

INSTITUTE OF CHARTERED SHIPBROKERS – LINER TRADES

Session 3

Ports, Terminals and Cargo Handling

Hellenic Management Centre – Feb/Mar 2021

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Course Outline

- (1) Introduction – Liner Shipping and the Container Revolution
 - (2) Liner Ships
 - (3) Ports, Terminals and Cargo Handling
 - (4) Through transport systems – containers and intermodal transport
 - (5) Container Lines and their networks – co-operation
 - (6) Container Lines and their networks – service structures
 - (7) Types of businesses in the liner sector – structure and organization
 - (8) Bills of Lading and other contractual documents
 - (9) Contracts between sellers and buyers
 - (10) Revenue and Costs in the Liner Business
 - (11) The Future for Liner/Container shipping
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Topics for this session

- Ports and container terminals – ownership, organisation and equipment
- Container terminal automation
- Cargo Handling
- Hazardous Cargo – IMO Regulations
- Ship stowage
- Verified Gross Mass (VGM)
- International Ship and Port Security Code



CONTAINER TERMINALS



Entry Channel to the Port



Access to the port:

- Minimum deviation from trade routes
- Pilotage
- Channel depth
- Tidal window
- Channel width
- Turning circle

QUAYS, CONTAINER YARD & INTERFACES





Vessel Operations - Cranes and Spreaders

Ship to Shore Cranes Lifting Equipment – Spreader Types

Single lift container spreader



Twin lift container spreader



Tandem lift container spreader



- Gantry cranes – cost around \$10m each
- Hard standing to support their weight, and rails on which they move
- Largest container ships can use up to 8 cranes at one time
- Each crane can move up to 30 – 35 container per hour
- Height and outreach of the cranes is important to handle large container ships (largest ships are 63 metres wide, and crane has to lift **over** up to 12 containers on deck)
- Different spreader types can optimise loading speed



Container Terminals – Yard Operation

- Yard operation needs sufficient space to maximise productivity
- Gantry Cranes – cost around \$1.5 - \$2m each
 - Rail mounted (RMG) or
 - Rubber tyred (RTG)
- Separate export, import and empty stacks
- Export stack organised to 'mirror' the stowage on the ship
- Import stack organised to allow delivery to customers



Container Terminals – internal movements

Moving containers between the ship and the yard, and between yard and road vehicle

- Tugmaster and Trailer - \$250,000 each
- Straddle Carrier - \$1m each
- Straddle Carriers can also operate the yard stacks in smaller terminals





Receiving by road



Rail Terminal sidings and gantry crane



Short Sea Feeder



Landside Operations at the Container Terminal

- Transfer to Road, Rail, Inland Barge and Short Sea Feeder
- Rail transfer needs rail sidings, preferably in dock, and gantry cranes
- Road transfer needs gates to process vehicles + containers, and transfer area within terminal
- Inland Barges (in terminals with inland river connections) normally have their own berth in the terminal
- Feeder Vessels will berth at the main terminal; containers are transferred into a transshipment stack between main line and feeder vessel

AUTOMATION OF CONTAINER TERMINALS

- A number of container terminals are fully automated
 - Can be fully computer driven, or remote controlled
 - Only around 1% of terminal capacity now automated, but growing
 - Benefits of
 - Reduced labour costs
 - Increased productivity
 - Improved health and safety
 - Challenges of
 - Union issues (job losses)
 - High capital costs
 - Heavy reliance on computers
-

Selected Top 50 Container Ports - 2018

SELECTED TOP 50 GLOBAL CONTAINER PORTS - 2018						
Global Rank	Port	2018 Volume s ('m TEU)		Global Rank	Port	2018 Volume s ('m TEU)
	Top Global/Asian Ports				Top European Ports	
 1	Shanghai, China	42.0		11	Rotterdam, Netherlands	14.5
2	Singapore	36.6		13	Antwerp, Belgium	11.1
3	Shenzhen, China	27.7		19	Hamburg, Germany	8.7
4	Ningbo, China	26.4		27	Bremerhaven, Germany	5.4
 5	Guangzhou, China	21.9		29	Valencia, Spain	5.1
 6	Busan, South Korea	21.7		31	Piraeus, Greece	4.9
7	Hong Kong, China	19.6		32	Algeciras, Spain	4.8
8	Qingdao, China	18.3		41	Felixstowe, UK	3.9
 9	Tianjin, China	16.0			Top North American Ports	
10	Jebel Ali, Dubai, UAE	15.0		17	Los Angeles, USA	9.5
				20	Long Beach, USA	8.1
				23	New York-New Jersey, USA	7.2
				36	Savannah	4.4

