory procedures and examining technical issues, planning parameters and sharing criteria with other services in order to calculate the risk of harmful interference.

The Future, Today

One of the Radio communication Sector's most important recent achievements has been the development and acceptance of the IMT-2000 global standard for cellular telephony.

Built on the vision of a single, worldwide standard which would harmonize today's often incompatible regional cellular systems, IMT-2000 will provide a global platform on which to build so-called `third-generation' services - fast data access, unified messaging and broadband multimedia in the form of exciting new interactive services.

Work began on IMT-2000 back in 1985 under the auspices of ITU-R Study Group 8. Known initially as FPLMTS (future public land mobile telecommunication systems), the standard soon became International Mobile

Telecommunications 2000, or IMT-2000, reflecting both the expected year of first implementation (the year 2000) and the fact that the standard is based around a radio-frequency allocation in the 2000 MHz band.

Aside from offering global roaming capabilities, IMT-2000 will spur the growth of new services such as mobile Internet through its ability to send and receive information at megabit data rates, a huge speed improvement on the rates supported by most of today's second-generation digital networks. In addition, dynamic resource control techniques built into the IMT-2000 standard will greatly improve the spectrum efficiency of third-generation systems and help lower operators' costs through increased network capacity.

The many years of cooperative work between ITU members, including equipment manufacturers, network operators and service providers, culminated in the selection of the main features of the vital IMT-2000 radio interface by a meeting in Fortaleza, Brazil, in March 1999. While the meeting left the door open to multiple access technologies (CDMA, TDMA and others), the need to achieve as much commonality as possible in new 3G systems eventually led to the harmonization of the CDMA-based proposals.

If work continues on track and the industry deploys 3G networks and services on the basis of the IMT-2000 standard, subscribers to third-generation cellular systems will soon benefit from the seamless global roaming and anytime, anywhere access that have been cornerstones of ITU's IMT-2000 development activities since the mid-1980s.

The first IMT-2000 third-generation systems are expected to become commercially available around 2002. They will in general initially operate alongside existing second-generation systems, with multimode handsets providing users with transparent, reliable wireless communications across regions, across countries and across networks.