 = Major Transshipment Hubs

Source: World Shipping Council

WHO RUNS THE CONTAINER TERMINALS?

- Port Authorities
- Independent Operating Companies (local or global)
- Line affiliated operators – either part of liner operations, or separate profit centre (e.g. Maersk = APMT, MSC – TIL)



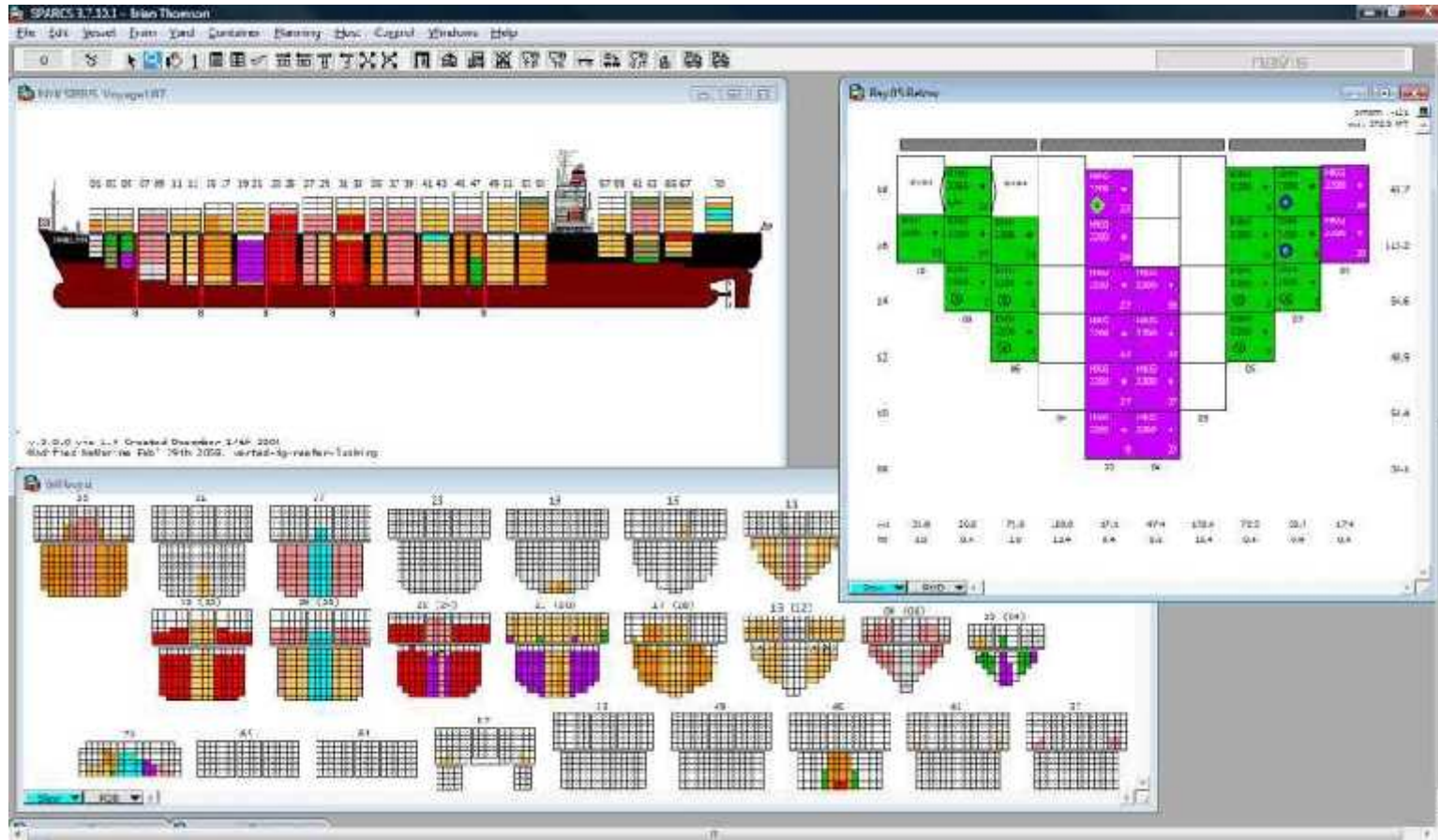
CONTAINER SHIP STOWAGE

- Six digit number identifies position on the ship
 - First two digits identifies the 'bay' (fore and aft)
 - 20ft bays = odd numbers
 - 40ft bays = even numbers
 - Bow to stern
 - Next two digits give position left to right
 - Rows to the right (starboard) = odd numbers
 - Rows to the left (port) = even numbers
 - Centre = '00'
 - Last two digits gives the height
 - Underdeck – 02,04,06,08 from bottom
 - On deck – 82,84,86,88
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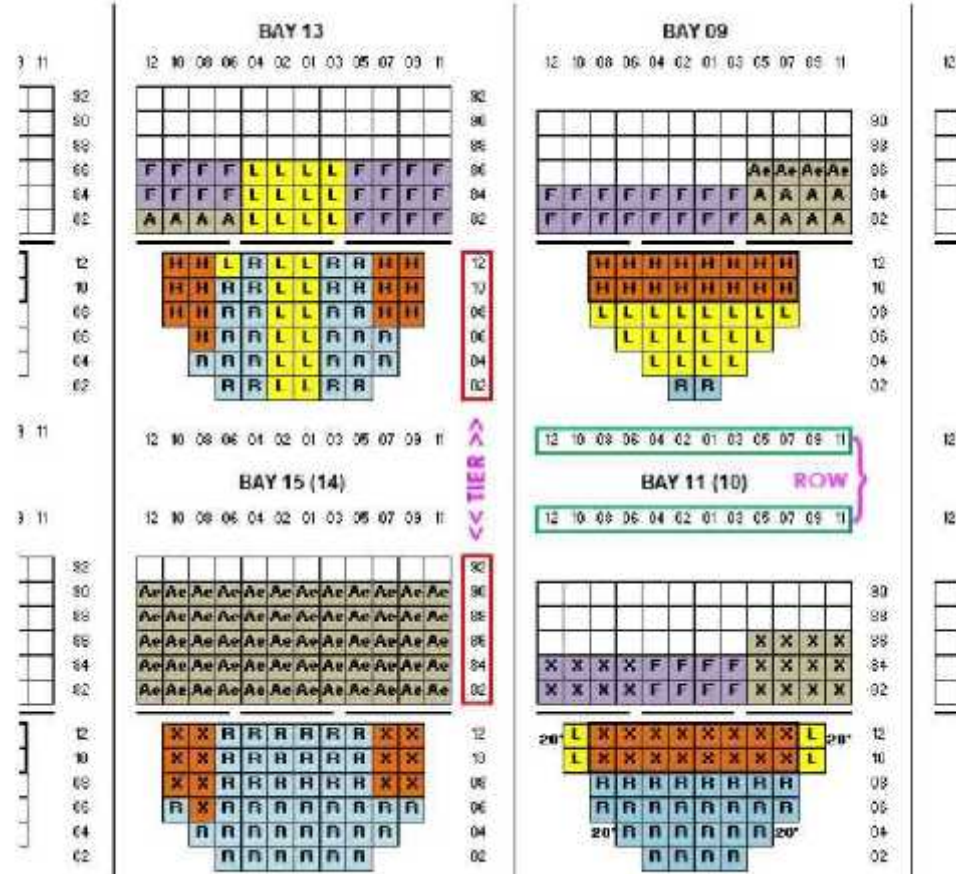
CONTAINER SHIP STOWAGE

- KEY ISSUES
 - Weight distribution
 - Heavy boxes at the bottom
 - Draft consideration – vessel max draft, plus port limitations
 - No bending
 - No overstows – ports usually 'block stowed'; restows take time and money!
 - Distribute boxes for a port over length of ship
 - To maximise number of cranes which can be worked
 - Hazardous and Reefer boxes
 - Specific locations
 - Plan for the following ports
 - Particularly if doing simultaneous discharge/load
 - Roles of Central Planner and Terminal Planner
 - Central Planner has the overview – determines the sections of the ship to be loaded at a particular port; only total numbers of boxes except for hazardous, and 'special' cargo which will be allocated by container
 - Terminal Planner — split into heavy/medium/light by port; allocates specific boxes to cells on the ship according to position in the terminal export stack
 - Terminal Operations will sequence the order of boxes moving from stack to quayside (and vice versa for imports)
 - Electronic Bay Plan – when completed sent electronically to Central Planner and next terminal
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STOWAGE INSTRUCTIONS



CONTAINER SHIP STOWAGE



Container Weight Verification



Why?

- MSC Napoli and other incidents
- Concern for stability/safety of the ship



Basic Requirement

- Shipper must provide verified gross mass of the container
- Otherwise the container shall not be loaded
- Part of SOLAS Convention
- Effective 1 July 2016

Container Weight Verification

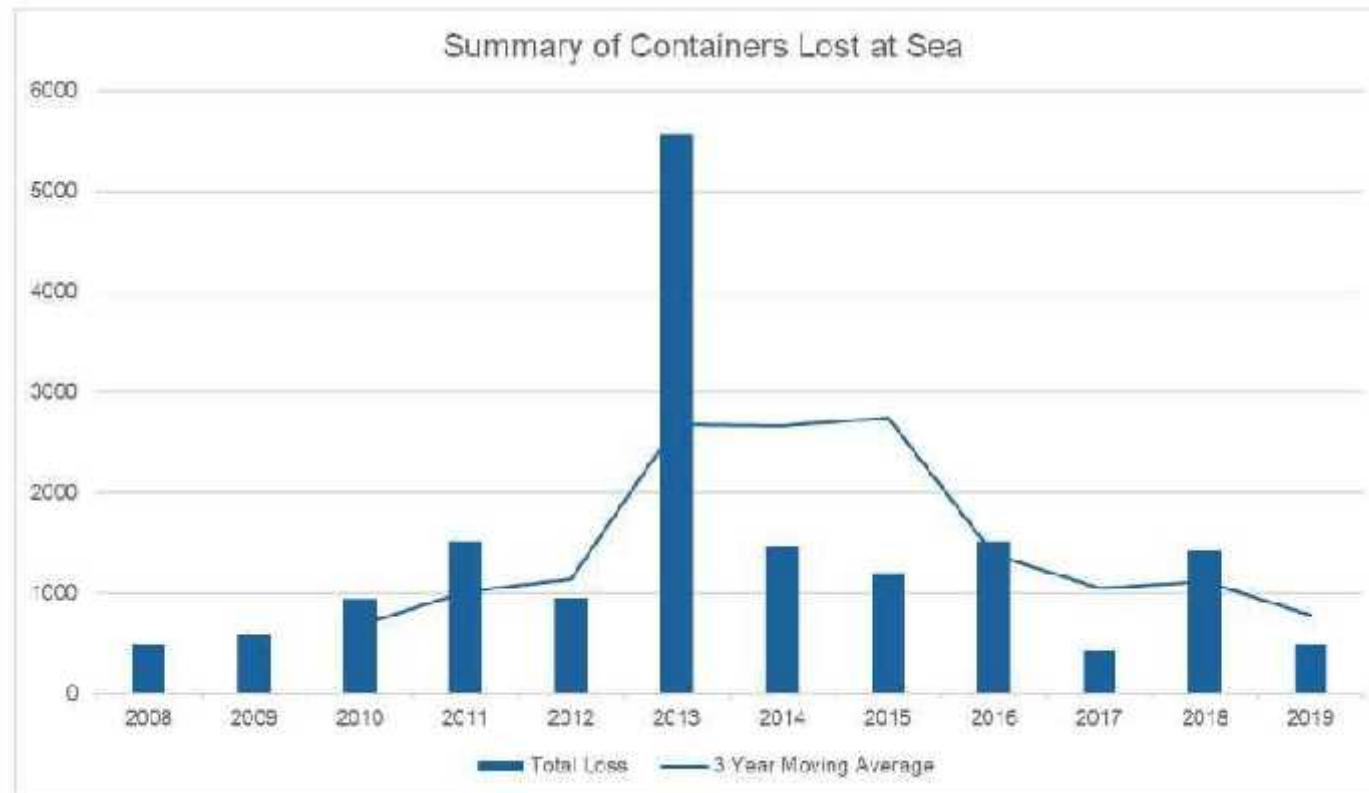


Who/How to weigh

- Method 1 – weigh container after it has been packed
- Method 2 – weigh all cargo/contents, and add to tare weight of container
- Shipper must weigh – cannot rely on weights provided by others
- Method 2 exception – use accurate weights of packages permanently marked on the package
- Shipper as named on the B/L must 'sign' i.e. a specific person named and designated by the shipper
- Can be remedied by packed container being weighed at the port



Containers lost at sea 2008-2019



Source: World Shipping Council

2013 loss due to sinking of MOL Comfort

What went wrong here?



30 November 2020
One Apus lost
approx. 1,900
containers

16 January 2021
Maersk Essen lost
750 containers

29 January 2021
MSC lost 41
containers

All occurred on
Trans-Pacific voyages

One Apus = 14,052 teu; incident en route Yantian to Los Angeles in heavy weather
Drone footage on <https://www.wkwebster.com/>

HAZARDOUS CARGO – IMO REGULATIONS



International Maritime Organization

- United Nations specialist agency
- Established as IMCO (Inter-Governmental Maritime Consultative Association) in 1948
- Convention entered into force 1958, first meeting 1962
- Name changed to IMO 1982
- 174 Member States (Armenia and Nauru joined in 2018)
- Non-governmental organisations as observers
- Major Conventions
 - SOLAS (Safety of Life at Sea)
 - MARPOL (International Convention for the Prevention of Pollution from Ships)
 - STCW(Standards of Training, Certification and Watchkeeping)
- Other conventions e.g. Recycling



IMDG CODE

The objective of the International Maritime Dangerous Goods (IMDG) Code is to:

- Enhance the safe transport of dangerous goods
- Protect the marine environment
- Facilitate the free unrestricted movement of dangerous goods

IMDG Code amplifies the requirements of

- Chapter VII of the 1974 SOLAS Convention
 - Annex III of MARPOL 73/78
 - Mandatory Application of the Code from 1 January 2004
 - Latest edition is 2018 Edition, came into force on 1 January 2020
 - Typically updated every two years
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IMDG CODE

The IMDG Code is an internationally agreed system which:

- Groups dangerous goods together based on the hazards they present in transport (classification).
 - Places the dangerous goods in packaging/tanks which are of appropriate strength and which will prevent the goods escaping.
 - Uses hazard warning labels and other identifying marks to identify dangerous goods in transport.
 - Requires standard documentation to be provided when dangerous goods are being transported.
 - Lays down principles for ensuring that dangerous goods which will react dangerously together are kept apart.
 - Lays down principles for where to place dangerous goods on board ship to ensure safe transport.
 - Provides emergency response advice for dangerous goods involved in a fire or spillage on board ship
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IMDG CODE

The purpose of the IMDG Code's classification system is:

- To distinguish between goods which are considered to be dangerous for transport and those which are not.
- To identify the dangers which are presented by dangerous goods in transport.
- To ensure that the correct measures are taken to enable these goods to be transported safely without risk to persons or property.

Dangerous goods are classified into **9 classes** according to properties. The way in which different classes of dangerous goods are handled in transport will depend upon these properties and hazards, for example:

- The type of packaging that can be used.
 - What classes of dangerous goods can be transported together in freight containers.
 - Where the goods can be stored within the port and on the ship
-

IMDG CODE

The nine classes are:

- Class 1 Explosives
- Class 2 Gases Flammable
- Class 3 liquids Flammable
- Class 4 solids
- Class 5 Oxidizing substances and organic peroxides
- Class 6 Toxic and infectious substances
- Class 7 Radioactive material
- Class 8 Corrosive substances
- Class 9 Miscellaneous dangerous substances

There are a number of sub-divisions in each class

These 9 hazard classes have been established internationally by a United Nations (UN) committee to ensure that all modes of transport (road, rail, air and sea) classify dangerous goods in the same way.

IMDG CODE

PSN and UN Number

Within each of the nine hazard classes dangerous goods are uniquely identified by two pieces of information:

- A four-digit number known as the UN Number which is preceded by the letters UN.
- The corresponding Proper Shipping Name (PSN).

For example, kerosene is identified in the IMDG Code by its UN Number UN 1223 and the PSN Kerosene.

Together the UN Number and PSN uniquely identify dangerous goods to:

- enable rapid and precise identification during transport to ensure the correct handling, stowage, segregation etc., and
 - in the event of an emergency, ensure that the correct procedures are followed.
-

IMDG CODE

Each Hazard Class is identified by labels:



Cargo packaging and the container or vehicle in which the goods are transported must be labelled

IMDG CODE

Dangerous Goods Declaration

For packing/shipping in containers, the declaration must be signed by the person controlling the container/vehicle operation, certifying that:

- The container/vehicle was clean, dry and apparently fit to receive the goods
- No incompatible goods have been packed into the container/vehicle
- All packages have been externally inspected for damage, and only sound packages packed
- Drums have been stowed in an upright position (unless specially authorized)
- All packages have been properly packed and secured in the container/vehicle
- The packages and the container/vehicle have been properly marked and labelled

Each dangerous goods consignment will also require a dangerous goods declaration signed by the shipper/supplier

IMDG CODE

Training Requirements:

The IMO Member Governments recognised that the safe transport of dangerous goods by sea is dependent upon the appreciation, by all persons involved, of the risks involved and on a detailed understanding of the IMDG Code requirements

Mandatory training requirements in the code highlight the need for all shore-based personnel involved in the shipment of dangerous goods to receive training commensurate with their responsibilities. The IMDG Code defines shore-based personnel as those who:

- classify dangerous goods and identify PSNs
 - pack dangerous goods
 - mark, label or placard dangerous goods
 - load/ unload CTUS
 - prepare transport documents for dangerous goods
 - offer dangerous goods for transport
 - accept dangerous goods for transport
 - handle dangerous goods in transport
 - prepare dangerous goods loading/stowage plans
 - load/unload dangerous goods into/ from ships
 - carry dangerous goods in transport
 - enforce, survey or inspect for compliance with applicable rules
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Hyundai Fortune – Gulf of Aden - 2006



The 274-meter Hyundai Fortune was rocked by a powerful explosion while heading west in the Gulf of Aden on March 21, 2006. Dozens of containers were blown overboard in the blast, creating a debris field that was estimated to be five miles around the vessel. The resulting fire burned for several days.

Cause of the explosion was never determined

Increasing incidence of container fires (hazardous containers – declared or not declared???)



More safety regulation needed??

Increased overboard loss of containers

Year	Boxes	Incidents	Fire	Weather	Collision	(Un)Loading	Other
2019	1,587	24	6	8	1	6	3
2018	382	17	4	6	2	2	3
2017	276	20	4	3	1	3	9
2016	144	16	4	4	2	3	3

Analysis based upon reports collated by Dynamar from various sources. Vessel losses included under other. Not all open source reports disclose container numbers; some containers will have been recovered. Fires relate to fires that start in containers

Three significant accidents in 2019

- Grande America (container fire – ship lost)
- MSC Zoe – heavy weather – off Dutch coast
- Yantian Express – container fire – North Atlantic

Source: Dynaliner

SECURITY

- Ships
- Ports
- Cargo



INTERNATIONAL SHIP AND PORT FACILITIES (ISPS) CODE

- Response to the terrorist attacks on New York in September 2001
 - IMO produced ISPS Code for ship and port/terminal security
 - Part of SOLOAS Convention – received almost immediate ratification
 - Code focuses on ships (>400gt) and ports
 - Imposes requirements on governments, ships and shipping companies, and ports
 - Code allows a Port State to deny entry to a ship without a valid certificate, or coming from a port that has not been certified as complying with the code
-

INTERNATIONAL SHIP AND PORT FACILITIES (ISPS) CODE

Governments

- Governments must appoint a Recognised Security organization (RSO) to certify the arrangements made in ports, on ships, and in the offices of shipping companies
- RSO's may be part of government (MCA in UK); a class society acting as an RSO, or a 3rd party organisation

ACTIONS

- approve security plans drawn up by ships and ports and testing their effectiveness. This process will include an inspection/audit
 - issue ships/ports with certificates of compliance
 - set security levels and provide guidance for protection from security incidents
 - establish the requirements for a declaration of security.
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INTERNATIONAL SHIP AND PORT FACILITIES (ISPS) CODE

- **Ships and shipping companies**
 - complete a ship security assessment to be 'carried out by persons with appropriate skills to evaluate the security of a ship'
 - carry on board a ship security plan approved by the administration
 - the company must 'ensure that the ship security plan contains a clear statement 'emphasizing the master's authority' and 'ensure that the company security officer, the master and the ship security officer are given the necessary support to fulfill their duties and responsibilities'
 - conduct training, drills and exercises on ship security.
-

INTERNATIONAL SHIP AND PORT FACILITIES (ISPS) CODE

- **Ports**
 - carry out a risk assessment and prepare a security plan for approval by the RSO, in a similar fashion to ships
 - specific requirements include the monitoring and control of access to the port/terminal facility, and the control of people and cargo within the port/terminal facility.
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INTERNATIONAL SHIP AND PORT FACILITIES (ISPS) CODE

Three Levels of Security

- **Responsibility of governments to set the level and change it as necessary**
 - **Security level 1: Normal**
 - This is the level at which the ship or port facility normally operates. The minimum appropriate protective security measures under level 1 need to be maintained at all times.
 - **Security level 2: Heightened**
 - This level should apply for as long as there is a heightened risk of a security incident, with appropriate additional protective security measures.
 - **Security level 3: Exceptional**
 - This level applies for the period of time when there is the probable or imminent risk of a security incident, even though it may not be possible to identify the specific target, with further additional protective security measures in place.
 - *Setting security level 3 should be an exceptional measure applying only when there is credible information that a security incident is probable or imminent, and should only be set for the duration of the identified security threat or actual security incident.*
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SECURITY – DOCUMENTARY CHECKS

- **2003 – USA introduced the ‘24 hour rule’**
 - Manifest to be lodged for all cargo destined to a USA port, 24 hours before loading **at the loading port**
 - Includes cargo to be transshipped at a US port for a non-US destination
 - US authorities vet the manifest and give clearance to load and/or retain certain boxes for inspection
 - Failure to comply could result in a ship being reused entry to a US port
 - This provides an incentive for shippers NOT to submit documentation late!
 - EU introduced similar legislation much later
 - Other countries have similar systems (Canada, China, Australia)
 - Other US Initiatives
 - C-TPAT
 - 10 + 2
 - Container Screening
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When a container ship 'nudges' a container crane!



Jebel Ali – May 2017

Questions from Past Exam Papers

Long delays can still occur at many modern container terminals and impact liner services for several reasons. Discuss the various reasons why port delays can occur and suggest ways in which liner services can combat such delays

(July 2020 Q6)

Discuss the criteria which govern the cargo stowage of a large container ship and an overview of the process that a carrier vessel stowage planner needs to consider.

(May 2019 Q4)
